

GLOBAL GREEN ENERGY RESEARCH: A SCIENTOMETRIC ANALYSIS

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ABSTRACT: - *The present study deals with scientometric study of Green energy literature during 2012-2016 using Scopus database. Multi authored articles are dominant i.e. 267 (87.2%), the year wise distribution of articles was high i.e. 81 26.47%), the mean of relative growth and Doubling Time for the first five year was 3.76 and 5.72, USA ranked first with 32 (9.15%), University are the major contributors with 230 (75.1%) contributions during the period 2012 to 2016. Majority of the articles are written in English language i.e. 99.0%, the average number of authors per article is 1.41%. “Applied Energy” scores the 1st rank which account to 46 (15.6%) of the total papers.*

KEY WORDS – *Green energy, Scientometrics*

Introduction:

Scientometrics is to provide quantitative characterization of scientific activity; scientometrics is branch of library and information science. In 1969, vassily V. Nalimov and Z.M. Mulchenko coined the Russian equivalent of the term 'scientometric' ('nalkometriyas') (Nalimov and Mulchenko, 1969). As the name would imply, this term is mainly used for the study of all aspects of the literature of science and technology. The term had gained wide recognition by the foundation in 1978 of scientometrics by Tibor Brawn in Hungary. According to its subtitle, scientometrics includes all quantitative aspects of the science of science,

communication in science, and science policy (Wilson, 2001). Soon after its foundation Nalimov became the consulting Editor. Some other early papers by Nalimov which helped to nature the nascent discipline of scientometrics include: (1970), Nalimov and Mulchnko (1969 a) and Nalimov et at. (1971).

Green Energy:

Green energy comes from natural sources such as sunlight, wind, rain, tides, plants, algae and geothermal heat. These energy resources are renewable, meaning they're naturally replenished. In contrast, fossil fuels are a finite resource that

take millions of years to develop and will continue to diminish with use.

Review of Literature:

Bala and Singh (2014) Scientometric is branch of Science. Scientometric explain about input and output resources in term of organizational structure. Scientometric is of measuring and analyzing Science. This paper critically analyses 316 scholarly communications published in the Indian Journal of Biochemistry & Bio-physics. The analysis cover mainly the number of articles, form of document cited, most cited Journals etc. Study reveals that single author contributed 18 (5.7%) while the rest of 162 (51.3%) articles were contributed by Multi authors. The contributions in this Journal from India are slightly more than those from the other countries.

Murugan & Balasubramani (2012) scientometric analysis is a technique to analyze the scientific publications in particular field of science at global level, performance of a country, performance of institutions and individual scientist. It helps the researcher and scientist to know the growth & development, research impact of particular field.

Gupta & et al. (2011) have analyzed the dementia research output from India during 2002-11 on different parameters including the growth, global publications share, citation impact, share of international collaborative papers, contribution of major most productive institutions and authors and patterns of research communication in most

productive journals. It is found that top 20 most productive countries in dementia research, India ranks 16th (with 1109 papers) with a global publication share of 1.24% and an annual average publication growth rate of 25.58% during 2002-11. India's publication efforts are quite low considering that to 3.7 million people suffering from dementia in India.

Methods & Materials:

The data has been extracted from SCOPUS international multidisciplinary database for database for the present study and the following search strategy has been used in the combined field of Title, Abstract & Keywords.

