EXECUTIVE SUMMARY

"SWOT Analysis of Renewable Energy Projects"

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Summary of the Thesis

1.0 Introduction

Energy in the form of electricity is a major foot print for shaping the growth & development pattern of any country in the world. The economic & Industrial scenario of India as well as world has been presently turning over to the radical changes in innovative technological up dating, simultaneously taking care of the developments in sustainable manner. In spite of continual increasing electricity energy demand, India has attempted to maintain the sustainable development of electricity sector. It is evident from the fact that ``**India is the third largest producer of electricity** as well **as the Second largest consumer of electricity** in the world as per Ministry of commerce & Industry, GoI. As far as installed sustainable Renewable Energy power projects is considered, **the India ranked Fifth Wind Energy project installed capacity, Fifth ranked in Solar Energy project capacity and Forth global position in overall Renewable Energy project capacity installed as of 2020``** as per Ministry of New & Renewable Energy (MNRE). India, time to time based on the introduction of different policies & regulations, set different targets of renewable energy, at present 175GW up to 2022 with achievement of only 94.44GW up to March 2021. India has tremendous potential of renewable energy sources and hence development of renewable energy projects. The trajectory scenarios of solar and wind power projects capacity at the year 2047 with different level of difficulties are reported as 479GW and 410 GW respectively as per NITI Ayog report.

The research problem identified is that India`s renewable energy (RE) potential is vast and largely untapped. Simultaneously with the increased demands, the opportunity of renewable energy also increased. However, the untapped renewable energy resources of the country were not being put to optimum use to the tune of availability, preliminary due to various constraints, weaknesses, challenges and threats faced by the stake holders say power developers, EPC agencies, financier, investors, promoter, regulator of electricity, national & international players, consumers and people at large. Thus, it seems to be very important to have research study undertaken to

identify, investigate and analyze the factors in terms of various dimensions of SWOT analysis and to find a suggestive overview to bridge the gap between installed renewable energy capacity and untapped potential.

As far as renewable energy projects is concerned, it is right opportunity for the research in the field as it is currently live and vibrant topic for research due to the fact that now a days every countries both developing and developed countries committed and focusing on the renewable energy projects due to tremendous naturally available renewable sources of energy.

2.0 Review of Literature

Energy is a necessary requirement for economic as well as social development of any nation. The demand of energy is going to be increased with increasing industrial activities, population growth and agricultural developments in the country. During the last decade several new concepts including introduction of renewable energy sources have emerged. The increased energy demands are thus, met through the widely available natural renewable energy resources such as solar, wind, bioenergy and small hydropower and or helps in reducing gap in supply –demand so as to meet the future energy demand in India. This chapter provides a quick over view of various empirical literatures available on the subject of renewable energy potentials, renewable energy policies, regulations and constraint, cost competitiveness, SWOT analysis etc based on renewable energy projects particularly utility scale solar PV projects and wind power projects with emerging issues related to the development in the renewable energy sources, technologies and projects. The literature on the subject matter is very large and hence it has been delimited to review some important literatures to outline the core issues.

The literature review is a previous work in the field of present study, review the critical perspective on the relevant literature including conclusive findings on the related subjects. The in depth literature review helps in identifying the research gap that will attempt to address and established to determine the focused problem of study on which research is to be conducted.

The literature review is presented in three sections:

- Section one provides a emerging literature on renewable energy sources and renewable energy development relating to global, national and state,
- Section two provides a scan of National & global renewable energy policies and regulations, renewable energy projects investment, risk, barriers & constraint and
- Section three deals with a present picture of the Renewable energy development issues, challenges, cost competitiveness and analysis etc

3.0 Research Methodology

Designing an appropriate, accurate and quality research methodology for the given problem is highly essential from the point of view of researcher. Therefore, due attention is paid for designing and then adhering to the appropriate research methodology throughout the research process for improving the quality of research.

3.1 Rationale of the Study

The Renewable energy is the key to the development of society and country as well. Moreover, the Government of India has set a goal of 175 Gigawatts (GW) cumulative renewable power installed capacity by the end of 2022 and submitted this Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention of Climate Change (UNFCCC). Further, India has set a target to increase the country`s share of renewable energy installed electricity capacity to 40 percentage by the end of 2030. NITI Ayog launched the India Energy Security Scenarios 2047 (IESS 2047), explores a range of potential future energy scenarios for India. As per MNRE annual report, so far cumulative installed renewable power capacity in India as of 31 March 2018 reached to 69.784 GW, 31 March 2019 reached to 78.316 GW and as of 31st March 2021 reached to 94.434GW . This indicates that India`s renewable energy (RE) potential is vast and largely untapped. As per IESS 2047, recent estimates show that India's solar potential is greater than 750 GW and its announced wind potential is 302 GW (may be higher than 1000 GW). It shows opportunity for

achieving as high of 410 GW of wind and 479 GW of solar PV by 2047.

With respect to the enormous demand for power in India, the opportunity of renewable power is also growing. However, the untapped renewable energy resources of the country were not being put to optimum use preliminary due to various constraints and challenges/weakness for the financing investment for financier, investors, promoter, regulator of electricity and private power developer as well. This research study focuses on various dimensions of SWOT analysis and provides such opportunities to bridge the gap between installed renewable energy capacity and untapped potential.

