Demographic Influence on Local and Unskilled Employment Generation in the Renewable Energy Sector

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ABSTRACT
Renewable energy is a critical component of the global effort to combat climate change and transition towards a sustainable future. Unlike finite fossil fuels such as coal, oil, and natural gas, renewable energy sources are derived from naturally replenishing resources that are abundant and widely available. These sources include sunlight, wind, water (hydroelectric), biomass, and geothermal heat. The objective of the author is to identify the demographical influence of the Public on the local and unskilled employment generation potential on green energy in Tirunelveli and surrounding areas. Methodology adopted is collecting primary data from the Public through survey.

Keywords: climate change, sustainable future, employment generation, Renewable energy

INTRODUCTION
Energy is a crucial component for industry, serving as a foundational element for sustainable development. Beyond its industrial applications, energy plays a significant role in social development by enabling heating, lighting, transportation, and contributing to education and scientific research. Current global patterns of energy supply and consumption are unsustainable on environmental, economic, and social fronts. Renewable energy, however, provides a sustainable path to a cleaner, greener, and more resilient future by utilizing nature's abundant resources, addressing climate change, enhancing energy security, and promoting economic growth. Renewable energy resources are plentiful and inexhaustible, offering a sustainable supply capable of meeting global energy demands indefinitely without depleting finite resources. The renewable energy sector drives economic growth and job creation, creating opportunities for innovation, investment, and local development, particularly in rural areas. A major challenge for renewable energy is its intermittency, with generation from solar and wind sources varying with weather conditions. Technological advances in energy storage, grid management, and hybrid systems are essential to mitigate this issue. The integration of renewable energy into existing grids and infrastructure necessitates significant investment and careful planning to ensure reliability, stability, and compatibility with traditional power sources. Policies, incentives, and regulatory frameworks are vital for accelerating the adoption of renewable energy technologies, attracting investments, and fostering market competition. Ongoing research and development are critical for enhancing the efficiency, reliability, and affordability of renewable energy technologies and exploring new possibilities like tidal and wave energy. At this point, the researcher has analyzed the demographic influence on public perceptions of employment generation associated with renewable energy.

Scope of the study
This study delves into the local and unskilled employment generation dynamics linked with Renewable Energy (RE) in Tirunelveli, with a keen focus on the socio-demographic features of the local population

Objective of the study
1.To assess public judgment regarding the potential for local employment generation from renewable energy projects across different demographic groups.
2. To evaluate public perceptions of the opportunities for unskilled employment generated by renewable energy projects among various demographic groups.

METHODOLOGY

This study utilized a primary quantitative survey through a questionnaire. The survey targeted individuals employed in various sectors of the renewable energy industry in Tirunelveli and surrounding areas, collecting data on their socio-demographic characteristics, employment status, educational background, and income levels.

LITERATURE REVIEW

Moana Simas et al. (2013) have assessed the employment opportunities in renewable energy. They have taken a case study on wind power in Brazil. This study introduces an innovative index for employment quantification based on production capacity rather than installed capacity. Lachlan Cameron et al. (2015) have presented the literature reviews on employment opportunities with renewable energy. This paper identified the employment impact of renewable energy growth. This paper reviews the literature published to date that inspects the job creation potential of renewable energy, mostly solar and wind. Margarita Ortega et al. (2020) explored the potential gross employment impact of renewable energy deployment, focusing on photovoltaics (PV), on-shore wind, and off-shore wind technologies in the European Union (EU) up to 2050. The analysis employs a novel methodology considering technology learning, trade effects, and policy scenarios. This study provides a comprehensive analysis of the future employment landscape associated with renewable energy deployment in the EU. It emphasizes the role of technology, trade, and policy scenarios in shaping job creation dynamics, offering valuable insights for policymakers and stakeholders in the renewable energy sector. Teeka Sohrab et al. (2019) Iran explored the potential of solar energy utilization in Iran by predicting its use and estimating the associated employment rates in 2050. Despite Iran's abundant fossil fuel resources, the focus on solar energy arises from its substantial solar radiation potential and numerous sunny days. The study uses data from the nominal capacity of the country's power plants between 1967 and 2016 to estimate the electricity required for 2050 by using a regression model. Charles Rajesh Kumar. J and M. A. Majid (2020 have discussed about the renewable energy sector's achievements, prospects, electricity generation, challenges, and opportunities, emphasizing the potential for substantial job creation and providing valuable insights for policymakers, investors, and stakeholders involved in renewable energy development in India

