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Web INTEractive management tool for coal Regions in transition



Deliverable 5.1

Documentation of training workshops

Public Report

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EXECUTIVE SUMMARY

The WINTER project aimed to support energy transitions in lignite coal regions by developing an interactive online platform. This platform provides detailed information on socio-economic and legal challenges, best practices in land rehabilitation, and preliminary findings from renewable energy sources scenarios. Task 5.1 focused on training workshops for stakeholders in Greece, Germany, and Poland, to introduce and train them on the platform, while collecting valuable feedback. The workshops included practical sessions on platform navigation, media analysis, land cover changes, and renewable energy site identification. Surveys from 52 stakeholders showed positive overall experiences, ease of use, and strong potential for aiding coal region management. Key improvement suggestions included regular data updates, expanded regional scope, more comprehensive socio-economic data, and enhanced usability features. Although the project is ending, the feedback offers a roadmap for future enhancements, ensuring the tool remains relevant and effective for supporting sustainable energy transitions.



PROJECT OVERVIEW

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1. INTRODUCTION

The WINTER project, which stands for Web Interactive Management Tool for Coal Regions in Transition, is designed to assist in the management and monitoring of energy transitions in regions formerly reliant on lignite coal. Its core objective is to develop an online interactive platform that serves as a comprehensive resource for stakeholders. This platform provides detailed information about the socio-economic and legal challenges these regions face, as well as opportunities arising from the energy transition. It showcases best practices in land rehabilitation and alternative land uses, and offers insights from spatiotemporal monitoring of land cover changes using open-source earth observation and geospatial data. Additionally, the platform presents preliminary findings from renewable energy sources (RES) scenarios, such as photovoltaic and wind parks, in selected areas.

Task 5.1, a crucial part of Work Package 5 (Dissemination and Stakeholder Involvement), aims to organize and conduct training workshops for key stakeholders in the coal transition process. These stakeholders include entities from the coal industry, research organizations, the energy sector, socioeconomic bodies, policy makers, local authorities, and environmental legislation consultants across three regions: Western Macedonia (Greece), Ruhr area (Germany), and Konin region (Poland).

The main goal of these workshops is to introduce participants to the interactive web platform and train them on its use. The workshops are designed to help stakeholders become proficient with the platform's features and functionalities. Moreover, the sessions aim to gather feedback and additional data from participants, which will be integrated into the platform to enhance its effectiveness and enrich the available information, thereby supporting the coal transition process more effectively.

The deliverable "Documentation of Training Workshops" provides a comprehensive account of the training sessions held in Greece, Germany, and Poland. It details the preparations, execution, participant feedback, and lessons learned from these workshops, offering valuable insights for future initiatives.

2. WORKSHOP PREPARATION

The preparation for the training workshops was centred around two key steps: the development of the Platform Guide and the creation of a detailed survey. These components formed the foundation of the workshop scenario and ensured that participants from Greece, Germany, and Poland could effectively engage with the content. Both the guide and the survey were translated into Greek, German, and Polish to facilitate easy participation and comprehension by all stakeholders.

Development of the Platform Guide

The Platform Guide (Appendix 1) was designed and produced by the Center for Research and Technology Hellas (CERTH) in Greece. This guide served as the cornerstone for the workshop scenarios, providing comprehensive instructions on navigating and utilizing the web interactive platform. It covered essential aspects such as the platform's navigation interface, data input methods, and available analysis features. To ensure broad accessibility, the guide was translated into Greek, German, and Polish, allowing stakeholders from all three regions to follow along seamlessly during the workshops. The guide is available for download and view in English language on the Winter's platform using the following link:

https://storymaps.arcgis.com/collections/103a6d18368f45559bf6ec5014009b25?item=6



Creation of the Survey

To evaluate the effectiveness of the web interactive platform and gather valuable feedback, a detailed survey (Appendix 1) was prepared. This survey aimed to assess participants' experiences with the platform and identify areas for improvement. The survey included sections on overall experience, ease of use, visual design, navigation, recommendations, future use, and the platform's application in the energy transition process. Like the Platform Guide, the survey was translated into Greek, German, and Polish to ensure that all stakeholders could easily participate and provide feedback.

These materials were essential in structuring the workshops and ensuring that stakeholders could engage fully, regardless of their language. The feedback collected through the survey would be instrumental in refining the platform and enhancing its usability and effectiveness in supporting the coal transition process.

3. WORKSHOP CONTENT

The training workshops conducted in Greece, Germany, and Poland were designed to introduce the web interactive platform to stakeholders and ensure they were well-equipped to utilize its features. The content of the workshops was structured to cover various aspects of the platform, focusing on both practical navigation and the application of its functionalities in the context of coal region transitions. The following sections outline the key components of the workshop content:

Introduction to the WINTER Platform

The workshops began with an introductory session that provided an overview of the WINTER project and its objectives. This section aimed to contextualize the platform within the broader scope of managing transitions in coal regions. Key topics covered included:

- The goals and importance of the WINTER project.
- An overview of the platform's development and its intended use.
- The benefits of using the platform for stakeholders involved in the coal transition process.

Navigation and Features

Participants were guided through the basic navigation of the platform, ensuring they could comfortably explore its various sections. This part of the workshop included:

- A walkthrough of the platform's user interface, highlighting key areas and features.
- Instructions on how to access different widgets and tools within the platform.
- Tips for efficient navigation and usage to maximize the platform's potential.

Media Analysis Dashboard

One of the core features of the WINTER platform is the Media Analysis Dashboard. This tool allows users to analyze media coverage related to coal transitions. The workshop content for this section included:



- An explanation of the Media Analysis Dashboard's purpose and capabilities.
- Demonstrations on how to perform media analysis using the dashboard.
- Practical exercises where participants could try out the tool and analyze sample data.

