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Geological data utilization in renewable energy mapping and volcanic region carbon storage feasibility

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Abstract

Geological data plays a crucial role in mapping renewable energy resources and assessing the feasibility of carbon storage in volcanic regions. This review explores the utilization of geological data in these areas, highlighting its significance and implications. Geological data is fundamental in mapping renewable energy resources, such as geothermal and hydroelectric energy. By analyzing geological structures, researchers can identify areas with high potential for these renewable energy sources. This mapping is essential for sustainable energy planning, as it allows policymakers to prioritize regions for renewable energy development based on geological suitability. Additionally, geological data is instrumental in assessing the feasibility of carbon storage in volcanic regions. Volcanic rocks have the potential to store carbon dioxide through mineral carbonation, a process where CO2 reacts with minerals to form stable carbonates. Geological data, including rock composition, porosity, and permeability, is used to evaluate the capacity of volcanic rocks to store carbon dioxide safely and effectively. The utilization of geological data in renewable energy mapping and volcanic region carbon storage feasibility has significant implications for sustainable energy development and climate change mitigation. By mapping renewable energy resources, countries can reduce their dependence on fossil fuels and transition to cleaner, more sustainable energy sources. Furthermore, assessing the feasibility of carbon storage in volcanic regions can help mitigate the impacts of climate change by sequestering CO2 emissions from industrial sources. In conclusion, geological data plays a crucial role in mapping renewable energy resources and assessing the feasibility of carbon storage in volcanic regions. By leveraging geological data, policymakers and researchers can make informed decisions about sustainable energy development and climate change mitigation.

Keywords: Geological Data Utilization; Renewable Energy; Mapping; Volcanic Region; Carbon Storage Feasibility

1. Introduction

Geological data plays a crucial role in understanding and harnessing renewable energy sources, offering valuable insights into resource distribution and suitability for development (Du, et. al., 2024, Jahanbakhsh, et. al., 2024). Additionally, in volcanic regions, geological data is instrumental in evaluating the feasibility of carbon storage, a key aspect of mitigating climate change. This paper explores the pivotal role of geological data in mapping renewable energy resources and assessing carbon storage feasibility in volcanic regions, highlighting its importance in sustainable energy planning and environmental conservation (Additionally, in volcanic regions, geological data is instrumental in evaluating the feasibility of carbon storage, a key aspect of mitigating climate change (Abdalqadir, et. al., 2024, Su, et. al., 2023).

Geological data provides essential information about subsurface structures, rock types, and geothermal gradients, enabling the identification and characterization of renewable energy resources (Adeoye, et. al., 2024, Udegbe, et. al., 2024). For instance, in geothermal energy exploration, geological data helps pinpoint areas with high heat flow and permeable rock formations, crucial for the development of geothermal power plants. Similarly, in hydroelectric power

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generation, geological data aids in locating suitable sites for dam construction, based on factors such as topography and soil composition.

Volcanic regions offer unique geological characteristics that make them potential sites for carbon storage (Albertz, Stewart & Goteti, 2023, Addy, et. al., 2024). The porous and permeable nature of volcanic rocks, coupled with their ability to chemically react with injected CO_2, makes them ideal candidates for carbon capture and storage (CCS) projects. Geological data helps assess the storage capacity, containment integrity, and long-term stability of volcanic formations, critical factors in determining the feasibility of CCS projects in these regions. This paper delves into the multifaceted role of geological data in renewable energy mapping and carbon storage feasibility assessment in volcanic regions. By examining the geological underpinnings of these processes, it seeks to elucidate the significance of geological data in shaping sustainable energy strategies and advancing climate change mitigation efforts.

Geological data is an invaluable asset in the quest for sustainable energy solutions and environmental stewardship. In the context of renewable energy mapping, geological data provides critical insights into the Earth's subsurface, helping to identify optimal locations for harnessing energy from natural resources like wind, solar, and geothermal heat (Hassan, et. al., 2024, Udegbe, et. al., 2024). Similarly, in volcanic regions, geological data plays a crucial role in assessing the feasibility of carbon storage, a vital component of efforts to mitigate climate change by capturing and sequestering carbon dioxide emissions. Renewable energy mapping relies on geological data to identify areas with high potential for energy generation (Ajala, et. al., 2024, Penerbit, 2020). For example, understanding the geological structures and formations can help pinpoint locations where wind speeds are consistently high, making them suitable for wind energy projects. Similarly, geological surveys can reveal areas with high solar irradiance, ideal for solar energy installations. These insights not only inform the selection of sites for renewable energy projects but also help optimize their design and operation, contributing to increased efficiency and sustainability. In volcanic regions, geological data provides critical information about the subsurface conditions that influence the feasibility of carbon storage projects (Oyewole, et. al., 2024, Udegbe, et. al., 2024). Volcanic rocks, with their unique properties, offer promising opportunities for storing CO_2 underground. Geological data helps assess the capacity of volcanic formations to safely and effectively store carbon dioxide, considering factors such as porosity, permeability, and sealing integrity. Understanding these geological characteristics is essential for evaluating the viability and long-term stability of carbon storage sites in volcanic regions.