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TITLE-ABS-KEY ( GREEN
AND ENERGY ) AND DOCTYPE ( AR ) AND P
UBYEAR > 2011 AND PUBYEAR < 2017
AND ( LIMIT-
TO ( SUBJAREA , "ENER" ) ) AND ( LIMIT-
TO ( EXACTKEYWORD , "ENERGY
EFFICIENCY" ) ).
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Objective:

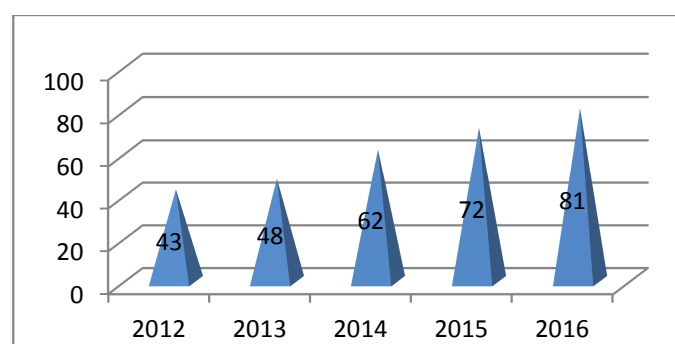
1. To identify the number year-wise distribution of publication.
2. To know relative growth and doubling time of publication.
3. To identify the authorship pattern of references per articles.
4. To find out the country wise distribution of cited articles

5. To know the organization wise contribution of articles.
6. To know the Language wise distribution of Publications
7. To identified core journals of articles.

Data Analysis:**Table No. 1:Year-wise distribution of Publication**

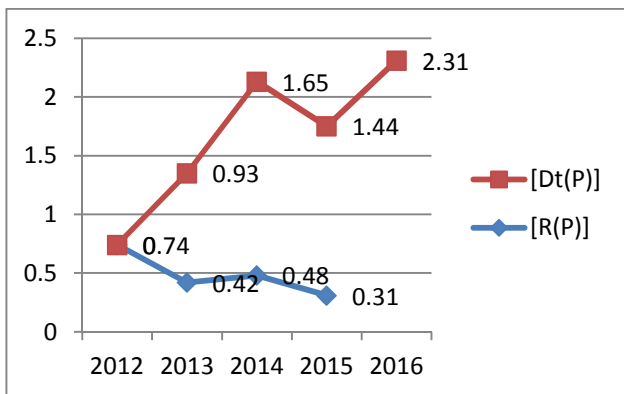
Sr. No	Year	No. of Articles	Percentage
1	2012	43	14.05
2	2013	48	15.68
3	2014	62	20.23
4	2015	72	23.52
5	2016	81	26.47
Total		306	100

The average no. of article publication was 306 articles per year. It observed that the contributions of earlier five years (2012-2016) the highest publication out of 306 articles 81 (26.47%) articles were published in 2016 and 43 (14.05%) articles lowest were in 2012 respectively.

Figure No. 1. Year-wise distribution of publication**Table No.2: Relative Growth Rate and Doubling Time of Publications**

Year	No. Of Publication	Cumulative no. of Publication	Log _e 1 ^p	Log _e 2 ^p	[R(P)]	Mean [R(P)]	[Dt(P)]	Mean [(Dt(P))]
2012	43	-	-	3.76	-	0.39	-	6.33
2013	48	91	3.76	4.51	0.74		0.93	
2014	62	139	4.51	4.93	0.42		1.65	
2015	72	225	4.93	5.41	0.48		1.44	
2016	81	306	5.41	5.72	0.31		2.31	

Figure No 2. Relative Growth Rate [R(P)] and Doubling Time [Dt(P)] of publication



The Relative Growth Rate [R(P)] and Doubling Time [Dt(P)] of publications are derived and presented in Table & Fig. no. 2. It can be noticed that the Relative Growth Rate of publications [R(P)] decreased from the rate of 0.74 in 2012 to 0.31 in 2015. The mean relative growth for the first five years (i.e. 2012 to 2016) The corresponding Doubling Time for different years [Dt(P)] gradually increased from 0.93 in 2013 to 2.31 in 2016.

