काशी हिन्दू विश्वविद्यालय BANARAS HINDU UNIVERSITY

Title

A Dissertation Report Submission to dept of economics for the paper code ECB-607

On

Employment Opportunities in Renewable Energy Sector

Under the Guidance of

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Semester – 6th

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Exam roll no-20214ECO001

CERTIFICATE

This is to certify that the work in the dissertation entitled **"Employment Opportunities In Renewable Energy Sector"** submitted by **Abhishek Kumar (Enrolment No. – 435148)** for the award of the degree of **Bachelor of Arts** to the **Banaras Hindu University, Varanasi** is a record of bonafide research works carried out by him under my direct supervision and guidance.

I considered that the dissertation has abided the standards and fulfilled the requirements of the rule and regulations relation to the nature of the degree. The content presented in the dissertation have not been submitted for the award of any other degree or diploma in this or any other university.

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Declaration

I hereby declare that this dissertation entitled "**Employment Opportunities In Renewable Energy Sector**" has been prepared by me in the department of economics at the Banaras Hindu University under the guidance of **Dr. Pankaj Kumar Soni**, Assistant Professor of Economics, Faculty of Social Science, **Banaras Hindu University.** The information deduced from the literature has been properly conceded in the text and a list of reference availed. No part of this dissertation was pastly presented for another degree or diploma at this or any other institution. I understand that my exploration must be appropriately referenced. I have followed the rules and regulations concerning referencing, citations and use of quotations as set out from the department procedure, this dissertation is my own work. Hence, there is no chance for plagiarism.

Abhishek Kumar

Date - 0705/2023

Acknowledgement

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Employment Opportunities in Renewable Energy Sector

Abstract

The renewable energy sector has emerged as a significant source of job creation in recent years. With increasing awareness of climate change and the need to transition to sustainable source of energy, government and business have been investing heavily in renewable energy. This has created wide range of employment opportunities in the sector, ranging from research and development to manufacturing, installation and maintenance of renewable energy infrastructure. The job market in renewable energy is expected to grow at a faster rate than most of other industries in the coming years. This study provides an overview of employment opportunities in the renewable energy sector and highlights some of the key factor driving job growth in this field.

Chapter 1

Introduction

The renewable energy sector has been experiencing significant growth in recent years, driven by global efforts to reduce carbon emissions and combat climate change. As the demand for clean energy sources continues to increase, the renewable energy sector is becoming an increasingly important source of employment opportunities.

The renewable energy sector encompasses a variety of technologies, including solar, wind, hydro, bioenergy, geothermal, and ocean energy. Each of these technologies offers unique opportunities for employment in a wide range of fields, from engineering and construction to research and development, project management, and sales and marketing.

Employment opportunities in the renewable energy sector are not limited to a specific region or country, as the demand for clean energy is global. This sector offers a diverse range of jobs, from entry-level positions to high-level executive roles, and is attracting talent from various industries and backgrounds.

In addition to providing employment opportunities, the renewable energy sector offers a range of benefits, including improving energy security, reducing greenhouse gas emissions, and promoting sustainable development. As such, the growth of the renewable energy sector is expected to continue in the coming years, providing increasing opportunities for employment and contributing to the transition towards a cleaner and more sustainable future.

The renewable energy sector has emerged as a key player in the global energy transition towards a cleaner and more sustainable future. As the world becomes increasingly aware of the urgent need to reduce greenhouse gas emissions and combat climate change, the demand for renewable energy has grown significantly. This has led to a surge in employment opportunities in the renewable energy sector, which spans across various industries and job roles.

The renewable energy sector offers employment opportunities in a wide range of fields, including manufacturing, installation, operations and maintenance, research and development, sales and marketing, and project management. As the sector continues to grow, there is an increasing

demand for skilled workers who are capable of designing, building, and maintaining renewable energy infrastructure.

The growth of the renewable energy sector has been driven by several factors, including government policies and incentives, declining costs of renewable technologies, and increasing public awareness and support for renewable energy. This has led to a shift towards cleaner and more sustainable energy sources such as solar, wind, hydro, and bioenergy, which has in turn created numerous job opportunities across the globe.

Overall, the renewable energy sector presents a significant employment opportunity for individuals looking to make a positive impact on the environment while also pursuing a fulfilling career. The trend of employment in the renewable energy sector is expected to continue its upward trajectory in the coming years, making it an attractive and promising field for job seekers.

Chapter 2

Literature Review

Literature reviews have been done on the aspects of "relationship between job opportunities & renewable energy sectors" and the findings of several literatures are as follows:

Cameron and Bob (2015): In The paper they presented the conclusion after doing literature review on the job opportunity linked to the renewable energy, where they did 70 studies and analysis the data which has published over the last decade . during their analysis to reviewed the publication that cover different countries. their overall conclusion was that there was lack of certainity that how many independent items should be included to do significant analysis. to estimate the employment factor, they took total of 31 independent items where only 14 items references provided good estimate of the employment factor in different stages such as manufacturing, assembling, installation. To estimate the value of operating and maintenance, they took 23 items.

Kumar and Majid (2020): In his review, he analyzed the data from ministry and NGOs and he found the prime objective to promote renewable energy. Advanced economic development, improve energy security, early access to energy and combat climate change. In his study he found that sustainable development is possible by promoting clean and renewable energy, during his study he also found that govt. backing of renewable plan leads to success. As per his analysis the renewable energy sector could create huge chunk of employment.

Baruah (2015): During her study, she tried to identify what are the opportunities and constraints the low-income women facing trouble in getting of jobs in this sector. She conducted qualitative and quantitative study under the joint program of TERI and SEWA group in 2012-13. She found that although reach to the technology, jobs are limited due to inadequate purchasing power and low social status. There is massive job opportunity for women at various stages of energy supply chain.

Maradin,Corovic and Mjeda(2017): Researchers analyzed various reports of IRENA and tried to draw the conclusion . Under their studies, they found that rapid economic development has propelled more quick use of renewable energy technology. During the study, he came to know that

the production and use of renewable pushed the development of new tech, generating new opportunities for the new emergent entrepreneurs who are ready to invest in component making industries. In his paper he drew positive and negative effect of renewable energy. in positive aspects, he found investment and use of renewable energy contributed effectively in economic growth and development. Moreover, the R&D promotes new and advanced technological change in emergent market.

Rio and Burguillo (2007): During his work, he tried to make the contribution in this context by developing and linking theoretical blueprint, which permit a detailed analysis of the effect of renewable energy on local sustainability. after doing intense study, he found renewable energy sources have the immense potential to contribute to the sustainable development of specific region by availing them with a wide variety of socioeconomic and environmental benefits. he applied the triangular constant capital approach.

Martinez and stephens (2016): They did study on gender diverse workforce in renewable energy, where they explained gender diversity in the energy workforce and illuminate the significance of systematic assessment of women participation in the work toward sustainable energy system In the study they found that there is gender inequality in the energy sector workforce was visible in countries across the globe. They highlighted the benefits of gender diversity and they concluded that companies were more female on the board of directors are more likely to actively invest in renewable energy.

Yeyanran and Qiangzhi (2015): Researchers took data from UNEP (2011) and did literature review on the green economy, clean energy policy and employment. They tried to highlight the relationship between the green economy jobs are never assimple as it appears. They also worked on the analysis of the relationship based on the study of green energy policy in various countries. During the literature study they found that the clean economy has a great positive effect on jobs in both low and high income countries.

Akella,Saini and Sharma(2009): Researchers conducted a broader study to show the tren of total emission reduction over the year, which disclosed ,emission reduction increasing after the installation of renewable energy system in inner areas of country. During their study they also

highlighted the concept of Clean Development Mechanism (CDM) which is one of the flexible mechanism under Kyoto protocol.

Baruah (2017): In her study, she threw light on the presentation of women in global energy sector. In her paper she reviewed the women's employment in renewable energy in advanced economies, rising economies and developing economies. She pointed out the commonalities and dissimilarities in occupational pattern of women employment in renewable energy in different part of the world and she made suggestion to promote women indulgence in clean energy with the help of data from OECD countries.

Eitan,Herman and Fischendler (2019): Researchers tried to figure out the role of the emergence of partnership in renewable energy, where they said renewable energy partnership promotes innovation and adoption of new technology, amalgamation of partners of having different capacity, knowledge and experiences create more appropriate base where innovation would grow swiftlier and healthier. They also focused on the relevance of community private sector cooperation in the renewable energy sector.

Literature Gap- But, all the above mentioned, researcher articles cannot present the trend of employments across the various sector of renewable energy.

Chapter 3

Objective, Methodology and Data source

Objective

- To study jobs prospects in renewable energy sector.
- To distribution of workforce across the sector.
- To study job opportunity in different green technology.
- To do trend analysis of jobs in various sectors

Methodology and Data source

Using Secondary data source, Trend in employment opportunity in renewable energy sector has been shown. Based on the data of International Renewable Energy Agency (IRENA) ,renewable energy and jobs annual review And International Energy Agency (IEA).

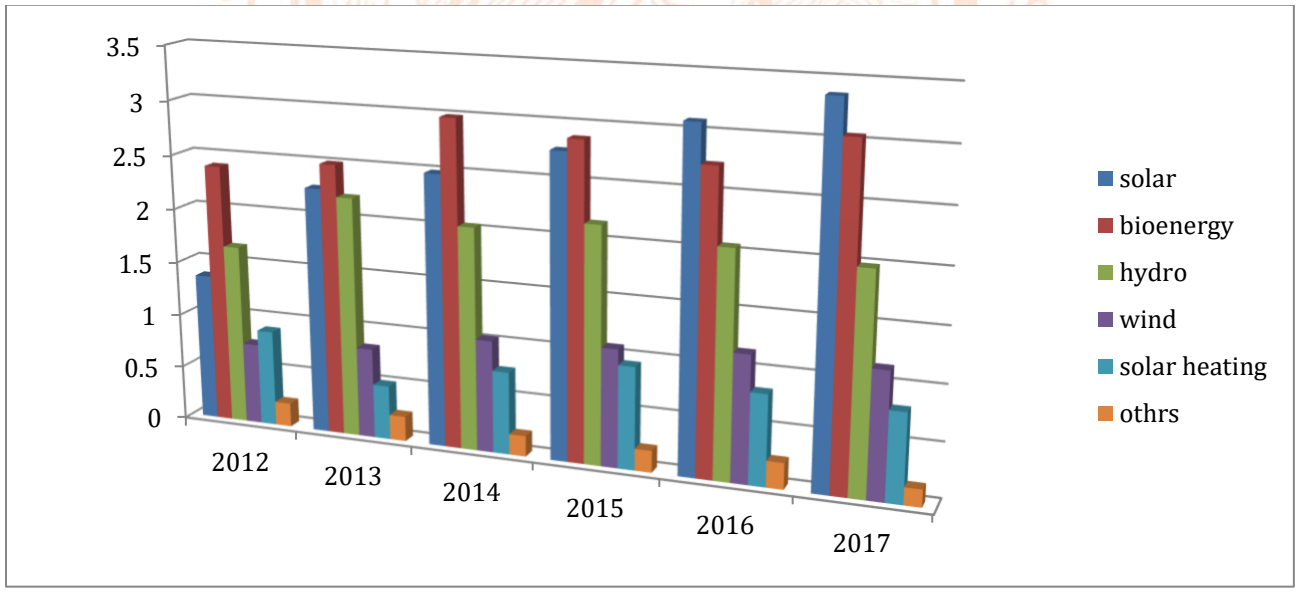
Chapter 4

Finding and Analysis

These employment trends are shaped by a multitude of factors, including costs, investment , and new and cumulative capacities , and by a broad array of policy measures to enable renewable energy deployment , generate viable supply chain and create a skilled workforce . The covid-19 pandemic continued to affect the global economy during 2021, altering both the volume and structure of energy demand.