Land Cover Changes Analysis

Monitoring land cover changes is crucial in the context of transitioning coal regions. The workshop covered this aspect by:

- Introducing the land cover changes analysis tool available on the platform.
- Explaining the importance of spatiotemporal monitoring in understanding land rehabilitation and alternative land uses.
- Demonstrating how to use the tool to visualize and analyze land cover changes over time.

Identification of Renewable Energy Sources (RES) Areas

The platform also helps in identifying areas suitable for renewable energy sources. The workshop content for this section included:

- An overview of the tool for identifying RES areas.
- Detailed instructions on how to use the tool to locate and assess potential sites for renewable energy projects.
- Practical examples where participants could explore and identify RES areas within their regions.

Practical Exercises and Hands-On Sessions

Throughout the workshop, participants engaged in hands-on sessions to practice using the platform. These practical exercises were designed to reinforce learning and ensure that participants could confidently use the platform independently. Key activities included:

- Interactive sessions where participants navigated the platform and explored its features.
- Q&A sessions to address any questions or challenges faced by participants during the exercises.

Summary and Feedback Collection

Each workshop concluded with a summary session that recapped the key points covered. Participants were encouraged to provide feedback on their workshop experience and the platform itself. This feedback was gathered through the pre-prepared survey.

4. WORKSHOP IMPLEMENTATION

4.1. GREECE

The training workshop in Greece took place in Athens on April 25th, 2024. The workshop attracted a broad array of stakeholders, including representatives from local and regional governments, Western Macedonia Region, Public Power Corporation S.A., University of Western Macedonia



and the Hellenic company for development rights in numbers in practice (Metavasi S.A.). This diverse attendance ensured a wide range of perspectives were included, leading to more comprehensive discussions and feedback.

The agenda was crafted to combine these discussions with practical training on the WINTER platform, giving participants a thorough understanding of how the platform can visualize and support the transition process in the coal mining areas under examination.



Figure 1. Stakeholders engaged in workshop activities in Athens

The WINTER project (Web Interactive Management Tool for Coal Regions in Transition) aims to facilitate stakeholder involvement in managing, developing, and monitoring the energy transition in post-lignite regions. It focuses on areas at various stages of transition, including the Konin region (Poland), Western Macedonia (Greece), and the Ruhr region (Germany). The platform includes information on each region's energy transition, visualizing socio-economic, legal frameworks, and emerging opportunities. It also showcases best practices for land rehabilitation and alternative land uses, using processed open-source earth observation and geospatial data.

The workshop in Athens began with an introductory session that provided an overview of the WINTER project and its objectives. Participants were briefed on the platform's significance in managing the transition process in coal regions. Stakeholders received laptops in order to test and explore the platform's features in real-time. Guided navigation sessions familiarized participants with the platform's user interface and functionalities, while practical exercises engaged them with the Media Analysis Dashboard, Story maps, widgets, Spatiotemporal and Energy Transition Application, and other tools that consist the Winter's platform ecosystem.

The WINTER platform is designed for user-friendly navigation, engaging users with a narrative approach. It hosts sections focusing on different regions, media analysis, and the WebGIS platform. Users can explore spatiotemporal changes from 1990 to 2021, visualize suitability scenarios for Renewable Energy Sources (RES) installation, and analyze media sentiment on highlighted energy transition topics. The platform offers interactive tools like the swipe widget for comparing land cover changes and the screening report for quantitative analysis based on active layers. Throughout the workshop, participants were encouraged to ask questions and provide immediate feedback, enhancing the learning experience. The interactive format and the suitable guidance from the instructors ensured that queries were adequately addressed and analyzed.

The feedback and discussion session at the end of the workshop allowed participants to share their thoughts on the platform's usability and functionality. The comments were mostly positive, with stakeholders highlighting the platform's potential usefulness, especially if it included more areas and more updated datasets. The workshop concluded with a summary of key points discussed and a suggestion section related to the next steps for integrating participant feedback and other aspects such as socio-economic and educational fields into future platform



development. Overall, the workshop in Athens was very successful in terms of the positive feedback from stakeholders as long as their user-friendly environment emphasized the importance of keeping the platform active and updated in order to support the transition process.

4.2. GERMANY

In the case of Germany, the training workshop was carried out within the context of another project meeting from the EU-project "HEI4S3-RM", funded by the EIT Raw Materials (01.07.2022 – 30.06.2024). The project meeting under the topic of "Innovation and Sustainability" was held from 19.03. – 21.03.2024 at the THGA University in Bochum, Germany. In sum, 33 participants were attending this meeting, whereby 13 of them were physically in Bochum and the other 20 participants joined the meeting online via Zoom. It was a special opportunity to carry out the workshop during this meeting for an hour on the 19th of March, because different achievements were made: On the one hand, it was the possibility to connect two different projects and introduce the WINTER project to a new audience. Therefore, new synergies were made. On the other hand, the workshop was visited by stakeholders from various countries, e.g. Poland, Serbia, Finland, Spain and Ukraine.

Due to the common interest of all stakeholders present to talk about the overarching energy transition, the question of how to deal with mining legacies is very obvious. Furthermore, the participants are primarily interested in developing, integrating and learning about new innovative concepts or technologies. The innovative WINTERS concept around the web platform combines and bundles these two interests. In this respect, this was the right audience to receive serious feedback on the basis of which further development and optimization can be carried out for the partners in WINTER. In addition, the stakeholders are also potential end users of this platform or at least those who can pass this knowledge on to other interested parties. The implementation of this workshop was therefore of enormous added value.