Data analysis:

Two parameters are considered for analysis. From the survey, the parameters such as opportunities for (i) Local employment(ii) Un skilled employment

Frame work of the study:
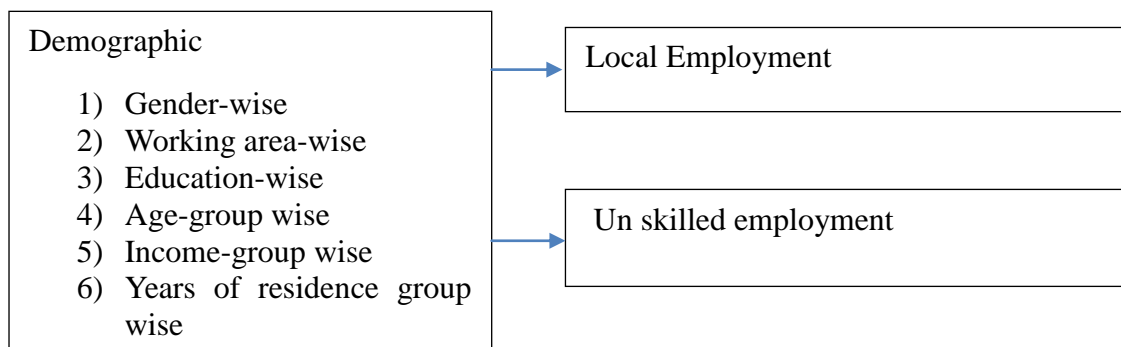
Data analysis and interpretation

Opinion based on Gender is depicted in Table:1.

Table 1

Gender		Local employment					Chi-square	P-value
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Female	Count	0	1	16	19	6	2.310	
	% within Gender	.0%	2.4%	38.1%	45.2%	14.3%		
Male	Count	9	12	94	144	34		
	% within Gender	3.1%	4.1%	32.1%	49.1%	11.6%		
Total	Count	9	13	110	163	40		
	% within Gender	2.7%	3.9%	32.8%	48.7%	11.9%		0.679

Both genders predominantly have positive attitudes towards local employment, with more males agreeing compared to females (49.1% vs. 45.2%). Females have a higher proportion of strong agreement (14.3%) compared to males (11.6%).There's a general positive attitudetowards local employment among both males and females, with a significant proportion in agreement or neutral. Females show a slightly higher inclination towards agreement and strong agreement. Males have a more varied distribution across the agreement spectrum, with notable proportions in the agree and neutral categories.Hence there is gender variations in opinion on local employment. We use chi-square test to test the hypothesis.

H_0: Opinion about Local employment is independent of gender.

H_1: Opinion about Local employment is dependent on gender

Result: There is no significant association between the variables at the 0.05 significance level. That is hypothesis H_0 is accepted. That is opinion about Local employment is independent of gender.

Opinion about unskilled employment is depicted in Table:2

Table 2. Unskilled employment

Gender		Unskilled employment					Chi-square	P-value
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Female	Count	0	3	8	20	11	5.073	
	% within Gender	.0%	7.1%	19.0%	47.6%	26.2%		
Male	Count	3	11	83	150	46		0.280
	% within Gender	1.0%	3.8%	28.3%	51.2%	15.7%		
Total	Count	3	14	91	170	57		
	% within Gender	.9%	4.2%	27.2%	50.7%	17.0%		

Both genders predominantly agree with unskilled employment, but females show a higher percentage of strong agreement compared to males (26.2% vs. 15.7%).Females have no respondents in the strongly disagree category, whereas males have a small percentage (1.0%). Overall, the majority of respondents (both genders combined) either agree (50.7%) or strongly agree (17.0%) with unskilled employment. There is a general acceptance and positive attitude towards unskilled employment among both males and females. Females show a stronger inclination towards agreement with unskilled employment compared to males, with a higher percentage in the agree and strongly agree categories.Males have a more varied distribution across the agreement spectrum, with a notable portion in the neutral category. Hence there is gender difference in opinion on unskilled employment. We use chi-square test to test the hypothesis.