Domestic market size is a major factor that affects employment generation in construction, installation, operation and maintenance. Building or maintaining a strong equipment manufacturing industrial base also needs sufficiently large and steady domestic demand. Only a few countries have become significant equipment producer. Trade restrictions may be required to protect a fledgling local industry, but policy makers need to strike a careful balance between such effort and minimizing cost for renewable energy projects

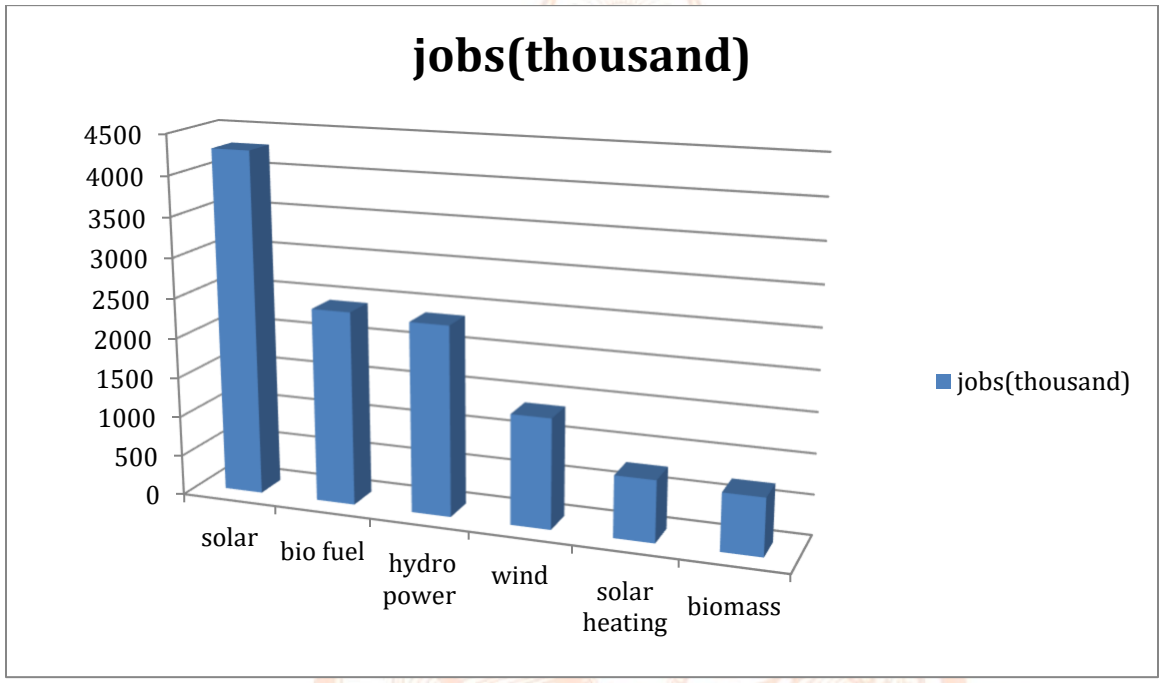
Figure 4.1: Jobs in different sectors year-wise (2012-17)



*Jobs in million

Source:- IRENA Jobs data

Figure 4.2: Global renewable energy employment



Source: IRENA Jobs data

4.1 SOLAR PHOTOVOLTAIC[1] (4.3 million jobs)

Table 4.1.1: The Top Countries for Solar PV Employment as Of 2021,

Country	Jobs(Million)
China	2.7
India	0.36
U.S	0.34

[1] Process of generation of electricity by using sunlight

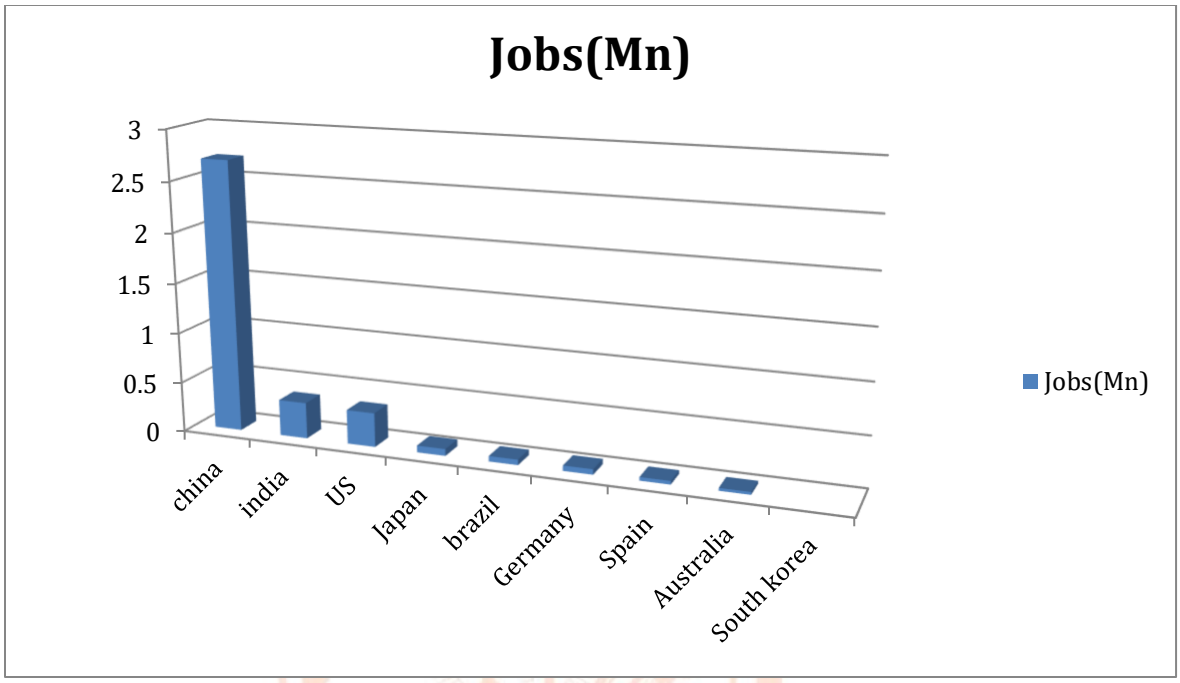
Japan	0.068
Brazil	0.054
Germany	0.053
Spain	0.035
Australia	0.027
South Africa	0.023
France	0.020

Source: IRENA jobs data

It's worth noting that employment numbers can vary depending on how they are defined and measured, and these figures are subject to change as the solar PV industry continues to grow and evolve.

It is worth noting that these figures represent direct employment in solar PV industry and do not include indirect jobs or jobs in related industries, such as manufacturing or installation. Additionally, the COVID-19 disruption has had an impact on employment figures in the sector with some countries experiencing a decline in solar PV jobs in 2020. However , the long term trend is still one of growth , as more countries invest in renewable energy and work towards decarbonisation.

Figure 4.1.1: Jobs in the solar PV in different countries.



Source: IRENA Jobs data

4.2 WIND (1.4 Million jobs)

The wind energy sector offers a wide range of job opportunities across various disciplines, including engineering, construction, maintenance, operations, and management. Here are some examples of jobs in the wind energy sector:

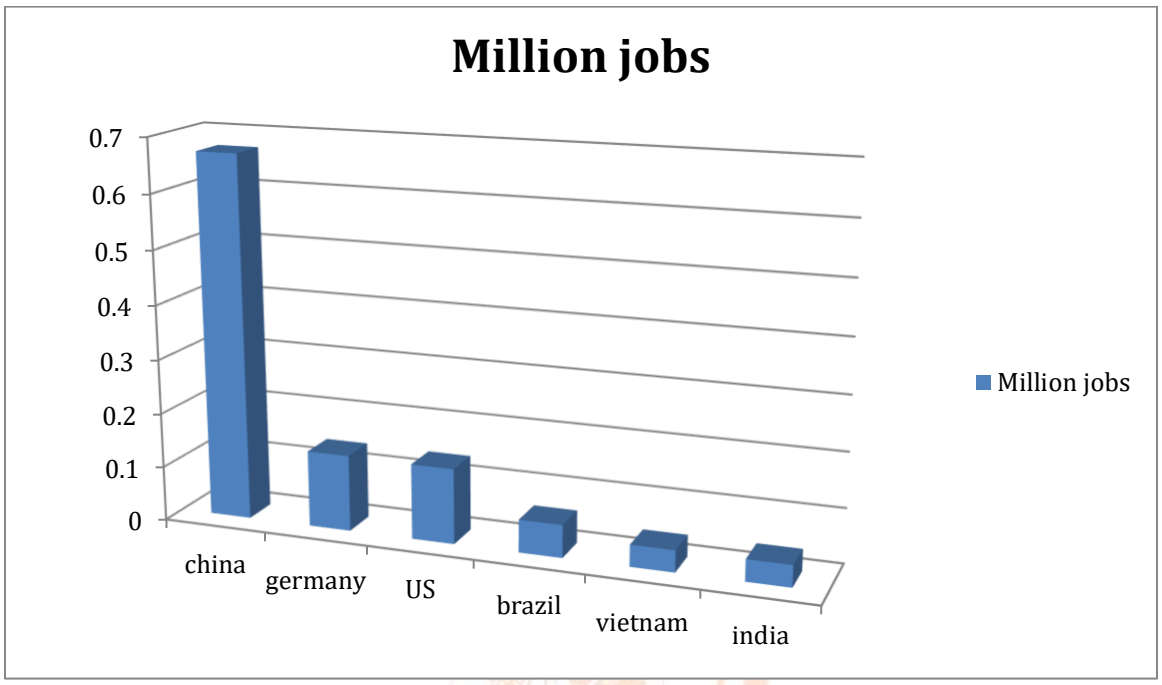
1. Wind turbine technician: Wind turbine technicians are responsible for installing, maintaining, and repairing wind turbines. This job requires technical skills and knowledge of electrical and mechanical systems.
2. Electrical engineer: Electrical engineers design and develop electrical systems for wind turbines and wind farms. They also work on the development of power grids to connect wind farms to the electrical grid.
3. Project manager: Project managers oversee the construction and installation of wind turbines and wind farms. They are responsible for managing budgets, timelines, and resources to ensure that projects are completed on time and within budget.

4. Environmental scientist: Environmental scientists assess the environmental impact of wind energy projects and develop strategies to minimize any negative effects on the environment.
5. Meteorologist: Meteorologists provide weather forecasting services to wind energy companies to help them optimize the performance of wind turbines.
6. Sales and marketing: Sales and marketing professionals are responsible for promoting wind energy products and services to customers and developing new business opportunities.
7. Data analyst: Data analysts use data to optimize the performance of wind turbines and wind farms, and to develop strategies to improve efficiency and reduce costs.
8. Finance and accounting: Finance and accounting professionals manage the financial aspects of wind energy projects, including budgets, financing, and accounting.

These are just a few examples of the many jobs available in the wind energy sector. As the demand for renewable energy continues to grow, there will be even more opportunities for skilled professionals in this field.

4.2.1 Wind employment: Top Countries

Figure 4.2.1: Jobs in wind energy in different countries



Source: IRENA Jobs data

4.3 Hydropower(2.4 million jobs)

There are several jobs in the hydropower sector that involve data analysis, management, and engineering. Some examples include:

1. Hydropower Plant Data Analyst: This role involves analyzing and interpreting data from the hydropower plant's equipment and systems, and identifying opportunities to improve plant performance and efficiency.
2. Hydropower Plant Engineer: This role involves designing, building, and maintaining hydropower plants, as well as analyzing data to optimize plant performance.
3. Hydropower Resource Analyst: This role involves analyzing and modeling water resources to determine the potential for hydropower development in specific locations.
4. Hydrology Data Analyst: This role involves analyzing and interpreting data related to hydrology, such as precipitation, snowpack, and streamflow, to help inform hydropower development and operations.

5. Environmental Compliance Analyst: This role involves analyzing and managing data related to environmental regulations and permits for hydropower plants, and ensuring compliance with these requirements.
    I. Renewable Energy Market Analyst: This role involves analyzing market data and trends related to renewable energy, including hydropower, to identify opportunities for growth and investment.
    II. Hydropower Project Manager: This role involves overseeing the planning, design, construction, and operation of hydropower projects, including managing data related to project timelines, budgets, and performance.