Figure 2. Insights from the workshop at THGA University, Bochum

The implementation of the workshop was divided into three basic phases. At the beginning, a short presentation on the WINTER project was given so that the project objectives and implementation were clear to all participants. Initial questions about the project status and a possible continuation of the project after completion were already answered by the presenters at this point. The web platform was then presented in detail and handed out to the participants using tablets. They were then able to familiarise themselves with the platform, with the WINTER project



staff on hand to answer questions and provide further assistance. The workshop participants were then asked to complete the survey on the platform. Finally, additional feedback was once again given transparently and openly. This related not only to the survey and the design or handling of the platform itself, but also to the extent to which the workshop's approach was perceived as successful or in need of improvement. This should improve future projects in order to achieve the highest possible level of participation and maintain interest in communicating relevant project topics.

4.3. POLAND

The training workshop in Poland took place in Konin on May 24th, 2024. It was held during the meeting of the Subcommittee for Eastern Wielkopolska, where current challenges related to the transformation of this region were discussed. The agenda was designed to integrate these discussions with hands-on training on the WINTER platform, providing participants with a comprehensive understanding of how the platform can support the transition process.

The workshop saw the participation of a wide group of stakeholders, including representatives from local and regional governments, local environmental NGOs, representatives of the Konin mine trade unions, and members of the local community. This diverse group ensured that various perspectives were represented, making the discussions and feedback more holistic.



Figure 3. Stakeholders engaged in workshop activities in Konin

The workshop was conducted according to plan, featuring several key activities. It began with an introductory session that provided an overview of the WINTER project and the objectives of the workshop. Participants were briefed on the importance of the platform in managing the transition process in coal regions. Stakeholders were then given tablets to test and explore the platform's features in real-time. Guided navigation sessions were conducted to familiarize participants with the platform's user interface and functionalities. Practical exercises allowed them to engage with the Media Analysis Dashboard, Energy Transition Application, and other tools available on the platform.

Throughout the session, participants were encouraged to ask questions and provide immediate feedback. This interactive format ensured that any queries were addressed on the spot, enhancing the learning experience. The feedback and discussion session at the end of the workshop allowed participants to share their thoughts on the platform's usability and functionality. The comments were predominantly positive, with stakeholders highlighting the platform's potential usefulness, especially if it included the latest data.

The workshop concluded with a summary of the key points discussed and a reiteration of the next steps for integrating participant feedback into the platform development. Overall, the workshop in Konin was a successful blend of discussion on regional transformation challenges and practical training on the WINTER platform. The positive feedback from stakeholders emphasized the



importance of keeping the platform updated with the latest data to maximize its utility in supporting the coal transition process.

5. STAKEHOLDER FEEDBACK

5.1. GREECE

The survey conducted during the workshop in Athens on Apri 25th, 2024, gathered feedback from 18 stakeholders. The following is an analysis of the survey results. The majority of the participants rated their overall experience as "Excellent" (10), "Very Good" (5) and "Good" (3) indicating a very positive reception. None participant rated their experience as "Fair," or "Poor". This suggests acceptable satisfaction with room for improvement. The tool was generally perceived as easy to use, with the majority of participants finding it "Very Easy" (11) or "Easy" (5) to understand and perform functionalities. However, two participants found it "Neutral," indicating a need for further simplification or additional training.



Figure 4. Survey results from the Athens workshop: overall experience (left image) and ease of use (right image)

The visual design and layout received very positive feedback, with most participants rating it as "Very Good" (9) and some as "Good" (3). There were no ratings of "Fair" or "Poor," indicating general approval of the design aspects.





Figure 5. Survey Results from the Athens Workshop: visual design and layout evaluation

The navigation and user interface were mostly seen as "Very Intuitive" (13) and "Somewhat Intuitive" (5), and only one participant was neutral. This suggests that the interface is generally user-friendly. Most participants would recommend the tool, with 15 stating they would "Definitely" recommend it and 2 recommending it "With Some Reservations." Only one participant was neutral, and none opposed recommending it, highlighting general approval with minor reservations. The majority indicated they were "Very Likely" (9) and "Somewhat Likely" (7) to continue using the tool, though only one participant was "Not Very Likely." The provide results indicate a very positive use of the platform in the future.



Figure 6. Survey Results from the Athens Workshop: navigation and user interface evaluation





Figure 7. Survey Results from the Athens Workshop: tool recommendation assessment



Figure 8. Survey Results from the Athens Workshop: future usage likelihood

A significant majority (16) believe the tool can support better management of coal regions in transition, though two participants disagreed. Most participants see the tool's greatest contribution in all aspects (legal, environmental, social). This indicates a strong perceived value in the tool's environmental applications.





Figure 9. Survey Results from the Athens Workshop: potential for coal region management (left image) and impact on energy transition focus (right image)

Thematic Areas or Data to be Added

The participants highlighted the necessity for the tool to be regularly updated with current data. They emphasized the importance of ongoing updates and the continuation of the project to maintain the tool's relevance. There was a call for a broader scope of data at the regional level and an expansion to include more areas. Suggestions included regions in not prospering areas of Europe, regions outside the EU, and more reions in Greek boundaries such as the Megalopolis region. Participants also requested the inclusion of data from third countries, abandoned industrial units, and other Environmental Impact Studies. Additionally, more information on social data and socioeconomic impacts, such as unemployment rates in intervention areas, was deemed essential. There was a strong emphasis on the need for comprehensive and up-to-date data to support effective decision-making, along with the possibility of connecting the platform to other data sources for monitoring purposes.

Additional Comments and Suggestions

Participants suggested several improvements to enhance the usability of the tool. They highlighted the need for multi-language support. The importance of ensuring data is up-to-date was suggested, with particular mentions of additional areas like Amyntaio and Ptolemaida. A feature allowing users to reset selected layers without having to uncheck each one individually was recommended. Additionally, suggestions were made to provide clear interpretations of terms used within the platform's legend, such as translating "mining active areas" to "areas with active mining exploitation." Furthermore, the addition of sliders for numerical range selection instead of manually typing values, more map color options, and validation of locations for photovoltaics were proposed to improve the overall user experience.