H_0: Opinion about Unskilled employment is independent of gender.

H_1: Opinion about Unskilled employment is dependent on gender

Result: There is no significant association between the variables at the 0.05 significance level. That is hypothesis H_0 is accepted. That is opinion about unskilled employment is independent of gender.

Table:3 discusses the opinion on Local employment by public working in RE and other areas.

Table 3. Local employment

			Local Employment					Chi-square	P-value
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Working area is RE?	NO	Count	3	4	25	26	4	6.532	
		% within Working area is RE?	4.8%	6.5%	40.3%	41.9%	6.5%		
	Yes	Count	6	9	85	137	36		0.163
		% within Working area is RE?	2.2%	3.3%	31.1%	50.2%	13.2%		
Total		Count	9	13	110	163	40		
		% within Working area is RE?	2.7%	3.9%	32.8%	48.7%	11.9%		

Both groups (working in Renewable Energy and not) exhibit notable differences in attitudes towards Local Employment. Respondents working in Renewable Energy generally show higher agreement rates towards Local Employment compared to those not in Renewable Energy. The distribution of attitudes varies between the groups, with distinct patterns of agreement, neutrality, and disagreement. As there are differences due to the area of working, there are variations in opinion on local employment. We use chi-square test to test the hypothesis.

H_0: Opinion about Local employment is independent of working area

H_1: Opinion about Local employment is dependent on working area

Result: The Pearson and likelihood ratio tests indicate no statistically significant association between working in Renewable Energy and attitudes towards Local Employment. The hypothesis could not be rejected.

Table:4 depicts the opinion about Unskilled employment based on working area.

Table 4. Unskilled employment – opinion based on working area

			Unskilled Employment					Chi-square	
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		P-value
Working area is RE?	NO	Count	1	5	22	27	7	7.366	0.118
		% within Working area is RE?	1.6%	8.1%	35.5%	43.5%	11.3%		
	Yes	Count	2	9	69	143	50		
		% within Working area is RE?	.7%	3.3%	25.3%	52.4%	18.3%		
Total		Count	3	14	91	170	57		
		% within Working area is RE?	.9%	4.2%	27.2%	50.7%	17.0%		

Both groups (working in RE and not) show notable differences in attitudes towards Unskilled Employment. Respondents working in RE generally have higher agreement rates towards Unskilled Employment compared to those not in RE. As there are differences due to the area of working, there may be variations in opinion on Unskilled employment. We use chi-square test to test the hypothesis.

H_0: Opinion about Unskilled employment is independent of working area

H_1: Opinion about unskilled employment is dependent on working area

Chi-square test assesses the null hypothesis that there is no association between the two categorical variables Working area is RE and opinion about Unskilled Employment.

Age group wise analysis for local employment is shown in the Table:5.

Table 5. Age wise analysis -for the local employment

			Local Employment					Chi-square	
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		P-value
Age	Under18	Count	0	0	1	3	0	18.790	
		% within Age	.0%	.0%	25.0%	75.0%	.0%		
	18-24	Count	3	4	27	38	7		
		% within Age	3.8%	5.1%	34.2%	48.1%	8.9%		
	25-34	Count	5	7	69	103	21		
		% within Age	2.4%	3.4%	33.7%	50.2%	10.2%		
	35-44	Count	1	2	12	14	11		
		% within Age	2.5%	5.0%	30.0%	35.0%	27.5%		.536
	45-54	Count	0	0	1	4	0		
		% within	.0%	.0%	20.0%	80.0%	.0%		

			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
		Age							
	55-64	Count	0	0	0	1	1		
		% within Age	.0%	.0%	.0%	50.0%	50.0%		
Total		Count	9	13	110	163	40		
		% within Age	2.7%	3.9%	32.8%	48.7%	11.9%		

The 25-34 age group has the highest number of respondents and also the highest percentage of respondents who agree with the statement.The 35-44 and 45-54 age groups also show a substantial proportion agreeing with the statement.The youngest age group (Under 18) has a smaller sample size, but the majority of respondents in this group also agree with the statement. This analysis suggests that there is a positive inclination towards agreement with the statement on "Local Employment" across different age groups. We use chi-square test to test the hypothesis.