Overall, the hydropower sector offers a variety of job opportunities that involve data analysis and management, as well as engineering and project management.

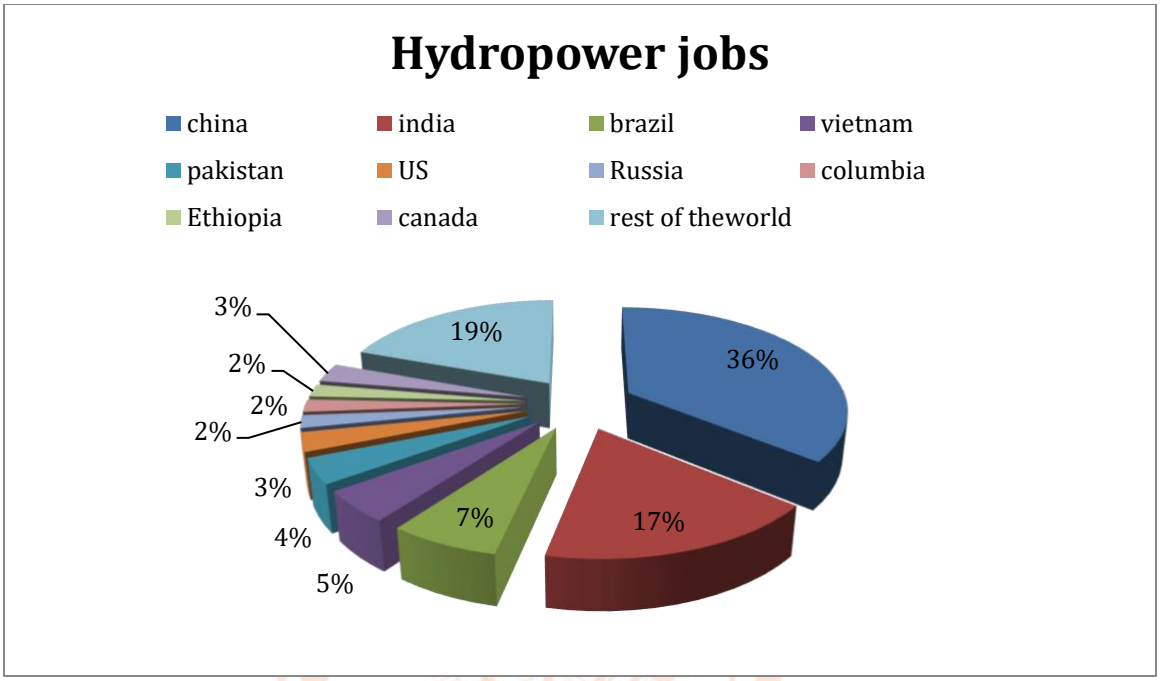
The number of jobs in the hydropower sector varies by country, depending on factors such as the size of the country, the level of investment in hydropower, and the availability of resources.

Here are some examples of countries and the estimated number of jobs in the hydropower sector:

1. China: It is estimated that the hydropower sector in China employs around 300,000 people.
2. Brazil: According to the Brazilian Association of Small Hydropower Plants (ABRAPCH), the small hydropower sector in Brazil employs around 85,000 people.
3. Canada: The Canadian Hydropower Association estimates that the hydropower sector in Canada employs around 35,000 people.
4. India: According to the Ministry of Power in India, the hydropower sector in India employs around 12,000 people.
5. United States: The National Hydropower Association in the United States estimates that the hydropower sector employs around 300,000 people.

These numbers are rough estimates and can vary depending on the source of data and the specific definitions used to define the hydropower sector.

Figure 4.3.1: Distribution of jobs in hydropower across the countries



Source: IRENA jobs data

4.4. LIQUID BIOFUELS

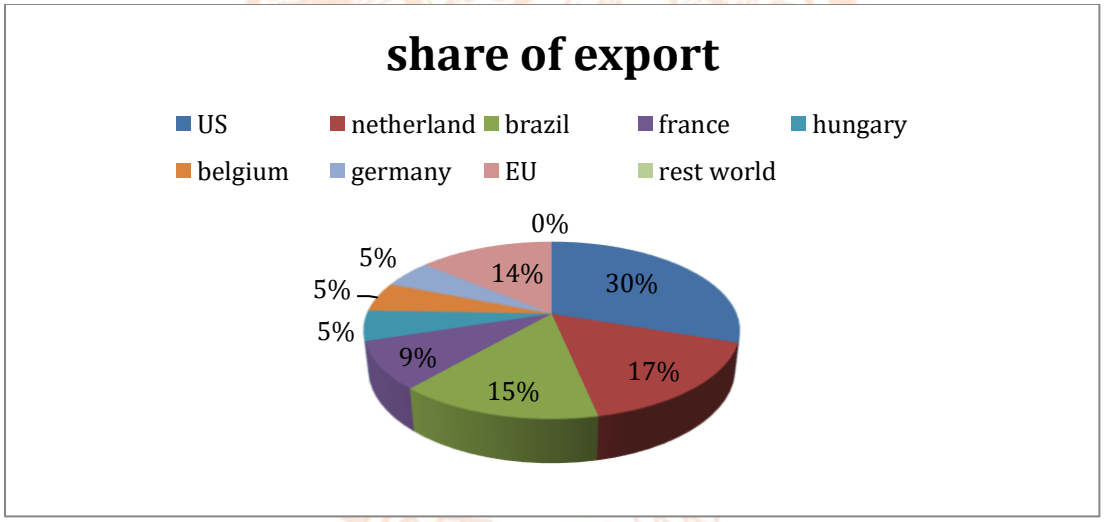
The liquid biofuel sector is a growing industry that offers a range of job opportunities in different fields. Here are some examples of jobs in the liquid biofuel sector:

1. Research Scientist: Research Scientists are responsible for conducting research to develop and improve liquid biofuels. They analyze data, develop experiments, and interpret results.
2. Chemical Engineer: Chemical Engineers design and develop the processes and equipment used in the production of liquid biofuels. They oversee the operation of production plants, troubleshoot problems, and optimize production.
3. Sales Representative: Sales Representatives are responsible for promoting and selling liquid biofuels to potential customers. They establish relationships with customers, negotiate sales contracts, and communicate product information.
4. Project Manager: Project Managers oversee the planning, implementation, and completion of projects related to liquid biofuels. They manage resources, timelines, and budgets to ensure that projects are completed on time and within budget.

5. Quality Control Analyst: Quality Control Analysts are responsible for testing and analyzing liquid biofuels to ensure that they meet quality standards. They use a variety of techniques to analyze samples and report findings to management.
6. Environmental Engineer: Environmental Engineers design and implement strategies to minimize the environmental impact of liquid biofuel production. They ensure compliance with environmental regulations and develop sustainable practices.
7. Operations Manager: Operations Managers oversee the day-to-day operations of liquid biofuel production facilities. They manage personnel, oversee production processes, and ensure compliance with safety and environmental regulations.

These are just a few examples of jobs in the liquid biofuel sector. Other roles may include marketing specialists, logistics coordinators, and regulatory affairs specialists. The industry is constantly evolving, and new opportunities are likely to emerge as the sector continues to grow.

Figure 4.4.1: Countries share in Export of Biofuels

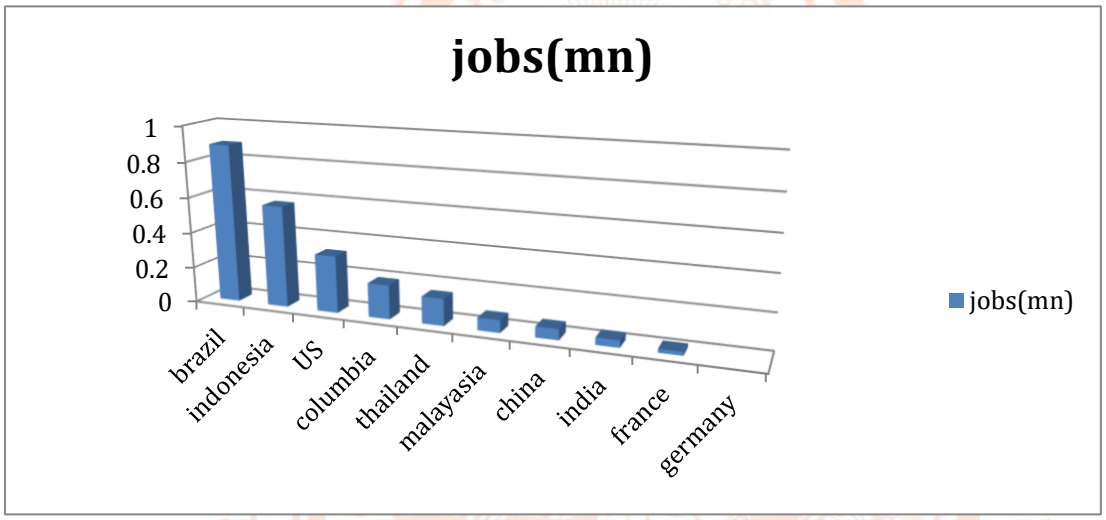


Source: IRENA jobs data

The biofuel industry is a growing sector that has the potential to create new jobs and economic opportunities in many countries around the world. The industry encompasses a wide range of activities, including research and development, production, distribution, and sales of biofuels.

The number of jobs in the biofuel industry can vary depending on a number of affecting factors, such as the size and maturity of the industry in a given country, the types of biofuels produced, and the policies and incentives in place to support the industry

Figure 4.4.2: Country wise Jobs in Biofuel(in Mn)



Source: IRENA jobs data

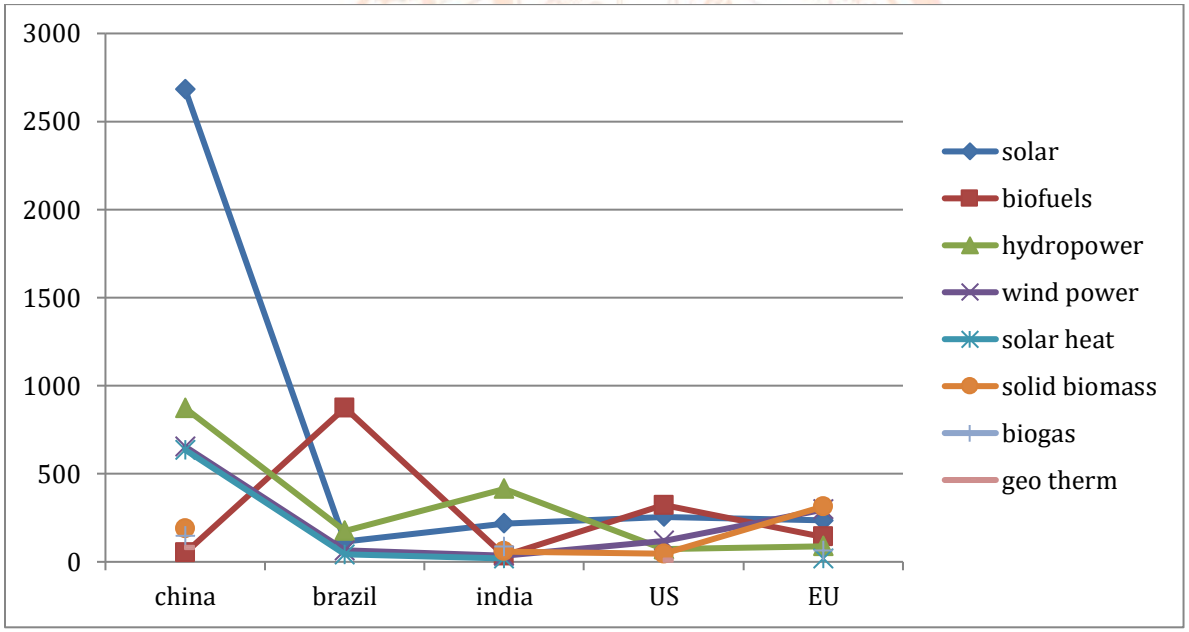
Table 4.4.1: Projected number of direct and indirect jobs in renewable energy across the globe, 2020-21.

