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Analysis Geography of Energy with the SOAR Method to Realise Sustainable Development Goals (SDGs)

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ABSTRACT

Geography of Energy is the science of combining or collaborating two major scientific fields, namely geography and energy. The science of Geography of Energy emerged in the 19th century precisely in 1961, when geographers answered problems in the field of energy to encourage the fulfilment of energy needs, spatial distribution, supply patterns, and areas of energy production. The temporal spatial analysis of energy production, distribution, and use is referenced extensively in many studies around the world. This study examines: 1) description of the perspective of the field of Geography of Energy; 2) analysis of the role of Geography of Energy scientists in realising SDGs point 7 with SOAR approach. The method used in this study is qualitative descriptive with SOAR approach. The conclusion of the study is that Geography of Energy is a science that is closely collaboration between the fields of Geography and Energy Science. Geography of Energy has a closeness between 4 sub fields, namely: (1) physical entities; (2) the main mediator of the environment-humans and/or society; (3) social relations; and (4) Geography of Energy Studies: the domain of GIScientist and cartography in the visualisation (map). Geography of Energy has the potential to be developed because it forms a very clear mindset that is needed when analysing, determining, predicting an energy resource in a region in order to realise the SDGs point 7 clean and affordable energy goals with information technology such as GISEnergy (Web-GIS based on energy data).

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1. INTRODUCTION

Geography of Energy is a science that results from the collaboration and combination of two fields of science, namely geography and Energy Science. According to energy geographer (Pasqualetti, 2004) is the study of energy development with its supporting subsystems, such as transport, markets, or patterns of use and their determinants from a spatial, territorial or resource management perspective. Geography are essential to understanding and addressing the current energy dilemma (Zimmerer, 2011). Systems of energy production, distribution and consumption resources are interwoven across the board as socio-environmental interactions that occur at various scales. Geography of Energy represents a convergence of theoretical-philosophical and engineering concepts born from the core subfields of geography, both in terms of past, current, and future patterns of energy production, distribution, and use at various geographic scales. This includes an emphasis on the material (e.g. biophysical, and technological) as well as immaterial (discursive, and cultural) spatial dimensions of imperatives (academic) and policies (applied) (Calvert et al., 2013).

For at least the past three decades, while geography of energy has existed as a subfield within geographic science, interest in energy issues is cyclical, surging as more and more energy crises, the study of energy development, transportation, market or usage patterns and their determining factors from a spatial, regional or resource management perspective (Solomon and Pasqualetti, 2004; Solomon et al, 2004). Calvert K., Pearce J and Mabee W.E. (2016) also said that geography of energy is a piercing spill of four sub-disciplines of geography. However, with energy taking center stage in regional, national, and international policy and public debate, scholarship in geography of energy has experienced a resurgence since the mid-2000s (Huber M, 2009).

The issues of Geography of Energy are central and important. Because it combines two components that are the pillars of the development of a region. The United Nations formulated its thinking by raising 17 issues in their entirety on the agenda called The Sustainable Development Goals (DGs). SDGs is an agenda approved by the United Nations in 2015, as a form of sustainability of the Millennium Development Goals (MDGs). Seventeen (17) issues on the SDGs Agenda include: 1) goal 1: No Poverty; 2) goal 2: Zero hunger; 3) goal 3: healthy and prosperous life (good health and well-being); 4) goal 4: Quality education (Good education); 5) goal 5: Gender Equality; 6) goal 6: clean water and sanitation (good water and sanitation); 7) goal 7: clean and affordable energy; 8) goal 8: Decent Work and economic growth; 9) goal 9: Industry, Innovation, and infrastructure); 10) goal 10: Reduced inequalities; 11) goal 11: Sustainable cities and communities; 12) goal 12: Responsible consumption and production; 13) goal 13: climate action; 14) goal 14: marine ecosystems (life below water); 15) goal 15: terrestrial ecosystems (life on land); 16) goal 16: peace, good justice, and strong institutions); and 17) goal 17: partnerships for the goals (UNDP, 2015).

