

A Comparison of the SAARC Renewable Energy Policies: Analytical Approach

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Abstract

The emerging global trend towards renewables and the prevailing slowdown of economic activity demands new policy based on emerging international standards and obligations. The objective of this study is to assess where the Alternative and Renewable Energy Policy 2019 stands in comparison to SAARC countries in the alternative and renewable energy sector by using text mining tools. By the use of text mining tools, lexical dispersion and word cloud in this study, we compare the renewable energy policies of SAARC region. Every policy has some bright and some grey areas which are discussed in the analysis chapter of this study. The study recommends that there is need of time to exchange the new renewable technologies based on innovative experience and designing of mechanism to enhance the local entrepreneurs among SAARC countries.

Keywords: SAARC, Renewable Energy Policies, Renewable Technology, Pakistan

1. Introduction

The global renewable energy policy developed by the international renewable energy agency, (IRENA) is a network of renewable energy policies agenda that has been adopted by many states as renewable energy portfolio standards (RPS). The policy framework of global renewable energy has ambitious targets in areas of power, transport, heating, and cooling. To unlock the potential of renewable energy and to gain the diverse benefits from renewable energy resources, the policy framework mainly focuses on reliable and resilient energy, job creation through green growth and reduced pollution as international climate goals. The SDG's Goal-7 ensures access to affordable and consistent energy services and advocates increase in renewable energy share in the global energy mix by 2030. This opens a new sphere of opportunities and challenges to the world nations. The countries on the globe are in modification and streamlining phase of power systems to congregate the developments and decarbonization in a better way. Technological advancements, business models, social needs, and environmental obligations are the catalysts in adaption of renewables in the energy system. The accelerated drift of warming planet, through storms, ice melts, drought, hunger, and migration, is compelling for the need to end the age of fossils rapidly. A new term "energy democracy" has been coined as advocates of renewable energy suggest (Burke & Stephens, 2018). Global investment trend in clean and hybrid energy sources is to make better environment. Global energy consumption is being projected to elevate to 30% by 2050. An expansion in energy is being practiced in the electrification from renewable energy sources worldwide. The renewables have the tendency of protection against the erratic global energy markets. A report of the International Energy Agency has drawn a numeric sketch of region-wise energy demand. The report explains that key energy-demand in the Asia Pacific region has an estimated rise of above 50 percent till 2050, which is more than half of world production. A new pattern of shift in renewable energy is being practiced by great economic powers across the globe. Mirza (2012) states that an updated Chinese growth diagram marks 350 GW hydro, 180 GW wind, 40GW biomass, and 30 GW solar Photovoltaic until 2020 (Mirza, Ahmed, & Khalil, 2012). European nations have been increasing renewable energy sources in energy mix since the last decade. The rationale behind this shift is that all the renewables are pro-environment, clean, safe, cheap and highly sustainable. Moreover, they are entitled to earn carbon credits under the Clean Development Mechanism. Renewable energy consumption has an advanced influence on economic growth than non-renewables. Indian government managed to establish 20GW of solar power generation in 2020. Brazil is committed to sustain and

increase in present fraction of nation's existing energy up to 50% and power up to 90% from renewable energy sources by 2025. The world has experienced growth in installation technology of wind and solar by 55% and 25% respectively (Ashfaq & Ianakiev, 2018). Countries having stable policy framework are active in renewable energy technologies' deployment to promote local economic value and job creation to enhance local industry. Around the world, there is an ever-growing energy demand for secure future investments. Since the last decade, renewables have seen an incredible evolution as well as the worldwide trend for investment in renewable energy projects has noticeably increased i.e., from 110 billion dollars to 300 billion dollars for last year's according to report of REN21, 2018. With the mature renewable technologies and sharp cost reductions, the nations are adopting new renewable energy targets to attain secure, sustainable, cost effective and eco-friendly energy. China enjoys a lead in wind power with 33.6% of global wind share, having generation capacity of 145,362 MW (IRENA, IEA, & REN21, 2018). A study was conducted by the Global Wind Energy Capacity on comparison of Pakistan and India wind energy power generation potential and found that Pakistan had remarkable wind power potential but no major spark has been exposed on this account. India has 25,088 MW wind generation capacity with 5.8% of global share in wind energy.

2. Literature Review

The renewable technologies of the world have made an established record of cost-effectiveness to distinguish with the usual relic energy.

Energy security is a major challenge in the progress of SAARC region as it is over populated region of world. According to World Bank (2014), SAARC region is the second fastest growing region in the world. But on the aspect of energy facilities and services most of the SAARC nations depend upon the single source of power generation. SAARC region has enormous potential of renewable energy. There are certain bottlenecks like policy, economic, technical, quality data and human resource for competition of renewable energy technologies in SAARC region. SAARC has Inter Government Framework Agreement for regional energy cooperation. It is needed to harmonize legal and regulatory frameworks, develop quality energy database, establish financial roadmap, and improve institutional capacities for SAARC regional energy trade and cooperation agreement.

