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RENEWABLE ENERGY EDUCATION: CHALLENGES FOR INDIAN YOUTH

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ABSTRACT
The purpose of this study is to understand the factors affecting the interest among students in pursuing Renewable Energy (RE) as a higher educational option. A survey among 1199 people from thirteen states and three union territories is used to obtain the primary data. Maximum respondents are from the four states of Karnataka, Kerala, Tamil Nadu and Gujarat. The first phase discusses the state-wise trends in Renewable Energy Development. The second phase shows the difference in interest levels of respondents based on Religious, Academic and Economic factors. Finally, recommendations are made on the basis of the study to help us understand alternatives that may be used to disseminate knowledge.
KEYWORDS:*Renewable, Energy, Education, Career, Skill Development*

1. INTRODUCTION

The number of people without electricity access in the world is over 1 Billion. The number is decreasing rapidly with India making significant progress in this field. 40 million people have been gaining electricity each year since 2011 with the electrification rate reaching an all-time high of 89 percent in 2016 (I.E.A., 2017). In light of that discussion, it is also interesting that renewable energy (RE) represents the world's fastest growing energy source, with a predicted consumption increase of 2.3% per year for the period 2015–2040 (Lucas et al., 2018)

India is also turning out to be a huge market when it comes to Renewable energy. It is predicted that RE may provide up to 24.4 million jobs worldwide by 2030 (I.R.E.N.A., 2016). The need for substantial growth opportunity in India has been realized, given its current dependence on crude oil, and thus a looming energy security crisis (Sen et al., 2016). India has a vast potential of renewable energy and is stepping up efforts to attain the goal of "20 11 20 20" by 2020 i.e. 20% reduction in GHG, 11% reduction in consumption of energy by bringing about attitudinal changes, 20% share of renewable energy and 20% conservation of energy from the year 2011 till 2020 (Singh, 2017). This opens up avenues for a lucrative business opportunity.

Many countries are now realizing the need to move rapidly into renewable energy, and they are seeking courses that meet their needs. The Internet has created a global market for courses. Training that focuses not only on the technical aspects but also the management, finance and project management aspects are required. For this, part-time courses, skill development training, and on-site practices are options worth considering. In a nutshell, the study covers how various demographic

and socio-economic factors affect the selection of renewable energy as a higher education option.

More specifically, the study is three-fold. Firstly, a comparative study of state-wise trends is presented. This compares the developments in various states and the interest of respondents from each state along with the possible reasons for that. Secondly, the religious, educational and economic factors are considered and studied. Lastly, suggestions are made in order to tackle the issues that have been brought forward through the study.

2. RESEARCH METHODOLOGY

A survey conducted at ICTI, Kerala, India was taken as the primary data for the study. The survey utilized an online portal for obtaining the data. The respondents were of the age group of 21 to 23 years. The sample set of the data is 1199. Of these, 55 were female and 1144 were male. The survey touched 13 states and three union territories in India. The survey is not a representative of the entire nation and its scope is limited only to the states and union territories from which entries were received. The responses were also compared with relevant literature.

3. RESULTS

3.1. State-wise distribution of renewable energy as a subject of higher study among youth of India

Maximum respondents were from the 4 states of Kerala, Tamil Nadu, Karnataka, and Gujarat. This consisted of 94.91 percent of all respondents. The result clearly demarcated the trends in these states from the rest.

A clearer picture can be obtained by referring figure 1. It suggests that students from Karnataka and Kerala were the ones that showed maximum interest with 36% and 29% of respondents being from these states respectively.

We will see individual trends in each of these 4 states.

3.1.1. Kerala

The second highest number of respondents are from Kerala with 29 percent. The state has a literacy rate of over 94 percent (census 2011). This might be one of the possible reasons for the high level of interest in a niche educational sector.

The renewable energy sector has shown significant growth in Kerala. The state nodal agency for renewable energy, Agency for Non-Conventional Energy and Rural Technology (ANERT) is one of the oldest in the county, established in 1986. ANERT is also one of the most active nodal agencies in the country with various active programmes to support renewable energy such as the 10000 Solar Rooftop Power Plant Programme, the Renewable Energy Census (providing free insurance to installations) etc. In addition to this, there are various large-scale solar installations in the state such as the Cochin Airport in Ernakulam, which is the world's first fully solar-powered airport and the Renewable Energy Park at Ramakkalmedu in Idukki. Such projects might be the main impetus for students from Kerala to pursue an education in this field and consequently, the reason for a higher number of respondents.