	World	China	Brazil	India	US	EU
Solar	4291	2682	115.2	217	255	235
Biofuel	2421	51	874.2	35	322.6	142

Hydropower	2370	872.3	176.9	414	72.4	89
Solar heating	769	636	42	19	--------	19
Solid biomass	716	190	-------	58	46.3	314
Biogas	307	145	-------	85	-------	64
Geothermal	196	78.9	-------	-------	8	60
Wind power	1371	654	63.8	35	120.2	298
total	12441	5309	1373.9	863	824.5	1221

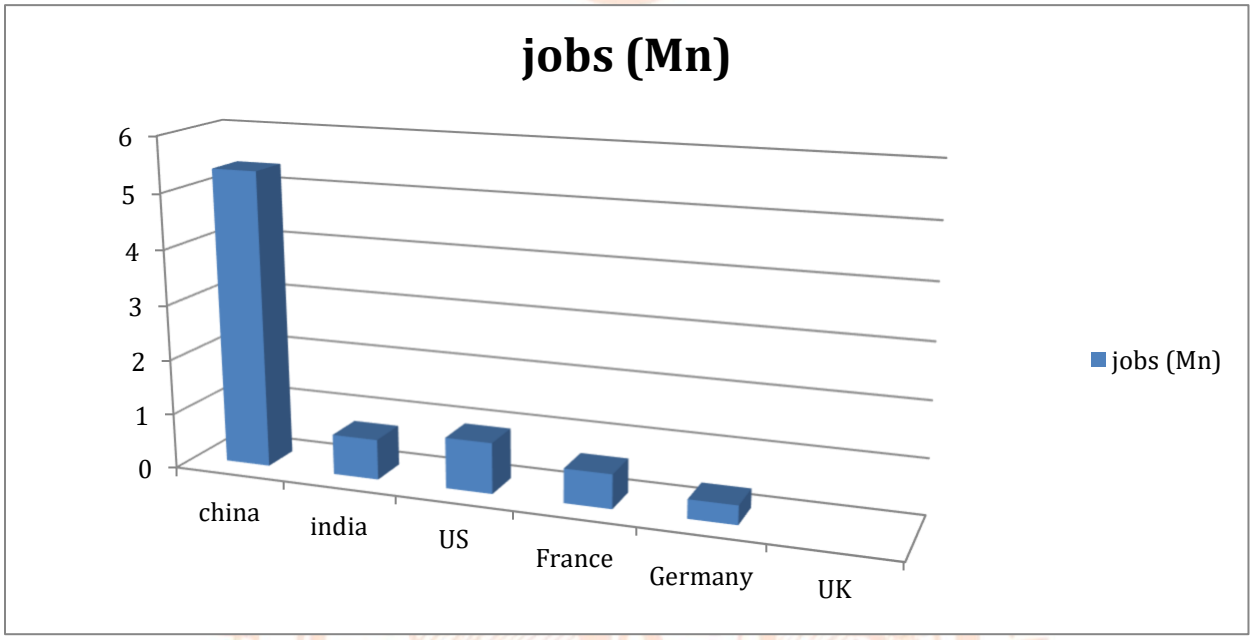
Source: IRENA jobs data

Figure 4.4.3: Distribution of jobs among countries



Source: IEA jobs review

Figure 4.4.4: Leading Countries and Jobs in Renewable Energy Sector



source: IRENA jobs data

Chapter 5

Trend Analysis of Employment Opportunity in Different Sources of Renewable Energy

Trend analysis of job opportunities in renewable energy sector have been done in- solar energy, wind energy, hydroenergy, bioenergy and solar heating/cooling

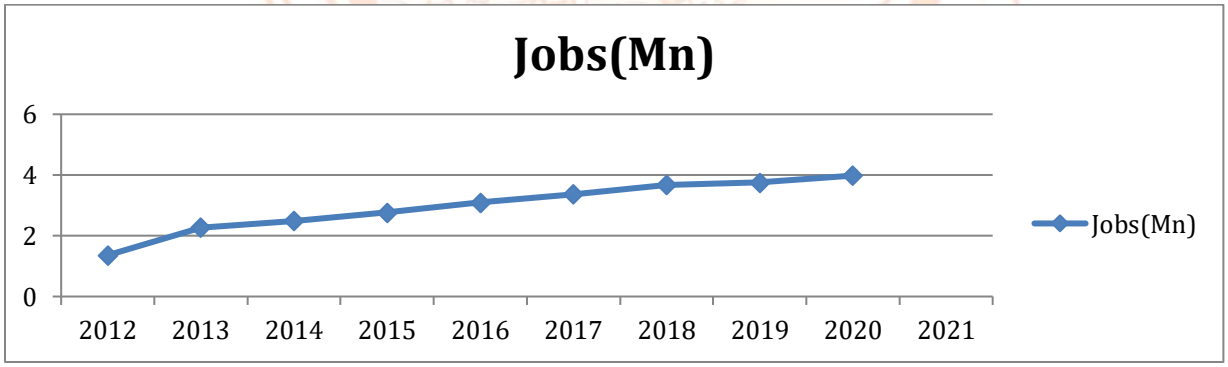
5.1 Solar Energy

Table 5.1.1: Jobs in SOLAR ENERGY

Year	Jobs(Mn)
2012	1.36
2013	2.27
2014	2.49
2015	2.77
2016	3.09
2017	3.37
2018	3.68
2019	3.75
2020	3.98
2021	4.29

Source: IRENA jobs data

Figure 5.1.1: Trend analysis of Employment in SOLAR PV



Source: IRENA jobs data

The solar energy sector has experienced remarkable growth over the past decade and has become one of the fastest-growing industries in the world. This growth has led to a significant increase in employment opportunities in the sector, with the creation of jobs spanning across various roles and industries.

The trend of employment in the solar energy sector is driven by several factors, including the declining cost of solar panels, government policies and incentives, and increasing public awareness about the benefits of solar energy.

In terms of job roles, the solar energy sector offers employment opportunities in a wide range of fields, including manufacturing, installation, sales and marketing, research and development, and project management. Some of the most in-demand positions in the solar energy sector include solar panel installers, solar energy system designers, sales representatives, and project managers. According to the US Bureau of Labor Statistics, solar photovoltaic (PV) installers are among the fastest-growing occupations in the United States, with an expected growth rate of 51% from 2019 to 2029. This trend is not limited to the United States alone; countries across the world are experiencing a surge in solar energy-related job opportunities.

Overall, the trend of employment in the solar energy sector is expected to continue its upward trajectory in the coming years, driven by the increasing demand for clean energy and the continued innovation and development of solar technologies.

In this direction, Gurugram (India) based International Solar Alliance (ISA), which is 114 members and signatory countries is doing significant job in the area of motivating the countries to join the ISA and promote the use of solar energy in order to reduce the emission and ensuring cheap and feasible source of energy and this make strong future estimates that employment opportunity will rise leaps and bounds very soon.

5.2 WIND ENERGY

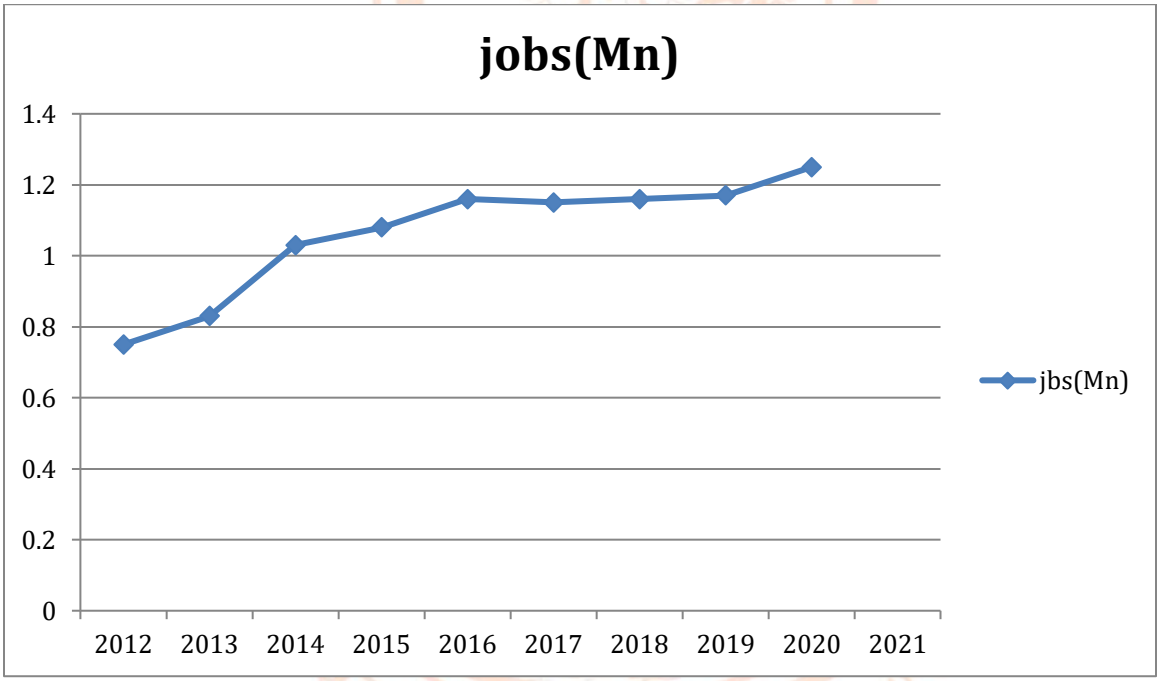
Table 5.2.1: Total number of jobs in wind energy (2012-21)

Year	Jobs(Mn)
2012	0.75

2013	0.83
2014	1.03
2015	1.08
2016	1.16
2017	1.15
2018	1.16
2019	1.17
2020	1.25
2021	1.37

Source: IRENA jobs data

Figure 5.2.1: Trend Analysis of employment in wind energy



Source: IRENA jobs data

The wind energy sector has been growing steadily over the past decade and has become a significant contributor to the global energy mix. This growth has led to an increase in employment opportunities in the sector, with the creation of jobs spanning across various roles and industries.

The trend of employment in the wind energy sector is driven by several factors, including government policies and incentives, the declining cost of wind turbines, and increasing public awareness about the benefits of wind energy.

In terms of job roles, the wind energy sector offers employment opportunities in a wide range of fields, including manufacturing, installation, maintenance, sales and marketing, research and development, and project management. Some of the most in-demand positions in the wind energy sector include wind turbine technicians, engineers, project managers, and sales representatives.

According to the Global Wind Energy Council (GWEC), the wind energy sector employed over 1.2 million people worldwide in 2020, with the majority of jobs located in China, Europe, and the United States. In the United States alone, the wind energy sector employed over 120,000 people in 2020, according to the US Bureau of Labor Statistics.

The trend of employment in wind energy sector is expected to continue its upward trajectory in the coming years, driven by the increasing demand for clean energy and the continued innovation and development of wind technologies. The international agencies have predicted that the wind energy sector could create up to 3.3 million jobs globally by 2030, up from 1.2 million in 2020.