Table 1 : SAARC Renewable Energy Potential (MW)

Country	Hydro	Wind	Solar
Afghanistan	27,000	200,000	7
Bangladesh	550	0	6
Bhutan	40,000	0	5
India	220,000	150,000	6
Maldives	0	0	5
Nepal	95,000	0	5
Pakistan	65,000	145,000	5.7
Sri Lanka	3,000	29,000	6

Source: IRAD

Table 2: Tabulated Literature Review

(Rahman & Velayutham, 2020)	Estimation approach for SAARC region found significant result of Bangladesh, Nepal, Sri-Lanka, and India on economic growth through efficient use of renewable energy sources.
(Zeb, Salar, Awan, Zaman, & Shahbaz, 2014).	Casual relation shows that the renewable development has effective environmental impacts with the decrease in carbon emission. Thus, there is positive impact in SAARC region by the use of renewable resources in energy production.
(Zeb et al., 2014).	GDP increases and carbon emissions decreases with renewable energy production in SAARC region.
Iftikhar, Najeeb, Mohazzam, & Khan, n.d.)	Framework of setup of regional energy grid to share electricity from common grid.
(Hanif, Aziz, & Chaudhry, 2019).	To accelerate investment trend in renewable technologies for carbon free sustainable economic growth, the green bond market is a valuable tool in SAARC region.

3. Research Methodology

This study was designed to conduct a comparative analysis of South Asian renewable energy policies and Pakistan renewable energy policy in 2019. This was a quantitative research to assess the policy landscape in order to attain the desired targets in the renewable energy sector.

3.1. Text Mining

New research methods and software techniques like R, Python, and Orange are being used in academia, government functions, and companies to tackle economics and finance. Every phase of policy-making process has some formation of verbal and written communication which is presented in electronic form to analyze large textual data through the tools of text mining. Text analytics is applied by using analytical tools of automated algorithms to find out textual data like official documents, annual reports to compare and sum up main concepts and keywords. As the technologies become mature, the accessibility of digital data is in extensive use. Text mining is a process to extract useful, interesting and hidden information from large unstructured and ambiguous textual data. The aim of text mining process is to turn the input from unstructured text into output structured data. The course of text mining includes retrieval and extraction of information, techniques of data mining, visualization and predictive analytics (Kumar & Bhatia, 2013). It was imperative to use text mining in this study to catch up the novel features of policy making process in Pakistan and it introduced fine distinction to policy documents. There was no text analysis available in literature on alternative and renewable energy policies of SAARC countries. This research work study was an effort to fill this literature gap about the comparison of alternative and renewable energy policies of SAARC countries in renewable energy sector. The following alternative and renewable energy policies of SAARC countries were reviewed.

Table 3: SRRAC Renewable Energy Policies

Country	Policy	Year
Afghanistan	Renewable Energy Policy	2015
Bangladesh	Renewable Energy Policy	2008
Bhutan	Alternative Renewable Energy Policy	2013
India	National Wind-Solar Hybrid Policy	2018
Maldives	Energy policy and strategy	2016
Nepal	Renewable Energy Subsidy Policy	2016
Pakistan	Alternative and Renewable Energy Policy	2019
Sri Lanka	National Energy Policy and Strategies	2008

The use of automated algorithms was helpful in reading of substantial manuscript and making synopsis of central themes of text. Text analytics is being used as a common approach for policy analysis internationally. Following are the steps that were performed for text analytics;

- Converted the scanned polices into text files and lower case.
- Analysis was performed after corpus building of all policies.
- Removed all punctuations, stop words, numbers and extra white spaces.
- Stemming; removed the common ending words from English.

3.2. Word Cloud and Limitations

Word cloud was also used for analysis of data. It is a tool of visualization to highlight the frequency of words in a text or in a document. One drawback about using word cloud is that the word cloud never explains the context of the content for different words as they simply demonstrate the stagnant vision of the content. Issues like empty spaces between words, co-occurrence, and node overlapping, can be controlled by using mathematical functions like Wordle, grid-based algorithm and family algorithm. A technique named entropy estimation, introduced by Kamel Aouiche, to control the visibility and measure the disparity of different font styles and sizes in used in word cloud.