Table No.3: Authorship Patterns research in Library Automation

Authorship Pattern	2012	2013	2014	2015	2016	Total	%
Single	4	1	14	5	15	39	12.7
Two	8	7	15	10	19	59	19.2
Three	13	12	8	22	21	76	24.8
Four	4	8	3	10	8	33	10.7
Five	5	10	13	9	11	48	15.6
More than Five	9	10	9	16	7	51	16.6
Total	43	48	62	72	81	306	100

Authorship pattern of the articles in presented in table no. 3, identified the distribution of articles according to the number of contributors. It shows that the number of Multi authors are more than single 39 (12.7%).

Figure No 3. Authorship Pattern

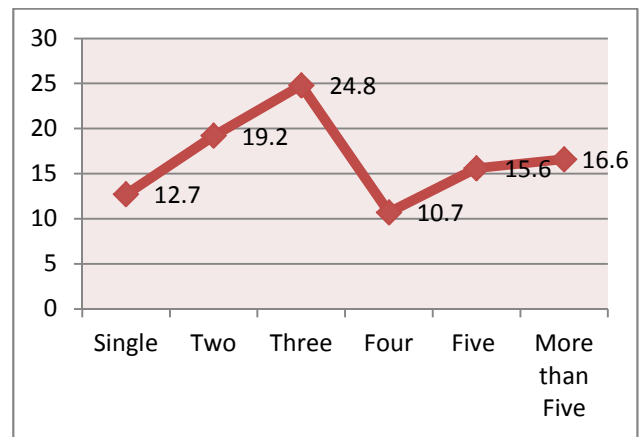


Table no 4. Country-wise distribution of Publications

Sr. no	Country	Articles	%
1	USA	32	9.15
2	China	27	8.82
3	United Kingdom	24	7.84
4	Italy	21	6.8
5	India	18	5.88
6	Germany	16	1.96
7	Malaysia	15	4.9
8	South Korea	14	4.57
9	Taiwan	13	0.98
10	Canada	11	0.32
11	Australia	11	0.32
12	Spain	10	3.26
13	Netherlands	7	2.28

14	Greece	7	2.28
15	Japan	7	2.28
18	Thailand	6	1.96
19	Turkey	6	1.96
16	Denmark	5	1.63
21	Norway	4	1.3
22	Finland	4	1.3
23	France	4	1.3
24	Iran	4	1.3
25	Singapore	3	0.98
26	Hungary	3	0.98
27	Mexico	3	0.98
28	Poland	3	0.98
29	Slovenia	3	0.98
30	South Africa	3	0.98
31	Switzerland	3	0.98
32	Belgium	2	0.65
33	Brazil	2	0.65
34	Jordan	2	0.65
35	Lebanon	2	0.65
36	Nigeria	2	0.65
37	Saudi Arabia	1	0.32
38	Serbia	1	0.32
43	Ghana	1	0.32
44	Kazakhstan	1	0.32
45	Kyrgyzstan	1	0.32
46	Lithuania	1	0.32
47	New Zealand	1	0.32
48	Pakistan	1	0.32
49	Portugal	1	0.32
Total		306	100

Table no. 4 indicates that USA, China, UK, and Italy have the majority of most cited records 32

(9.15%); 27 (8.82%); 24 (7.84%) and 21 (6.80%), respectively.

Table No. 5: Organizational Contributions of Articles

Organization	2012	2013	2014	2015	2016	Total	%
University	34	37	48	52	59	230	75.1
Research Institute	9	11	14	20	22	76	24.8
Total	43	48	62	72	81	306	100

Table No 5 and fig no 4, it is seen that universities are the major contributors with 230 (75.1%) contributions during the period 2012 to 2016. While the research institutions contributed 76 (24.8%) respectively.