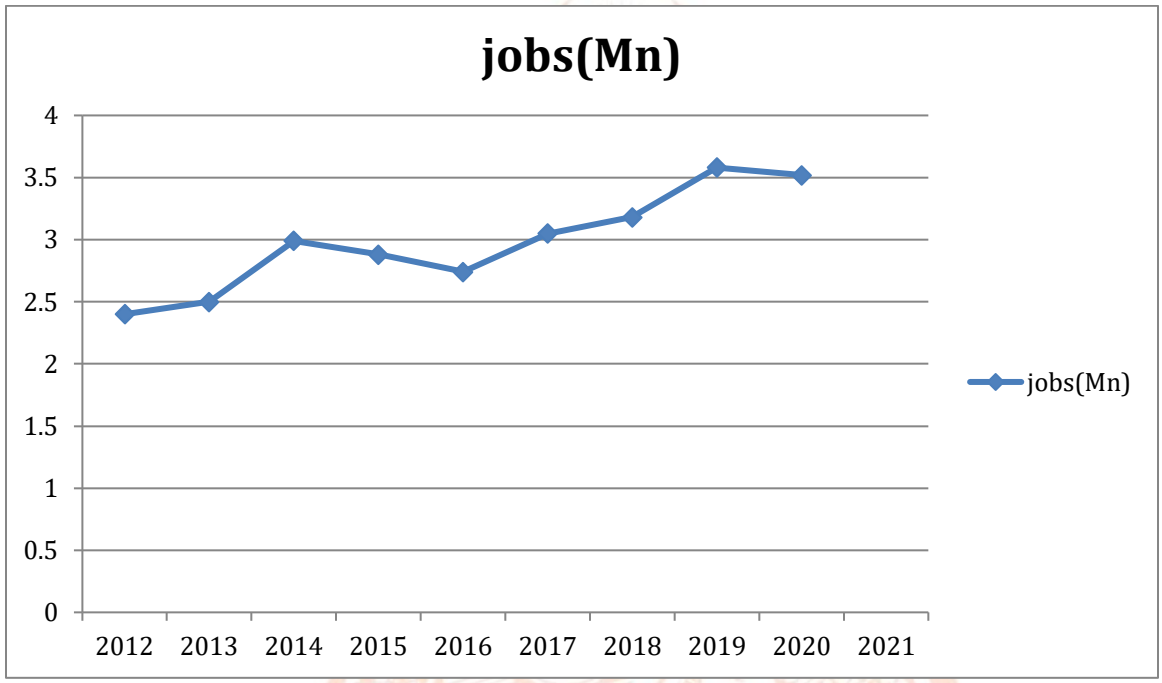
5.3 BioEnergy

Table 5.3.1: Total number of jobs in Bioenergy(2012-21)

year	Jobs(Mn)
2012	2.40
2013	2.50
2014	2.99
2015	2.88
2016	2.74
2017	3.05
2018	3.18
2019	3.58
2020	3.52
2021	3.44

Source: IRENA jobs data

Figure 5.3.1: Trend Analysis of employment generation in Bioenergy



Source: IRENA jobs data

The bioenergy sector has been growing in importance in recent years, as it provides a sustainable and renewable source of energy. This growth has led to an increase in employment opportunities in the sector, with the criterion of jobs spanning across various roles and industries.

The trend of employment in the bioenergy sector is driven by several factors, including government policies and incentives, increasing demand for renewable energy, and advancements in technology that make it easier and more cost-effective to produce bioenergy.

In terms of job roles, the bioenergy sector offers employment opportunities in a wide range of fields, including agriculture, forestry, engineering, research and development, and project management. Some of the most in-demand positions in the bioenergy sector include biomass plant operators, biofuel production technicians, researchers, and engineers.

According to the IEA, the bioenergy sector employed over 3 million people worldwide in 2019, with the majority of jobs located in the agricultural and forestry sectors. In the United States alone, the bioenergy sector employed over 130,000 people in 2020, according to the US Department of Energy.

The trend of employment in the bioenergy sector is expected to continue its upward trajectory in the coming years, driven by the increasing demand for renewable energy and the continued innovation and development of bioenergy technologies. The IEA predicts that the bioenergy sector could create up to 7 million jobs globally by 2050, up from 3 million in 2019.

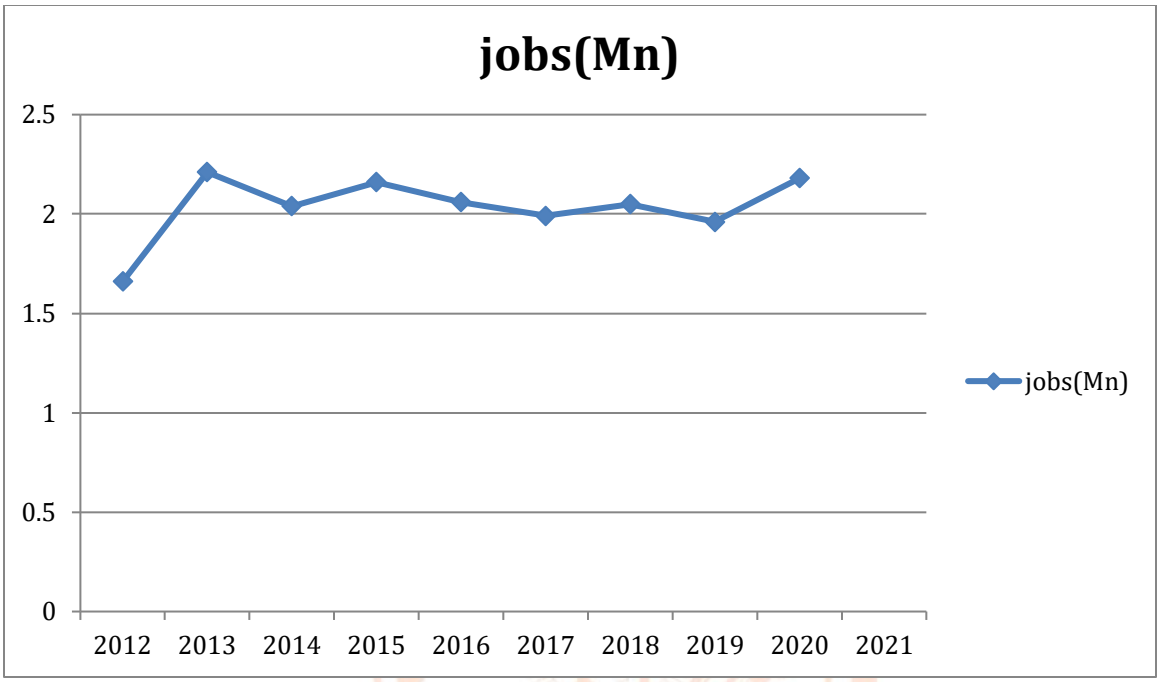
5.4 Hydropower

Table 5.4.1: Total number of jobs in Hydropower

Year	Jobs(Mn)
2012	1.66
2013	2.21
2014	2.04
2015	2.16
2016	2.06
2017	1.99
2018	2.05
2019	1.96
2020	2.18
2021	2.37

Source: IRENA job data

Figure 5.4.1: Trend analysis of Employment generation in Hydropower



Source: IRENA Jobs data

The hydroenergy sector has been a longstanding source of renewable energy, and it continues to play a significant role in the global energy mix. This sector has seen some growth in recent years, which has led to an increase in employment opportunities in this sector, with jobs spanning across various role and industries.

The trend of employment in the hydroenergy sector is driven by several factors, including government policies and incentives, the need for reliable and stable sources of energy, and the increasing demand for renewable energy.

In terms of job roles, the hydroenergy sector offers employment opportunities in a wide range of fields, including engineering, construction, operations, maintenance, and project management. Some of the most in-demand positions in the hydroenergy sector include hydroelectric plant operators, civil engineers, mechanical engineers, and project managers.

According to the IEA, the hydroenergy sector employed over 2 million people worldwide in 2019, with the majority of jobs located in the construction, operation, and maintenance of hydroelectric power plants. In the United States alone, the hydroenergy sector employed over 66,000 people in 2020, according to the US Department of Energy.

The trend of employment in the hydroenergy sector is expected to remain relatively stable in the coming years, driven by the continued demand for reliable and stable sources of energy. However, the growth potential for employment in this sector may be limited due to the maturity of the industry and the lack of significant technological advancements in recent years.

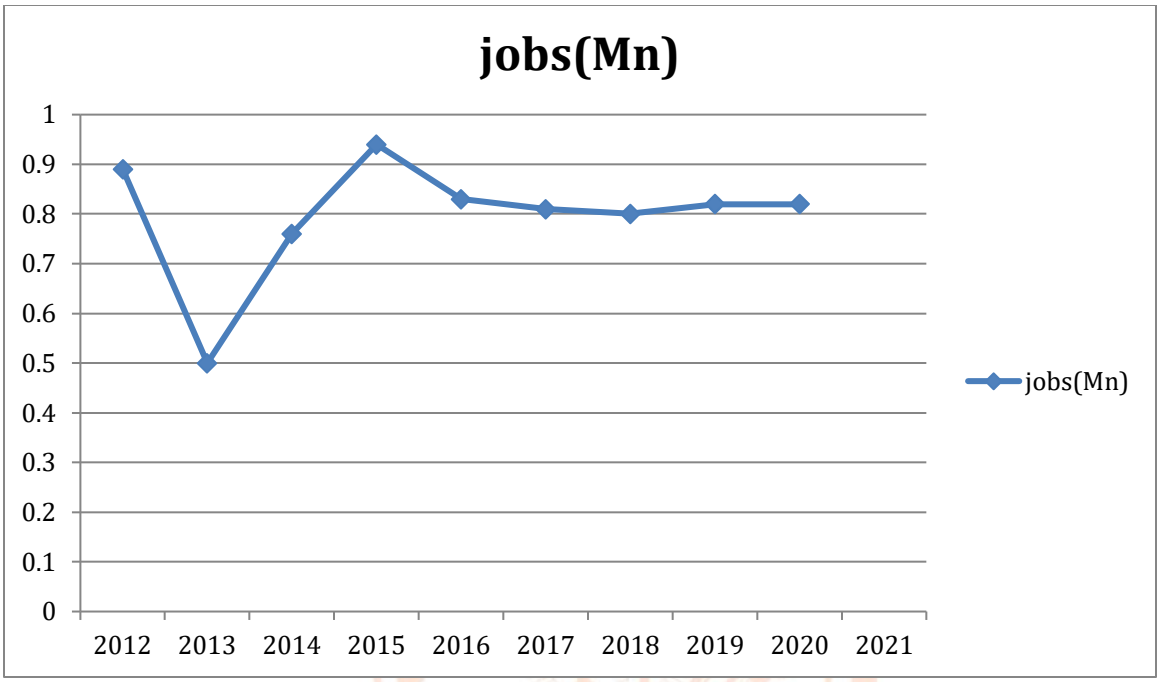
5.5 Solar heating/cooling

Table 5.5.1: Total number of jobs in solar heating/cooling

year	Jobs(mn)
2012	0.89
2013	0.50
2014	0.76
2015	0.94
2016	0.83
2017	0.81
2018	0.80
2019	0.82
2020	0.82
2021	0.77

Source: IRENA jobs data

Figure 5.5.1: Yearly trend of Employment in Solar Heating/Cooling



Source: IRENA jobs data

The trend of employment in solar heating/cooling is generally positive and expected to continue to grow in the coming years. As more and more people become aware of the benefits of renewable energy and the need to reduce carbon emissions, the demand for solar heating/cooling systems is expected to increase.

According to the multilateral agencies, the number of people employed in the renewable energy sector reached 11.5 million globally in 2019, up from 10.3 million in 2017. While specific data on employment in solar heating/cooling is not readily available, it is expected that this growth in the renewable energy sector will lead to an increase in employment opportunities in all areas of renewable energy, including solar heating/cooling.

In addition, governments and organizations around the world are implementing policies and initiatives to promote the use of renewable energy , including solar heating/cooling. these policies are expected to further boost the growth of the industry and create new job opportunities.

Particularly, the report notes that the construction and installation of solar thermal systems, such as solar water heater , accounts for a significant portions of the employment in the solar heating

and cooling sector. Other job opportunities including research and development, engineering, project, management, and maintenance and repair.

Overall, the trend of employment in solar heating and cooling appears to be positive, with increasing demand for skilled workers in this field as the world transitions to cleaner energy sources.

Chapter 6

Future Prospect of Employment in Renewable energy Sector

The future prospects of employment in the renewable energy sector are very promising. As the world shifts towards sustainable energy sources, there will be a growing demand for professionals with skills in renewable energy technologies, project management, research and development, and policy-making.

According to a report by the International Renewable Energy Agency (IRENA), the renewable energy sector could employ 42 up to million people globally by 2050, up from 11 million in 2018. This represents a significant opportunity for job creation, especially in developing countries where renewable energy is becoming a key driver of economic growth.

