"ASSESSING THE EFFECTIVENESS OF POLICIES OF WIND ENERGY IN INDIA WITH SPECIAL EMPHASIS ON THE DECISION MAKING PROCESS OF FIRMS DURING WIND ENERGY AUCTIONS"

A thesis submitted to the
UPES

For the award of
Doctor of Philosophy
in
Management

BY
Divik Kandpal

Oct 2023

SUPERVISOR

Dr. Anil Kumar

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School of Business
UPES
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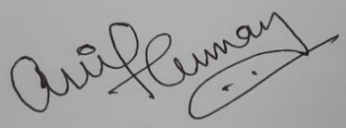
Certificate

I certify that **Mr. Divik Kandpal** has prepared his thesis entitled **"Assessing the Effectiveness of Policies of Wind Energy in India with Special Emphasis on the Decision-Making Process of Firms during Wind Energy Auctions"**, for the award of PhD degree from the University of Petroleum & Energy Studies, under my guidance.

He has carried out work at the School of Business, University of Petroleum & Energy Studies.



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JAIPURIA
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LUCKNOW NOIDA JAIPUR INDORE

CERTIFICATE

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ABSTRACT

The Indian energy sector is coal-dominant; this not only has burdened Indian energy supply seriously, but also has led to many environmental negatives, especially pollution and the climate change as well as leading to increase in import bill. In all this mix of things, renewable energy (RE) development is a key way to address these challenges and meet future energy demand while minimizing the risks of traditional energy supplies(Kilinc-ata, 2017).One of India's major advantages is that its RE potential is vast and largely untapped. Recent estimates show that India's solar potential is greater than 750 GW and its announced wind potential is 302 GW (actual could be higher than 1000 GW) (Niti Ayog, 2015).

In 2021, at COP 26, India had announced its goal of meeting 50% of its energy requirements from RE and to be net zero by 2070. In addition , the non-fossil target for 2030 has been set at 500 GW, which includes around 140 GW of wind, 70 GW hydro (large and small) and 300 GW of solar(Hossain, 2022). Among these, Wind energy is the second fastest growing RE source in India. With an installed capacity of 43.2 GW, it constitutes about 40% of the country's installed renewable power capacity and is 4th in the world in terms of wind energy capacity. Wind energy investments have been always driven by various policy instruments .However there has always been abrupt changes in the policies which have disrupted the growth of industry, exposed risks and created uncertainty for investors. Accelerated Depreciation (AD) benefit was introduced in 1994, with a depreciation rate of 100 per cent, which was reduced to 80 per cent in 2002 and the scheme was withdrawn in March 2012, it was subsequently reinstated in2014 but again in 2016 the rate was reduced to 40%. In past, 70% of the new wind capacity has been added through AD route. Since FDI were not eligible for AD provision, the central government launched the Generation Based Incentives (GBI) scheme in 2009.

The scheme aimed to expand the investor base and incentivize generation by offering an incentive of Rs. 0.50 per KWh of electricity generation for a duration ranging from 4 to 10 years, with a maximum limit of Rs. 100 lakhs per MW .GBI was discontinued in 2012, and subsequently, was reintroduced in 2013 and finally discontinued in 2017. Annual installations with annual installed capacity fell from 3,168 MW in 2011– 12 to 1,700 MW in 2012–13 due to abrupt withdrawal of GBI and AD. There has been poor implementation of RPOs as mandated by central govt by state utilities and there is considerable variation in policies with respect to banking, wheeling and third party sales among various states. In 2016-17 , government brought in auctions or competitive bidding in place of prevalent FiTs which along with withdrawal of GBI and reduction of AD to 40% again disrupted the market resulting in the dip in both commissioning and allotment of new projects in 2017 .There has been slow implementation of auctioned projects due to land acquisition issues and grid connection problems.

With a deployment of only 35.128GW till Dec 2018 , India is far away from reaching its stated goal of 60 GW of wind energy installation till 2022 (Niti Ayog, 2015)and it needed 20 GW of capacity within the next two years, considering the two to three years needed to commission wind projects.