This paper explores the role of geological data in renewable energy mapping and carbon storage feasibility assessments in volcanic regions. By examining how geological data is used to identify renewable energy resources and assess carbon storage potential, it highlights the importance of geological information in driving sustainable energy development and climate change mitigation strategies.

2. Geological Data in Renewable Energy Mapping

Geological data plays a crucial role in mapping renewable energy resources, enabling informed decisions for sustainable energy planning and development (Edwards, et. al., 2022, Oyegoke, et. al., 2020, Raad, Leonenko & Hassanzadeh, 2022). Geological data helps identify regions with high geothermal potential by analyzing factors such as heat flow, subsurface temperatures, and geological structures like fault lines and magma chambers. Mapping these geological features allows for the identification of suitable locations for geothermal power plants, where heat from the Earth's crust can be harnessed to generate electricity or provide direct heating.

Geological data is essential for mapping suitable sites for hydroelectric dams and run-of-the-river projects. Geological surveys assess factors such as river flow patterns, elevation changes, and rock formations to determine the feasibility and capacity of hydropower installations (Kumoro, et. al., 2022, Oyebode, Olowe & Makanjuola, 2023). Understanding the geological characteristics of a region helps optimize the design and operation of hydroelectric facilities, maximizing energy production while minimizing environmental impact. Remote sensing techniques, including satellite imagery and aerial surveys, are used to identify surface features indicative of renewable energy resources (Ajala, et. al., 2024, Udegbe, et. al., 2024). Geological features such as fault lines, volcanic activity, and topographical variations can be detected and analyzed to assess the potential for renewable energy generation. Direct geological surveys involve on-the-ground assessments of rock formations, soil types, and subsurface characteristics. Geologists collect samples and data from various depths to understand the geological composition of an area and its implications for renewable energy development.

Geospatial technologies combine geological data with geographic information systems (GIS) to create detailed maps and models of renewable energy resources. These tools facilitate spatial analysis, allowing planners to identify optimal locations for energy infrastructure based on geological factors (Elbarbary, et. al., 2022, Howari & Ghrefat, 2021). Renewable energy mapping guides sustainable energy planning by providing insights into the distribution and potential of renewable resources. By leveraging geological data, policymakers, energy developers, and planners. Geological mapping helps pinpoint regions with abundant renewable energy resources, enabling targeted investments in infrastructure and technology. By understanding the geological characteristics of an area, planners can design renewable energy projects to maximize resource utilization and efficiency, ensuring optimal energy output (Hoang & Nguyen, 2021, Oyebode, et. al., 2020). Mapping renewable energy resources allows for the identification of environmentally sensitive areas where development should be minimized to preserve biodiversity and ecosystems. Enhance Energy Security: Diversifying energy sources based on geological mapping reduces reliance on fossil fuels and enhances energy security by tapping into locally available renewable resources.

In summary, geological data-driven mapping of renewable energy resources is essential for facilitating sustainable energy planning and advancing the transition towards a low-carbon future. By harnessing the power of geological insights, stakeholders can make informed decisions that optimize resource utilization, minimize environmental impact, and promote long-term energy sustainability (Digitemie & Ekemezie, 2024, Shaikh & Birajdar, 2024). Geological data plays a critical role in renewable energy mapping, offering valuable insights into the potential and feasibility of various renewable energy sources. Here are additional points to consider regarding the significance of geological data in renewable energy mapping:

Geological data helps assess the viability of geothermal energy projects by identifying regions with high geothermal gradients and heat flow. Geological surveys provide information on subsurface rock formations and groundwater circulation patterns, which are crucial for determining the suitability of a site for geothermal development (Ajala, et. al., 2024,. Udegbe, et. al., 2024). While solar energy primarily relies on climatic factors such as sunlight availability, geological data can complement solar energy mapping efforts. Geological features like terrain elevation, slope, and aspect influence solar radiation levels, affecting the efficiency and feasibility of solar power installations. Geological data aids in identifying optimal locations for wind energy projects by considering factors such as topography, surface roughness, and wind patterns. Geospatial analysis helps create wind resource maps, guiding the development of wind farms in areas with high wind energy potential (Oyebode, et. al., 2022, Roga, et. al., 2024). Geological data contributes to assessing the suitability of regions for biomass energy production and hydropower generation. Knowledge of soil types, land cover, and hydrological characteristics helps identify areas where biomass crops can thrive and where hydropower plants can be effectively integrated into river systems.

Geological data, when integrated with other spatial data sets such as land use, infrastructure, and environmental data, supports comprehensive energy planning. This holistic approach considers geological factors alongside socio-economic and environmental considerations, leading to more sustainable energy development strategies (Coruhlu, et. al., 2022, Oyebode, et. al., 2015). Geological data assists in assessing geological risks associated with renewable energy projects, such as landslides, seismic activity, and soil erosion. Understanding these risks allows developers to implement mitigation measures and ensure the long-term stability and safety of renewable energy infrastructure. Geological data sharing among stakeholders, including government agencies, research institutions, and private companies, promotes collaboration and informed decision-making (Aremu, Olodo & Olaitan, 2020, Olowe, 2018). Open-access geological databases and platforms facilitate data sharing and contribute to more efficient renewable energy mapping and planning processes. In conclusion, geological data is essential for mapping renewable energy resources and supporting sustainable energy planning and development. By leveraging geological insights, policymakers and energy developers can make informed decisions that optimize resource utilization, minimize environmental impact, and advance the transition to a renewable energy future (Biu, et. al., 2024, Obaigbena, et. al., 2024, Onu, Pradhan & Mbohwa, 2023, Onwuka & Adu, 2024).

3. Geological Data in Carbon Storage Feasibility Assessment

Geological data plays a crucial role in assessing the feasibility of carbon storage in volcanic regions, which offer unique geological characteristics favorable for carbon sequestration (Ofodile, et. al., 2024, Raza, et. al., 2022). Here's an exploration of the role of geological data in assessing carbon storage feasibility in volcanic regions: Volcanic regions are characterized by the presence of volcanic rocks such as basalt, which have high levels of calcium, magnesium, and iron. These rocks have the ability to chemically react with CO_2 through a process called mineral carbonation, converting the gas into stable carbonate minerals. The permeability and porosity of volcanic rocks also play a significant role in determining their suitability for carbon storage.

Geological data is instrumental in assessing the carbon storage capacity of volcanic rocks. Data on rock composition, mineralogy, porosity, and permeability are essential for estimating the volume of CO_2 that can be safely stored (Hu, et. al., 2023, Owoola, Adebayo & Olowe, 2019). Geophysical surveys, such as seismic imaging and gravity surveys, provide information on subsurface rock structures and help identify suitable storage sites. Geochemical analyses of rock samples help determine the reactivity of volcanic rocks with CO_2, influencing the effectiveness of carbon storage. Carbon storage feasibility assessment in volcanic regions is crucial for climate change mitigation (Ajala, et. al., 2024, Ochuba, et. al., 2024). Volcanic rocks have the potential to sequester large quantities of CO_2 over long periods, providing a sustainable solution for reducing greenhouse gas emissions. By assessing the feasibility of carbon storage in volcanic regions, policymakers and researchers can identify suitable sites for carbon capture and storage (CCS) projects, contributing to global efforts to mitigate climate change.

The utilization of geological data in carbon storage feasibility assessments is essential for ensuring the safe and effective implementation of CCS projects in volcanic regions (Odejide & Edunjobi, 2024, Odeyemi, et. al., 2024). By leveraging geological insights, researchers and policymakers can identify optimal storage sites, estimate storage capacities, and assess the long-term stability of stored CO_2. This information is critical for advancing CCS technologies and accelerating the transition to a low-carbon future. Geological data serves as the cornerstone of assessing carbon storage feasibility in volcanic regions, offering valuable insights into the suitability and capacity of these geological formations for effective carbon sequestration. Expanding on the role of geological data in carbon storage feasibility assessment:

Detailed geological mapping provides essential information about the distribution, composition, and structure of volcanic rocks within a region. By analyzing geological maps, researchers can identify potential storage sites and assess the spatial extent of suitable geological formations for carbon storage (Ajala, 2024, Oyebode, Adebayo & Olowe, 2015). This data helps prioritize areas with favorable geological conditions, optimizing the selection of storage sites. Geophysical techniques, such as seismic surveys and well logging, enable the characterization of subsurface rock properties crucial for carbon storage. Seismic imaging allows researchers to visualize subsurface structures and identify potential reservoirs for CO_2 injection. Well logging provides detailed information about rock porosity, permeability, and fluid saturation, aiding in the assessment of storage capacity and CO_2 migration pathways.