Some of the key areas where employment opportunities are expected to grow in the renewable energy sector include:

1. Solar Energy: With solar energy becoming more affordable and efficient, there will be a growing demand for solar energy installers, engineers, and designers.
2. Wind Energy: As wind energy continues to grow, there will be a need for wind turbine technicians, engineers, and project managers.
3. Energy Storage: The growth of renewable energy will also require energy storage solutions, creating new jobs in battery technology, and energy storage system installation and maintenance.
4. Electric Vehicles: The shift towards electric vehicles will also create new jobs in manufacturing, maintenance, and charging infrastructure.

Overall, the renewable energy sector is poised for significant growth in the coming years, providing ample opportunities for employment and career growth.

Chapter 7

CONCLUSION

In conclusion, employment opportunities in the renewable energy sector are expected to continue growing in the coming years. This is due to the increasing global demand for clean and sustainable energy sources, driven by concerns over climate change and the need to reduce greenhouse gas emissions.

Renewable energy jobs can range from installation and maintenance of solar panels and wind turbines to research and development of new technologies. As the sector expands, there will also be opportunities for skilled professionals in fields such as engineering, project management, and finance.

The renewable energy sector offers not only the potential for job growth but also the chance to make positive impact on the environment and contribute to a sustainable future. It is a promising field for those interested in pursuing a career that aligns with their values and contributes to a better world.

The employment opportunities in the renewable energy sector are vast and diverse, and they are expected to grow rapidly in the coming years. As the world shifts towards cleaner and sustainable sources of energy , there will be high demand for skilled professionals in various areas, such as engineering, research and development, construction, project management, and more.

Renewable energy sources such as solar, wind, geothermal, and hydroelectric power are increasingly becoming more affordable and accessible, which will lead to more investments in the sector and subsequently, more job opportunities. Additionally, government policies and incentives promoting the use of renewable energy are also contributing to the growth of the sector.

Therefore, if you are looking for a career in a field that is not only lucrative but also environmentally conscious, the renewable energy sector is an excellent option to consider. With

the right education, training, and experience, you can build a fulfilling career while making a positive impact on the planet.

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Employment Opportunities In Renewable Energy Sector

Abstract The renewable energy sector has emerged as a significant source of job creation in recent years. With increasing awareness of climate change and the need to transition to sustainable sources of energy, governments and businesses have been investing heavily in renewable energy. This has created a wide range of employment opportunities in the sector, ranging from research and development to manufacturing, installation, and maintenance of renewable energy infrastructure. The job market in renewable energy is expected to grow at a faster rate than most other industries in the coming years. This study provides an overview of employment opportunities in the renewable energy sector and highlights some of the key factors driving job growth in this field.

Introduction

The renewable energy sector has been experiencing significant growth in recent years, driven by global efforts to reduce carbon emissions and combat climate change. As the demand for clean energy sources continues to increase, the renewable energy sector is becoming an increasingly important source of employment opportunities. The renewable energy sector encompasses a variety of technologies, including solar, wind, hydro, bioenergy, geothermal, and ocean energy. Each of these technologies

offers unique opportunities for employment in a wide range of fields, from engineering and construction to research and development, project management, and sales and marketing.

Employment opportunities in the renewable energy sector are not limited to a specific region or country, as the demand for clean energy is global. This sector offers a diverse range of jobs, from entry-level positions to high-level executive roles, and is attracting talent from various industries and backgrounds.

In addition to providing employment opportunities, the renewable energy sector offers a range of benefits, including improving energy security, reducing greenhouse gas emissions, and promoting sustainable development. As such, the growth of the renewable energy sector is expected to continue in the coming years, providing increasing opportunities for employment and contributing to the transition towards a cleaner and more sustainable future.

The renewable energy sector has emerged as a key player in the global energy transition towards a cleaner and more sustainable future. As the world becomes increasingly aware of the urgent need to reduce greenhouse gas emissions and combat climate change, the demand for renewable energy has grown significantly. This has led to a surge in employment opportunities in the renewable energy sector, which spans across various industries and job roles. The renewable energy sector offers employment opportunities in a wide range of fields, including manufacturing, installation, operations and maintenance, research and development, sales and marketing, and project management. As the sector continues to grow, there is an increasing demand for skilled workers who are capable of designing, building, and maintaining renewable energy infrastructure.

The growth of the renewable energy sector has been driven by several factors, including government policies and incentives, declining costs of renewable technologies, and increasing public awareness and support for renewable energy. This has led to a shift towards cleaner and more sustainable energy sources such as solar, wind, hydro, and bioenergy, which has in turn created numerous job opportunities across the globe.

Overall, the renewable energy sector presents a significant employment opportunity for individuals looking to make a positive impact on the environment while also pursuing a fulfilling career. The trend of employment in the renewable energy sector is expected to continue its upward trajectory in the coming years, making it an attractive and promising field for job seekers. Top of Form Top of Form

LITERATURE REVIEW

1.

2. Cameron and Bob(2015): In The paper they presented the conclusion after doing literature review on the jobopportunity linked to the renewable energy, where they did 70 studies and analysis the data which has published over the last decade . during their analysis to reviewed the publication that cover different countries . their overall conclusion was that there was lack of certainity that how many independent items should be included to do significant analysis . to estimate the employment

factor, they took total of 31 independent items where only 14 items references provided good estimate of the employment factor in different stages such as manufacturing, assembling, installation. To estimate the value of operating and maintenance , they took 23 items.

3. Kumar and Majid(2020): In his review , he analysed the data from ministry and NGOs and he found the prime objectiveto promote renewable energy . Advanced economic development , improve energy security , early access toenergy and combat climate change . In his study he found that sustainable development is possible by promoting clean and renewable energy , during his study he also found that govt. backing of renewable plan leads to success. As per his analysis the renewable energy sector could create huge chunk ofemployment.

4. Baruah(2015): During her study , she tried to identify whats the opportunity and constraints the low-income womenfacing trouble in getting of jobs in this sector. She conducted qualitative and quantitative study under the joint program of TERI and SEWA group in 2012-13. She found that although reach to the technology , jobs are limited due to inadequate purchasing power and low social status. There are massive job opportunity for women at various stages of energy supply chain.

5. Maradin,Corovic and Mjeda(2017): Researchers analysed various reports of IRENA and tried to draw the conclusion .Under their studies , they found that rapid economic development has propelled the more quick use of renewable energy technology, During study he came to know that the production and use of renewable pushed the development of new tech, generating new opportunities for the new emergent entrepreneurs who are ready to invest in component making industries. In his paper he drew positive and negative effect of renewable energy . in positive aspects , he found investment and use of renewable energy contributed effectively in economic growth and development. Moreover the R&D promotes new and advanced technological change in emergent market.

6. Rio and Burguillo(2007): During his work , he tried to make a contribution in this context by developing and linkingtheoretical blueprint, which permit a detailed analysis of the effect of renewable energy on local sustainability. after doing intense study, he found renewable energy sources have a immense potential to contribute to the sustainable development of specific region by availing them with a wide variety of socioeconomic and environmental benefits . he applied the triangular constant capital approach.

7. Martinez and stephens(2016): They did study on gender diverse workforce in renewable energy, where they explainedgender diversity in the energy workforce and illuminate the significance of systematic assessment of women participation in thework toward sustainable energy system In the study they found that there is gender inequality in the energy sector workforce was visible in countries across the globe. They highlighted the the benefits of gender diversity and they concluded that companies were more female on the board of directors are more likely to actively invest in renewable energy.

8. Yeyanran and Qiangzhi(2015): Researchers took data from UNEP(2011) and did literature review on the greeneconomy, clean energy policy and employment. They tried to highlight the relationship between the green economy jobs are never assimple as it appears. They also worked on the analysis of the relationship based on the study of green energy policy in various countries. During the literature study they found that the clean economy has a great positive effect on jobs in both low and high income countries.

9. Akella,Saini and Sharma(2009): Researchers conducted a broader study to show the tren of total emission reductionover the year, which disclosed ,emission reduction increasing after the installation of

renewable energy system in inner areas of country. During their study they also highlighted the concept of clean development mechanism(CDM) which is one of the flexible mechanism under Kyoto protocol.

10. Baruah(2017): In her study, she threw light on the presentation of women in global energy sector. In her paper shereviewed the women"s employment in renewable energy in advanced economies, rising economies and developing economies. She pointed out the commonalities and dissimilarities in occupational pattern of women employment in renewable energy in different part of the world and she made suggestion to promote women indulgence in clean energy with the help of data from OECD countries.

11. Eitan,Herman and Fischendler(2019): Researchers tried to figure out the role of the emergence of partnership inrenewable energy, where they said renewable energy partnership promotes innovation and adoption of new technology, amalgamation of partners of having different capacity, knowledge and experiences create more appropriate base where innovation would grow swiftlier and healthier. They also focused on the relevance of community private sector cooperation in the renewable energy sector. Objective -To study jobs prospects in renewable energy sector. -To distribution of workforce across the sector. - To study job opportunity in different green technology. -To do trend analysis of jobs in various sectors Methodology And Data source Using Secondary data source, Trend in employment opportunity in renewable energy sector has been shown. Based on data of

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International Renewable Energy Agency(IRENA) renewable energy and jobs annual review And International E Agency(

IEA).

Analysis

solar 2012 2013 2014 2015 2016 2017 1.36 2.27 2.4899999999999998 2.77 3.09 3.3699999999999997 bioenergy 2012

2013 2014 2015 2016 2017 2.4 2.5 2.9899999999999998 2.88 2.74 3.05 hydro 2012 2013 2014 2015 2016 2017

1.6600000000000001 2.21 2.04 2.16 2.06 1.9900000000000051 wind 2012 2013 2014 2015 2016 2017

0.75000000000000466 0.83000000000000063 1.03 1.08 1.1599999999999899 1.1499999999999897 solar heating

2012 2013 2014 2015 2016 2017 0.89000000000000029 0.5 0.76000000000000512 0.94000000000000061

0.83000000000000063 0.81 othrs 2012 2013 2014 2015 2016 2017 0.22000000000000058 0.23 0.19000000000000059 0.2 0.24000000000000021 0.16000000000000059

*Jobs in million

These employment trends are shaped by a multitude of factors , including costs , investment , and new and cumulative capacities , and by a broad array of policy measures to enable renewable energy deployment , generate viable supply chain and create a skilled workforce . The covid-19 pandemic continued to affect the global economy during 2021 , altering both the volume and structure of energy demand . Domestic market size is a major factor that affects employment generation in construction , installation , operation and maintenance. Building or maintaining a strong equipment manufacturing industrial base also needs sufficiently large and steady domestic demand . Only a few countries have become significant equipment producer.Trade restrictions may be required to protect a fledgling local industry, but policy makers need to strike a careful balance between such effort and minimizing cost for renewable energy projects. Figure 2 Global renewable energy employment

jobs(thousand) solar bio fuel hydro power wind solar heating biomass 4291 2421 2370 1371 769 716 Column1 solar bio fuel hydro power wind solar heating biomass Column2 solar bio fuel hydro power wind solar heating biomass 1.1 SOLAR PHOTOVOLTAIC(4.3 million jobs)

Here are the top countries for solar PV employment as of 2021, 1. China – 2.7 million jobs

2. India - 360,000 jobs 3. United States - 345,000 jobs 4. Japan - 68,000 jobs 5. Brazil - 54,000 jobs 6. Germany 53,000 jobs 7. Spain - 35,000 jobs 8. Australia - 27,000 jobs 9. South Korea - 23,000 jobs 10. France - 20,000 jobs It's worth noting that employment numbers can vary depending on how they are defined and measured, and these figures are subject to change as the solar PV industry continues to grow and evolve.Top of Form

It's worth noting that these figures represent direct employment in the solar PV industry and do not include indirect jobs or jobs in related industries, such as manufacturing or installation. Additionally, the COVID-19 interruption has had an impact on employment figures in the sector, with some countries experiencing a decline in solar PV jobs in 2020. However, the long-term trend is still one of growth, as more countries invest in renewable energy and work towards decarbonization.