3.2 Statement of the Problem

As far as renewable energy is concern, it is one of the most important, live and vibrant topic for research. It is due to the fact that now a days every countries both developing and developed countries committed and focusing on the renewable energy projects due to environmental awareness, energy security of the country, naturally available sources of energy and lot many reasons best known to everyone, However due to some constraints, weaknesses, challenges and threats same is not being optimally utilised to the tune of availability. In this context various studied have been conducted regarding the renewable energy sources, financial & investment opportunities, awareness, Project cost effectiveness, regulatory policies, support mechanism, challenges, competitions faced by various developers, EPC contractors, policy makers, national & international players, consumers and people at large. Thus it seems to be important to have research study considering all aspect of renewable energy projects. Hence the descriptive and analytical study undertaken to identify and analyse the factors in terms of SWOT analysis and to find a suggestive overview. The statement of problem is as under:

"SWOT Analysis of Renewable Energy Projects"

3.3 Research Objectives

The primary aim and objective of the present study is:

1. To understand the Global and Indian Renewable Energy mix scenario, available potential of renewable energy resources, present scenario of renewable energy projects, scope of development of Renewable Energy Projects.
2. To understand the changing scenario, key driving policies & regulations, support mechanisms for renewable energy projects.
3. To understand the developmental opportunities and strengths for renewable energy project.
4. To understand & analyse the manufacturing resources & value chain for development of renewable energy projects.
5. To understand the market dynamic & cost competitiveness for development of renewable energy projects.
6. To understand and analyze the challenges, weaknesses and threats of Renewable energy projects.
7. To study about the perception of stack holders on viability of Renewable Energy projects.
8. To outline a suggestive overview to overcome the challenges, weaknesses and threats associated with, for development of Renewable Energy projects.
9. Suggestive measures to utilize optimally the available potential of renewable energy resources and development of renewable energy projects sustainably.

3.4 Hypotheses of the Study

$H0_1$: There is no significant difference in the perception about different state/area have different Renewable Energy potential.

$H0_2$: There is no significant association between available renewable energy potential and achievement of Government target.

$H0_3$: There is no significant difference in the perception about existing policies and supports helps in achieving the government target for renewable energy projects across different States of India.

$H0_4$: There is no significant difference in the perception about criticality of various risks associated to investment in utility scale renewable energy projects across various organization groups.

$H0_5$: There is no significant association between installation of renewable energy projects and opportunities for green employment generation to boost India's economy

$H0_6$: There is no significant relationship between potential of renewable energy (solar & wind energy) and opportunities for solar power project development.

$H0_7$: There is no significant difference in the perception about effectiveness of value chain for RE project component from other countries across Types of Organization.

$H0_8$: There is no significant difference in perception about cost for procurement of materials for renewable energy projects from India & abroad across types of organizations.

$H0_9$: There is no significant relationship between Government target and available manufacturing capacity in India to meet target.

$H0_{10}$: There is no significant difference in the perception about challenges faced for development of utility scale renewable energy projects across Years of experience group

$H0_{11}$: There is no significant difference in the perception about project cost viability about solar / wind power project across Types of Organization

$H0_{12}$: There is no significant difference in the perception about awareness for renewable energy project development across various regions/ states of India.

$H0_{13}$: There is no significant difference in Regulatory policy related factors affecting the development of utility scale renewable energy projects within different experience group.

$H0_{14}$: There is no significant difference in factors related to current challenges for installation of renewable energy projects within different organizational group.

3.5 Research Design

In this study, the combination of two types of research design will be used:

- Exploratory research:
- Descriptive research

3.6 Data Collection Technique

The ***primary research*** data will be collected from the various employees and management personnel of prominent organizations, Independent power producers and financial institutions, stake holders, the utility scale renewable energy projects sectors both public sector as well as private sector developers and investors of organized sector, bulk purchasers and others who have been contributing significantly in the development and exploitation of renewable energy sources about perception of renewable energy through Non Disguised closed ended Questionnaire and structured interviews. The questionnaire will be framed on the base of objectives of the study. The questionnaire will be pretested and revised if necessary. The ***secondary data*** will be collected from reliable and authentic sources like published research papers, published articles, research reports, newspapers, and various authentic websites. The other data which will be used for the purpose of the study will be taken from books, e-books, internet literatures, magazines, journals and electronic media through both online and offline mode.

3.7 Sample Size

The exact percentage or number of representative sample element (units) from selected each stratum from suppliers, EPC contractors, Stake holders, Consultants, Service providers, Policymakers and Regulators, decision makers, senior management, academicians, Public Sector Organizations and Private Sector Organizations involved in solar and wind utility scale renewable energy projects is considered as sample for research study. As each stratum is having more homogeneous characteristics than the other stratum, thereby estimating

each of the stratums more accurately leads to better estimate of the Target population, hence stratified sampling method is used to have more reliable, accurate and detail information. However, the exact sample size determination for the purpose of collection of the primary data is calculated as under:

$$\textbf{Sample Size (n)} = \frac{\boldsymbol{\pi}\,(\mathbf{1}-\boldsymbol{\pi})\,\boldsymbol{z}^{\mathbf{2}}}{\boldsymbol{D}^{\mathbf{2}}}$$

The sample size determination formula is obtained from Naresh K. Malhotra and Satya Bhushan Dash (2011) 'Marketing Research – An Applied Orientation' 6th Edition, Pearson, Page number 364`.