Fig No. 4: Organizational Contributions of articles

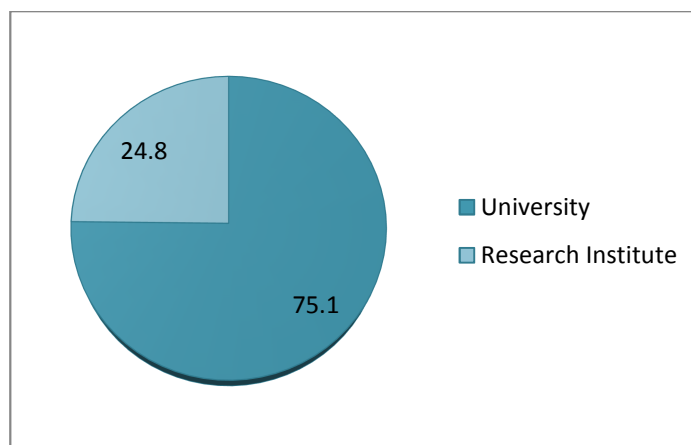


Table no.6: Language wise distribution of Publications

Sr. No.	Language	No. of Articles	%
1	English	303	99.0
2	Chinese	2	0.65
3	Polish	1	0.32
Total		306	100

Table no 6 shows the languages of expression with the number of articles. In the current study, 3 languages i.e. English, Chinese and Polish. Majority of the articles with 303 (99.0 %) are written in English language.

Fig. No. 5: Language wise distribution of Publications

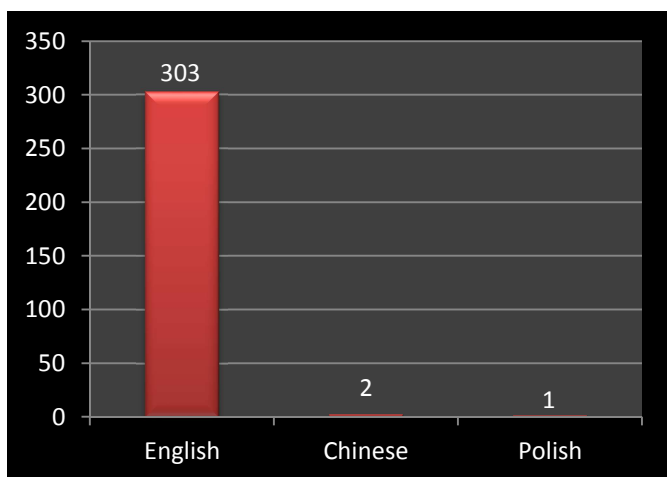


Table No. 7: Most ranked list of Journal

Sr. No	Name of the Journal	No. of Articles	Rank No.	%
1	Applied Energy	46	1	15.03
2	Energy Policy	34	2	11.1
3	Journal of Cleaner Production	29	3	9.47
4	Energy	17	4	5.55
5	Renewable Energy	16	5	5.22
6	Renewable and Sustainable Energy Reviews	14	6	4.57
7	Energy Efficiency	11	7	3.59
8	Sustainability (Switzerland)	7	8	2.28
9	ACS Sustainable Chemistry and Engineering	6	9	1.96
10	International Journal of Hydrogen Energy	6	9	1.96
11	Solar Energy	6	9	1.96
12	Energy and Environment	5	10	1.63
13	Energy and Environmental Science	5	10	1.63
14	Biomass and Bioenergy	4	11	1.3
15	Energy Economics	4	11	1.3
16	Energy Education Science and Technology Part A: Energy Scien	4	11	1.3
17	Solar Energy Materials and Solar Cells	4	11	1.3
18	Sustainable Cities and Society	4	11	1.3
19	Biotechnology for Biofuels	3	12	0.98
20	Energy Conversion and Management	3	12	0.98
21	Energy Engineering: Journal of the Association of Energy Eng	3	12	0.98
22	Energy Research and Social Science	3	12	0.98
23	International Journal of Energy Technology and Policy	3	12	0.98
24	International Journal of Green Energy	3	12	0.98
25	Nano Energy	3	12	0.98
26	Nature Environment and Pollution Technology	3	12	0.98
27	Advanced Science Letters	2	13	0.65
28	Applied Thermal Engineering	2	13	0.65
29	Dianwang Jishu/Power System Technology	2	13	0.65
30	Energy Sources, Part B: Economics, Planning and Policy	2	13	0.65
31	Energy Strategy Reviews	2	13	0.65
32	Green Energy and Technology	2	13	0.65
33	Journal of Materials Chemistry A	2	13	0.65
34	Journal of Photonics for Energy	1	14	0.32
35	Journal of Solar Energy Engineering, Transactions of the ASM	1	14	0.32
36	Strategic Planning for Energy and the Environment	1	14	0.32
37	Agroecology and Sustainable Food Systems	1	14	0.32
38	Asia-Pacific Journal of Chemical Engineering	1	14	0.32
39	Biomass Conversion and Biorefinery	1	14	0.32
40	Building Simulation	1	14	0.32