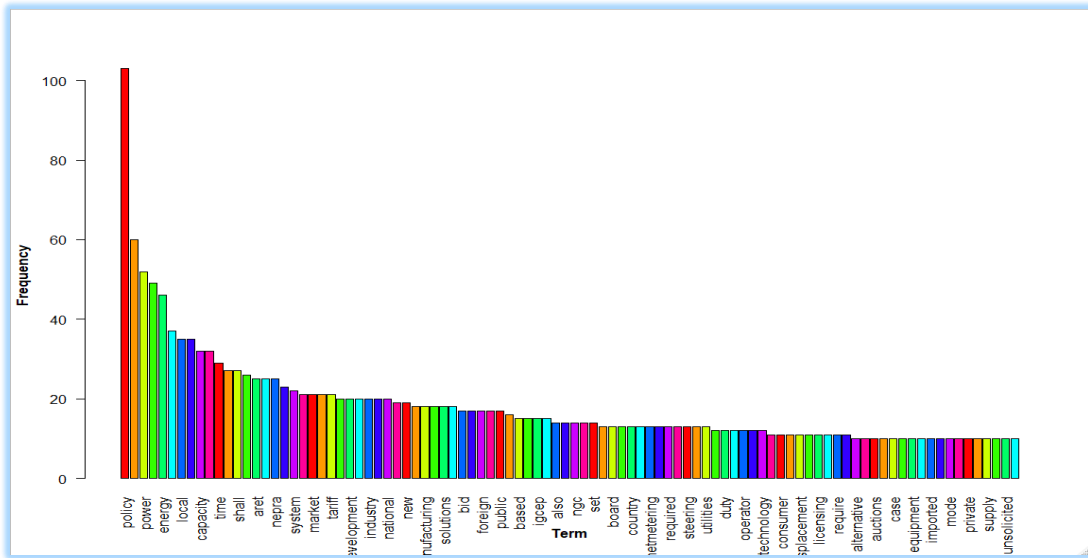
4. Analysis

Empirical Findings of Alternative and Renewable Energy Policy 2019 Pakistan

In raw form, AREP 2019 Pakistan consists of 30 pages, 115 paragraphs, 9281 words and 67069 characters. After detailed text processing which includes removal of punctuations, numbers, white spaces, English stop words, there were 47737 characters left.

Figure 1 illustrates the lexical dispersion of the majority repeated terms in AREP 2019. The graph is showing the common words frequency in the policy document in such a way that each stripe shows the occurrence of a word, while each row represents the entire text. It describes that the word “policy” has more cluster and ‘power’, ‘energy’, ‘capacity’, have been used maximum time.

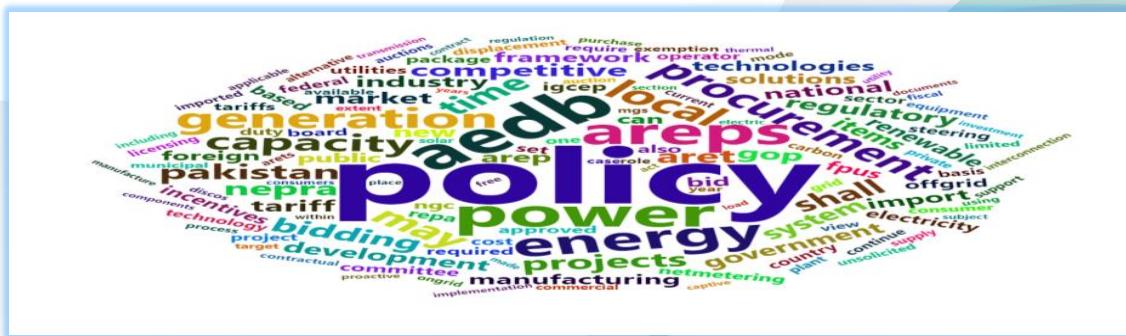
Figure 1: Word Frequency plot of AREP 2019 Pakistan



Source: Author's own compilation

Figure 2 shows the word cloud with different colors and font size shows more frequent terms and words in the document. It illustrates that Pakistan has comprehensive and diverse agenda on alternate and renewable energy technologies. The document of AREP 2019 gives more focus on power generation projects and off grid solutions by the use of renewable energy technologies as policy options. The AEDB has been given the task to mobilize the local renewable energy market and increase the capacity of local manufactures within institutional framework. The policy advised NEPRA to determine tariff on incentive basis and introduce auctions and procurement processes through competitive bidding as major policy intervention. Nevertheless, Pakistan AREP 2019 has covered the policy and institutional frames but it is weak in laying down implementation strategy.