The SDGs consist of various development pillars, not only economic and social pillars but also environmental pillars (Astari et al., 2021). SDGs agenda point 7 raises issues with the goal of clean and affordable energy (affordable and clean energy). From Goals SDGs point 7, it is necessary to realise an effort and action to ensure access to affordable, reliable, sustainable energy and modern for all. This is the background of this study, how the role of Geography of Energy scientists in answering regional problems to realise the SDGs and what and where the urgency of Geography of Energy scientists can be implemented as a form of SDGs agenda succession.

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2. RESEARCH METHOD

This study uses descriptive analysis research methods, to explain and analysis each research objective. Descriptive research was conducted using the approach of geography-energy science, namely the relationship of ecological, regional, and spatial with a combination of Energy Science in the form of sources, processes, and outputs of energy itself. The analysis of this study using the SOAR method (Strengths, Opportunities, Aspiration, Results). The objectives of this study are 1) Describe the perspective of the field of Geography of Energy Science; 2) Analyse the role of Geography of Energy Science in realising SDGs point 7 with SOAR approach. The analysis steps in this study are illustrated in **Figure 1**.

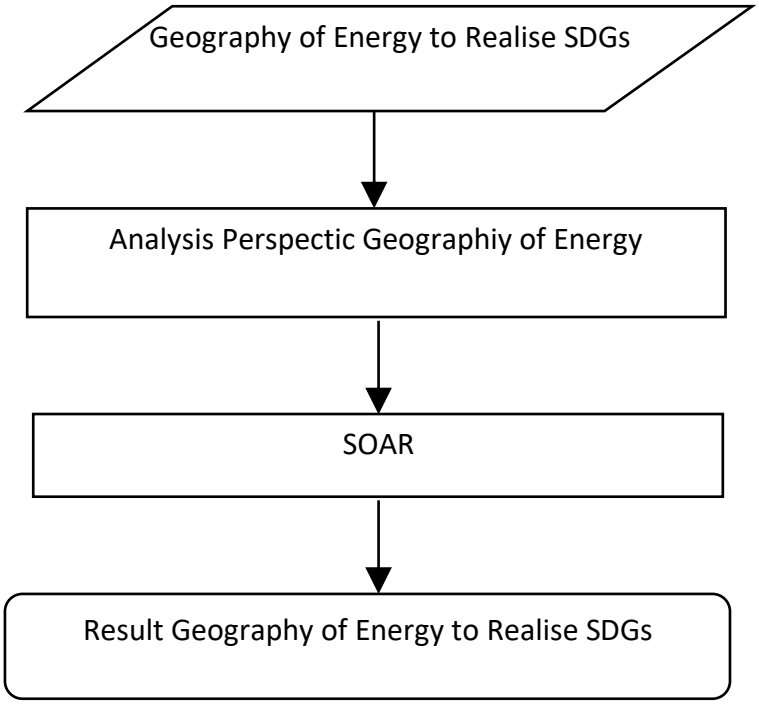

Figure 1. Frame of mind Analysis Geography of Energy

3. RESULTS AND DISCUSSION

Perspective Description Geography of Energy

Geography is a very complex science with a very wide range of material objects (Arild Holt-Jensen, 2003). Geography can be grouped into the social sciences or natural sciences depending on what kind of 'geography' (Saptorini et al., 2021). Suharsono and Budi (in Aksa et al., 2019) stated that sometimes the geographer (especially in Indonesia) stuck on the science of auxiliary geography and often intersects with other clumps of science. Many scientific collaborations related to geography have emerged, such as social geography (collaboration of geography with social science), urban geography (collaboration of geography with urban science) and so on. The authors of this study, want to dissect the collaboration of geography and other sciences, namely energy.

Energy is known to be an important component in human life on earth (Owens, 1986). Energy is obtained from various natural processes and can be transformed from man-made with the help of technology and information (Cook E.F., 1976; Lumbangaol, P. H., 2017). Advances in science and technology have had a major impact on the fields of human life,

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including energy innovation (Akbar et al., 2022). Energy is divided into two (2) namely renewable energy, and non-renewable energy. Renewable energy is a natural product that exists in this world, such as the sun, waves, wind, water and others. While non-renewable energy, such as petroleum, natural gas, coal, and nuclear energy (Tarigan, E, 2014; Thamrin et al., 2018; Iriwati et al., 2021).