H_0: Opinion about local employment is independent of age of the respondents

H_1: Opinion about local employment is dependent on the age of the respondents

The Pearson Chi-Square test yield non-significant results. Therefore, based on this, we do not have sufficient evidence to conclude that there is a significant association between the categorical variables. Hence hypothesis is accepted.Table: 6 depicts agewise analysis for unskilled employment.

Table 6. age wise analysis -unskilled employment

			Unskilled Employment					Chi-square	P-value
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Age	Under18	Count	0	1	1	1	1	20.501	
		% within Age	.0%	25.0%	25.0%	25.0%	25.0%		
	18-24	Count	1	5	25	38	10		
		% within Age	1.3%	6.3%	31.6%	48.1%	12.7%		
	25-34	Count	2	6	57	108	32		
		% within Age	1.0%	2.9%	27.8%	52.7%	15.6%		.427
	35-44	Count	0	1	8	19	12		
		% within Age	.0%	2.5%	20.0%	47.5%	30.0%		
	45-54	Count	0	1	0	3	1		
		% within Age	.0%	20.0%	.0%	60.0%	20.0%		
	55-64	Count	0	0	0	1	1		
		% within Age	.0%	.0%	.0%	50.0%	50.0%		
Total		Count	3	14	91	170	57		
		% within Age	.9%	4.2%	27.2%	50.7%	17.0%		

This analysis indicates age-related differences in attitudes towards unskilled employment, with younger individuals leaning towards agreement and older individuals showing stronger positive sentiments. The majority opinion across all age groups tends to be favourable towards unskilled employment.As there are differences in various age groups. We use chi-square test to test the hypothesis about association about opinion of unskilled employment with age group.

H_0: Opinion about unskilled employment is independent of age of the respondents

H_1: Opinion about unskilled employment is dependent on the age of the respondents

The Pearson chi square test indicates that there is no significant association between the categorical variables being tested (since their p-values are 0.427).Hence,the hypothesis is accepted.Education wise analysis in respect of local employment is shown in Table: 7.

Table 7. Education wise analysis-Local employment

			Local Employment					Chi-square	P-value
			Strongly Disagree	Dis agree	Neutral	Agree	Strongly Agree		
Education Level	Matriculation	Count	0	0	1	4	0	18.931	
		% within Education Level	.0%	.0%	20.0%	80.0%	.0%		
	ITI	Count	1	2	3	6	4		
		% within Education Level	6.2%	12.5%	18.8%	37.5%	25.0%		
	Diploma	Count	5	8	55	74	12		
		% within Education Level	3.2%	5.2%	35.7%	48.1%	7.8%		
	Under graduation	Count	2	2	33	59	19		
		% within Education Level	1.7%	1.7%	28.7%	51.3%	16.5%		
	Post graduation and higher	Count	1	1	18	20	5		0.272
		% within Education Level	2.2%	2.2%	40.0%	44.4%	11.1%		
Total		Count	9	13	110	163	40		
		% within Education Level	2.7%	3.9%	32.8%	48.7%	11.9%		

The data indicates generally positive attitudes towards local employment among respondents, with higher levels of education correlating with more positive attitudes. Diploma holders, undergraduates, and those with postgraduate education show the highest proportions of positive attitudes towards local employment. These findings underscore the potential impact of education on individuals' perceptions and attitudes towards employment opportunities within their local communities. We use chi-square test to test the hypothesis.

H_0: Opinion about local employment is independent of education level of the respondents

H_1: Opinion about local employment is dependent on the education level of the respondents

Based on the test results, there is no statistically significant association between education level and local employment attitudes among the sample population. Hence the hypothesis could not be rejected.