According to the given formula, the Sample Size is works out as under:

$n = \pi\,(1 - \pi)\,z^2 \div D^2$

$n = 0.75\,(1\text{-}0.75)\,(1.96)^2 \div (0.05)^2$

$n = 0.75\,(0.25)\,(3.8416) \div (0.0025)$

$n = 0.75\,(0.25)\,(3.8416) \div (0.0025)$

$n = 0.6375 \div 0.0025$

n = 255.12 so, sample size is round off with 255 numbers of sample.

Sr No	Stakeholders	Approx Nos	Nos of Management Personnel's	Total Nos
1	Project Developers	8-10	3-4	35
2	EPC contractors	20-25	3-4	95
3	Consultant	8-10	2-3	30
4	Policy maker	3-4	1-2	5
5	Investor/Financier	6-8	2-3	15
6	Manufacturers / Suppliers	8-10	2-3	20
7	R& D Institutions	4-5	1-2	10
8	Independent Power Producers/ Generators Equipment Supplier	6-8	3-4	20
9	Academicians	6-8	1-2	10
10	MNCs/ Globally	5-6	2-3	15
	Total			255

3.8 Reliability of the Data

In the present study the research study is on the ground of questionnaire, the reliability index is tested on the surveyed questionnaire. The researchers has utilised the statistical package for social science (SPSS) tools for reliability analysis with the support of Cronbach`s Alpha co-efficient, being a well-known method of reliability measurement in research, the range of which varies from 0 to 1. Here the Cronbach`s Alfa of given 252 nos of items is 0.975 which is nearby 1, which indicates that reliability index is **97.5%** , concludes that overall primary data information collected is most credible and best internal consistency of reliability between the given variables. The validity of the questionnaire has been measured with the help of Factor Analysis method. The factor analysis is applied to reduce the large numbers of variables into a small set of summarised variables, referred to as factors. In the present study the various factors related to statements of utility scale renewable energy projects has been factorised to explain he relationship among various variables. Hence in this present research study factor analysis is suitably utilized for varying the validity of the research. The factor analysis is being carried out on questions as narrated in chapter of data analysis & interpretations consisting of various factors through Principal Component Analysis (PCA).

3.9 Limitations of the Research Study

- As the data may be collected through the questionnaire there may be possibility that employees, management personnel, developers, investors, stake holders, institutions may not be fully loyal in answering the questions, also there is bias mind due to company to company competition which may cause misleading data.
- Due to work pressure and lake of time, interest as well as knowledge of the employees they may not fill the questionnaire properly.
- The Time Constraint in collecting the responses is one of the limitations as the data will be collected from out station developers,

investors, stake holders, institutions within the period of one year, would be a limiting factor.

- The Cost Constraint is limiting factor as the increased sample size increases the cost of data collection.
- The data is collected from government, PSU organizations and private sector related to the research field. Hence the result may or may not be generalized.

3.10 Delimitations of the study:

- The studies is delimited to the large utility scale ground mounted solar photovoltaic (PV) and onshore wind renewable energy projects in Indian geographical boundary and not considers the small scale renewable energy projects hence, analysis and recommendations for tapping of untapped renewable energy sources and development of such renewable energy projects have been done.
- This study will not considered small scale hydro, solar heating system, solar rooftop, Concentrated solar projects, waste to energy, tidal power, geo thermal power, bio gas/biomass/baggage base projects, offshore wind projects and other form of renewable energy projects.
- This study will not criticize any policy, act, regulations, targets or guidelines provided by any of the Government. Also will not provide any specific recommendations on any private or government organizations/institutions which are outside the scope of the report.
- The study also will not explicitly examine the effect of climate change legislation in the form of an economy-wide cap or tax on greenhouse gas emissions, on bilateral cooperation in renewable energy, although it will describe how these mechanisms could affect the market for renewable energy power projects. Such legislation or a global agreement to reduce emissions would eventually influence the structure, financing and is motivated by a range of factors.

4.0 Findings of the Research Study

Demographic characteristics of Stake holders group for this research:

Respondents located in select states of India:

- Result of the study depicts the distribution of the respondents from various regions / states of India. The data indicates that the respondents are from 12 (twelve) states, mostly having high renewable energy potentials zones. Out of total 252 respondents, 105 (41.7%) respondents are from Gujarat, 21 (8.3%) respondents are from Maharashtra, 45 (17.9%) respondents are from Karnataka, 9 (3.6%) respondents are from Madhya Pradesh, 6 (2.4%) respondents are from Rajasthan, 9 (3.6%) respondents are from Uttar Pradesh, 32 (12.7%) respondents are from NCR/ Delhi, 13 (5.2%) respondents are from Tamil Nadu, 7 (2.8%) respondents are from Hariyana, 3 (1.2%) respondents are from Uttara Khand, 1 (0.4%) respondents is from Telangana, 1 (0.4%) respondents is from West Bengal.
- **Distribution of respondents on the ground of Types of Organization:**

  Result of the research depict that the distribution of respondent from various organization shows that out of total 252 respondents, the majority of respondents are from private organization about 165 (65.5%), 28 (11.1%) respondents are from public organization, 9 (3.6%) respondents are from joint venture organization, 36 (14.3%) respondents are from government organization, 14 (5.6%) respondents are from non-government organization.

- **Distribution of respondents on the ground of years of experience group:**

  Result of the research study depicts the distribution of the respondents on the ground of years of experience group. The data indicates that the respondents are from 4 (four) experience group, mostly respondents are from renewable energy field. Out of total 252 respondents, 148 (58.7%) respondents are having more than 10 years of experience, 46 (18.3%) respondents are having 5 to 10 years of experience, 44 (17.5%)

respondents are having 2 to 5 years of experience and 14 (5.6%) respondents are having experience up to 2 years.