It was in the 1960s when growth in energy demand was first recognized among characteristics of geographical spatial distribution and patterns of energy supply, production, and demand everywhere (John D. Chapman, 1961). It was not until 1961 that a discussion arose about the role of geographers in the field of energy and answers to general geographical questions such as patterns and spatial understanding of energy production, distribution and needs came to the foreground. The temporal spatial analysis of energy production, distribution, and use is referenced extensively in many studies around the world (Luten, 1971; Manners, 1971).

Geography teaches that there is a limit in every science or limitation in the science of geography, depending on how we treat science on this earth. Emissions, temperatures, and climate disasters are just the first consequences of what we are experiencing today and the culprits for our future. The relationship between the environment and society is one of the fundamental areas of Geography of Energy. Geography should be a framework for explaining many aspects of energy characteristics. Some of these characteristics can be characterized as follows (Karanikolas, N, Vagiona, D, 2016):

a. Spatio-temporal characteristics of energy production, chains, and use. This condition is carried out using many and different scales, ranging from international to regional scales;
b. Geographical imagination of the spatial identity of energy;
c. Geography of the past to future energy behavior and patterns;
d. Interaction between energy producers and energy users; and
e. Current and Future Energy World Political Geography.

It can be concluded that Geography of Energy is a science that is closely interrelated with the fields of geography and energy science. Geography of energy when studied in more depth is a science that has a closeness between 4 sub-fields, namely:

1. Physical entities: those from the origin of natural processes transformed through physical systems (geography of physical processes);
2. The main Mediator of the relationship of the environment with humans and/or society is the existence of synergy between subfields;
3. Social relations - with physical entities, with social considerations as energy resources through the process of political-economic-cultural policies that become the main agent in the spatialization of social activities; and
4. The Domain of Geography-Energy Studies develops the domain of GIScientist and cartography in the presentation of its visualization (maps).

In scientific studies, the position of Geography of Energy can be described in the body of Knowledge diagram as listed in **Figure 2**.

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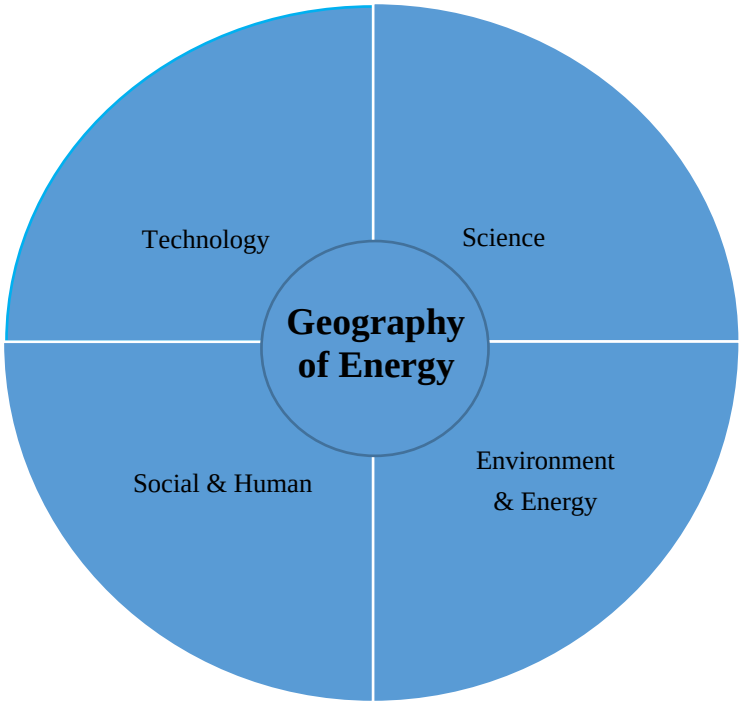

Figure 2. Body of Knowledge Geography of Energy

The geography of energy intersects with a variety of supporting sciences and collaborative components within them. Geography of Energy is a science related to other sciences, such as science (science), environment (Environment) & energy (Energy), technology (engineering), and social (Social) & human (human). Geography of Energy as a science can greatly collaborate with other sciences, especially with Geographic Information Systems (GIS) and Remote Sensing (remote sensing). This Geography of Energy is a scientific study focusing on natural energies (new renewable energy on earth) that can be developed further such as water energy, wind, air, soil, rocks, oil, waves, sun (solar), and others.