Figure 2 shows the district-wise distribution of respondents in Kerala. It is interesting to note that the district of Ernakulam showed a disproportionately high number of respondents. This may be attributed to the presence of large solar projects such as the Cochin Airport which further strengthens our earlier claim. This also shows us the need to spread more awareness in the remaining districts.

3.1.2. Tamil Nadu

Until July 2018, Tamil Nadu was the leading Renewable Energy Market in India and one of the top 9 Renewable Energy markets in the world (Wynn, 2018). Tamil Nadu has approximately 10,820 Megawatts of renewable energy installed capacity as of January 2018 (Ceanicin, 2018). Apart from this, the Tamil Nadu Energy Development Agency (TEDA), the state nodal agency for MNRE, has launched numerous programmes such as the Rooftop Capital Incentive Scheme and the Solar

Powered Green House Scheme to promote renewable energy in the state.

The existence of such projects in the state and the high involvement of government in renewable energy promotion has turned renewable energy into a highly desirable educational field. These might be a few reasons for the fact that a significant 19 percent of the respondents are from Tamil Nadu.

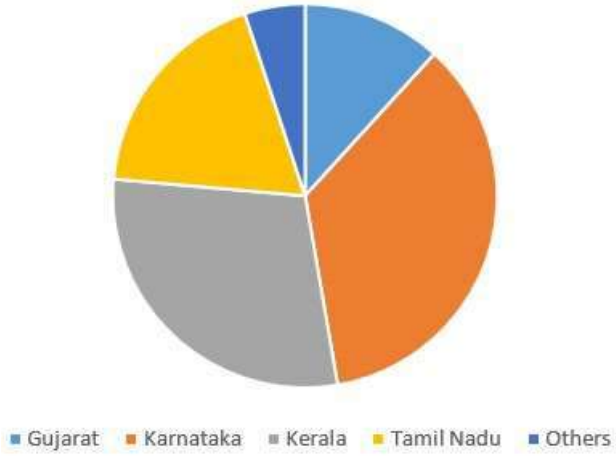

Figure 1: State-wise distribution data of respondents

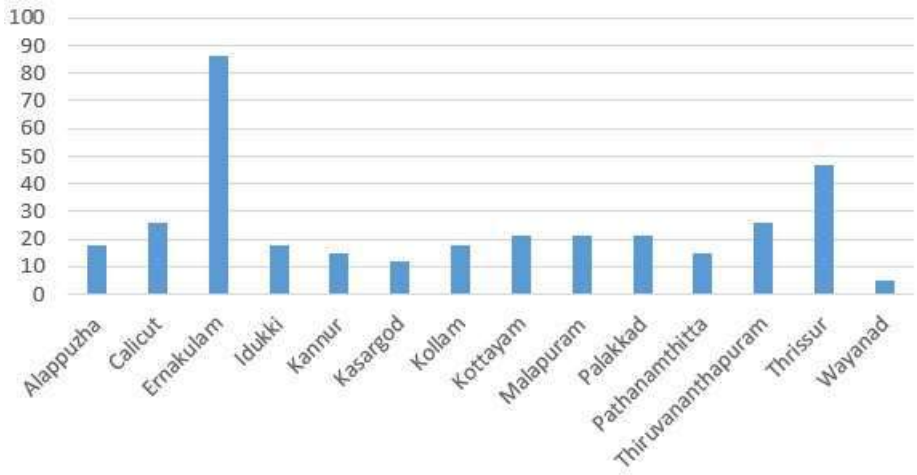

Figure 2: Distribution of respondents among districts in Kerala

3.1.3. Karnataka

Maximum respondents in the survey are from Karnataka i.e. 36 percent. This might be directly linked to the fact that since July 2018, Karnataka is the leading state in terms of installed Renewable energy capacity. In 2017/18, an increase in total installed capacity from about 7 GW to 12.3 GW took place (Buckley and K., 2018). The government has also been actively supporting renewable energy projects. The Karnataka Electricity Regulatory Commission (KERC) has exempted solar power generators from "wheeling charges, banking charges, and cross-subsidy charges" since August 2014 for projects selling directly to customers (KERC, 2014).