Million jobs china US india japan bangladesh brazil 2.68 0.27 0.23 0.16 0.12000000000000002 0.12000000000000002

Series 2 china US india japan bangladesh brazil Series 3 china US india japan bangladesh brazil 1.2 WIND(1.4 Million jobs)

The wind energy sector offers a wide range of job opportunities across various disciplines, including engineering, construction, maintenance, operations, and management. Here are some examples of jobs in the wind energy sector: 1.

Wind turbine technician: Wind turbine technicians are responsible for installing, maintaining, and repairing wind turbines.

This job requires technical skills and knowledge of electrical and mechanical systems.

2. Electrical engineer: Electrical engineers design and develop electrical systems for wind turbines and wind farms. They also work on the development of power grids to connect wind farms to the electrical grid. 3. Project manager: Project managers oversee the construction and installation of wind turbines and wind farms. They are responsible for managing budgets, timelines, and resources to ensure that projects are completed on time and within budget. 4. Environmental scientist: Environmental scientists assess the environmental impact of wind energy projects and develop strategies to minimize any negative effects on the environment. 5. Meteorologist: Meteorologists provide weather forecasting services to wind energy companies to help them optimize the performance of wind turbines. 6. Sales and marketing: Sales and marketing professionals are responsible for promoting wind energy products and services to customers and developing new business opportunities. 7. Data analyst: Data analysts use data to optimize the performance of wind turbines and wind farms, and to develop strategies to improve efficiency and reduce costs. 8. Finance and accounting: Finance and accounting professionals manage the financial aspects of wind energy projects, including budgets, financing, and accounting.

These are just a few examples of the many jobs available in the wind energy sector. As the demand for renewable energy

continues to grow, there will be even more opportunities for skilled professionals in this field.
Top of Form Wind employment : top countries

Million jobs china germany US brazil vietnam india 0.67000000000000592 0.14000000000000001

0.13800000000000001 6.0000000000000032E-2 4.0000000000000022E-2 4.0000000000000022E-2
Series 2

china germany US brazil vietnam india Series 3 china germany US brazil vietnam india

1.3 HYDROPOWER(2.4 million jobs)

. There are several jobs in the hydropower sector that involve data analysis, management, and engineering. Some examples include: 1. Hydropower Plant Data Analyst: This role involves analyzing and interpreting data from the hydropower plant's equipment and systems, and identifying opportunities to improve plant performance and efficiency.

2. Hydropower Plant Engineer: This role involves designing, building, and maintaining hydropower plants, as well as analyzing data to optimize plant performance. 3. Hydropower Resource Analyst: This role involves analyzing and modeling water resources to determine the potential for hydropower development in specific locations. 4. Hydrology Data Analyst: This role involves analyzing and interpreting data related to hydrology, such as precipitation, snowpack, and streamflow, to help inform hydropower development and operations. 5. Environmental Compliance Analyst: This role involves analyzing and managing data related to environmental regulations and permits for hydropower plants, and ensuring compliance with these requirements. 6. Renewable Energy Market Analyst: This role involves analyzing market data and trends related to renewable energy, including hydropower, to identify opportunities for growth and investment. 7. Hydropower Project Manager: This role involves

overseeing the planning, design, construction, and operation of hydropower projects, including managing data related to project timelines, budgets, and performance.

Overall, the hydropower sector offers a variety of job opportunities that involve data analysis and management, as well as engineering and project management. Top of Form

The number of jobs in the hydropower sector varies by country, depending on factors such as the size of the country, the level of investment in hydropower, and the availability of resources.

Here are some examples of countries and the estimated number of jobs in the hydropower sector:

1. China: It is estimated that the hydropower sector in China employs around 300,000 people.
2. Brazil: According to the Brazilian Association of Small Hydropower Plants (ABRAPCH), the small hydropower sector inBrazil employs around 85,000 people. 3. Canada: The Canadian Hydropower Association estimates that the hydropower sector in Canada employs around 35,000 people. 4. India: According to the Ministry of Power in India, the hydropower sector in India employs around 12,000 people. 5. United States: The National Hydropower Association in the United States estimates that the hydropower sector employs around 300,000 people.

These numbers are rough estimates and can vary depending on the source of data and the specific definitions used to define the hydropower sector.

hydropower job china india brazil vietnam pakistan US Russia columbia Ethiopia canada rest of world

0.37000000000000038 0.17600000000000021 7.5000000000000011E-2 5.1999999999999998E-2

3.5000000000000001E-2 2.7000000000000236E-2 2.0000000000000011E-2 1.7999999999999999E-2

1.7000000000000001E-2 1.4999999999999998E-2 0.19500000000000001

Top of Form

1.4 LIQUID BIOFUELS

The liquid biofuel sector is a growing industry that offers a range of job opportunities in different fields. Here are some examples of jobs in the liquid biofuel sector: 1. Research Scientist: Research Scientists are responsible for conducting research to develop and improve liquid biofuels. They analyze data, develop experiments, and interpret results.

2. Chemical Engineer: Chemical Engineers design and develop the processes and equipment used in the production of liquid biofuels. They oversee the operation of production plants, troubleshoot problems, and optimize production. 3. Sales Representative: Sales Representatives are responsible for promoting and selling liquid biofuels to potential customers. They establish relationships with customers, negotiate sales contracts, and communicate product information. 4. Project Manager: Project Managers oversee the planning, implementation, and completion of projects related to liquid biofuels. They manage resources, timelines, and budgets to ensure that projects are completed on time and within budget. 5. Quality Control Analyst: Quality Control Analysts are responsible for testing and analyzing liquid biofuels

to ensure that they meet quality standards. They use a variety of techniques to analyze samples and report findings to management. 6. Environmental Engineer: Environmental Engineers design and implement strategies to minimize the environmental impact of liquid biofuel production. They ensure compliance with environmental regulations and develop sustainable practices. 7. Operations Manager: Operations Managers oversee the day-to-day operations of liquid biofuel production facilities. They manage personnel, oversee production processes, and ensure compliance with safety and environmental regulations.

These are just a few examples of jobs in the liquid biofuel sector. Other roles may include marketing specialists, logistics coordinators, and regulatory affairs specialists. The industry is constantly evolving, and new opportunities are likely to emerge as the sector continues to grow. Top of Form

share of export US netherland brazil france hungary belgium germany EU rest world 0.24100000000000021

0.13200000000000001 0.11799999999999998 6.9000000000000034E-2 4.3999999999999997E-2

4.3000000000000003E-2 4.1000000000000002E-2 0.111

The biofuel industry is a growing sector that has the potential to create new jobs and economic opportunities in many countries around the world. The industry encompasses a wide range of activities, including research and development, production, distribution, and sales of biofuels.

The number of jobs in the biofuel industry can vary depending on a number of affecting factors, such as the size and maturity of the industry in a given country, the types of biofuels produced, and the policies and incentives in place to support the industry

jobs(mn) brazil indonesia US columbia thailand malayasia china india france germany 0.89 0.56999999999999995 0.32000000000000206 0.19 0.15000000000000024 7.0000000000000021E-2 6.0000000000000032E-2 4.0000000000000022E-2 2.0000000000000011E-2 Series 2 brazil indonesia US columbia thailand malayasia china

india france germany Series 3 brazil indonesia US columbia thailand malayasia china india france germany Table 1 Projected number of direct and indirect jobs in renewable energy across the globe, 2020-21. world

china brazil india US EU Solar 4291 2682 115.2 217 255 235 Biofuels 2421 51 874.2 35 322.6 142 Hydropower 2370 872.3 176.9 414 72.4 89 Solar heating 769 636 42 19 -------- 19 Solid biomass 716 190 ------- 58 46.3 314 Biogass 307 145 ------ 85 ------- 64 Geothermal 196 78.9 ------- ------- 8 60 Wind power 1371 654 63.8 35 120.2 298 total 12441 5309

1373.9 863 824.5 1221

solar china brazil india US EU 2682 115.2 217 255 235 biofuels china brazil india US EU 51 874.2 35

322.60000000000002 142 hydropower china brazil india US EU 872.3 176.9 414 72.400000000000006 89 wind power china brazil india US EU 654 63.8 35 120.2 298 solar heat china brazil india US EU 636 42 19 19 solid biomass china brazil india US EU 190 58 46.3 314 biogas china brazil india US EU 145 85 64 geo therm china brazil india US EU 78.900000000000006 8

Table2. LEADING COUNTRIES AND JOBS IN RENEWABLE ENERGY
SECTOR Jobs(mn) China 5.37 India 0.73 US 0.92 France 0.60 Germany 0.344 UK 0.35

jobs (Mn) china india US France Germany UK 5.37 0.73000000000000065 0.92 0.62000000000000344

0.34400000000000008 Series 2 china india US France Germany UK Series 3 china india US France Germany UK

Column2 china india US France Germany UK

1. Trend Analysis Of Employment Opportunity In Different Sources of Renewable Energy. 1.1 SOLAR ENERGY

year JOBs(Mn) 2012 1.36 2013 2.27 2014 2.49 2015 2.77 2016 3.09 2017 3.37 2018 3.68 2019 3.75 2020 3.98 2021 4.29 total 31.05

Trend analysis of Employment in SOLAR PV

Jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 1.36 2.27 2.4899999999999998 2.77 3.09

3.3699999999999997 3.68 3.75 3.98 Series 2 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Explanation The solar energy sector has experienced remarkable growth over the past decade and has become one of the fastest-growing industries in the world. This growth has led to a significant increase in employment opportunities in the sector, with the creation of jobs spanning across various roles and industries.

The trend of employment in the solar energy sector is driven by several factors, including the declining cost of solar panels, government policies and incentives, and increasing public awareness about the benefits of solar energy. In terms of job roles, the solar energy sector offers employment opportunities in a wide range of fields, including manufacturing, installation, sales and marketing, research and development, and project management. Some of the most in-demand positions in the solar energy sector include solar panel installers, solar energy system designers, sales representatives, and project managers. According to the US Bureau of Labor Statistics, solar photovoltaic (PV) installers are among the fastest-growing occupations in the United States, with an expected growth rate of 51% from 2019 to 2029. This trend is not limited to the United States alone; countries across the world are experiencing a surge in solar energy-related job opportunities.

Overall, the trend of employment in the solar energy sector is expected to continue its upward trajectory in the coming years, driven by the increasing demand for clean energy and the continued innovation and development of solar technologies.

In this direction , Grugram(India) based International Solar Alliance(ISA), which is 114 members and signatory countries is doing significant job in the area of motivating the countries to join the ISA and promote the use of solar energy in order to reduce the emission and ensuring cheap and feasible source of energy and this make strong future estimates that employment opportunity will rise leaps and bounds very soon.

1.2 WIND ENERGY

year Jobs(Mn) 2012 0.75 2013 0.83 2014 1.03 2015 1.08 2016 1.16 2017 1.15 2018 1.16 2019 1.17 2020 1.25 2021 1.37 total

Trend Analysis of employment in wind energy

jbs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 0.75000000000000355 0.83000000000000063 1.03

1.08 1.1599999999999924 1.1499999999999924 1.1599999999999924 1.1700000000000021 1.25 Series 2 2012 2013

2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Explanation The wind energy sector has been growing steadily over the past decade and has become a significant contributor to the global energy mix. This growth has led to an increase in employment opportunities in the sector, with the creation of jobs spanning across various roles and industries.

The trend of employment in the wind energy sector is driven by several factors, including government policies and incentives, the declining cost of wind turbines, and increasing public awareness about the benefits of wind energy. In terms of job roles, the wind energy sector offers employment opportunities in a wide range of fields, including manufacturing, installation, maintenance, sales and marketing, research and development, and project management. Some of the most in-demand positions in the wind energy sector include wind turbine technicians, engineers, project managers, and sales representatives.