5.2. GERMANY

Of the 33 stakeholders present, 22 ultimately agreed to complete the survey in full. The remaining 11 declined to do so without giving any further reasons.



The results of the online survey questions are primarily very positive, with most participants rating the "overall experience with the WINTER Web Application Tool" as "Very Good (10) or "Good" (8) and even "Excellent" (3). Only one participant rated it as "Fair" (1). This shows a clear indication of a positive overview for the platform. Coming to the usage of the Web Application Tool itself, using the given manual, the rating was as follows: "Very easy" to understand (12) or "Easy" (10) to understand. This represents a consistently positive perception of use.



Figure 10. Survey results from the Bochum workshop: overall experience and ease of use

The visual design and layout were rated very differently, as it got positive and negative feedback: "Excellent" (3), "Very Good" (6), "Good" (7), "Fair" (5), and "Poor" (1). Impressions differ here, but it is important to remember that perception is an individual matter. However, there is room for further improvements in the presentation. Similar results can be seen in the application of the navigation and the user interface, where the majority finds the interface "Very intuitive, easy to use" (10), but also "Somewhat intuitive, could be improved" (6) and also "Neutral" (5) with one response saying it is "Not very intuitive, needs improvement" (1).



Figure 11. Survey results from the Bochum workshop: visual design and layout





Figure 12. Survey results from the Bochum workshop: intuitive navigation

A majority of respondents is positive in recommending the Web Application Tool to others with "Definitely, it is highly recommended" (10), "Yes, with some reservation" (8), and "Neutral" (4). The results are more divided regarding the further usage of the Web Application Tool by "Very likely" (4), "Somewhat likely" (13) and "Neutral" (5). This indicates the possibility in enhancing the further usage of the tool for better accessibility.



Figure 13. Survey results from the Bochum workshop: potential for recommendation





Figure 14. Survey results from the Bochum workshop: future usage

All respondents agree that the Web Application Tool can be used for the better management of coal regions in transition (22). Apart from that, the last question "In which aspect of energy transition do you think that the Web Application Tool can contribute the most?", the answers were divided with "Environmental aspects" (11), followed by "Social" (6), then "Combination of all three aspects" (3) and lastly "Legal" (2). The latter diversity in the responses in particular can also be attributed to individual interests or fields of employment that are related to the respondents.



Figure 15. Survey results from the Bochum workshop: Potential for coal region management and impact on energy transition

Thematic Areas or Data to be Added

The participants were asked to add thematic areas or even data to optimise the experience of the Web Application Tool as a whole. In this case, various comments and suggestions were



provided, ranging from adding various educational and economic aspects, but also to gain more experience from other projects as well. This was one of the main reasons this workshop was carried out throughout the meeting of another EU-project. It shows that this approach can be useful in the future as well. Lastly, one of the participants added information about the future perspectives of the regions.

Additional Comments and Suggestions

The question for further suggestions and additional comments in general was also taken advantage of. Still, it has to be mentioned that these comments are relatively mixed. The most comments were made on the particular point of how to improve the usability of the Web Application Tool based on experience and manual by usage. Therefore, it was mentioned that, on the one side, the manual is very detailed, but, on the other side, it is too long. Another participant added that the manual is very helpful, just as it is. Another comment was about the platform itself, saying it would be best to layout the platform in a way, where a further manual would not be needed at all. This basically means that the platform is not intuitive enough at the moment and enhancement should be a consideration in the future.

5.3. POLAND

The survey conducted during the workshop in Konin on May 24th, 2024, gathered feedback from 12 stakeholders. The following is an analysis of the survey results.

The majority of the participants rated their overall experience as either "Good" (6) or "Very Good" (5), indicating a positive reception. Only one participant rated their experience as "Fair," and none rated it as "Poor" or "Excellent." This suggests general satisfaction with room for improvement. The tool was generally perceived as easy to use, with the majority of participants finding it either "Easy" (7) or "Very Easy" (3) to understand and perform functionalities. However, one participant found it "Difficult," indicating a need for further simplification or additional training.



Figure 16. Survey results from the Konin workshop: overall experience and ease of use

The visual design and layout received positive feedback, with most participants rating it as "Very Good" (9) and some as "Good" (3). There were no ratings of "Fair" or "Poor," indicating general approval of the design aspects.





Figure 17. Survey Results from the Konin Workshop: visual design and layout evaluation

The navigation and user interface were mostly seen as "Somewhat Intuitive" (5) and "Very Intuitive" (4), though two participants were neutral, and one felt that it needed improvement. This suggests that while the interface is generally user-friendly, there are areas for enhancement. Most participants would recommend the tool, with three stating they would "Definitely" recommend it and seven recommending it "With Some Reservations." Two participants were neutral, and none opposed recommending it, highlighting general approval with minor reservations. The majority indicated they were "Somewhat Likely" (8) to continue using the tool, though three participants were "Not Very Likely." One participant remained neutral. This mixed response indicates a positive but cautious outlook on future use.



Figure 18. Survey Results from the Konin Workshop: navigation and user interface evaluation





Figure 19. Survey Results from the Konin Workshop: tool recommendation assessment



Figure 20. Survey Results from the Konin Workshop: future usage likelihood

A significant majority (10) believe the tool can aid in better management of coal regions in transition, though two participants disagreed. The explanations for the negative responses included the following arguments:

- The tool focuses mainly on the area of open-pit mines, while the just transition involves the entire Eastern Wielkopolska region.
- The data is incomplete the tool does not analyze the entire region, and the available data is from several years ago.

Most participants see the tool's greatest contribution in the "Environmental" aspect (10), with two believing it can contribute to all aspects (legal, environmental, social). This indicates a strong perceived value in the tool's environmental applications.