In addition to this, various large-scale installations such as the Pavagada Solar Park, set to be the largest solar park in the world, are under construction. The presence of such projects ensures large-scale employment opportunity in the state. Considering all these factors, renewable energy is a good option for higher education for students from Karnataka. This is also clear from the active response from the state.

3.1.4. Gujarat

Gujarat is another state with a comparatively significant number of respondents with 12 percent. There can be three main reasons for this occurrence. Firstly, Gujarat Energy Development Agency

(GEDA), the nodal agency for MNRE is one of the most active nodal agencies in the country. The agency has released various schemes such as the recently released Suryashakti Kisan Yojana (SKY). This scheme provides a huge incentive for farmers by allowing them to generate electricity through solar for their consumption and sell the surplus back to the grid. The second reason might be the presence of good business opportunity. Presence of large open areas in the state is ideal for installation of Renewable Energy projects. Similarly, there are lucrative investment opportunities in the neighbouring state of Rajasthan as well with its geographical and climatic advantage (Pandey et al., 2012). The third reason might be the presence of eminent institutions in the state providing education and research opportunities such as the Gujarat Energy Research and Management Institution (GERMI), which is one of the leading energy research institutes in the country.

These factors play a huge role in motivating students in the state to pursue education and career in this field. This fact is evident from the number of respondents from the state.

3.2. Religious Disparity & Reservation Status

3.2.1. Religion

Majority of the respondents come from a Hindu background. Out of all the respondents, 75.89 percent followed Hinduism, 13.59 percent followed Christianity, and 8.75 percent followed Islam. The number of respondents from other categories i.e. Atheism, Jainism and Sikhism were negligible with only 1.33 percent. Figure 3 shows the state-wise distribution of respondents. The 4 categories considered are Hinduism, Christianity, Islam and Others (Atheism, Buddhism, Jainism, and Sikhism).

Figure 4 shows the distribution within states. Kerala showed a comparatively uniform distribution with only 46.41 percent respondents following Hinduism and 38.68 percent following Christianity. This was not the case with the rest of the states. Presence of other religions was almost negligible in these states with 94.32 percent, 89.63 percent, and 85.44 percent Hindus in Gujarat, Tamil Nadu, and Karnataka respectively. The trend was similar in rest of the states with 80.33 percent of Hindu respondents.

The reason for this non-uniformity may be attributed to the population distribution in India. Indian population consists of about 80.5 percent Hindus, 13.4 percent Muslims, 2.3 percent Christians and 3.8 percent people from other religions. (Census 2011).

The results of the survey are directly in line with our findings. A high percentage of Hindu and Christian respondents participated in the survey but the number was significantly low for Muslims. Though the national population consists of 13.4 percent Muslims, only 8.75 percent of the total respondents were from this category. This shows a lack of interest in the field. Lower literacy rates for Muslims in the country is one of the main reason that can be attributed to this trend. From a study published in 2007, the enrolment rate of Hindu kids in schools was 84 percent and 68 percent for boys and girls respectively. At the same time, the number for Muslim boys and girls was 68 percent and 57 percent in case of Muslim kids (Borooah and S, 2005). This shows that the lack of participation may directly be attributed to the lack of education for Muslims.

3.2.2. Caste Based Distribution

A caste-based reservation has been existent in India for a long time. There is reservation in all government-run educational institutions and government jobs. 22.5 percent of all seats are reserved for Scheduled Caste (SC) and Scheduled Tribe (ST) categories. In addition to this, 27 percent of seats are reserved for Other Backward Castes (OBC) since 1993 in jobs and since 2008 in educational institutions (Deshpande, 2017). The reservation system has highly affected the education and job sector in India. This is more prevalent in some states compared to others. We can see different trends in each city in Figure 5.