Geography of energy has a derivative science under which is a detailed section (scope) that is detailed and detailed again, if we think and study in depth again, such as geography-oil and gas, geography-electricity, and so on. The details are taken from the analysis of the origin of the energy process (source energy), the process of forming energy (processed energy), and the systematics (physics) of the formation of energy (energy system) that exists on Earth (geo).

Geography of Energy's SOAR Approach to Realising the SDGs

SOAR analysis is an approach that consists of Strengths, Opportunities, Aspirations, and Results. This analysis is an innovative and power-based approach to strategic thinking and planning (Stavros & Cole, 2013). Aspirations and results analysis the external environment, while strengths and opportunities analysis the environment internal of a problem.

Geography of Energy as a separate science to realise the SDGs has the potential to be developed because it forms a comprehensible mindset that is needed when analysing, determining, and predicting an energy resource in a region at any time. Comprehensive and sustainable analysis researchers present in the following **Table 1**.

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Table 1. Matric SOAR Science Geography of Energy to Realise SDGs

S - O / A - R	**Strength**	**Opportunities**
	1. Has 3 special approaches in energy analysis (spatial approach, environmental approach and complex approach); 2. Have technology tools that are characteristic and specific geography, namely GIS and Remote Sensing; 3. Analysis with a comprehensive, detailed, detailed, and actual geography approach related to energy potential, location - area distribution of energy, and energy predictions in the future; 4. Can display beautiful and attractive visualisation; and 5. An unique and highly expandable perspective.	1. Mastery of Technology of Information (IT) and supporting applications that can be improved; 2. Human Resources (HR) which continues to increase and develop with technology and Information Literacy; 3. Accelerating the development of Geography of Energy in realising energy-friendly; 4. Access control and information analysis; and 5. Have ideas, perspectives of thought and a framework of thought patterns that are thorough and very complex
Aspiration 1. Collaboration with other fields of study; and 2. Interest in other areas of studying the field of Geography of Energy is very much	**Strategy S-A** 1. Cooperation with other scientists (multidisciplinary science) to realise SDGs 7th point for clean, integrated, and affordable energy; 2. Developing Geography of Energy curriculum at diploma, bachelor level to support the acceleration of SDGs success; 3. Encourage the existence of the geography profession program (Geograph) as a strengthening of Geography Science in the field of energy;	**Strategy O-A** 1. Optimization of Human Resources (HR) by specifically multiplying Energy geographers; 2. Facilitate and promote scientific forums and energy experts for discussion, collaboration of ideas to develop clean, integrated, affordable and Sustainable Energy; and 3. Support and increase workshops and training before graduating geography students, as a provision for geography graduates.
Result 1. Can create a sustainable science; 2. The creation of Energy Information Technology to realise clean, integrated, and affordable energy in accessibility, availability, and low price; 3. Innovation and creativity of Geography Science in the utilisation and study of energy that is able to adapt to the environment in order to realise the SDGs; and 4. The creation of an Energy Information System to support the 7th SDGs.	**Strategy S-R** 1. Creating a geography tool for mapping new and renewable energy; 2. Manage energy Geodatabase with complete and comprehensive information system; and 3. Creating GISEnergy (Web-based GIS Energy data)	**Strategy O-R** 1. The existence of Professional Certification cooperation in the field of Geography of Energy; and 2. Increase the accessibility of information, disseminate information (socialisation) in order to create mastery of access and information to increase innovation and creativity of Geography scientists.

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Analysis of Table 1. on the SOAR matrix shows the following results:

a. Aspect of Strengths:

The Strength aspect describes the strength that is specifically owned by the component under study, namely the Geography of Energy. Based on the results obtained several strengths are described as follows:

1. Has 3 special approaches in energy analysis (spatial approach, environmental approach and complex approach);
2. Have technology tools that are characteristic and specific geography, namely GIS and remote sensing;
3. Analysis with a comprehensive, detailed, detailed, and actual geography approach related to energy potential, location-area distribution of energy, and energy predictions in the future;
4. Can display attractive visualization; and
5. A unique and highly expandable perspective.

b. Aspect of Opportunities:

The opportunities aspect describes the analysis of what opportunities are currently available, can be developed in the future, and can obtain benefits in the future. Opportunities from the results of the analysis include:

1. Mastery of technology Information and supporting applications that can be improved;
2. Human resources (HR) which continues to increase and develop with Technology and Information Literacy;
3. Accelerating the development of Geography of Energy in realising energy-friendly;
4. Access control and information analysis; and
5. Have ideas, perspectives of thought and a framework of thought patterns that are thorough and very complex.

c. Aspect of Aspiration:

The aspiration aspect describes how aspirations are created from various elements and analysis more deeply by the author to form a synergistic and related mindset. Aspriasi is written as follows:

1. Collaboration with other fields of study; and
2. Interest in other areas of studying the field of geography of energy is very much

d. Aspect of Result:

The resulting aspect explains that the result of a mindset or an idea that has what goals it wants and will achieve is a form of a picture of strength by looking at opportunities and aspirations regarding Geography of Energy in realising the SDGs. The results of this interpretation and analysis are listed as follows: can create a sustainable science;

1. The creation of energy information technology to realise clean, integrated, and affordable energy in accessibility, availability, and low price;
2. Innovation and creativity of geography science in the utilization and study of energy that can adapt to the environment to realise the SDGs; and
3. The creation of an energy information system to support the 7th SDGs.

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Geography of Energy Strategy in Realising Sustainable Development Goals (SDGs)

Strategy of S-A

The strategy of S-A which is a strategy Strength-Aspiration of the results of analysis and interpretation of the author, the following are the results:

1. Cooperating with other scientists (multidisciplinary science) to realise SDGs 7th point for clean, integrated, and affordable energy;
2. Developing Geography of Energy curriculum at diploma and bachelor level to support the acceleration of SDGs success;
3. Encouraging the existence of the geography profession program (Geograph) as a strengthening of Geography Science in the field of energy;

Strategy of O-A

Strategy of O-A which is an Opportunity-Aspiration strategy from the results of the analysis and interpretation of the author, the following are the results:

1. Optimization of Human Resources (HR) by specifically multiplying energy geographers;
2. Facilitate and promote scientific forums and energy experts for discussion, and collaboration of ideas to develop clean, integrated, affordable and sustainable energy; and
3. Support and increase workshops and training before graduating geography students, as a provision for geography graduates.

Strategy of S-R

Strategy of S-R which is a strategy Strength-Result of the results of the analysis and interpretation of the author, the following are the results:

1. Creating a geography tool for mapping new and renewable energy;
2. Manage energy geodatabase with a complete and comprehensive information system; and
3. Creating GIS energy (web-based GISEnergy).

Strategy of O-R

The strategy of O-R which is a strategy Opportunities-Result of the results of analysis and interpretation of the author, the following are the results:

1. The existence of Professional Certification cooperation in the field of Geography of Energy; and
2. Increase the accessibility of information, disseminate information (socialization) to create mastery of access and information to increase innovation and creativity of Geography scientists

4. CONCLUSIONS

This research concludes that Geography of Energy is a science that is closely interrelated with the fields of geography science and energy Science. Geography of Energy, when studied in more depth, is a science that has a close relationship between 4 sub-fields, namely: (1) physical entities: originating from the origin of natural processes that are transformed through physical systems (physical process geography); (2) the main Mediator of environmental relations with humans and/or society which is the existence of synergy between sub fields; (3) social relations – with physical entities, with social consideration as energy resources through the process of political-economic-biodata policies that become the main agent in the spatialization of social activities; and (4) The Domain of Geography of Energy

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Studies develop the domain of GIScientist and cartography in the presentation of its visualization (map).

Geography of Energy as a separate science to realise the SDGs has the potential to be developed because it forms a very clear mindset that is needed when analysing, determining, and predicting an energy resource in a region at this time and in the future. Geography of Energy is a sub-field that is the basis for realising the SDGs 7th point of clean and affordable energy goals (affordable and clean energy), can be relied in the era of information technology by making a kind of GISEnergy (Web-GIS based on energy data) for the development of Geography Science.

5. RECOMMENDATIONS

This research still needs to be developed in more depth. This research can be used as the basis of Geography of Energy science which has the potential to be further detailed. The author receives input, suggestions, and cooperation for the development of this research.

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