Figure 2: Word Cloud of AREP 2019 Pakistan

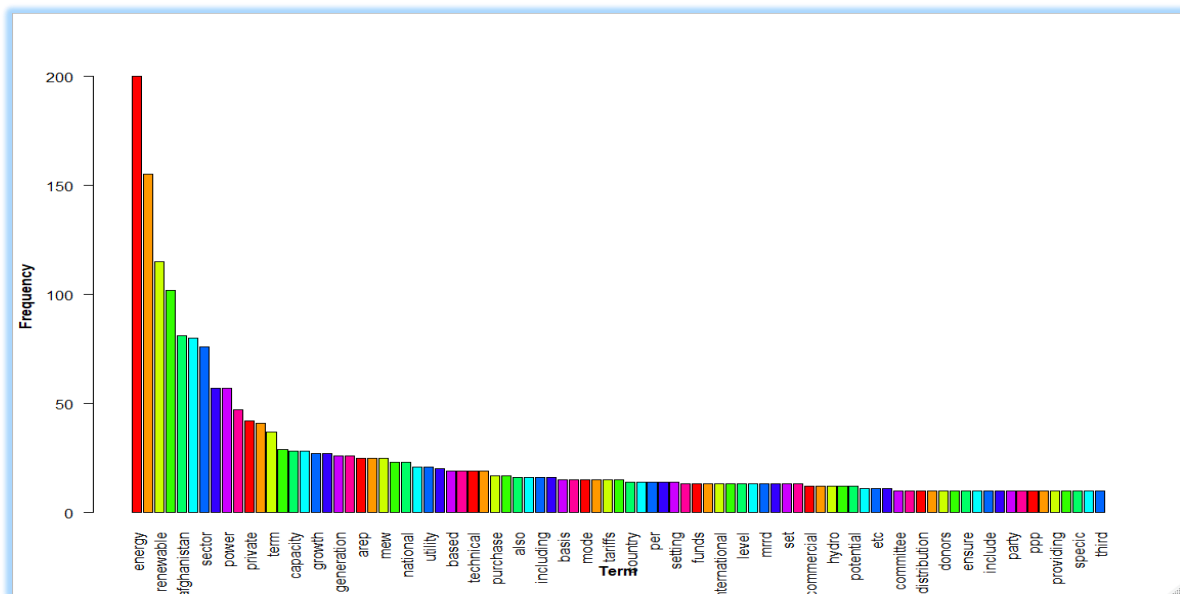


Source: Author's own compilation

Empirical Findings of Renewable Energy Policy 2015 Afghanistan

In raw form, Renewable Energy Policy 2015 Afghanistan consists of 69 pages both in English and Afghan National language, 127 paragraphs, 11257 words and 133364 characters. After data cleaning, the left characters are 53823.

Figure 3: Word Frequency plot of REP 2015 Afghanistan



Source: Author’s own compilation

Figure 3 is a lexical dispersion showing most frequent terms in Renewable Energy Policy 2015. It illustrates that the word ‘energy’ has more occurrence in the document from top to end. The word like ‘power’, ‘national growth’, and ‘capacity’ are repeated frequently. The words ‘hydro’ and ‘potential’ are used in between. The word ‘Afghanistan’ appears 130 times in the text.