4.1 Findings in view of respondent perceptions:

- **Respondents contribution in development of renewable energy projects**

  It is revealed that 45.2 percentage of manufacturers agree & 41.7 percentage are strongly agree for their contribution in development of renewable energy projects

  It is revealed that 61.5 percentage of suppliers agree & 25.4 percentage are strongly agree for their contribution in development of renewable energy projects

  It is revealed that 59.9 percentage of EPC contractors strongly agree & 37.3 percentage are agree for their contribution in development of renewable energy projects

  It is revealed that 73.8 percentage of project developers are strongly agree & 25.8 percentage are agree for their contribution in development of renewable energy projects

  Moreover, It is view that 38.5 percentage of investors strongly agree & 30.6 percentage are agree for their contribution in development of renewable energy projects

  It is found that 38.5 percentage of financiers agree & 30.6 percentage are strongly agree for their contribution in development of renewable energy projects

  It is noticed that 58.7 percentage of policy maker strongly agree & 35.7 percentage are agree for their contribution in development of renewable energy projects

  Further, It is revealed that 48.8 percentage of consultant agree & 19.4 percentage are disagree for their contribution in development of renewable energy projects

  It is indicated that 63.1 percentage of power purchaser strongly agree & 29.0 percentage are agree for their contribution in development of renewable energy projects

It is clarified that 62.3 percentage of independent power producers strongly agree & 31.3 percentage are agree for their contribution in development of renewable energy projects

It is noticed that 52.8 percentage of captive users strongly agree & 37.3 percentage are agree for their contribution in development of renewable energy projects

It is further, noticed that 43.7 percentage of research institute agree & 22.2 percentage are dis-agree for their contribution in development of renewable energy projects

It is concluded that 64.3 percentage of promoter of renewable energy strongly agree & 29.8 percentage are agree for their contribution in development of renewable energy projects

It is further concluded that 53.2 percentage of renewable energy power trader strongly agree & 32.1 percentage are agree for their contribution in development of renewable energy projects

It is observed that 40.1 percentages of other stake holders agree & 44.8 percentages don't know for their contribution in development of renewable energy projects.

- **Respondents operating in renewable energy project basket**

  It is revealed that 91.6 percentages i.e. 230 out of total 252 respondents are operating in on grid utility scale solar renewable energy projects.

  It is further, revealed that 35.5 percentages i.e. 89 out of total 252 respondents are on shore utility scale wind renewable energy projects.

- **Respondents perception regarding potential of solar power project development:**

  It is revealed from the study that 50.79 percentages of respondents strongly agree and 19.4 percentages agree for tremendous potential of solar power project development.

  However, it is also revealed that only 2.77 percentages of respondents strongly agree and 11.11 percentages agree target of 100GW of solar power project will be achieved up to 2022. Majority of respondents i.e. 22.62 percentages are disagree and 6.74 percentages are strongly disagree for achievement of said target.

Further, it is also revealed that only 5.55 percentages of respondents strongly agree and 3.57 percentages agree that the installation of solar power projects are growing as desired to fully utilize the available renewable energy sources. Majority of respondents i.e. 23.80 percentages are disagree and 21.82 percentages are strongly disagree.

- **Respondents perception regarding potential of wind power project development:**

  It is revealed from the study that 54.76 percentages of respondents strongly agree and 15.87 percentages agree for tremendous potential of wind energy source.

  It is also, revealed from the study that 44.84 percentages of respondents strongly agree and 23.41 percentages agree for tremendous potential of wind power project development.

  However, it is also revealed that only 1.98 percentages of respondents strongly agree and 10.71 percentages agree target of 60GW of wind power project will be achieved up to 2022. Majority of respondents i.e. 21.83 percentages are disagree and 10.32 percentages are strongly disagree for achievement of said target.

  Further, it is also revealed that only 1.19 percentages of respondents strongly agree and 3.96 percentages agree that the installation of wind power projects are not growing as desired to fully utilize the available wind energy sources. Majority of respondents i.e. 24.20 percentages are disagree and 23.80 percentages are strongly disagree.

- **Respondents perception regarding availability of renewable energy potential and achievement of government target:**

  It is revealed from the study that 56.2 percentages of respondents strongly agree that the available RE potential is more than government target requirements and 35.1 percentages agree that the available RE potential is sufficient for government target requirements.

  It is also, revealed from the study that 67.3 percentages of respondents opine that their support are very important for achievement of government target of renewable energy projects and 25.90 percentages of respondents opine that their support are important for achievement of government target of renewable energy projects

- **Respondents perception in view of organizational support for achievement of government target:**

  The study revealed that 59.92 percentages of respondents perceived very high importance (80% and more) organizational support and 23.80 percentages high (50 to 80%) organisanal support for achievement of government target of solar renewable energy projects.

  The study revealed that 32.54 percentages of respondents perceived very high importance (80% and more) organizational support, 15.47 percentages high (80 to 50%) and 20.63 percentages medium (50 to 20%) organisanal support for achievement of government target of wind renewable energy projects.

  It is also, revealed from the study that 65.07 percentages of respondents perceived very high significance (80% and more) and 20.63 percentages of respondents perceived high significance (80 to 50%) for organization to install solar renewable energy projects in order to utilize optimally the available potential of renewable energy sources.