According to the Global Wind Energy Council (GWEC), the wind energy sector employed over 1.2 million people worldwide in 2020, with the majority of jobs located in China, Europe, and the United States. In the United States alone, the wind energy sector employed over 120,000 people in 2020, according to the US Bureau of Labor Statistics. The trend of employment in the wind energy sector is expected to continue its upward trajectory in the coming years, driven by the increasing demand for clean energy and the continued innovation and development of wind technologies. The International agencies predicts that the wind energy sector could create up to 3.3 million jobs globally by 2030, up from 1.2 million in 2020.

1.3 BioEnergy year Jobs(Mn) 2012 2.40 2013 2.50 2014 2.99 2015 2.88 2016 2.74 2017 3.05 2018 3.18 2019 3.58 2020 3.52 2021 3.44 total 30.28

Trend Analysis of employment generation in Bioenergy

jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2.4 2.5 2.9899999999999998 2.88 2.74 3.05 3.18 3.58

3.52 Series 2 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Explanation The bioenergy sector has been growing in importance in recent years, as it provides a sustainable and renewable source of energy. This growth has led to an increase in employment opportunities in the sector, with the creation of jobs spanning across various roles and industries.

The trend of employment in the bioenergy sector is driven by several factors, including government policies and incentives, increasing demand for renewable energy, and advancements in technology that make it easier and more cost-effective to produce bioenergy.

In terms of job roles, the bioenergy sector offers employment opportunities in a wide range of fields, including agriculture, forestry, engineering, research and development, and project management. Some of the most in-demand positions in the bioenergy sector include biomass plant operators, biofuel production technicians, researchers, and engineers.

According to the IEA, the bioenergy sector employed over 3 million people worldwide in 2019, with the majority of jobs located in the agricultural and forestry sectors. In the United States alone, the bioenergy sector employed over 130,000 people in 2020, according to the US Department of Energy.

The trend of employment in the bioenergy sector is expected to continue its upward trajectory in the coming years, driven by the increasing demand for renewable energy and the continued innovation and development of bioenergy technologies. The IEA predicts that the bioenergy sector could create up to 7 million jobs globally by 2050, up from 3 million in 2019.

1.5 Hydropower

year Jobs(Mn) 2012 1.66 2013 2.21 2014 2.04 2015 2.16 2016 2.06 2017 1.99 2018 2.05 2019 1.96 2020 2.18 2020 2.37 total 16.64

Trend analysis of Employment generation in Hydropower

jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 1.6600000000000001 2.21 2.04 2.16 2.06

1.9900000000000067 2.0499999999999998 1.960000000000006 2.1800000000000002 Series 2 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Explanation The hydroenergy sector has been a longstanding source of renewable energy, and it continues to play a significant role in the global energy mix. This sector has seen some growth in recent years, which has led to an increase in employment opportunities in the sector, with jobs spanning across various roles and industries.

The trend of employment in the hydroenergy sector is driven by several factors, including government policies and incentives, the need for reliable and stable sources of energy, and the increasing demand for renewable energy. In terms of job roles, the hydroenergy sector offers employment opportunities in a wide range of fields, including engineering, construction, operations, maintenance, and project management. Some of the most in-demand positions in the hydroenergy sector include hydroelectric plant operators, civil engineers, mechanical engineers, and project managers.

According to the IEA, the hydroenergy sector employed over 2 million people worldwide in 2019, with the majority of jobs located in the construction, operation, and maintenance of hydroelectric power plants. In the United States alone, the hydroenergy sector employed over 66,000 people in 2020, according to the US Department of Energy.

The trend of employment in the hydroenergy sector is expected to remain relatively stable in the coming years, driven by the continued demand for reliable and stable sources of energy. However, the growth potential for employment in this sector may be limited due to the maturity of the industry and the lack of significant technological advancements in recent years.

1.6 Solar Heating/Cooling

year Jobs(Mn) 2012 0.89 2013 0.50 2014 0.76 2015 0.94 2016 0.83 2017 0.81 2018 0.80 2019 0.82 2020 0.82 2021 0.77 total 7.12

Yearly trend of Employment in Solar Heating/Cooling

jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 0.89 0.5 0.76000000000000312

0.94000000000000061 0.83000000000000063 0.81 0.8 0.82000000000000062 0.82000000000000062 Series 2

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Explanation The trend of employment in solar heating/cooling is generally positive and expected to continue to grow in the coming years. As more and more people become aware of the benefits of renewable energy and the need to reduce carbon emissions, the demand for solar heating/cooling systems is expected to increase.

According to the multilateral agencies, the number of people employed

While specific data on employment in solar heating/cooling is not readily available, it is expected that this growth in the renewable energy sector will lead to an increase in employment opportunities in all areas of renewable energy, including solar heating/cooling.

In addition, governments and organizations around the world are implementing policies and initiatives to promote the use of renewable energy, including solar heating/cooling. These policies are expected to further boost the growth of the industry and create new job opportunities.

particular, the report notes that the construction and installation of solar thermal systems, such as solar water heaters, accounts for a significant portion of the employment in the solar heating and cooling sector. Other job opportunities include research and development, engineering, project management, and maintenance and repair. Overall, the trend of employment in solar heating and cooling appears to be positive, with increasing demand for skilled workers in this field as the world transitions to cleaner energy sources.

2. Future Prospect Of Employment in Renewable energy Sector.

The future prospects of employment in the renewable energy sector are very promising. As the world shifts towards sustainable energy sources, there will be a growing demand for professionals with skills in renewable energy technologies, project management, research and development, and policy-making. According to a report by

could employ 42 up to million people globally by 2050, up from 11 million in 2018. This represents a significant opportunity for job creation, especially in developing countries where renewable energy is becoming a key driver of economic growth.

Some of the key areas where employment opportunities are expected to grow in the renewable energy sector include: 1. Solar Energy: With solar energy becoming more affordable and efficient, there will be a growing demand for solar energy installers, engineers, and designers.

2. Wind Energy: As wind energy continues to grow, there will be a need for wind turbine technicians, engineers, and project managers. 3. Energy Storage: The growth of renewable energy will also require energy storage solutions, creating new jobs in battery technology, and energy storage system installation and maintenance. 4. Electric Vehicles: The shift towards electric vehicles will also create new jobs in manufacturing, maintenance, and charging infrastructure.

Overall, the renewable energy sector is poised for significant growth in the coming years, providing ample opportunities for employment and career growth. Top of Form

Bottom of Form

CONCLUSION In conclusion, employment opportunities in the renewable energy sector are expected to continue growing in the coming years. This is due to the increasing global demand for clean and sustainable energy sources, driven by concerns over climate change and the need to reduce greenhouse gas emissions.

Renewable energy jobs can range from installation and maintenance of solar panels and wind turbines to research and development of new technologies. As the sector expands, there will also be opportunities for skilled professionals in fields such as engineering, project management, and finance.

The renewable energy sector offers not only the potential for job growth but also the chance to make a positive impact on the environment and contribute to a sustainable future. It is a promising field for those interested in pursuing a career that aligns with their values and contributes to a better world.

the employment opportunities in the renewable energy sector are vast and diverse, and they are expected to grow rapidly in the coming years. As the world shifts towards cleaner and sustainable sources of energy, there will be a high demand for skilled professionals in various areas, such as engineering, research and development, construction, project management, and more.

Renewable energy sources such as solar, wind, geothermal, and hydroelectric power are increasingly becoming more affordable and accessible, which will lead to more investments in the sector and subsequently, more job opportunities. Additionally, government policies and incentives promoting the use of renewable energy are also contributing to the growth of the sector.

Therefore, if you are looking for a career in a field that is not only lucrative but also environmentally conscious, the renewable energy sector is an excellent option to consider. With the right education, training, and experience, you can build a fulfilling career while making a positive impact on the planet.

solar 2012 2013 2014 2015 2016 2017 1.36 2.27 2.4899999999999998 2.77 3.09 3.3699999999999997 bioenergy 2012

2013 2014 2015 2016 2017 2.4 2.5 2.9899999999999998 2.88 2.74 3.05 hydro 2012 2013 2014 2015 2016 2017

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share of export US netherland brazil france hungary belgium germany EU rest world 0.24100000000000021

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jobs (Mn) china india US France Germany UK 5.37 0.73000000000000065 0.92 0.62000000000000344

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jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2.4 2.5 2.9899999999999998 2.88 2.74 3.05 3.18 3.58

3.52 Series 2 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

hydropower job china india brazil vietnam pakistan US Russia columbia Ethiopia canada rest of world

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3.500000000000001E-2 2.7000000000000236E-2 2.0000000000000011E-2 1.7999999999999999E-2 1.7000000000000001E-2 1.4999999999999998E-2 0.19500000000000001

solar china brazil india US EU 2682 115.2 217 255 235 biofuels china brazil india US EU 51 874.2 35

322.60000000000002 142 hydropower china brazil india US EU 872.3 176.9 414 72.400000000000006 89 wind power china brazil india US EU 654 63.8 35 120.2 298 solar heat china brazil india US EU 636 42 19 19 solid biomass china brazil india US EU 190 58 46.3 314 biogas china brazil india US EU 145 85 64 geo therm china brazil india US EU

78.900000000000006 8 jobs(mn) brazil indonesia US columbia thailand malayasia china india france germany 0.89 0.56999999999999995 0.32000000000000206 0.19 0.15000000000000024 7.0000000000000021E-2 6.0000000000000032E-2 4.0000000000000022E-2 2.0000000000000011E-2 Series 2 brazil indonesia US columbia thailand malayasia china

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1.08 1.1599999999999924 1.1499999999999924 1.1599999999999924 1.1700000000000021 1.25 Series 2 2012 2013

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Million jobs china germany US brazil vietnam india 0.67000000000000592 0.14000000000000001

0.13800000000000001 6.0000000000000032E-2 4.0000000000000022E-2 4.0000000000000022E-2 Series 2

china germany US brazil vietnam india Series 3 china germany US brazil vietnam india jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 0.89 0.5 0.76000000000000312

0.94000000000000061 0.83000000000000063 0.81 0.8 0.82000000000000062 0.82000000000000062 Series 2

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Million jobs china US india japan bangladesh brazil 2.68 0.27 0.23 0.16 0.12000000000000002 0.12000000000000002

Series 2 china US india japan bangladesh brazil Series 3 china US india japan bangladesh brazil

Jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 1.36 2.27 2.4899999999999998 2.77 3.09

3.3699999999999997 3.68 3.75 3.98 Series 2 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 Series 3 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

jobs(thousand) solar bio fuel hydro power wind solar heating biomass 4291 2421 2370 1371 769 716 Column1 solar bio fuel hydro power wind solar heating biomass Column2 solar bio fuel hydro power wind solar heating biomass jobs(Mn) 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 1.6600000000000001 2.21 2.04 2.16 2.06

1.9900000000000067 2.0499999999999998 1.960000000000006 2.1800000000000002 Series 2 2012 2013 2014

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Matching text	As the text appears in the source.

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1/3	SUBMITTED TEXT	15 WORDS	70%	MATCHING TEXT	15 WORDS
International Renewable Energy Agency(IRENA) renewable energy and jobs annual review And International Energy Agency(			International Renewable Energy Agency, Abu Dhabi. IRENA, 2020b. Renewable Energy and Jobs – Annual Review 2020, International Renewable Energy Agency,		

W https://sdgs.un.org/sites/default/files/2023-01/SDG%207%20Policy%20Briefs%202021.pdf

2/3	SUBMITTED TEXT	18 WORDS	88%	MATCHING TEXT	18 WORDS
in the renewable energy sector reached 11.5 million globally in 2019, up from 10.3 million in 2017.			in the renewable energy sector reached 11.5 million in 2019, up from 7.3 million in 2012.		

W https://sdgs.un.org/sites/default/files/2023-01/SDG%207%20Policy%20Briefs%202021.pdf

3/3	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS
the International Renewable Energy Agency (IRENA), the renewable energy sector			International Renewable Energy Agency (IRENA), the renewable energy sector		

W https://epj.min-pan.krakow.pl/pdf-143043-71163?filename=The%20development%20of.pdf