Percentage of respondents from general category was found to be maximum in nearly all states except Tamil Nadu. In Gujarat, 47.5 percent of the population was from general category, 23.4 percent

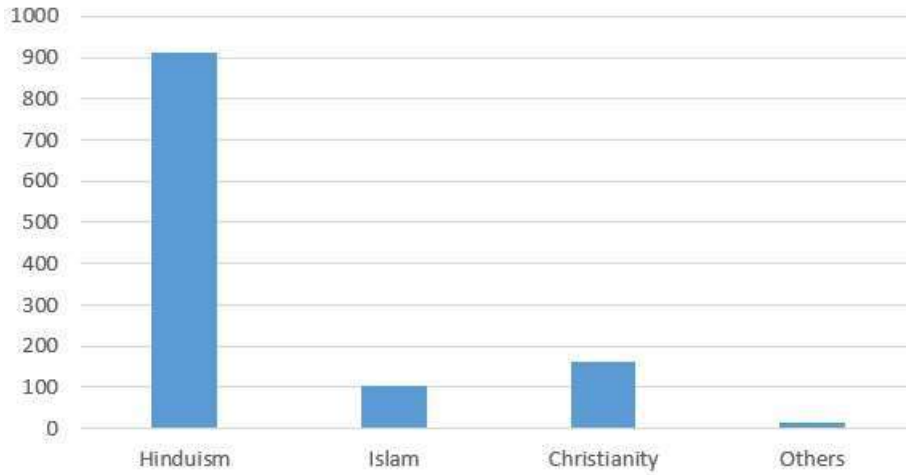

Figure 3: Religion-based distribution among states

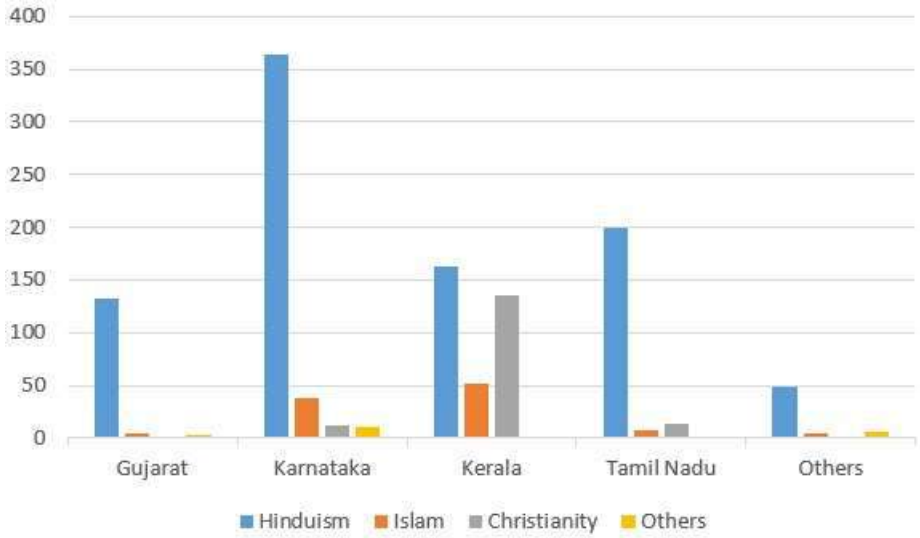

Figure 4: Religion-based distribution within states

Figure 5: Caste-based distribution within states

from OBC and the rest from other categories. Karnataka exhibited the most uniform distribution with 33.3 percent of the population in General Category, 38 percent from OBC and the remaining from other castes. Kerala had the maximum percentage of population from General Category with 52.4 percent. Only 24.6 percent of the population was from OBC while the number from other individual categories was almost negligible. The only state that showed a significant anomaly was Tamil Nadu with General category covering only 11.26 percentage of the population. The percentage of respondents from OBCs was disproportionately high with 76.13 percentage. This was an anomaly from the general trend in the country. There is one possible cause that may be attributed to this disparity i.e. the Reservation Policy in Tamil Nadu. The reservation policy in Tamil Nadu is different from all other states in India. While other states provide a maximum of 49.5 percent reservation, Tamil Nadu's reservation policy provides 69 percent reservation. This has significantly affected the educational trend in the country. More people from reserved castes are showing interest in higher studies, especially in niche areas. This raises a point for the government to consider while analysing the reservation policy in the state.

3.3. Academic Factors

Multiple factors affect a respondent's interest in pursuing higher education. Two main factors that were considered are:

1. Academic performance of the respondent in their undergraduate studies.
2. Presence of institutions of higher education providing renewable energy as a subject.