Figure 21. Survey Results from the Konin Workshop: potential for coal region management (left) and impact on energy transition focus (right)

Thematic Areas or Data to be Added

The participants highlighted the necessity for the tool to be regularly updated with current data. They emphasized the importance of ongoing updates and the continuation of the project to maintain the tool's relevance. There was a call for a broader scope of data at the regional level and an expansion to include more areas. Additionally, participants requested more information on social data, underscoring the need for comprehensive and up-to-date data to support effective decision-making.

Additional Comments and Suggestions

Participants suggested several improvements to enhance the usability of the tool. They highlighted the need for multi-language support, specifically the ability to select the Polish language. The importance of ensuring data is up-to-date was reiterated. There was also a suggestion to include a feature allowing users to reset selected layers without having to uncheck each one individually. Furthermore, participants stressed the importance of considering the entire subregion when discussing just transition, ensuring comprehensive and inclusive planning and data representation.

6. CONCLUSIONS AND LESSONS LEARNED

This chapter summarizes the combined results of the stakeholder feedback surveys conducted in Greece, Germany, and Poland as part of the WINTER project. The surveys aimed to evaluate the WINTER Web Application Tool's effectiveness, usability, and potential for supporting the coal regions in transition. The feedback collected provides valuable insights into the tool's strengths and areas for improvement, offering a holistic view across the three countries.

The workshops attracted a broad array of stakeholders, including representatives from local and regional governments, universities, public power corporations, development companies, and environmental NGOs. Additionally, international stakeholders involved in other EU projects from Poland, Serbia, Finland, Spain, and Ukraine participated, fostering opportunities for new



synergies. This diverse participation ensured comprehensive discussions and feedback, reflecting a wide range of perspectives and expertise. In total, 52 stakeholders participated, with 18 from Greece, 22 from Germany, and 12 from Poland.

The majority of stakeholders across all three countries rated their overall experience with the WINTER Web Application Tool positively. Most respondents found the tool to be effective in providing relevant information and supporting decision-making processes in the context of coal region transitions. However, there were some variations in ratings, indicating areas where user experience could be enhanced.



Figure 22. Survey results: overall experience

Stakeholders generally found the WINTER tool easy to use, particularly appreciating the clarity of the provided manual. The majority of participants in each country rated the ease of understanding and performing functionalities as either "Very Easy" or "Easy." Nonetheless, a few respondents faced challenges, highlighting the need for ongoing improvements in user guidance and interface simplification. The visual design and layout of the tool were well-received, with high ratings across all three countries. Stakeholders appreciated the aesthetic appeal and the logical arrangement of information, which facilitated ease of navigation and data interpretation. This positive feedback underscores the importance of maintaining a user-friendly and visually appealing interface. Feedback on navigation and the intuitiveness of the user interface was mostly positive, with stakeholders finding the tool generally intuitive and easy to navigate.

Figure 23. Survey results: ease of use

Figure 24. Survey Results: visual design and layout evaluation

Figure 25. Survey Results: navigation and user interface evaluation

A significant proportion of stakeholders expressed their willingness to recommend the WINTER tool to others. While many would recommend the tool without reservations, some had minor reservations, primarily related to the need for more up-to-date data and additional functionalities. Stakeholders' likelihood of continuing to use the WINTER tool in the future was generally positive, with many indicating they were "Somewhat Likely" or "Very Likely" to continue using it. This reflects a positive outlook on the tool's potential to support ongoing and future projects, provided it continues to evolve and incorporate user feedback.

Figure 26. Survey Results: tool recommendation assessment

Figure 27. Survey Results: future usage likelihood

The majority of respondents (92% of all responses) believed that the WINTER tool could aid in the better management of coal regions in transition. The tool's ability to integrate environmental data and support legal and social aspects of the transition process was particularly appreciated.

However, the stakeholder feedback across Greece, Germany, and Poland highlighted several key areas for improvement to enhance the effectiveness and usability of the WINTER Web Application Tool. Common themes emerged from the surveys, providing a comprehensive roadmap for future developments.

Building on the insights gained from the survey results, stakeholders provided several constructive suggestions for enhancing the WINTER Web Application Tool. These suggestions aimed to address the identified areas for improvement and ensure the tool remains effective and user-friendly.

- 1) **Data Updates**: Regular updates were emphasized as essential to ensure the data remains current and relevant. Continuous updates would enhance the tool's utility and accuracy, addressing the concerns raised about outdated information.
- 2) Expanded Scope: Respondents recommended expanding the study areas to include more regions both within and beyond Europe. This expansion would provide a more comprehensive view of coal region transitions, accommodating the varied geographical contexts and challenges faced by different regions.
- 3) **Socioeconomic and Environmental Data**: Incorporating more comprehensive socioeconomic and environmental data was frequently mentioned. This includes data on unemployment, stakeholder opinions, and broader social impacts of the energy transition, which would enrich the tool's analytical capabilities and relevance.

- 4) **Usability Enhancements**: Several usability improvements were suggested to make the tool more intuitive and accessible:
 - Adding multi-language support to cater to diverse user bases, making the tool more inclusive.
 - Simplifying the user interface to reduce reliance on the manual and enhance intuitive use.
 - Providing options to change color schemes for better visual clarity and user preference.
 - Enabling easier layer management, such as the ability to reset selected layers without manually unchecking each one, to streamline the user experience.

By integrating these suggestions, the WINTER project can significantly enhance the tool's functionality and user experience. The feedback underscores the necessity for ongoing development and adaptation of the tool to meet the evolving needs of stakeholders involved in managing coal region transitions. This comprehensive approach ensures that the WINTER Web Application Tool remains a valuable asset for supporting sustainable and effective energy transitions in coal regions.