All the above points highlight that there has been no major review and analysis of policies which have implemented and subsequently amended over a period of time which has led to sudden changes in major policies leading to uneven growth and adverse effect on wind energy industry in India with a deployment of only 35.128GW till Dec 2018 despite being a priority focus area of government. In addition, with tariffs touching as low as Rs 2.43 / MW in the wind energy auctions, has also created doubts with respect the financial viability of these projects and likelihood of unviable bidding, which can create a lot of risks.

Companies may have thrown caution to the wind to undercut competitors in an effort to capture a larger share of India's promising RE market and there is requirement to understand the decision making process of firms and the various uncertainties faced and factors which are being considered by them while bidding in the auctions conducted by Solar Energy Corporation of India(SECI).

Given the above background, the business problem can be defined as:-

Erratic introduction and removal of incentives and changes in policies by government has reduced the sector growth and has led to opportunity losses for the industry

The above business problem motivates the researcher to perform this study.A detailed literature review has been carried out to understand the wind energy sector's evolution, growth, and challenges in India and the status of the research on it. Using 7 keywords , 8 databases and 107 journals have been explored and 120 articles studied. Literature Review identified certain gaps which include requirement for a detailed country specific studies on the development, challenges and barriers in wind energy growth. Most of the studies focused on sector overview, covering broadly the historical developments, policies /incentives introduced by govt and challenges/ barriers in the growth of wind energy in India. RE policies as a whole have been tested and policies related to wind and solar have not been tested separately. The sector has been marked by the introduction of large incentives and sudden withdrawals and subsequent re-introduction , still only limited studies have been carried out assessing the effectiveness of wind energy policies in India . In addition , no study is there on the reverse auction mechanism introduced in 2017. The types and kind of uncertainties faced by firms during the auction process are not known as well as factors considered by firms during the bidding have also not been identified.

The theoretical premise is based on Behavioural Theory of Firm. In this theory ,the literature has given very little attention to the environment and its effect on the goal-formation process and the pricing and output decisions .

Literature says nothing about the threat of potential entrants and regulatory procedures. Impact of routines which have been adopted for uncertainty avoidance in the decision making process is required to be further studied. The impact of satisficing behaviour and bounded rationality in decision making adopted in uncertain conditions needs to be studied. The research questions & research objectives formulated for this research study are presented as given under:

Research Problem :*Although the wind energy auctions have started since 2017, the type of uncertainties faced by firms and their responses during the decision making process of bidding in wind energy auctions is not known. Further, there is a lack of knowledge about the factors being considered while bidding by the firms.*

Research Question 1 :*Have the various state polices for development of wind energy industry in India been effective?*

ResearchObjective 1: *To assess the effectiveness of state level policies in development of wind energy in 7 select Indian states.*

The research question is descriptive and relationship based , therefore quantitative research method has been chosen and analysis is done based on panel data techniques. The empirical analysis is based on annual data for seven Indian states for the period 2003–2018. Panel data methods to estimate the impact of different policy variables on installation capacity of wind energy in the Indian states has been employed. We estimate the following equation using the fixed-effects and random-effects regressions results and hausman test to determine which test is more suitable.

$$Y_{it} = \alpha_i + \beta X_{it} + +\gamma Z_{it} + \varepsilon_{it} \quad (1)$$

where, Y_{it} represents the cumulative installation capacity of wind energy in India in year ,X_{it} represents the policy variables namely, renewable purchase obligations (RPO), feed-in-tariff (FiT), wheeling charge and energy banking facility , it also includes the control variables such as per capita income and the level of industrialization (measured through the manufacturing share) in the respective states. α_i is the differential intercept term which captures the heterogeneity across the states and ε_{it} is the random error term. Due to heteroscedasticity and cross-section dependence in the data ,fixed-effects regression with Driscoll-Kraay standard errors has been preferred. Further to strengthen and give robust results, sensitivity analysis has also been carried out.

Research Question 2(a): *What has been the role of central government policies of AD and GBI in the development of wind energy in India?*

Research Objective 2 (a): *To assess the effectiveness of central government policies of AD and GBI in development of wind energy in India*

Research Question 2(b):*What are the various uncertainties faced by firms and their response in the decision making process for bidding in wind energy auctions in India ? What are the factors considered in making bidding decisions in wind energy auctions?*

Research Objective 2(b): *To identify the uncertainties faced by firms and their responses in the decision making process for bidding during wind energy auctions and identify the factors considered in the same*

Research Question 2 is exploratory in nature, therefore the Qualitative research method using Nvivo software has been chosen for this study. In the first step, a data collection protocol consisting of a detailed questionnaire was prepared and semi-structured interviews were conducted. Then the interviews were coded into text and were converted into the transcript by collating the responses into a single response sheet for every research question separately. In the next step, data cleaning was done to eliminate special characters, numeric values and spaces from the transcript.