3.3.1. Academic performance of the respondents

Figure 6 shows the academic performance of respondents in their undergraduate study. We can see that the number of exceptionally high and low performing students is less. The maximum proportion of respondents i.e. 49.3 percent are in the 70-79 percentage marks bracket. It is also interesting to note that the 60-80 percent marks bracket comprises 82.9 percent of total respondents. This shows that most of the respondents were average performing students during undergraduate studies. There may be two main reasons for this trend. The low performing students may not be opting for another higher study option and would prefer to work. Another factor can be that low performing students are more prone to dropping out of college. The lack of interest from high performing students also shows the importance of a better way to spread awareness about renewable energy and its scope in India.

3.3.2. Institutions providing Renewable Energy as a higher educational option

Energy is generally not regarded as a higher education discipline. This is because students from other disciplines such as mechanical, chemical etc. study a few aspects of this broad subject. The problem with this is that only topics related to the individual subjects are covered and not the whole concept which includes the management side of dealing with energy related issues (Acikgoz, 2011). This signifies the need for establishing energy as a separate discipline.

It is worth mentioning that there are a few colleges in India which provide the option of pursuing masters in renewable energy but the number is very less. Also, there are almost no options for students wanting to pursue a bachelor's in renewable energy in India. In the 2016-17 All India Council for Technical Education (AICTE) list of approved colleges that provide technical education in India, there were 10355 Colleges (A.I.C.T.E., 2016). Out of these, only about 30 colleges listed Masters in RE as one of their offerings.

A list of colleges providing Masters in RE in India is given in table 1.

This list is a cause of concern. Even out of the thirty-two existing colleges, 17 are concentrated in Tamil Nadu and Rajasthan. This signifies even lesser awareness in the remaining states. The study shows the importance of dissemination of renewable energy knowledge in a different manner. This could either mean promotion of online portals

for renewable energy education or other skill development sessions to train efficient professionals to work in this field.

3.4. Economic Factors

Economic factors can highly influence the interest of a person in pursuing masters. The main factors that may influence this decision are:

1. Job opportunities in the field of study - Lack of job in the present market may easily dissuade a person from choosing a particular field of study.

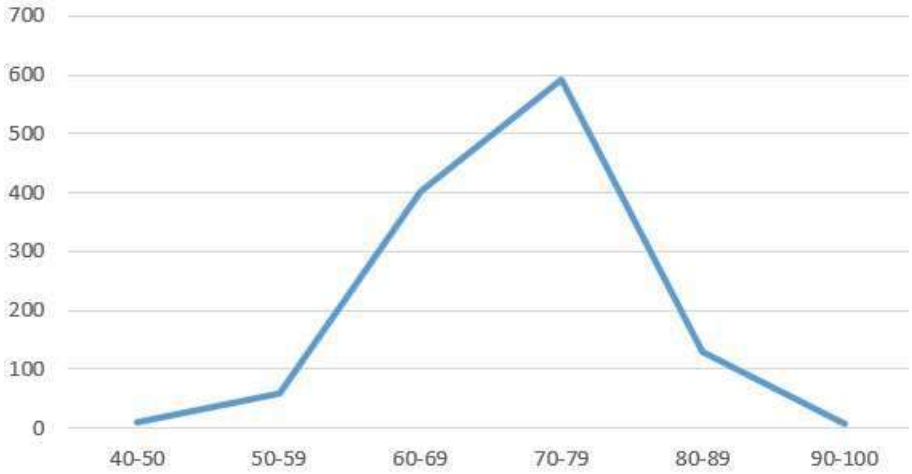

Figure 6: Academic Performance-based distribution

2. Household Income of the family - The financial pressure from low-income family usually forces students to work right after college.

3. Existing loans also prevent students from considering higher education options.

Few of the major economic factors that could be examined in the study are:

3.4.1. Household Income

Figure 7 shows a comparison of household income of respondents.

The respondents are categorized into 4 main categories. The dependent variable is the total annual income of the family. We can see that maximum respondents i.e. 36.28 percent are from the below ₹100,000, low-income category. In contrast, only 4.59 percent of the respondents are from a household with an annual income higher than ₹1,000,000.

(₹1 = 0.014 $ as on 21 Aug 2018)

3.4.2. Parental Occupation

Occupation of parents highly influences a student's choice. Figure 8 gives a comparison of various occupational sectors in which the parents of the respondents work.