Although the WINTER project is coming to an end, the insights and feedback collected provide a valuable foundation for future work. The positive reception and constructive suggestions indicate a strong potential for further development and enhancement of the tool. While these changes may not be implemented within the current project framework, the recommendations offer a clear roadmap for subsequent initiatives. By building on the work done in the WINTER project, future efforts can ensure that coal regions have the necessary tools to navigate the transition to sustainable energy effectively.

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APPENDICES

APPENDIX 1 PLATFORM GUIDE

INTRODUCTION

The WINTER project (Web **INTEractive** management tool for coal Regions in transition) aims to guide and facilitate the involvement of stakeholders in issues related to the management, development, and monitoring of the energy transition in regions that are in the post-lignite era. The primary goal of the project is to design and produce an online interactive platform for managing regions most affected by the transition. This project aims to holistically examine areas that represent both the initial (Western Macedonia, Greece, and the Konin area, Poland) and mature stages (Ruhr region, Germany) of the transition process, to ensure broad replicability of results and best practices in other regions facing similar challenges.

The platform includes information on the energy transition of each region, visualizing both the challenges they face at the socio-economic and legal levels and the emerging opportunities. Additionally, it presents examples of best practices for land rehabilitation and alternative land uses, showcasing cases from mining sites and highlighting the results of spatiotemporal monitoring of land cover changes through the processing of open-source earth observation and geospatial data. Finally, the platform illustrates preliminary results of implemented renewable energy sources (e.g. photovoltaic and wind parks) scenarios within the boundaries of selected areas

The geospatial datasets cover two different periods:

- From 1990 to 2018:

The first period is based on the open Corine Land Cover (CLC) data with regional spatial coverage. Visit the WINTER platform by scanning the QR code with your mobile/tablet camera

CLC products, provided by the European Copernicus program, offer a pan-European record of land cover and land use types in 44 thematic categories.

- From 2018 to 2021:

The second period is covered by the results of processing Sentinel-2 satellite images through machine learning algorithms focusing within the mines of Western Macedonia and Konin. The purpose of the machine learning results is to classify and monitor changes in land cover within the boundaries of the mines. Specifically, land cover was classified into the following five classes: 'vegetation', 'infrastructures', 'active mining areas', 'bare soil', and 'water bodies'.

NAVIGATION ON THE WINTER PLATFORM

The WINTER project features a centralized platform hosting five sections, each focusing on Western Macedonia region (Greece), Konin region (Poland), </u> the Ruhr area (Germany), 4 Media analysis, and 5 the WebGIS platform (Figure 1). The presented a user-friendly navigation structure offers experience, designed to engage users with a narrative approach. It effectively showcases the WINTER project outcomes, employing a top-down perspective that guides users through the intricate details and findings of the project. This storytelling presentation not only enhances user engagement but also facilitates a deeper understanding of the project's impact and insights across the various regions and thematic sectors it encompasses.

Figure 1. Welcome screen of Winter Platform.

The sections numbered 2& 3 specifically dedicated to each study area, offering insights into their socio-economic characteristics ("Western Macedonia region"), legal frameworks ("Legal Framework"), exemplary land rehabilitation practices ("Mine Rehabilitation and Reclamation Showcase"), geospatial data for spatiotemporal land changes monitoring of cover ("Spatiotemporal evolution"), and preliminary scenarios for the suitability installation of Renewable Energy Sources (RES) ("Renewable Energy Sources scenarios").

The following figures presenting the sub-sections (tabs) of Western Macedonia regarding its legal framework and best rehabilitation practices. Specifically, users can have a comprehensive view of the steps involved in the legislative process for land rehabilitation in Greece (Figure 2).

Figure 2. Thematic tab related to the legislation framework for energy transition in Greece.

Additionally, users are capable to explore the existing rehabilitated and reclaimed activities in mining areas in Western Macedonia as well as in other regions of Greece (Figure 3). They can also visit the corresponding tabs for other countries to explore the various methods of rehabilitation and reclamation cases.

Figure 3. Rehabilitation examples in Western Macedonia.

***Note:** Users can easily and quickly navigate to different sections either from the tab that appears at the top of each section (Figure 4) or from the button that is always visible in the upper left corner of the platform.

Figure 4. List of tabs/sections of Winter Platform.

An additional feature available on the platform is the spatiotemporal monitoring of the study areas at a regional level from 1990 to 2018, and at a local level within the open-pit mines from 2018 to 2021. Users can observe the evolution of these areas through the exploration of diagrams (Figure 5), the use of interactive tools such as the **swipe widget**, and descriptive analysis of land use products.

Figure 5. Temporal Changes in Land Coverage at Amynteo lignite mine (2018-2021).

Finally, users can navigate through suitability scenarios for the installation of Renewable Energy Sources (RES) using descriptive texts and interactive maps. Specifically, the scenarios focus on an area of interest southwest of the Ptolemaida mine, where suitable areas for the installation of photovoltaic parks are depicted in yellow, and suitable areas for wind parks are illustrated in blue (Figure 6).

Figure 6. Screenshot from an interactive map comparing the two different preliminary suitability scenarios for the installation of Renewable Energy Sources (RES).

MEDIA ANALYSIS DASHBOARD

Section hosts a detailed presentation on key terms that appear in the media of each country related to news concerning the energy transition. Through the analysis of specific words, the sentiment of public opinion is illustrated.

Understanding how the media presents the energy transition and how it influences discussions around it is particularly important for assessing social acceptance in the study areas.

In the following example, the user can visit the subsection of Media Dashboard and examine the 3 most important words related to the energy transition (Decarbonization, Green Deal, Just Transition).

The media dashboard features interactive charts on its left side (Figure 7), which display the annual frequency of each word's appearance for the 3 countries involved in the project.

Figure 7. Screenshot from the Media Dashboard regarding the analysis of the annual frequency of occurrence of words (Decarbonization, Green Deal, Just Transition) in each country.