Uniformity of cases was done for these files. In the next step, stop words were defined. Finally, these transcripts were imported into NVivo for analysis. Word cloud was generated, which is used in extracting the main content from the analysis followed by thematic and sentiment analysis using the feature of auto code. A mix of text mining and qualitative content analysis was utilized so that thematic convergence was evident from the data collected in the interview transcripts.

Findings of Research Objective 1 brings out that state level policies like FiT, RPOs, wheeling and banking also had a positive impact in the growth and development of wind energy in respective states Both FiT and economic growth are the robust determinants of wind energy installation across the Indian states. The analysis based on Research Objective 2 shows that subsidies, tax reliefs, customs duty exemptions provided by the government in 1990s have been the historical factors which have led to the growth of wind energy in India and among these AD and later GBI were main drivers. Currently, climate finance is also one of the drivers of wind energy in India currently. There is mismatch between availability of suitable land for wind projects and presence of corresponding substations/ power evacuation infrastructure. Also there is a gap between transmission infrastructure development and wind project development, as both have different gestation periods. Further findings of Research Objective 2 shows that though ,SECI supports WPDs in case of delay in transmission infrastructure development by giving time line extensions and no penalties are put , but Overall transmission infrastructure availability remains a big challenge for Wind Power Developers(WPDs).Renegotiation of Power Purchase Agreements(PPAs) and reduction of off-take is legally incorrect and leads to uncertainty, which further reduces investor sentiment in state as well as also affects the overall outlook towards the sector and makes them more apprehensive.

The kind of uncertainties are much lesser in central auctions as SECI is the Off-take guarantor and no revisiting or renegotiation of tariffs happens. Land and Transmission infrastructure are interlinked and cannot be considered in isolation. WPDs want to set up project where there is good wind resource availability but there are issues with transmission and evacuation infrastructure like substation will not come up there. Land is a state subject and state specific challenges will always be there. The challenges and risks with land related issue in wind is same as that with any other industry in India. All Industrial players have to be ready to take this specific risk . Overall WPDs have learned to manage this risk. The weak financial strength of Discoms is also a major challenge for WPDs as it leads to non-clearance of dues on time, thereby affecting the developers' finances (higher interests to pay to lenders). Therefore ,now all WPDs prefer central tenders by SECI as multiple levels of payments assurance have been built in. This is indicative of the fact that OEMs and WPDs are facing challenges which are negatively affecting the Wind Energy Industry in India profile of WPDs is shifting to large bigger players, liquidity is available and no forward or reverse integration between WPDs and OEMs is happening. Also Green Finance is available easily and Liquidity is not a challenge for wind energy sector. However , Introduction of auctions has also changed the profile of WPDs and small companies increasingly finding it difficult to participate in the auctions. No likely forward or reverse integration happening between OEMs and WPDs as the risk profiles of both are very different .OEMs are not in good financial health and WPDs don’t want to take on risks off OEMs as they are purely technologically oriented and IPPs don’t have overall wherewithal to run that business .Inferences from study bring out that E-reverse auction is the most efficient way of pricing discovery and it's a completely transparent and fiercely fought and fiercely competitive process .

However ,E reverse auction is suitable only when there is limited competition and favours all the large players or the players who are having least cost of capital and WPDs are facing challenges in e reverse auctions and want to migrate to closed bid or conventional single tendering system. As per WPDs there is a requirement of pipeline visibility of projects for better planning , timely signing of PPAs and removal of the clause of matching the L1 bid price within 2% range (L1 +2%) in a particular auction as it disrupts the financial planning of bidders especially if L1 has quoted unrealistically low prices . In addition there is a requirement of hybrid or a mix of solar, wind and storage instead of plain vanilla wind energy auctions. The analysis on the biding strategies adopted by WPDs shows that Bidders are disciplined, a floor price or lower cut-off is set and they seldom go below that as they don't have a mandate. Bidding price or cut off price is determined by doing calculations on pre researched assumptions and by how aggressive WPD is to win and do they have equivalent opportunity at hand if you lose. The main psychological factors in auctions are forward thinking, cumulative type of thinking and Leap of faith. Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues, commodity price and Forex and Interest rates are major uncertainties faced by WPDs. All WPDs do competitor analysis at their level by using all available data and information, analysing past pattern , their recent interactions, collecting data from different channels like land aggregators etc.