Geochemical analysis of volcanic rocks helps determine their reactivity and capacity for mineral carbonation, a process that converts CO_2 into stable carbonate minerals. By analyzing rock samples, researchers can assess the mineral composition and abundance of reactive minerals such as olivine and plagioclase. This data guides the selection of suitable rocks for carbon storage and predicts the rate of CO_2 mineralization, influencing the overall effectiveness of carbon sequestration. Understanding the hydrogeological conditions of volcanic regions is essential for evaluating the potential risks associated with CO_2 injection and storage (Fagorite, et. al., 2022, Rasool, Ahmad & Ayoub, 2023, Zheng, et. al., 2021). Geological data informs hydrogeological studies, enabling researchers to assess groundwater flow patterns, aquifer properties, and potential groundwater contamination risks. This information is critical for designing safe injection strategies and implementing monitoring protocols to ensure the long-term integrity of carbon storage reservoirs (Edunjobi, 2024, Raji, et. al., 2024). By leveraging geological data and employing multidisciplinary approaches, researchers can conduct comprehensive assessments of carbon storage feasibility in volcanic regions. These assessments inform decision-making processes, guide the development of carbon storage projects, and contribute to the advancement of sustainable energy solutions aimed at mitigating climate change.

4. Implications of Geological Data Utilization

Geological data utilization has profound implications for sustainable energy development, climate change mitigation, and informed decision-making in energy and environmental policy (Farayola, et. al., 2023, Ochuba, et. al., 2024). Geological data plays a crucial role in identifying and assessing renewable energy resources, such as geothermal and hydroelectric energy, contributing to the development of sustainable energy sources (Ajala & Balogun, 2024, Olowe, 2018). By mapping geological formations and understanding subsurface characteristics, researchers can locate optimal sites for renewable energy projects, ensuring efficient resource utilization and reducing reliance on fossil fuels. This, in turn, promotes the growth of the renewable energy sector and supports the transition to a more sustainable energy mix.

Geological data is essential for assessing the feasibility of carbon capture and storage (CCS) technologies, which play a key role in mitigating climate change (Aremu, Aremu, & Olodo, 2015, Roy, Mohanty & Misra, 2023). By identifying suitable geological formations for CO_2 storage, researchers can estimate the potential carbon sequestration capacity and evaluate the effectiveness of CCS projects in reducing greenhouse gas emissions. Geological data also informs the selection of sites for reforestation and afforestation projects, which help sequester carbon from the atmosphere and mitigate the impacts of climate change. Geological data provides policymakers with valuable insights for making informed decisions related to energy and environmental policy (Aremu, et. al., 2015, Raji, et. al., 2024). By understanding the geological characteristics of a region, policymakers can develop policies that support the sustainable development of energy resources, while minimizing environmental impact. Geological data also helps policymakers assess the risks and benefits of different energy sources, guiding the formulation of policies that promote energy security, environmental sustainability, and economic growth. The utilization of geological data has far-reaching implications for sustainable energy development, climate change mitigation, and informed decision-making in energy and environmental policy (Olodo, et. al., 2017, Olatunde, Adelani & Sikhakhane, 2024). By harnessing the power of geological data, stakeholders can advance the transition to a more sustainable energy future and address the challenges posed by climate change.

Utilizing geological data for renewable energy mapping and volcanic region carbon storage feasibility holds significant implications across various domains, extending beyond just energy and environmental sectors (Arinze, et. al., 2024, Olowe & Adebayo, 2015). The strategic use of geological data in renewable energy mapping allows for the identification of cost-effective sites for energy infrastructure development. By pinpointing areas rich in renewable resources like geothermal or hydroelectric potential, nations can invest in projects that yield high returns on investment while reducing reliance on expensive fossil fuels (Hassan, et. al., 2024, Olodo, et. al., 2020). Similarly, assessing carbon storage feasibility in volcanic regions enables the exploration of new revenue streams through carbon capture and storage initiatives, potentially fostering economic growth and job creation in affected regions. The application of geological data in renewable energy mapping and carbon storage feasibility drives technological innovation (Ayanda, et. al., 2018, Ololade, 2024). Researchers and engineers leverage advanced geological modeling techniques and data analytics to optimize energy resource exploration and extraction processes. Additionally, advancements in carbon storage technologies, informed by geological data, contribute to the development of more efficient and reliable methods for mitigating greenhouse gas emissions, driving progress towards global climate goals.