Users can compare the different stages between countries and also focus exclusively on one of them by zooming in on the map (Figure 8) or selecting the polygon of the country of interest.

Figure 8. Screenshot from the media dashboard related to the analysis of the annual frequency of words' appearance, focusing on Greece.

At the bottom part of the media dashboard (3 gauges), the mean tonality news related to each word is depicted at Figure 9. The tone is categorized into positive, neutral, and negative feeling. Users can select the country (2) and the word (3) of interest to illustrate the mean tonality (4) conveyed by the media for each term.

Figure 9. Screenshot from the media dashboard regarding the analysis of the tonality of each word in the media analysis report of the Winter.

ENERGY TRANSITION APPLICATION

Users can utilize all the geospatial results of the WINTER project to conduct their own preliminary studies on the energy transition in Western Macedonia, Konin, and the Ruhr. Section shots the WebGIS platform, which offers a set of geospatial and user-friendly tools/widgets that can be used for visualizing land use changes and

suitability scenarios for the installation of Renewable Energy Sources (RES) (Figure 10).

Figure 10. Main window of Winter WebGIS platfrom.

EXPLORATION OF WINTER STUDY AREAS

Users can quickly and easily navigate through the analyzed areas being examined in the WINTER project, using the "Study areas" icon. In the following example (Figure 11), the user can focus on the Amynteo mine by activating the "Study areas" icon (1) and selecting the Amynteo area ("Amynteo") (2). The map will automatically zoom into the area of interest (3). Following the same approach, the user can navigate to other areas of interest as well.

Figure 11.Screenshot of the activation icon titled as "Study areas".

THEMATIC LAYERS AND SPATIOTEMPORAL COMPARISON OF LAND COVER CHANGES USING SWIPE TOOL

The platform offers the capability of visualizing the land cover and the comparison between them for the study period of the project.

ACTIVATION OF THEMATIC LAYERS

In the following example, users can activate/deactivate the land cover layers for the Amynteo mine by selecting the "layers" icon (1) in order to open the grouped layers "Land Cover (Western Macedonia)" (2) (Figure 12).

Figure 12. Activation and selection of thematic layers.

Subsequently, they can activate the land cover layers for the period from 2018 to 2021. In this particular example, land cover for 2018 (3) and 2021 (4) are activated.

***Note:** The platform is designed to display layers in a hierarchical order based on which layers are active; thus, in this instance, the 2018 layer is shown first. Users can easily distinguish each category of land cover by its designated color, as illustrated in the subsequent image (Figure 13).

In order to view the legend, click on the arrow located to the left of the active layer's name. Land cover is categorized into five classes: green represents "Vegetation," blue illustrates "Water bodies," brown indicates "Bare soil," red is used for "Infrastructures," and purple depicts "Active mining area."

Figure 13. Legend related to the land cover categories of Amynteo in terms of the activated thematic layer.

USING SWIPE WIDGET

Following this, users are able to compare the changes made within the time interval of the two selected levels, they can select the "swipe widget" icon (5) and then move the vertical bar (6) which appears on the map (Figure 14) to the right or left. It should be noted that, on the left of the bar, the layer (land use 2018) which is selected in the window opened with the swipe widget is displayed, while on the right is the second layer, which has been selected for comparison (in this case 2021).

Figure 14. Screenhsot for the utilization of the swipe widget.

***Note:** The swipe widget application requires 2 active/selected layers of the same type so that it can perform the comparison.

QUANTITATIVE ANALYSIS OF LAND COVER CHANGES USING SCREENING REPORT

One of the most important capabilities of the webgis platform is the quantitative comparison of land use changes which can help to a better understanding of the evolution of regions towards energy transition, as well as to identify trends related to it. This analysis can be achieved through the "screening" widget.

ACTIVATING CORINE LAND COVER DATASETS

In the example below, users can examine the land use/land cover changes in a particular area by activating the layers icon **(1)** and selecting the Corine Land Cover (Western Macedonia) group layer **(2)** (Figure 15).

Figure 15. Screenshot from the selection of group layers of interest .

Users then activate 2 levels as in Figure 16 below. In this case, the Corine Land Cover layers for the 1990 (CLC 1900 (WM)) **(3)** and 2018 (CLC 2018 (WM)) **(4)** periods were selected (Figure 16).

Figure 16. Screenshot from the activation of the selected Corine land cover datasets in Western Macedonia.

As in the previous application, the layer that appears on the platform always follows the hierarchical order of the active layers. Thus, the layer that appears in this case is CLC 1990 (WM). If the user wishes to see what each land cover/land use category represents, they can display them by clicking on the arrow and opening the legend window. Indicatively, "**Arable land**" is categorised in yellow, "**Forest**" in green, "**Industrial**, **commercial and transport units**" in violet, "**Mine, dump and construction sites**" in purple, and "**Urban fabric**" in red (Figure 17).

Figure 17. Legend related to the Corine land cover datasets in Western Macedonia.

SCREENING WIDGET

For the following example, a "**Demo**" region has been preselected in the "**Study areas**" icon, which users can select in order to easily follow the steps below (Figure 18).

Figure 18. Selection of the Demo area from the Study areas icon.

The next step is clicking on the "screening" widget icon (5) and select the "Draw" field (6) (figure 19). At this point, users can choose between 3 geometries of delineating the area of interest, either by drawing a point, a rectangle or a polygon. In this example, a point was selected by clicking

on the icon (7).

Once the drawing geometry is set, users can select their area of interest by left-clicking (8) on the map window. Then a buffer zone around the point of interest can be selected by choosing the unit of measurement and the size. In the depicted example, point is chosen as drawing geomtry, unit of measurement is the kilometre, and a radius of three kilometres (9) is defined. A red circle will then be created automatically on the map window to depict the area under examination. The final step is completed by pressing the report button (10) (Figure 19).