  It is also, revealed from the study that 29.36 percentages of respondents perceived very high significance (80% and more), 14.28 percentages of respondents perceived high significance(80 to 50%) and 22.22 percentages of respondents perceived moderate significance (50 to 20%) for organization to install wind renewable energy projects in order to utilize optimally the available potential of renewable energy sources.

- **Respondents perception regarding opportunities of green employment to boost the India`s developing economy:**

  The study revealed that 98.81 percentages of respondents agree for creation of opportunities for solar power project green employment to boost India`s developing economy.

  The study revealed that 96.82 percentages of respondents agree for creation of opportunities for wind power project green employment to boost India`s developing economy.

- **Respondents perception regarding viable range of project cost for utility scale Solar renewable energy projects:**

It is revealed from the study that 30.95 percentages of respondents perceived the viable project costing range of 5 to 4.5 Cr per MW, 26.59 percentages of respondents perceived the range of 4.5 to 4.0 Cr per MW, 25.40 percentages of respondents perceived the range of 5.5 to 5.0 Cr per MW. It is also revealed that only 4.36 percentages of respondents perceived the range of 6.0 to 5.5 Cr per MW, 3.17 percentages of respondents perceived the range of 3.5 to 3.0 Cr per MW as well as 9.13 percentages of respondents perceived the range of 4.0 to 3.5 Cr per MW.

- **Respondents perception regarding viable range of project cost for utility scale wind renewable energy projects:**

  It is revealed from the study that 34.13 percentages of respondents perceived the viable project costing range of 6 to 5.5 Cr per MW, 27.38 percentages of respondents perceived the range of 5.0 to 4.5 Cr per MW, 24.60 percentages of respondents perceived the range of 5.5 to 5.0 Cr per MW. It is also revealed that only 1.59 percentages of respondents perceived the range of 3.5 to 3.0 Cr per MW, 2.38 percentages of respondents perceived the range of 4 to 3.5 Cr per MW as well as 9.52 percentages of respondents perceived the range of 4.5 to 4.0 Cr per MW.

- **Respondents perception regarding initial project cost for utility scale solar renewable energy projects:**

  It is revealed from the study that 63.10 percentages of respondents perceived the high initial cost for utility scale solar renewable energy projects, 26.19 percentages of respondents perceived the normal initial cost. However, it is also revealed that only 9.52 percentages of respondents perceived very high initial cost and 0.79 percentages of respondents perceived low initial cost for development of utility scale solar renewable energy projects.

- **Respondents perception regarding initial project cost for utility scale wind renewable energy projects:**

  It is revealed from the study that 49.20 percentages of respondents perceived the high initial cost for utility scale wind renewable energy projects, 39.28 percentages of respondents perceived very high initial

cost. However, it is also revealed that only 11.11 percentages of respondents perceived normal initial cost for development of utility scale wind renewable energy projects.

- **Respondents perception regarding operation & maintenance cost for utility scale solar renewable energy projects:**

  It is revealed from the study that 62.70 percentages of respondents perceived the normal operation & maintenance cost for utility scale solar renewable energy projects, 21.42 percentages of respondents perceived the high operation & maintenance cost. However, it is also revealed that only 10.32 percentages of respondents perceived low operation & maintenance cost, 3.17 percentages of respondents perceived very high operation & maintenance cost, 1.98 percentages of respondents perceived very low operation & maintenance cost for development of utility scale solar renewable energy projects.

- **Respondents perception regarding operation & maintenance cost for utility scale wind renewable energy projects:**

  It is revealed from the study that 47.22 percentages of respondents perceived the high operation & maintenance cost for utility scale wind renewable energy projects, 32.14 percentages of respondents perceived normal operation & maintenance cost. However, it is also revealed that only 13.88 percentages of respondents perceived very high operation & maintenance cost, 05.55 percentages of respondents perceived low operation & maintenance cost for development of utility scale wind renewable energy projects.

Objective 1: To understand the Global and Indian Renewable Energy mix scenario, available potential of renewable energy resources, present scenario of renewable energy projects, scope of development of Renewable Energy Projects.

- It is revealed from the mean score of descriptive statistics analysis for potential of solar renewable energy in India that India has tremendous potential for solar energy, indicates the **strength** as well as there are tremendous scope for solar power project development, indicates the **opportunity** . However, the stake holders perceived that they don`t

know whether the target for 100 GW of solar power projects will be achieved or not. Further, mean score revealed that that majority of the stake holders don`t know that `Installation of solar power projects are growing at a speed as desired which may fully utilized the available solar resource` revealed a **weakness** factor for wind energy projects development.

- It is revealed from the mean score of descriptive statistics analysis for potential of wind renewable energy in India that majority of the stake holders strongly agree that India has tremendous potential of wind energy indicates the **strength** as well as there are tremendous scope for wind power project development indicates the **opportunity**. However, the majority of stake holders disagree that `The target of 60 GW of wind power project will be achieved up to 2022`. Again it is revealed that majority of the stake holders dis agree that `Installation of wind power projects are growing at a speed as desired which may fully utilized the available wind energy resource` revealed a **weakness** factor for wind energy projects development.
- It is also revealed that majority of the stake holders agree that Different state/area have different solar energy potential however, in case of wind energy potential majority of the stake holders strongly agree that Different state/area have different wind energy potential, which is **weakness** so far as opportunity for equal devilment of renewable energy projects are concerned.