Effective utilization of geological data in renewable energy and carbon storage initiatives can lead to positive social and environmental outcomes (Hassan, et. al., 2024, Olorunsogo, Jacks & Ajala, 2024). Increased deployment of renewable energy infrastructure reduces air pollution and dependence on fossil fuels, thereby improving public health and quality of life in communities. Furthermore, carbon storage feasibility assessments help mitigate the impacts of climate change by sequestering CO2 emissions underground, safeguarding ecosystems and biodiversity in vulnerable regions. The sharing and exchange of geological data for renewable energy mapping and carbon storage feasibility transcend national boundaries, fostering international cooperation and diplomacy (Igah, et. al., 2023, Olowe & Kumarasamy, 2021). Collaborative efforts among countries to address common energy and environmental challenges through data-driven initiatives promote goodwill and strengthen diplomatic relations. Moreover, joint research endeavors and knowledge-sharing initiatives enable nations to collectively tackle global issues like climate change, enhancing global resilience and sustainability (Jacks, et. al., 2024, Raji, et. al., 2024). In essence, the implications of geological data utilization in renewable energy mapping and volcanic region carbon storage feasibility extend across economic, technological, social, environmental, and diplomatic realms, shaping policies, driving innovation, and fostering cooperation towards a more sustainable future.

5. Challenges and Future Directions

One of the primary challenges is the availability and quality of geological data. In some regions, data may be scarce or outdated, making it difficult to conduct accurate assessments for renewable energy mapping and carbon storage feasibility (Ikumapayi, et. al., 2022, Lottu, et. al., 2024s). Geological data often comes from diverse sources and formats, posing challenges in integrating and interoperating different datasets. Ensuring compatibility and consistency across various geological datasets is essential for reliable analysis and decision-making.

Assessing the uncertainty associated with geological data and its impact on renewable energy projects and carbon storage feasibility is another challenge. Uncertainties in geological conditions, such as subsurface heterogeneity or seismic activity, can affect project planning and implementation (Nageri, et. al., 2013, Olowe & Kumarasamy, 2017). Current geological data collection and analysis techniques may have limitations in terms of resolution, accuracy, and efficiency. Overcoming these technological limitations is crucial for enhancing the reliability and applicability of geological data in renewable energy mapping and carbon storage assessments. Continued advancements in remote sensing technologies, such as LiDAR (Light Detection and Ranging) and satellite imagery, offer opportunities for collecting high-resolution geological data over large areas (Ololade, 2024, Sharma, Gupta & Pandey, 2021). These technologies enable more comprehensive and cost-effective data acquisition for renewable energy mapping and carbon storage assessments.

Leveraging big data analytics and machine learning algorithms can enhance the analysis of geological data for renewable energy mapping and carbon storage feasibility (Ochuba, et. al., 2024, Raji, et. al., 2024). These techniques enable automated processing, pattern recognition, and predictive modeling, facilitating more accurate and efficient decision-making. Developing integrated geospatial modeling platforms that combine geological, geophysical, and environmental datasets can improve the integration and visualization of geological data. These platforms provide decision-makers with comprehensive tools for assessing renewable energy potential and carbon storage feasibility.

Future trends may involve the adoption of multi-criteria decision analysis frameworks that incorporate geological, environmental, economic, and social factors into decision-making processes (Francis & Thomas, 2023, Ogundipe, Odejide & Edunjobi, 2024). These holistic approaches ensure more sustainable and socially equitable renewable energy development and carbon storage initiatives. With increasing concerns about climate change impacts, future directions may focus on integrating geological data into climate resilience and adaptation strategies. This includes identifying renewable energy resources and carbon storage opportunities that contribute to climate mitigation and adaptation efforts.