The theoretical contribution of the study is based on the analysis of responses received .The study confirm that WPDs show Bounded Rationality and Satisficing Behaviour while bidding during auctions. A predecided lower cut off or walk away tariff is arrived at prior to biding . All WPDs are rational and disciplined investors and the predecided walk away tariff is seldom breached.The bidders show rational and satisficing behaviour based on decision made by senior management with regards to following a walk away tariff ,which has been made based on assumptions considering all information available.

The study also confirms the irrational behviour by promotor / entreprenuer driven firms where in decision making is irrational , assumptions or decisions on bidding prices can be reworked during bidding based on whims/decisions of the promotor as well as due to their easy accessibility or presence during auctions .

The study concludes with identifying areas of future study. Offshore wind energy is a neglected area. Efficacy of the National Off-Shore Wind Energy Policy, its current status, and challenges and drivers for the growth of offshore wind energy are recommended areas to be worked upon. In addition, strategy, competitiveness, and business models being followed by various companies in the wind energy sector is also a niche area to work on. Also, there is a need to study and compare the policies, drivers of growth, and challenges between wind and solar in India and the wind sector in other countries. In addition, there is a planned capacity addition of 10 GW in the form of hybrid projects that combine turbines with solar panels as well; however, no research on the subject is available(R. K. Singh, 2021). The sustainibility and efficacy of hybrid auctions (Wind-Solar) as well as the strategy, business models and challenges for WPDs/ RE Developers also required to be studied.

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Dehradun,

...../...../2023 Divik Kandpal

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LIST OF ABBREVATIONS

AD	Accelerated Depreciation
AP	Andhra Pradesh
BTF	Behavioural theory of the firm
CASE	Commission for Additional Sources of Energy
CD	Cross-sectional dependence
CDM	Clean Development Mechanism
CERs	Certified Emission Reduction
CERC	Central Energy Regulatory Commission
C & I	Commercial and Industrial
COP21	21st Conference of the Parties
CSIR	Council for Scientific and Industrial Research
DISCOMs	Distribution Companies
DNES	Department of Non-Conventional Energy Sources
D-K	Driscoll and Kraay
E R A	Environmental Risk Assessment
FDI	Foreign Direct Investors
FE	Fixed Effect
FiTs	Feed-in Tariffs
FGLS	Feasible Generalized Least Squares
GBI	Generation Based Incentives
GOI	Government of India
GSDP	Gross State Domestic Product
GUVNL	Gujarat Urja Vikas Nigam Limited
GW	Giga Watt
GWEC	Global Wind Energy Council
HAWTs	Horizontal-Axis Wind Turbines
IEX	Indian Energy Exchange

IEGC	Indian Electricity Grid Code
ISTS	Inter State Transmission System
IPPs	Independent Power Producers
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
IWEA	Indian Wind Energy Association
KW	Kilo Watt
KWh	Kilo Watt Hour
MEDA	Maharashtra Energy Development Agency
MNRE	Ministry of New and Renewable Energy
MNES	Ministry of Non-Conventional Energy Sources
MoP	Ministry of Power
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MoF	Ministry of Finance
MW	Mega Watt
NAPCC	National Action Plan on Climate Change
NCEF	National Clean Energy Fund
NTPC	National Thermal Power Corporation of India
NOWEP	National Offshore Wind Energy Policy
NOCs	No Objection Certificates
OEMs	Original Equipment Manufacturers
O&M	Operations and Maintenance
PCSE	Panel Corrected Standard Errors
PGCIL	Power Grid Cooperation of India Limited
PPA	Power Purchase Agreement
QAN	Qualitative Associated Network
RE	Renewable energy
REC	Renewable Energy Certificate
REP	Renewable Energy Promotion
REZ	Renewable Economic Zone