Figure 4: Word Cloud of REP 2015 Afghanistan



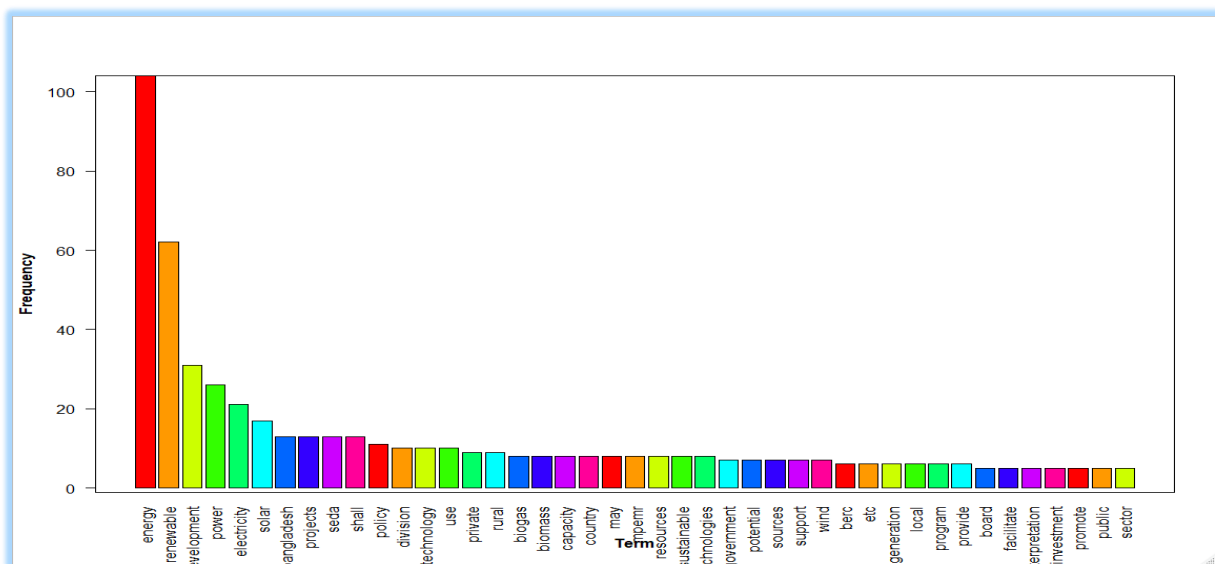
Source: Author’s own compilation

The word cloud shows that Afghanistan REP 2015 used renewable energy resources as green energy. As compared to AREP 2019, there are similarities between the two documents. As both the policies are more concern about power generation projects through renewable energy technologies. The common cloud in both policies consist of words like ‘power’, ‘projects’, ‘energy’, ‘generation’ ‘development’, ‘electricity’, ‘utility’. The document lacks the role of institutions, both public and private, in the implementation of policy. In comparison with AREP 2019, the REP 2015 lacks in diversity of renewable energy technologies and oversight of the renewable electricity market.

Empirical Findings of Renewable Energy Policy 2008 Bangladesh

In raw form, Renewable Energy Policy of Bangladesh consists of only 8 pages, 36 paragraphs, 2166 words, and 15763 characters. After data cleaning process, there are 12474 characters left.

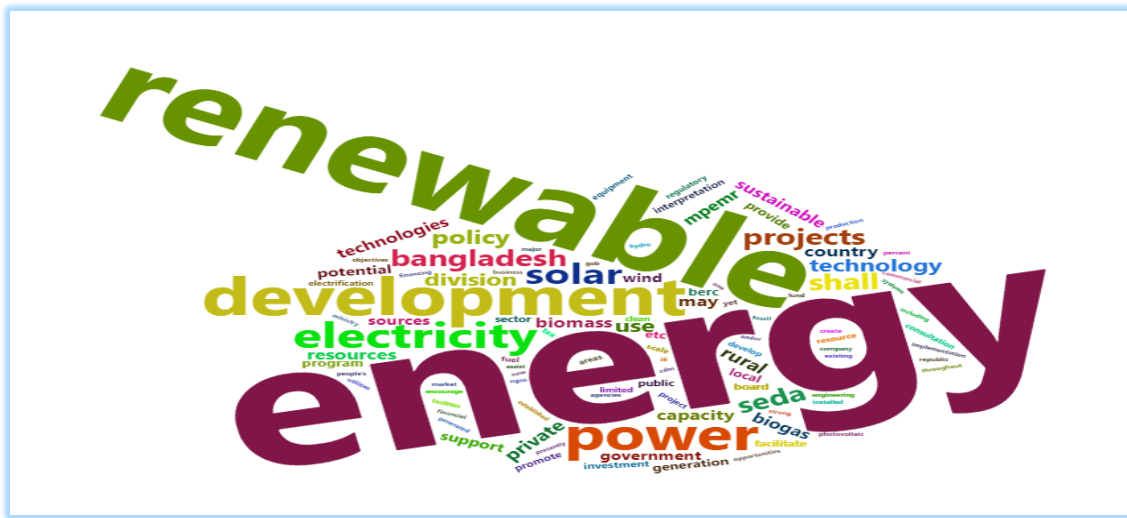
Figure 5: Word Frequency plot of REP 2008 Bangladesh



Source: Author's own compilation

Figure 5 is lexical dispersion which shows the word ‘energy’ as most repeated in the document. The words like ‘power’, ‘electricity’, ‘solar’, ‘projects’, ‘generation’, are located in middle of document.