Based on the education qualifications, analysis of unskilled employment is shown at Table:8 :

Table 8. Education based analysis: Unskilled Employment

			Unskilled Employment					Chi-square	P-value
			Strongly Disagree	Dis agree	Neutral	Agree	Strongly Agree		
Education Level	Matriculation	Count	0	0	2	3	0	19.008	.268
		% within Education Level	.0%	.0%	40.0%	60.0%	.0%		
	ITI	Count	0	3	5	8	0		
		% within Education Level	.0%	18.8%	31.2%	50.0%	.0%		
	Diploma	Count	1	4	44	82	23		
		% within Education Level	.6%	2.6%	28.6%	53.2%	14.9%		
	Under graduation	Count	1	4	27	58	25		
		% within Education Level	.9%	3.5%	23.5%	50.4%	21.7%		
	Post	Count	1	3	13	19	9		

	graduation and higher	% within Education Level	2.2%	6.7%	28.9%	42.2%	20.0%	
Total		Count	3	14	91	170	57	
		% within Education Level	.9%	4.2%	27.2%	50.7%	17.0%	

Across all education levels, the majority of respondents have positive attitudes (Agree or Strongly Agree) towards unskilled employment. The data suggests a generally positive outlook towards unskilled employment among respondents, with higher levels of education associated with more positive attitudes. Diploma holders, undergraduates, and postgraduates show particularly favourable attitudes towards unskilled employment, reflecting potential shifts in perceptions and expectations based on educational background. We use chi-square test to test the hypothesis.

H_0: Opinion about unskilled employment is independent of education level of the respondentsH_1:Opinion about unskilled employment is dependent on the education level   of the respondents

Based on the test results, there is no statistically significant association between education level and unskilled employment attitudes among the sample population. Hence the hypothesis could not be rejected.

Table:9 depicts analysis based on monthly income of the respondents on local employment

Table 9. Income group wise analysis-Local employment

			Local Employment					Chi-square	P-value
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Monthly Income	No Income	Count	2	5	31	73	9		
		% within Monthly Income	1.7%	4.2%	25.8%	60.8%	7.5%		
	less than 20K	Count	2	6	41	45	8		
		% within Monthly Income	2.0%	5.9%	40.2%	44.1%	7.8%		
	20k-50k	Count	3	2	32	32	13		
		% within Monthly Income	3.7%	2.4%	39.0%	39.0%	15.9%	64.810	0.000
	50k-75k	Count	2	0	6	9	1		
		% within Monthly Income	11.1%	.0%	33.3%	50.0%	5.6%		
	> 75k	Count	0	0	0	4	9		
		% within Monthly Income	.0%	.0%	.0%	30.8%	69.2%		
Total		Count	9	13	110	163	40		
		% within Monthly Income	2.7%	3.9%	32.8%	48.7%	11.9%		

The most common attitudes towards local employment across all income groups are Agree (48.7%) and Neutral (32.8%), followed by Strongly Agree (11.9%). The data indicates that attitudes towards local employment vary across different income groups, with higher income groups generally expressing more positive attitudes. However, positive attitudes (Agree and Strongly Agree) are prevalent across all income categories, suggesting a generally favourable perception of local employment. We use chi-square test to test the hypothesis.

H_0: Opinion about local employment is independent of income level of the respondentsH_1: Opinion aboutlocal employment is dependent on the income level of the respondents

Based on the chi-square test results, there is a statistically significant relationship between local employment attitudes and monthly income levels. Hence, hypothesis is rejected.

We have discussed about unskilled employment based on income group in Table:10.

Table 10. Income group wise analysis-Unskilled employment

			Unskilled Employment					Chi-square	P-value
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Monthly Income	No Income	Count	1	5	35	63	16	32.91	0.008
		% within Monthly Income	.8%	4.2%	29.2%	52.5%	13.3%		
	less than 20K	Count	0	4	25	56	17		
		% within Monthly Income	.0%	3.9%	24.5%	54.9%	16.7%		
	20k-50k	Count	1	4	28	38	11		
		% within Monthly Income	1.2%	4.9%	34.1%	46.3%	13.4%		
	50k-75k	Count	1	0	2	10	5		
		% within Monthly Income	5.6%	.0%	11.1%	55.6%	27.8%		
	> 75k	Count	0	1	1	3	8		
		% within Monthly Income	.0%	7.7%	7.7%	23.1%	61.5%		
Total		Count	3	14	91	170	57		
		% within Monthly Income	.9%	4.2%	27.2%	50.7%	17.0%		

The data indicates that attitudes towards unskilled employment vary across different income groups, with higher income groups generally expressing more positive attitudes. However, positive attitudes (Agree and Strongly Agree) are prevalent across all income categories, suggesting a generally favourable perception of unskilled employment. We use chi-square test to test the hypothesis.