RfS	Request for Selection
RPOs	Renewable Purchase Obligations
RTP	Renewable Technology Park
SAD	Special Additional Duty
SECI	Solar Energy Corporation of India
SERCs	State Energy Regulatory Commission
TANGDECO	Tamil Nadu Government Generation and Distribution Corporation
TN	Tamil Nadu
TWH	Tera Watt Hour
VAT	Value-Added Tax

CHAPTER-1

INTRODUCTION

1.1 BACKGROUND

India is a growing economy with manufacturing sector becoming bigger part of it, incomes are rising and the country is becoming more urbanized. Sustaining and driving this growth further and to provide grid electricity and improving energy access to rural households poses a formidable challenge on the energy systems in the country. Presently, India boasts a cumulative installed electricity generation capacity of 405 GW, which surpasses this year's peak demand of 200 GW in our nation. To put it in perspective, even India's coal-based power generation capacity is more extensive than its highest electricity consumption peak.(ET Energyworld, 2022; MoP, 2022). Although India's electricity generating capacity exceeds the power demand, certain regions within the country encounter severe power deficits due to several reasons, including insufficient coal supply, substantial losses in transmission and distribution, and the precarious financial state of utilities. Electricity consumption of India is projected to reach 4 trillion units by 2030, driven primarily by three key factors. First, an estimated 230 million individuals will gain access to electricity for the first time, increasing overall demand. Second, the availability of electricity will lead to the phasing out of diesel-powered gensets. Lastly, the Make in India initiative is expected to spur heightened economic activity, further boosting power demand (ET, 2016).

As in other developing and developed countries, major commercial fuels like coal and petroleum products meet the energy requirements. The dominance of coal in the Indian energy sector has not only seriously burdened the country's energy supply but has also resulted in several environmental drawbacks, particularly pollution and the pressing issue of climate change, which is currently in the global spotlight(A. K. Singh & Parida, 2013).

In addition, petroleum products increase import bill and overall there is depletion of fossil fuels sources. Amidst this assortment of challenges, the growth of RE serves as a crucial approach to tackle these issues and fulfil the forthcoming energy demand while reducing the perils linked with traditional energy supplies (Kilinc-ata, 2017). India's RE potential is huge but is mostly untapped and undiscovered, which gives it a significant advantage. Recent evaluations reveal that India's solar energy capacity exceeds 750 GW, with the declared wind energy potential at 302 GW, though the actual figure could potentially exceed 1000 GW(Niti Ayog, 2015).During the 2021 COP26 summit, India declared its objective of achieving 50% of its requirement of energy through RE sources and becoming net-zero by 2070. Furthermore, India has set a non-fossil fuel target of 500 GW by 2030, comprising approximately 140 GW of wind power, 70 GW of hydroelectricity (both small and large), and 300 GW of solar power (Hossain, 2022).

1.2 WIND SECTOR IN INDIA- BACKGROUND AND EVOLUTION

In India, the utilization of wind energy dates back to the 1950s when it was utilized for the task of pumping water for both household and agricultural needs. CSIR established a committee in 1952 to investigate the available resources which can used for the development and economic possibilities of wind energy. CASE was setup by government to give impetus to RE and was effectively the beginning of wind energy programme in the country. CASE was later converted into the DNES in 1982(Shubham Sharma & Sinha, n.d.). This period primarily involved wind resource assessment and setting up of demonstration projects. In 1982, the government initiated a programme to assess the wind resource across the country by establishing over 600 stations that cover 25 states. It aimed to monitor and map the available wind resources(Jagadeesh, 2000). In Gujarat's Veraval region, India’s first wind project was established in 1985 which

connected to grid a 40 KW machine, and its success demonstrated the technical feasibility of operating grid-connected wind turbines in India.