Figure 6: Word Cloud of REP 2008 Bangladesh



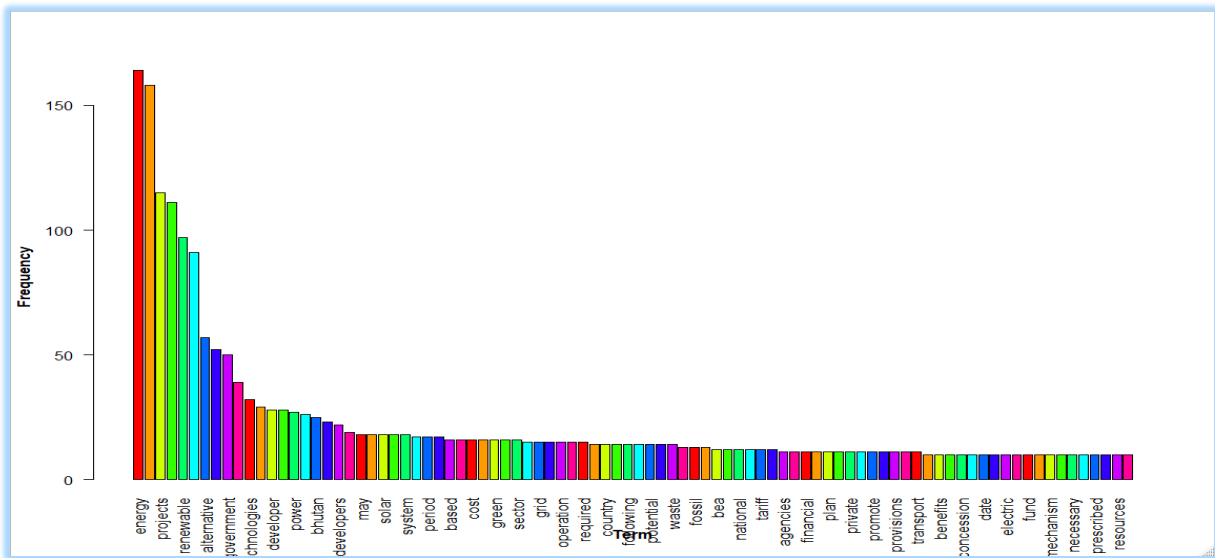
Source: Author's own compilation

It is relatively small word cloud but highlights the importance of renewable energy technologies as sustainable growth for country. The cloud describes that policy is more centric in power generation from all the available renewable resources like solar, wind, biomass and biogas. The share of power generation from solar is relatively higher than other renewable energy resources in the country. Although, the REP 2008 of Bangladesh is an old but not outmode document. The document depicts that an institutional arrangement named “Sustainable Energy Development Agency” (SEDA) with legislative stands has been established. The SEDA works as a central agency for promotion and development of sustainable energy. In comparison with AEDB Pakistan, SEDA Bangladesh has clearer role and responsibilities. Both policies AREP 2019 and REP 2008 Bangladesh have similar terms like ‘fiscal incentives’, ‘local and municipal governments’, and ‘regulatory’. The policy document lacks in implementation mechanism.

Empirical Findings of Alternative and Renewable Energy Policy 2013 Bhutan

In raw form, Alternative and Renewable Energy Policy 2013 Bhutan consists of 46 pages, 162 paragraphs, 8713 words, and 62010 characters. After data cleaning, 46596 characters are left in document.

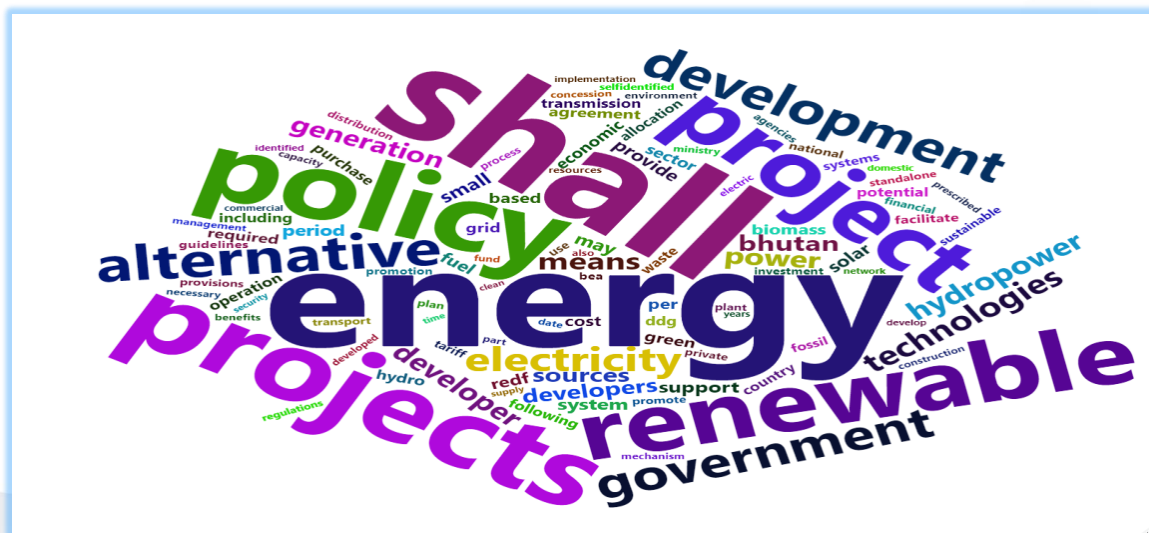
Figure 7: Word Frequency plot of AREP 2013 Bhutan



Source: Author's own compilation

Figure 7 is lexical dispersion showing the words of 'energy' and 'projects' with the highest frequency. The words like 'development', 'government', 'green', 'power', 'developer' and 'solar' are located in the middle of the document.