Figure 19. View from the activation of the Screening tool settings.

Users can view the area of all land cover/land use types that are within the specified area of interest in square kilometres by clicking on the cross icon

 $\stackrel{\textcircled{}}{=}$ as shown in steps **11** and **12** (Figure 20).

Figure 20. Quick results from the Screening report widget.

It should be noted that the created inventory concerns only the active layers; therefore in this example, land use for the years 1990 and 2018 have been analysed. Layers accompanied by the exclamation mark ⁽¹⁾ indicate that there is no information recorded, either because they are not active or because the study area is outside their boundaries. It worths to be mentioned that the comparison could include additional time periods related to the available layers. At the end of the analysis, users can print/save the result **(13)** (Figures 20 & 21).

Figure 21. Printing/saving functionality of Screening tool.

Based on the two generated tables (Figure 22) for the two years of land use/land cover (1990 & 2018), it is observed that the urban fabric (from 4.14 km^2 to 4.72 km^2) and the industrial zone have increased by 2.28 km², while the arable land has decreased (from 23.81 km² to 21.17 km²).

Sur	nmary					
	Name	Count	Area(km²)	Length(km)		
CLC	: 1990 (WM)	4	28.26	N/A		
CLC 2018 (WM) 14		14	28.26	N/A		
CLO	C 1990 (WM)					
#	# Class Area(km²)		Area(km²)			
1	Industrial, commercial and transport units		0.30	0.30		
2	Urban fabric		4.14	4.14		
3	Arable land		23.81	23.81		
CLO	C 2018 (WM)					
#		Class		Area(km²)		
1	Forest		0.09			
2	Industrial, commercial and tr	ansport units	2.28	2.28		
3	Urban fabric 4.7		4.72			

Figure 22. Screenshot from the exported results of Screening widget.

UTILIZATION OF TOOLS FOR IDENTIFYING RENEWABLE ENERGY SOURCES (RES) INSTALLATION AREAS

Within the WINTER project, a preliminary analysis of the suitability of areas for the installation of Renewable Energy Sources (RES) was conducted. This study used open geo-spatial data (altitude, elevation. land use) and the legal/institutional framework of each country. Users can explore the preliminary results of the applied RES scenarios to get a quick overview of their area of interest.

ACTIVATING LAYERS

In the following example, users can activate the levels with the scenarios for the suitability of RES installation for the study area of Western Macedonia by following steps **1** and **2** (Figure 23).

Figure 23. Screenshot of the available grouped layers of interest.

After selecting the group layers of the "Suitability scenarios for the installation of Renewable Energy Sources (Western Macedonia)", the layers (Figure 24) that relate to the area where the scenarios were applied will be shown as ("Area of Interest (AOI)") for the installation of wind f"rms ("WP"), for the installation of photovoltaic parks ("PV") and a layer concerning the areas which meet the same specifications for both types of RES ("Overlapped") installation. In the next step the users can activate the layers they wish. In this case, the boundaries of the area of interest (3) and the layer for the PV park scenario (4) are visualised.

Figure 24. Screenshot from the activation of the layers of interest.

USING DRAW WIDGET

As shown in Figure 25, the areas that are likely to be suitable for the installation of PV are shown in yellow. Users can also, focus on their areas of interest within the boundaries of the applied RES scenario, using the planning tool **(5)**, create polygons or other drawings **(6)** to enable them to calculate various geometrical properties.

Figure 25. Settings of the Draw tool.

Once the delineation is selected, users can activate the "Show area measurement" button and the "Unit" button (Figure 26).

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Figure 26. Activation of the area calculation property.

Then, having drawn the areas, they can individually calculate their area **(8)** in square kilometres (Figure 27).

Figure 27. Illustration of the area calculation of the drawn area of interest.

APPENDIX 2 STAKEHOLDER FEEDBACK QUESTIONNAIRE

WINTER – WEB Application Tool

Stakeholder feedback questionnaire

Thank you very much for taking the time to participate in our WINTER Web Application Tool survey. Your opinion is important for us to better understand the transformation processes in coal regions. This survey is being carried out as part of the EU WINTER project. You can find more information here: WINTER - RFCS Accompanying Measure (winter-project.eu)

- 1. How would you rate your overall experience with the WINTER Web Application Tool?
 - Excellent
 - □ Very good
 - Good
 - 🗆 Fair
 - Poor
- 2. How easy was it to understand and perform the functionalities of the Web Application Tool based on the manual provided?
 - □ Very easy
 - Easy
 - Neutral
 - Difficult
 - □ Very difficult
- 3. How would you rate the visual design and layout of the Web Application Tool?
 - Excellent
 - □ Very good
 - □ Good
 - 🗆 Fair
 - Poor
- 4. Were the navigation and user interface intuitive and easy to use?
 - └ Very intuitive, easy to use

 \Box Somewhat intuitive, could be improved

- Neutral
- □ Not very intuitive, needs improvement
- \Box Very difficult to navigate and use

5. Would you recommend this Web Application Tool to others based on your experience with it?

- \Box Definitely, it is highly recommended
- \Box Yes, with some reservations
- □ Neutral
- □ No, not recommended

6. How likely are you to continue using this Web Application Tool in the future?

- Very likely
- □ Somewhat likely
- Neutral
- □ Not very likely
- \square Not at all likely
- 7. Do you think that the Web Application Tool can be used for the better management of coal regions in transition?
 - 🗆 Yes

□ No (please explain)

- 8. In which aspect of energy transition do you think that the Web Application Tool can contribute the most?
 - 🗆 Legal
 - Environmental
 - Social
 - \square All of the above
- 9. Are there any thematic areas or data you would like to see added to the Web Application Tool?

10. Do you have any additional comments or suggestions for improving the usability of the Web Application Tool, based on your experience with the manual and using the tool?