Objective 2: To understand the changing scenario, key driving policies & regulations, support mechanisms for renewable energy projects.

- It is revealed from the mean score of descriptive statistics for perception of various respondent/stack holders regarding various policies identified to help to promote the government target for development of renewable energy projects that majority of the stake holders strongly agree to a very great extent that the policies like Exemption from custom duty, Income tax holidays and Payment Security mechanism. As the majority of stake holders' respondents to a very great extent i.e. 54.40% for Exemption from custom duty, 56.0% for Income tax holidays and 44.0% for Payment Security mechanism,

hence the said policies are the **strength** for to promote the government target.

- It is revealed from the mean score of descriptive statistics for perception of various respondent/stack holders regarding various policies identified to help to promote the government target for development of renewable energy projects that majority of the stake holders agree to a great extent that the policies like Feed in Tariff, Preferential Tariffs, Renewable Generation Obligation, No inter-state transmission charges, Foreign Direct Investment, Funding from government institutions for financing term loan, Enforcement of renewable purchase Obligation and Off-takers- Power Purchase Agreement hence the said policies are the **opportunity** for to promote the government target.
- It is revealed from the mean score of descriptive statistics for perception of various respondent/stack holders regarding various policies identified to help to promote the government target for development of renewable energy projects that majority of the stake holders agree to a moderate extent that the policies like Accelerated Depreciation, Generation Based Incentives (GBI), Renewable Energy Certificates (REC), Viability Gap Funding (VGF), Central Financial Assistance (CFA), Budgetary support for R&D and demonstration of technology, Competitive bidding process, Introduction/revision of solar policy, Hybrid solar wind policy and Policy for revamping of existing solar-wind, hence the said policies are again the **opportunity** to promote the government target.
- It is revealed from the mean score of descriptive statistics for perception of various respondent/stack holders regarding various policies identified to help to promote the government target for development of renewable energy projects that majority of the stake holders agree to a moderate extent that the policies like Imposition of Safeguard duty. However majority of respondents i.e. 44.40% not at all agree that this policy supports to promote the government target for development of renewable energy projects hence the said policies are considered as **weakness** to promote the government target.

Objective 3: To understand the developmental opportunities and strengths for renewable energy project.

- The mean values of the variables measured for perception of various stake holders for their responsibility / contribution for the development of renewable energy projects based on descriptive statistics under table 5.5 revealed that contribution of all stake holders are less than the average score of 3. This indicates the **strength** that all stake holders contributes for development of renewable energy projects hence getting good opportunities for development of renewable energy projects.
- The mean values of the variables measured for perception of various respondent/stack holders regarding various policies identified to help to promote the government target for development of renewable energy projects based on descriptive statistics under table 5.8 revealed that majority of policies identified are less than the average score of 3. This indicates the **opportunity** that majority of available policies are favoring to promote the government target for development of renewable energy projects hence getting good opportunities.
- The mean values of the variables measured for potential of solar renewable energy in India shown under table 5.6 revealed that opportunities available as the mean average score are less than 3, which indicates that the development of solar renewable energy projects are having more **opportunity** factor.
- It is revealed from the mean score of descriptive statistics with respect to factors influencing the decision of installation of renewable energy projects that majority of the stake holders strongly agree to a very great extent that the factor like Payment security mechanism, Land policies, Waiver of transmission & wheeling charges, Exemption of custom duties, Availability of renewable energy resources, Availability of evacuation facility and Government target for RE capacity, which revealed the **strength**. As the majority of stake holders respondents to a very great extent i.e. 50.40% for Payment security mechanism, 65.1% for Land policies, 46.0% for Waiver of transmission & wheeling charges, 65.6% for Exemption of custom duties,

73.0% for Availability of renewable energy resources, 55.2% for Availability of evacuation facility and 59.1% for Government target for RE capacity.

- It is revealed from the mean score of descriptive statistics with respect to factors influencing the decision of installation of renewable energy projects that majority of the stake holders agree to a great extent that the factor like Centre level policy supports, State level policy support, Easy of procedure for RE project, Low cost funding from Government institutions, Low cost funding from Private Banks and Institutions, Development of Solar Parks at different states, Waiver of transmission & wheeling charges, Renewable Purchase Obligation (RPO), Imposition of safeguard duty, Availability of off takers and Supply chain network, which indicates the **opportunity** as far as given factors is considered.
- It is revealed from the mean score of descriptive statistics with respect to factors influencing the decision of installation of renewable energy projects that majority of the stake holders agree to a some extent that the factor like Policy for disposal of solar panels and Availability of facility for disposal of solar panel which indicates the **opportunity** as far as given factors is considered.
- It is revealed from the mean score of descriptive statistics to assess the evaluation of perception of various respondent/stockholders regarding various "motivation support behind the decision on investing in utility scale renewable energy projects" that the motivation support like Renewable power are the future, Returns on generations, Congenial policies in renewable energy at state level, Government targets for renewable energy development, Lower operating cost, Secured payment mechanism, Availability of renewable energy resources, Open access / third party sale of power are having average mean score less than 3 which indicates the opportunities available hence this statement related having more **opportunity** factor.

Objective 4: To understand & analyze the manufacturing resources & value chain for development of renewable energy projects.

- It is revealed that there exists significant difference in the perception about effectiveness of value chain for RE project component from other countries across the Years of experience group.