Figure 8: Word Cloud of AREP 2013 Bhutan



Source: Author's own compilation

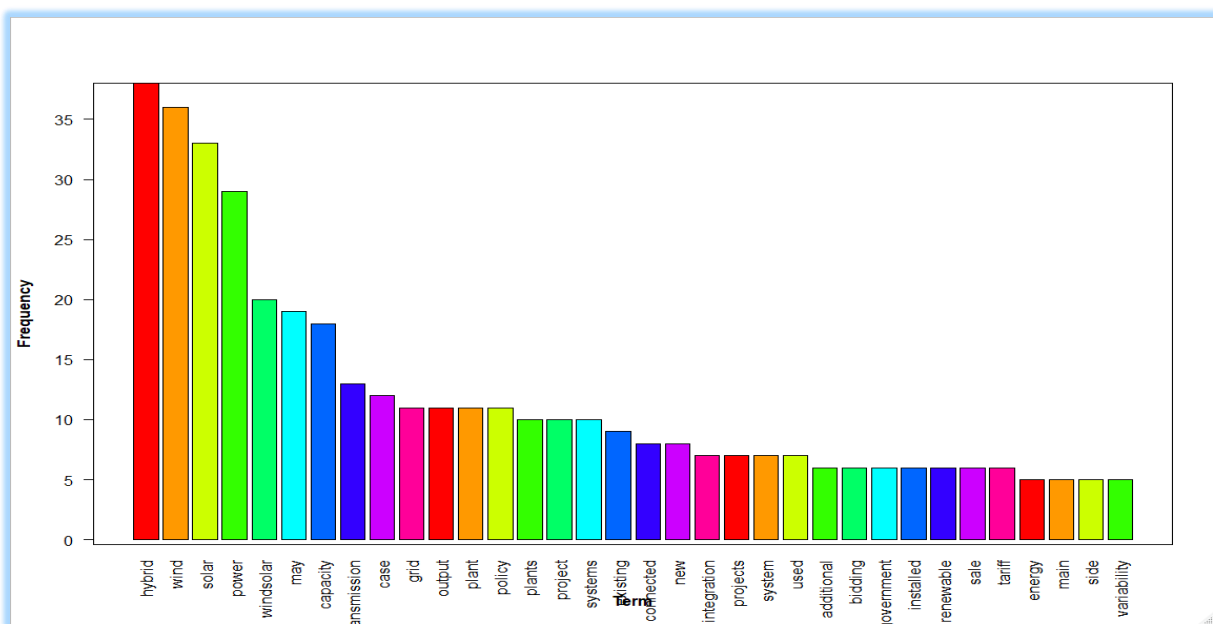
The word cloud of AREP 2013 Bhutan illustrates that it is a substantial document and have enough stuff related to renewable energy. The policy document highlights the alternative renewable projects developments. The document depicts a solid institutional arrangement as there is an inclusive fusion of different ministries and department of renewable energy (DER).

In comparison with AREP 2019 Pakistan, AREP 2013 Bhutan has investment model for on-grid small renewable projects. The text describes that government of Bhutan has well managed the implementation mechanism with monitoring and evaluation programs. Like AREP 2019 Pakistan, AREP 2013 Bhutan also focuses on decentralized and standalone renewable energy projects. The document narrates that Bhutan has clear and broad fiscal incentive mechanism along with carbon market and delivery mechanisms. AREP 2013 Bhutan is much better and in-depth document. It covers all areas from renewable resource allocation to transmission and distribution for the development of matured renewable technologies in the country.

Empirical Findings of National Wind-Solar Hybrid Policy 2018 India

In raw form, the National Wind-Solar Hybrid Policy 2018 India has 8 pages, 33 paragraphs, 1640 words, and 11052 characters. 8447 characters are left after data cleaning. This policy is precise as compared to AREP 2019 Pakistan and mainly focuses on solar and wind.

Figure 9: Word Frequency plot of National Wind-Solar Hybrid Policy 2018 India



Source: Author’s own compilation

Figure 9 shows the lexical dispersion illustrates that the word ‘hybrid’ is repeated the maximum times in the document. The words ‘solar’, ‘wind’, ‘plants’, ‘projects’, and ‘integration’, appear in the entire text with adjacent gaps.

Figure 11 shows the lexical dispersion of word frequency. The word ‘energy’ appears from the start to the end of the text. The words ‘electricity’, ‘efficiency’, ‘services’, ‘reliable’ and ‘sustainable’ come at regular interval in the text.