In 1988, Horizontal-Axis Wind Turbines (HAWTs) with ratings ranging from 18.5 to 100 KW were effectively installed and operated at five distinct locations across India. This milestone provided additional validation of the potential for establishing grid-connected wind farms in the nation (Sinha, C. S., Kandpal, 1990)**.** A dedicated Ministry ,MNES was setup in India in 1992 and the industry gradually expanded as private sector participation was introduced into the sector. This expansion received substantial support through various fiscal incentives and tax advantages, including AD, preferential FiTs, and customs and excise duty exemptions. Notably, the 100% AD on wind-power equipment emerged as the most enticing financial incentive during the 1990s(Rajsekhar, Van Hulle, & Jansen, 1999) . It was changed to 80% in 2002. In 2006, the name of MNES was changed to the MNRE.(Purohit & Purohit, 2009)**.**Since FDI were not eligible for AD provision, the central government launched the GBI scheme in 2009. The scheme aimed to expand the investor base and incentivize generation by offering an incentive of Rs. 0.50 per KWh of electricity generation for a duration ranging from 4 to 10 years, with a maximum limit of Rs. 100 lakhs per MW. Between 2009 and 2011, investors could choose between AD and GBI based on their preferences, resulting in a doubling of annual installations. However, the removal of AD and GBI in 2012 led to a 50% decline in capacity additions. Consequently, the scheme was reintroduced in April 2013(Bayar, 2013b)**.**The Electricity Act of 2003 made it mandatory for large electricity consumers, captive power plants, discoms etc to meet a some portion of their power requirement through RE, using RPOs. REC was introduced in 2010 to support solar, wind, and other renewable energy sources. Obligated entities could purchase wind RECs instead of buying renewable power to meet their RPOs. Each wind REC (non-solar) was equivalent to 1 MWh of wind energy generated. (Kar & Sharma, 2015)**.**However ,the

implementation of India's RPO policy has not been substantial. In 2016, Indian government transitioned to an e-reverse auction mechanism for the allocation of wind projects, with SECI being the nodal agency for the same.

Along with the introduction of auction incentive of GBI was removed and AD has been reduced to 40% . Wind energy auctions have since then are happening on regular basis and tariffs have touched even Rs 2.44 /KWH. Table 1.1 describes the wind energy potential and installations across various states in India.

Table 1.1 : State Wise Wind Power Potential and Installations

State	**Wind Potential(In GW)**		**Installed Wind Capacity(In GW) (As on 31 May 2023)**
	100 m	**120 m**	
Gujarat	84.43	142.56	10.41 GW
Rajasthan	18.77	127.75	5.2 GW
Maharashtra	45.39	98.21	5.03 GW
TN	33.79	68.75	10.12 GW
MP	10.48	15.40	2.85 GW
Karnataka	55.85	124.15	5.2 GW
AP	44.22	74.90	4.09 GW
Others	9.28	43.78	0.3 GW
Total	302.25	695.50	43.2 GW

Source :("India Adds 275 MW of New Wind Capacity in Q1 2022; Gujarat Leads," 2022; MNRE, 2022, 2023)

As is evident from Table 1 above that Gujarat leads in the total installations in the country and is followed by Tamil Nadu. Table 1.2 below brings out the timeline of development of wind energy in India.

Table 1.2 :Timeline of Development of Wind Energy in India

Setting up of CASE	1981	
	1982	CASE changed to DNES
The first wind energy demonstration project with a capacity of 1.15 MW set up in Tuticorin.	1986	
IREDA(Public Financing arm) established	1987	
	1989	IREDA starts wind project financing
AD scheme started with 100% depreciation rate	1990	
	1991	The Electricity Act was revised to facilitate private sector involvement and establish licensing agreements with international wind companies.
Opening up the wind sector to private participants through liberalization	1992	Full-fledged Ministry of Non-Conventional Energy Sources (MNES) established
	1993	Exemption of wind turbines from excise duty and sales tax, reduction in import duties for wind turbine components (such as rotor blades), and the issuance of state wind power procurement guidelines
Guidelines for turbine approval and certification issued.	1995	
	2002	AD reduced to 80%

The EA 2003 enacted, mandating the creation of preferential wind tariffs	2003	
	2004	Maharashtra issued first regulations on RPO
Indian wind projects entered the CDM markets to generate CERs.	2005	The National Electricity Policy of 2005 mandates a gradual escalation in the contribution of electricity generated from non-conventional sources
Ministry renamed as Ministry of New and Renewable Energy (MNRE)	2006	The National Tariff Policy instructed SERCs to establish RPOs.
Establishment of NAPCC (The plan outlined that by 2020, the RPO share would reach 15%)	2008	Regulations governing Open Access were introduced and PGCIL and IEX started functioning.
	2009	Introduction of GBI
Guidelines on REC was issued by CERC	2010	The Indian Electricity Grid Code of 2010 integrated specific provisions for the connection, operations, forecasting, scheduling, and commercial settlement of wind and solar generating facilities.
IEX & PGCIL initiate REC trading	2011	Introduction of NCEF and RRF.
AD & GBI withdrawn	2012	
The implementation of Renewable Regulatory Fund was put into effect after experiencing delays on previous occasions.	2013	Reinstatement of GBI and introduction of Low cost financing
Reinstatement of AD	2014	