Future directions may emphasize international collaboration and data sharing initiatives to address global energy and environmental challenges. By sharing geological data and expertise across borders, countries can collectively advance renewable energy deployment and carbon storage solutions on a global scale (Okafor, et. al. 2024, Olowe, Oyebode & Dada, 2015). Addressing the challenges and exploring future directions in the utilization of geological data for renewable energy mapping and carbon storage feasibility is essential for advancing sustainable energy development and mitigating climate change impacts. Through technological innovation, integrated decision-making frameworks, and international collaboration, geological data can play a pivotal role in shaping the future of renewable energy and carbon storage initiatives.

Challenges in utilizing geological data for renewable energy mapping and volcanic region carbon storage feasibility are multifaceted. Firstly, the complexity of geological structures and processes in volcanic regions can pose challenges in accurately characterizing subsurface conditions (Raji, et. al., 2024, Olowe, Wasiu & Adebayo, 2019). Volcanic terrains often exhibit high variability in geological features, such as rock types, fractures, and fault lines, which can influence the suitability of sites for renewable energy projects or carbon storage.

Secondly, the availability and accessibility of geological data in volcanic regions may be limited. Volcanic areas are often remote or environmentally sensitive, making data collection challenging and costly. Moreover, existing geological data may be fragmented or outdated, requiring extensive efforts to compile and interpret (Ochuba, et. al., 2024, Okoro, et. al., 2023). Thirdly, the integration of geological data with other datasets, such as climate data or socio-economic factors, is crucial for comprehensive decision-making. However, achieving seamless integration can be hindered by differences in data formats, standards, and scale, requiring advanced data management and analysis techniques.

In terms of future directions, advancements in geoscientific research and technology offer promising opportunities for overcoming these challenges (Ochuba, et. al., 2024, Okoye, et. al., 2024). For instance, the development of advanced geophysical imaging techniques, such as 3D seismic surveys or ground-penetrating radar, can enhance the resolution and accuracy of subsurface imaging in volcanic regions. These technologies enable more detailed mapping of geological structures and properties, aiding in the identification of suitable sites for renewable energy projects or carbon storage.

Additionally, the integration of geological data with other geospatial datasets, such as land use, biodiversity, or cultural heritage, can provide a more holistic understanding of the environmental and societal impacts of renewable energy projects or carbon storage initiatives (Oladeinde, et. al., 2023, Shoetan, et. al., 2024). This integrated approach can help in designing more sustainable and socially responsible projects, aligning with global efforts towards climate change mitigation and sustainable development.

Furthermore, future directions may involve the development of advanced modeling and simulation tools for assessing the feasibility and impacts of renewable energy projects or carbon storage in volcanic regions. These tools can enable stakeholders to evaluate different scenarios and optimize project designs, considering geological, environmental, and socio-economic factors (Ochuba, et. al., 2024, Olatunde, Adelani & Sikhakhane, 2024). Addressing the challenges and embracing future directions in the utilization of geological data in renewable energy mapping and volcanic region carbon storage feasibility is essential for promoting sustainable energy development and environmental conservation in volcanic regions (Jacks, et. al., 2024, Oladeinde, et. al., 2023). Through continued research, technological innovation, and interdisciplinary collaboration, the potential of geological data to inform decision-making and mitigate climate change impacts can be maximized.

6. Conclusion

In conclusion, geological data plays a crucial role in renewable energy mapping and carbon storage feasibility assessment, particularly in volcanic regions. The utilization of geological data helps identify suitable locations for renewable energy projects, such as geothermal or hydroelectric plants, and assess the feasibility of carbon storage in volcanic rocks. This data provides valuable insights into subsurface conditions, such as rock types, fractures, and fault lines, which are essential for making informed decisions regarding energy development and environmental conservation.

It is imperative to emphasize the importance of continued research and utilization of geological data for sustainable energy development and climate change mitigation. By leveraging advanced geoscientific research and technology, stakeholders can overcome challenges related to data availability, accessibility, and integration, enabling more accurate and comprehensive assessments of renewable energy potential and carbon storage feasibility in volcanic regions.

A call to action is needed to encourage interdisciplinary collaboration among geoscientists, policymakers, and industry stakeholders to maximize the benefits of geological data in renewable energy mapping and carbon storage feasibility assessment. Through continued research, innovation, and knowledge sharing, we can unlock the full potential of volcanic regions for sustainable energy development while mitigating the impacts of climate change.

In conclusion, the utilization of geological data is essential for achieving our goals of sustainable energy development and ecological balancing in volcanic regions. By recognizing the importance of geological data and taking proactive steps to enhance its utilization, we can pave the way for a more sustainable and environmentally responsible future.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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