It can be seen that maximum respondents were from the self-employed sector i.e. 37.61 percent. There were almost similar responses from the government and private sector categories i.e. 23.4 percent and 16.2 percent respectively. The agricultural sector also showed a good response with 17.51 percent coming from that single occupation.

The state-wise occupational distribution is indicated in Figure 9. It is evident that all states show a similar trend with maximum respondents from the self-employment category.

3.4.3. Existing Student Loans

Student loans are highly favoured as they make higher education equitable and accessible to a larger population. It also allows students to pay off the loans by contributing a part of their future income (Duraisamy and M., 2016). Students with existing loans that were taken for bachelor's studies face two major obstacles in further pursuing higher education. The first one is the pressure on the person to get a job in order to pay off the existing loan. The other reason is that students with existing loans cannot get a second loan for pursuing education

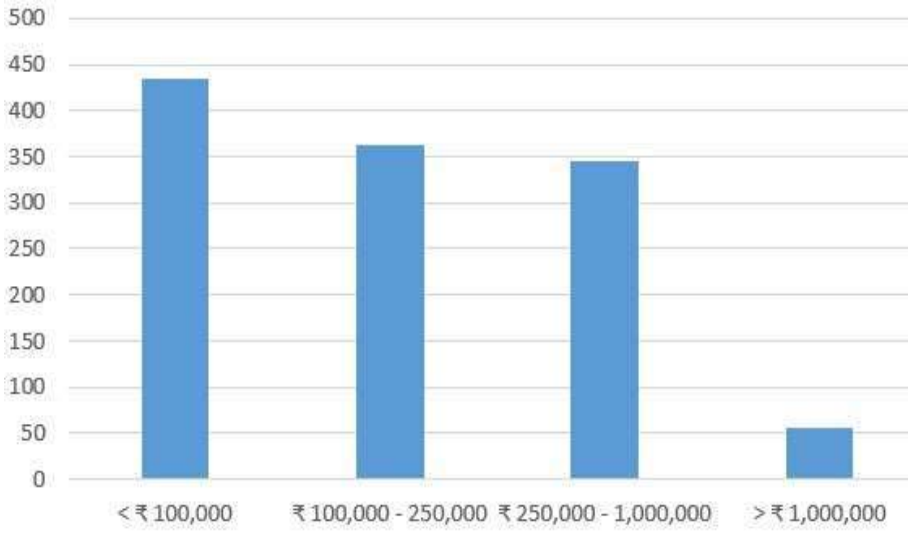

Figure 7: Income-based distribution

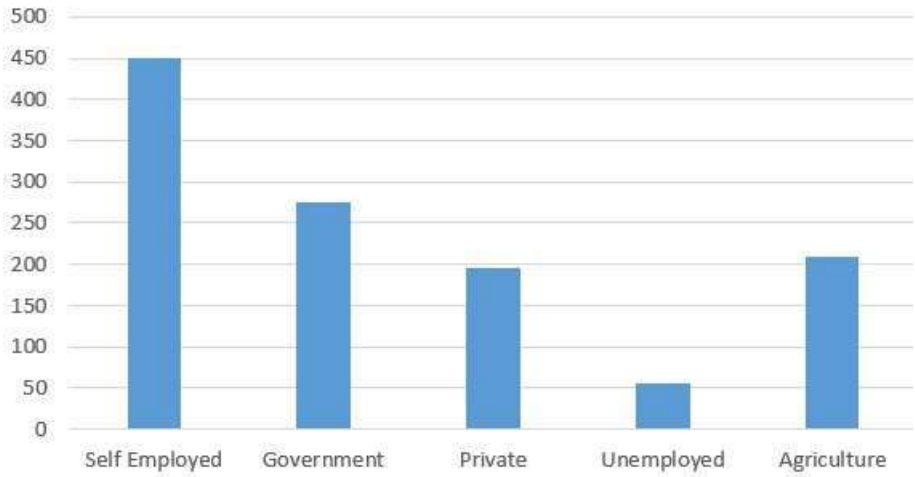

Figure 8: Occupation-based distribution

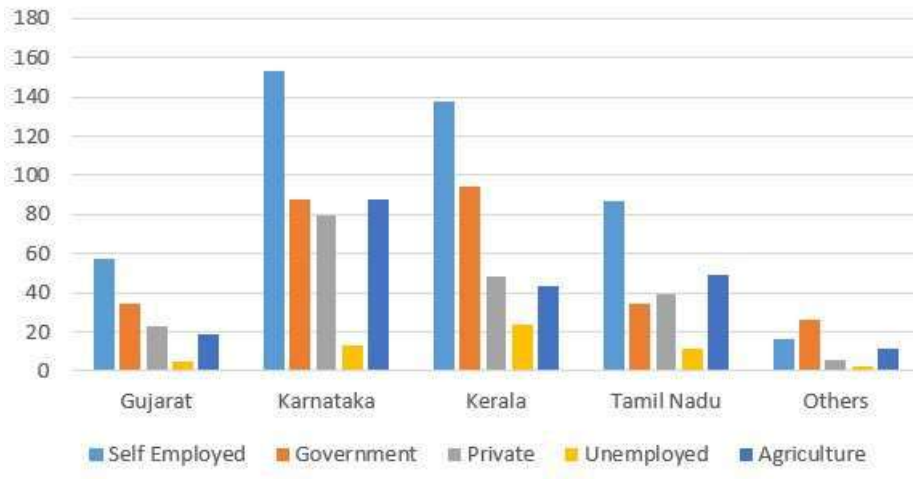

Figure 9: Occupation based distribution within states

Table 1: List of Colleges providing masters in RE in India

S.No	Name of University	State
1	Eternal University	Uttar Pradesh
2	College of Technology and Engineering	Rajasthan
3	Deenbandhu Chhotu Ram University of Science and Technology	Haryana
4	Guru Kashi University	Punjab
5	ICFAI College	Rajasthan
6	Geetanjali Institute of Technical Studies	Rajasthan
7	Kalasalingam Academy of Research and Education	Tamil Nadu
8	Karunya Institute of technology and Science	Tamil Nadu
9	Maharana Pratap College of Agriculture and Technology	Rajasthan
10	Maulana Azad National Institute of Technology	Madhya Pradesh
11	Mewar University	Rajasthan
12	Nitte Meenakshi Institute of Technology	Karnataka
13	Periyar Maniammai College of Technology for Women	Tamil Nadu
14	Rajasthan Technical University	Rajasthan
15	Rayat Bahra University	Punjab
16	Sam Higginbottom university of Agriculture, Technology, and Sciences	Uttar Pradesh