H_0: Opinion about unskilled employment is independent of income level of the respondents

H_1: Opinion about unskilled employment is dependent on the income level of the respondents

The Pearson Chi-Square test evaluates the hypothesis that there is association between unskilled employment attitudes and monthly income groups. With a typical significance level (alpha) set at 0.05, p-values (0.008) are less than 0.05. Therefore, we have enough evidence to reject the null hypothesis. Table:11 discusses about the analysis based on years of residence.

Table 11. Year of residence wise analysis-Unskilled employment

			Local Employment					Chi-Square	P-value
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Year of Residence	0-15	Count	5	8	67	92	30	7.446	.489
		% within Year of Residence	2.5%	4.0%	33.2%	45.5%	14.9%		
	16-30	Count	3	4	40	60	8		
		% within Year of Residence	2.6%	3.5%	34.8%	52.2%	7.0%		
	>30	Count	1	1	3	11	2		
		% within Year of Residence	5.6%	5.6%	16.7%	61.1%	11.1%		
Total		Count	9	13	110	163	40		
		% within Year of Residence	2.7%	3.9%	32.8%	48.7%	11.9%		

Within each "Year of Residence" category, the percentages show how individuals distribute across different levels of Local Employment. Among those aged 0-15 years, 45.5% agree and 52.2% agree in the 16-30 years and 61% agree in above 30 years of residence. We use chi-square test to test he hypothesis.
H0: Opinion about local employment is independent of years of residence of the respondents
H1: Opinion about local employment is dependent on the years of residence of the respondents
Based on the chi-square tests performed, we do not find sufficient evidence to conclude an association between "Year of Residence" and "Local Employment" categories. Hence hypothesis could not be rejected.Table 12 depicts analysis based on year of residence on unskilled employment.

Table 12. Analyis on years of residence -unskilled employment

			Unskilled Employment					Chi-Square	P-value
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Year of Residence	0-15	Count	2	9	58	93	40	8.318	.403
		% within Year of Residence	1.0%	4.5%	28.7%	46.0%	19.8%		
	16-30	Count	1	3	28	68	15		
		% within Year of Residence	.9%	2.6%	24.3%	59.1%	13.0%		
	>30	Count	0	2	5	9	2		
		% within Year of Residence	.0%	11.1%	27.8%	50.0%	11.1%		
Total		Count	3	14	91	170	57		
		% within Year of Residence	.9%	4.2%	27.2%	50.7%	17.0%		

Within each "Year of Residence" category, the percentages show how individuals distribute across different levels of Unskilled Employment. Among those aged 0-15 years, 46.0% agree and 59% agree in the 16-30yearsand 50% agree in 30 yrs of residence. We use chi-square test to test the hypothesis.
H0: Opinion about unskilled employment is independent of years of residence of the respondentsH1: Opinion about unskilled employment is dependent on the years of residence of the respondents
Based on the chi-square tests performed, we do not find sufficient evidence to conclude an association between "Year of Residence" and "Unskilled Employment" categories. Hence hypothesis could not be rejected.

Suggestions and Conclusions

The analysis reveals that public opinion on local and unskilled employment opportunities in the renewable energy sector in Tirunelveli and surrounding areas is generally positive, with no significant differences based on gender, working area, ageor years of residence. This indicates a broad consensus across different demographic groups on the benefits of renewable energy employment. However, income levels show a significant relationship with employment opinions, suggesting that economic status influences perceptions. To enhance the positive impact of renewable energy on local employment, policymakers and industry stakeholders should implement targeted interventions for different income groups, such as additional training and education programs to help lower-income individuals gain the necessary skills. Creating a supportive policy environment with incentives and regulatory frameworks can attract more investment, thereby increasing job opportunities. Continued research and development to improve renewable energy technologies and make them more affordable and efficient will further contribute to local economic development and job creation, ensuring that the benefits are widely distributed.

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