- It is revealed that there does not exist significant difference in the perception about effectiveness of value chain for RE project component from other countries across Types of Organization.
- It is revealed that there exist significant association between Government target and available manufacturing capacity in India to meet target.
- It is revealed that 36.1% respondent perceived that the manufacturing capacity is not sufficient, 20.2% agree to a very less sufficient manufacturing capacity and 18.7% to a less sufficient manufacturing capacity, this concludes that insufficient manufacturing capacity effects the development of renewable energy projects. The mean score of descriptive statistics analysis also revealed that there is insufficient manufacturing capacity in India, which indicates the **weakness** factor.

Objective 5: To understand the market dynamic & cost competitiveness for development of renewable energy projects.

- It is revealed that there exists significant difference in the perception about cost competition for development of solar power projects across the various states of India, which revealed the threat that some of the states may not developed which have high cost competition. However, In the case of Wind power projects developments, it is revealed that there is no significant difference in the perception about cost competition for development of wind power projects across the various states of India, which indicates the **strength** for the wind project development.
- It is revealed that there exists significant difference in the perception regarding the initial cost of the setting up of utility scale solar power projects across Years of Experience group, which revealed **weakness**. However, In the case of Wind power projects developments, there is no significant difference in the perception regarding the initial cost of the setting up of utility scale solar power projects across Years of Experience group, which revealed that each state gets the equal **opportunity** irrespective of initial cost.

- It is revealed that there is no significant difference in the perception regarding the initial cost of the setting up of utility scale solar power projects across Types of Organization. However, In the case of Wind power projects developments, there exists a significant difference in the perception regarding the initial cost of the setting up of utility scale wind power projects across Types of Organization.
- It is revealed that there is no significant difference in the perception regarding the operation & maintenance cost of the setting up of utility scale solar power projects across Years of Experience group. Further, In the case of Wind power projects developments, it is also revealed that there is no significant difference in the perception regarding the operation & maintenance cost of the setting up of utility scale solar power projects across Years of Experience group, which indicates the equal **opportunity** for both solar & wind projects to be established irrespective of operation & maintenance cost.
- It is revealed that there is no significant difference in the perception regarding the operation & maintenance cost of the setting up of utility scale solar power projects across Types of Organization. Further, In the case of Wind power projects developments, it is also revealed that there is no significant difference in the perception regarding the operation & maintenance cost of the setting up of utility scale solar power projects across Types of Organization which indicates the equal **opportunity** for both solar & wind projects to be established irrespective of operation & maintenance cost.
- It is revealed that there exists significant difference in the perception about cost of procurement of materials from India and Other countries across Types of Organization, which revealed the **threat** so far as the make in India concept is concerned.
- It is revealed that majority of respondents organization prefer to import main component from China (82.94%), Vietnam (55.95%) and Malaysia (49.60%) for solar power projects and Denmark (57.94%), Switzerland (42.46%), Germany (36.90%) for wind power projects, which is again a **threat** so far as the make in India concept is concerned.

- It is revealed that there exists association between investment risk and investment cost associated with renewable energy projects. Further, the analysis results indicate positive correlation to the tune of 52.2 percentages between two variables of `investment risk' and 'investment cost' associated with renewable energy projects.

Objective 6: To understand and analyze the challenges, weaknesses and threats of Renewable energy projects.

- It is revealed that there is no significant difference in the perception regarding challenges faced for development of utility scale renewable energy projects across Types of Organization. As a researcher, it is to be considered as Strength for the organizations as there is equal opportunity for development of renewable energy projects to each state.
- It is also revealed that there is no significant difference in the perception about challenges faced for development of utility scale renewable energy projects across Years of experience group. Again, it is to be considered as Strength for the management personnel's as there is equal opportunity for development of renewable energy projects to each state.
- The mean values of the variables measured for `Installation of solar power projects are growing at a speed as desired which may fully utilized the available solar energy resource` shown under table 5.6 revealed that installations of solar projects are more than average score of 3, which indicates the **weakness** factor for development of solar renewable energy projects.
- The mean values of the variables measured for `the target of 60 GW of Wind power project will be achieved up to 2022` and `Installation of wind power projects are growing at a speed as desired which may fully utilized the available solar energy resource` shown under table 5.7 revealed that the variables are more than average score of 3, which indicates the **weakness** factor for achievement of government target for development of wind renewable energy projects.

- The mean values of the variables measured for perception of various respondent/stack holders regarding various policies identified to help to promote the government target for development of renewable energy projects based on descriptive statistics under table 5.8 revealed that some of policies identified are more than the average score of 3. This indicates the **weakness** factor that the available policies likes Renewable Energy Certificates, Viability Gap Funding, Imposition of Safeguard duty and Competitive bidding process are not favoring to promote the government target for development of renewable energy projects hence creating challenges.

- It is revealed from the mean score of descriptive statistics to assess the evaluation of perception of various respondent/stockholders regarding various "motivation support behind the decision on investing in utility scale renewable energy projects" that the motivation support that High tariff rates and provision of renewable energy certificates are having average mean score more than 3 which indicates the **weakness** exists hence this statement related having more **weakness factor**.

Objective 7: To study about the perception of stack holders on viability of Renewable Energy projects.