17	Structural Engineering Research Centre	Tamil Nadu
18	Sunrise University	Rajasthan
19	Suresh Gyan Vihar University	Rajasthan
20	TERI school of advanced studies	Delhi
21	Gandhigram Rural Institute	Tamil Nadu
22	Indian Institute of Technology	Delhi
23	Indian Institute of Technology	Maharashtra
24	National Institute of Technology	Tamil Nadu
25	National Institute of Technology	Himachal Pradesh
26	Amrita Vishwa Vidyapeetham	Tamil Nadu

27	Devi Ahilya Viswavidyalaya	Madhya Pradesh
28	Tezpur University	Assam
29	Vellore Institute of Technology	Tamil Nadu
30	SRM University	Tamil Nadu
31	Amity Institute of Renewable and Alternative Energy	Delhi
32	School of Energy Studies, Jadavpur University	West Bengal

Out of all the respondents, 73.23 percent of the respondents did not have an existing loan. The range of loan amount was from ₹6000 to ₹1,500,000. The average loan amount was ₹258640 with a standard deviation of ₹153,031. This shows that a large existing student loan and the pressure to pay off that loan might be the reason stopping a majority of the population from persuading higher education.

The study shows that economic factors play a decisive role in a student's future. Alternate funding options such as scholarships, awards for past achievements etc. need to be promoted either by private industries or by the government to nurture development in this sector.

4. CONCLUSIONS AND SUGGESTIONS

From the above results and findings, we can see that there are various socio-economic factors that affect a student's decision to take up renewable energy as a higher education and career option. There are a number of actions that can be taken in order to help boost this interest. A few possibilities are:

1. Creation of a common portal to access any RE data.
2. Scholarship program specifically in this field to tackle the economic constraints.
3. Awards to promote innovation and interest among youth.
4. Skill development programmes through active participation in on-site projects.

These are the main necessities to promote RE as a field that can match up to already existing academic fields in India. A collective effort needs to be made by individuals, industries and government to achieve this task.

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