41	Chemical Engineering and Processing: Process Intensification	1	14	0.32
42	ChemSusChem	1	14	0.32
43	Distributed Generation and Alternative Energy Journal	1	14	0.32
44	Economics and Policy of Energy and the Environment	1	14	0.32
45	Electric Power Systems Research	1	14	0.32
46	Energy and Fuels	1	14	0.32
47	Energy for Sustainable Development	1	14	0.32
48	Energy, Sustainability and Society	1	14	0.32
49	Fuel	1	14	0.32
50	Fuel Processing Technology	1	14	0.32
51	High Technology Letters	1	14	0.32
52	IEEE Power and Energy Magazine	1	14	0.32
53	International Journal of Ambient Energy	1	14	0.32
54	International Journal of Electrical Power and Energy Systems	1	14	0.32
55	International Journal of Emerging Electric Power Systems	1	14	0.32
56	International Journal of Energy Economics and Policy	1	14	0.32
57	International Journal of Environmental Sustainability	1	14	0.32
58	International Journal of Sustainable Development and Plannin	1	14	0.32
59	International Journal of Sustainable Energy	1	14	0.32
60	Journal of Chemical Technology and Biotechnology	1	14	0.32
61	Journal of Energy Engineering	1	14	0.32
62	Journal of Energy in Southern Africa	1	14	0.32
63	Journal of Natural Gas Science and Engineering	1	14	0.32
64	Journal of Power Sources	1	14	0.32
65	Journal of Sustainable Development	1	14	0.32
66	Journal of Wind Engineering and Industrial Aerodynamics	1	14	0.32
67	Lecture Notes in Energy	1	14	0.32
68	Proceedings of Institution of Civil Engineers: Energy	1	14	0.32
69	Rivista di Studi sulla Sostenibilita	1	14	0.32
70	Rynek Energii	1	14	0.32
71	Smart and Sustainable Built Environment	1	14	0.32
72	Sustainable Energy Technologies and Assessments	1	14	0.32
73	Thermal Science	1	14	0.32
74	Water and Energy International	1	14	0.32
75	Wiley Interdisciplinary Reviews: Energy and Environment	1	14	0.32
76	WSEAS Transactions on Environment and Development	1	14	0.32
Total		306		

Table No 7 identified a rank list of journals, the study reveals that “Applied Energy” scores the 1st rank which account to 46 (15.6%) of the total papers. “Energy Policy” scored second rank with 34 (11.1%) papers and “Journal of Cleaner Production” 1746 (9.47%) scored third rank in the rank list.

Findings and Conclusions:

- 1.The Year-wise distributions of 30 articles published from 2012-2016. The maximum number of articles 81 (26.47%) were in the year 2016.
- 2.The mean relative growth for articles in the first five years 2013 to 2016 is (0.74%) reduced to (0.31%).
- 3.The number of Multi authors are more in number than Single authors.
- 4.USA, China, UK, Italy have the majority of most cited records in Literature.
- 5.Universities are the major contributors with 230 from 2012-2016 and followed by research institute with 76.
- 6.English is the highest language in literature.
- 7.Applied Energy scores highest.

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