- It is revealed that there exists significant difference in the perception about project cost viability about solar power project across Types of Organization, which indicates **weakness** factor. However, In the case of Wind power projects development, there is no significant difference in the perception about project cost viability about Wind power Project across Types of Organization, which revealed **opportunity** for each state for setting up of wind energy projects.
- The mean values of the variables measured for perception of various respondent/stack holders regarding various "points contribute to make utility scale renewable energy project more affordable and viable" for development of renewable energy projects based on descriptive statistics under table 5.12 revealed that majority of points identified are less than the average mean score of 3. This indicates the points stated are supporting for

viability that majority of the points contributing are favoring to viability for development of renewable energy projects, this revealed the **strength** factor so far as renewable energy project viability is concerned.

Objective 8: To outline a suggestive overview to overcome the challenges, weaknesses and threats associated with, for development of Renewable Energy projects.

- The analysis revealed that there exist significant association between Government target and available manufacturing capacity in India to meet target. However, it is revealed that majority of respondents i.e. 75.0% respondent perceived that the manufacturing capacity is not sufficient, to less sufficient manufacturing capacity, hence researchers suggestion is clear that government shall promote the local manufacturing facility for major/main component of the utility scale renewable power projects to meet the increasing demand/ target set by government of India.
- The analysis revealed that there does not exists significant difference in the perception about grid connectivity / evacuation issues for statement like Inadequate transmission infrastructure, Mismatch between the available corridor and necessary demand Centre, High cost of establishment of transmission lines, Right of Way (RoW) issues. Transmission system Supervision charges and Wheeling & transmission charges as the significance value (p-value) for this statements is well beyond the significance level of 0.05 except in case of statement `` Procedure for connectivity permission``
- This concludes that the following challenges needs to be overcome as it persists for the perception point of view of stake holders from various states and organizations. The suggestive points are:
  - All states have to establishment transmission infrastructure facility on PPP model which supports in reduction in cost of transmission of renewable energy power. This also supports in reduction of mismatch between the available corridor and necessary demand Centre hence the renewable power generated can be consumed at respective load Centre

- The government shall have to support to resolve the Right of Way (RoW) issues by notifying the charge for the private lands and also helps to remove encroachments of lands.
- The different states have different charges for transmission & wheeling which is to be stream lined and to enhance the development of the renewable energy projects targets waiver of such charges is to be given for a particular development periods.
- Single window policy is needs to be established for all procedures and registrations just like MSME registration window.

5.0 Suggestions & Recommendations of the Research Study

- ✓ Facility development for domestic manufacturing of equipment's in large scale production.
- ✓ Provision of government waste lands to developers on token lease rent for atleast 30 years, and
- ✓ Government intervention for providing supports for lease private lands at certain fixed cost and support for right of way issues for development of renewable energy projects.
- ✓ Government support for capital subsidy both for project & transmission network.
- ✓ Government shall identify the high potential area for solar radiation and windy zones of each states and offer it for potential developers & EPC agencies for development of either large scale solar or wind projects along with providing of all supportive infrastructures like evacuation/ connectivity facility, Roads & transportation, all necessary permissions & registration, power purchase agreements for 25 year with defined charges.
- ✓ Providing of transmission facilities and or support of government for land for establishing of transmission facility.
- ✓ State electricity shall provide adequate capacity of connectivity at and near the renewable energy project sites to reduce cost & losses of renewable energy.
- ✓ Removing/ waive off of safe guard duties / anti-dumping duties, basic custom duties for import of equipment's & materials from foreign countries.

- ✓ Ease of procedure for Supply Chain Management for import of raw & finished goods, with waiver of custom & excise duty.
- ✓ State Government shall encourage tax holidays & tax exemptions policies.
- ✓ Aggressive Research & Development in technology up-gradation
- ✓ Assured off takers of RE power & power purchase agreements for 25 years without change / reduction in tariff.
- ✓ Assured payment security mechanism by government and strict adherence to must run status.
- ✓ Single window, one shot online registration & approvals of every document by state government and nodal agencies and timely approval of system from developers to avoid procedural delay.
- ✓ Secured government mechanism to mitigate high investment cost.
- ✓ Focus on the renewable energy projects across the country instead of concentrating to few states with either solar, wind or hybrid renewable energy projects.
- ✓ Each state government shall ensure the firm renewable energy policy throughout the life cycle of the projects.
- ✓ State & Centre government support for capital subsidy & low interest cost financing.
- ✓ Mandatory & stringent norms for renewable purchase obligation to industries & commercial customers.
- ✓ The government shall focus on awareness programs among the various states regarding the utilization of maximum available renewable energy resources

6.0 Conclusion of the Research Study

- It is evident that the majority classes of respondents are highly reach in terms of experience of utility scale renewable energy projects as such 58.7 %age respondents are having more than 10 years of experience in the field.
- The majority of respondents are from Gujarat state containing 41.7 percentages next to which falls Karnataka contains 17.9 percentages and NCR/Delhi having 12.7 percentages of respondents.

- The majority of respondents i.e. 65.5 percentages are from Private companies, followed by government companies respondent to the tune of 14.3 percentages.
- The majority of stake holders respondents i.e. 21.29% are EPC contractor, followed by Project developer 18.07% and consultant 13.52%.
- The mean value revealed that stake holders like manufacturers, EPC contractors, Project developers, policy makers, power purchasers, Independent power producers, Captive users, Promoters of renewable energy, renewable energy power traders are strongly agree that they are the contributors for development of renewable energy projects. Further the mean values revealed that Suppliers, Investors, Financiers, consultants agree that they too are contributors for development of renewable energy projects.

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