Figure 12: Word Cloud of Energy policy and strategy 2016 Maldives



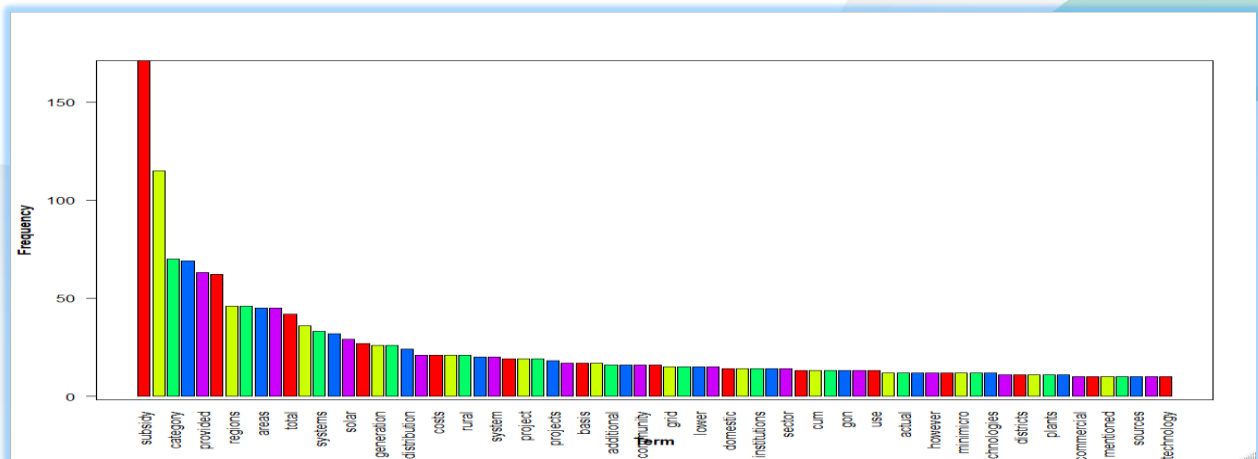
Source: Author’s own compilation

The word cloud narrates that policy calls attention to reliable, efficient and eco-friendly renewable resources. The policy design shows that it is a blue print of sustainable development goal 7 (SDG-7). The document more or less describes different policy options. Like AREP 2019 Pakistan, the policy is committed to strengthen the institutional capacities, regulatory framework and for promotion of renewable energy technologies in the country.

Empirical Findings of Renewable Energy Subsidy Policy 2016 Nepal

In raw form, Renewable Energy Subsidy Policy 2016 Nepal has 17 pages, 104 paragraphs, 6268 words, and 41532 characters. 31813 characters are left after cleaning process.

Figure 13: Word Frequency plot of Renewable Energy Subsidy Policy 2016 Nepal



Source: Author’s own compilation

5. Conclusion

The text analytics of this study portrays that all the renewable policies of SAARC region have mainly focused on power generation for electricity purpose. Among SAARC nations, Afghanistan is lagging in funds from international donors to uphold its capacity building for renewable energy technologies and local experts. Bangladesh has robust legal framework as Bangladesh Energy Regulatory Commission (BERC) has the regulatory mandate for energy sector and it has played a vital role to attract private sector investments. Bhutan's government is more vigilant and responsive towards green and clean energy. The Bhutan's document is a guiding roadmap for rest of SAARC nations as it exhibits firm institutional arrangements and inclusive implementation mechanism. India is the only country of SAARC region that has Ministry of New and Renewable Energy. Nepal's subsidy policy is a major achievement in developing the renewable energy market and investment mobilization. The Alternative Energy Promotion Centre (AEPIC) Nepal is responsible for the provision of all types of technical and financial support for decentralized renewable energy technologies. Maldives' renewable energy road map is a collinear with the environmental concerns and it is an attempt to attain the SDG 7 goal. Pakistan has comparatively better institutional setup than other SAARC countries. It owns NEPRA as a regulatory body and AEDB aims to promote renewable energy technologies. Sri Lanka has clear institutional role with implementation strategies. The word cloud of Pakistan, Sri Lanka, Nepal, and Bhutan policies illustrates that these are attentive in employment generation through small renewable energy projects by the involvement of local communities as well as by upgrading the domestic industries and renewable energy markets. The commitment of SARRC countries in adaption of alternate and renewable energy will decrease the carbon emission in the region.

5.1 Recommendations

- To support the renewables procurements, innovative and emerging policy options like virtual power purchase agreements, utility green tariff scheme, and green premium products under voluntary programs that are adopted in various countries should also be exchanged among SAARC countries.
- Innovative experiences among SAARC nations should be exchanged in adaption of novel technologies as well as for fiscal incentives to promote renewable energy technologies.
- SAARC nations should take forward initiatives to design a mechanism of local entrepreneurship like Sri Lanka engaged business, research and local communities.

- There should be integrated computer technology and artificially intelligent energy management system in SAARC countries.

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