	2015	The Indian government announced its ambition to achieve 175 GW of RE capacity by 2022, including a substantial 60 GW contribution from wind energy.
AD reduced to 40%	2016	E Reverse Auctions approved by MNRE on June 14, 2016. (1,000 MW ISTS Wind Power Project)
	2016	Introduction of policy on Repowering of Wind Turbines
GBI discontinued	2017	First Tender on e-reverse wind auctions was issued
Formation of RPO Monitoring Cell	2018	
RfS(Tranche-XII) of Wind Energy E Reverse Auctions issued in Oct 2021 (1200 MW)	2021	
	2022	Results of Tranche XII of E Reverse Auctions announced in May 2022

1.3. WIND ENERGY STATUS-ACROSS THE WORLD

Till December 2022, collective capacity of wind turbines worldwide amounts to 906 GWs, which is adequate to cater to over 7% of the global electricity demand. Notably, China spearheaded wind energy generation expansion, accounting for nearly 70%, followed by the United States at 14% and Brazil at 7%(IWEA, 2022). The top 10 wind energy producing nations by the end of 2022 have been highlighted in Table 1.3.

Table 1.3: Top 10 Wind Energy Status Across the World

Country	Installed Capacity(In MW)
China	365964
USA	140 862
Germany	66 315
India	41 930
Spain	29 308
UK	28 537
Brazil	24 163
France	21 120
Canada	15 295
Sweden	14 557

Source : (IRENA, 2023)

The various wind energy policies in vogue in various countries have been compiled and tabulated as under in Table 1.4:

Table 1.4 : Various Wind Energy Policies in Vogue in the World

AREA	POLICY	BRAZIL	CHINA	DENMARK	GERMANY	GREECE	INDIA	IRELAND	ITALY	PORTUGAL	SPAIN	UK	USA
Remun erations	FiT	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	
	Premium or Adder System			Y	Y						Y		
	Auction or Tendering System	Y	Y				Y	Y			Y	Y	
	Tax Based Electricity Production Incentive												Y
	Spot Market Trading			Y	Y		Y	Y	Y		Y	Y	
	Investment Subsidy or Tax Credit			Y		Y							Y
	Tradable Green Certificate or REC								Y		Y	Y	Y
	Concessionary Finance through Government Supported Agencies	Y	Y										Y
	Concessions on Import Duty	Y	Y										
Targets or Standar ds	Renewable Purchase Obligation or Renewable Portfolio Standard						Y						Y
	Federal or Statewise Targets (Bidding or Indicative)	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y
Permiss ions	Project Sitting Guidelines	Y		Y		Y	Y				Y	Y	Y
	Project Permitting Process		Y	Y		Y		Y	Y	Y	Y	Y	Y
Grid Integrat ion	Priority Access to Grid	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	
	Grid Code			Y		Y	Y				Y		

Source: Own Compilation

1.4 WIND ENERGY ELECTRONIC REVERSE AUCTIONS

In the mix of various state and central level incentives that were given the basic allocation methodology followed was FiT with PPAs signed for generally 20-25 years between State Government Utility and the Wind Power Producers. The details of the prevalent FiT has been elaborated in **Table 1.5** below. In 2016-17, MNRE decided to migrate from FiT regime to e reverse auctions and SECI was designated as the primary agency responsible for conducting these auctions and subsequently selling electricity to the respective state utilities.. The objective behind conducting auctions is to establish a clear and transparent procedure for the inter-state trade of wind-generated energy at a price which has been established through a competitive bidding and e-reverse auction mechanism. Auctions serve a dual purpose: they enable States/UTs with no wind resource to meet their non-solar RPOs and also drive investments in the sector. In February 2017, SECI conducted its inaugural wind auction successfully wherein Rs. 3.46 per unit price was achieved. Remarkably, the prices determined during this auction were lower than the average pooled energy cost of multiple states .Following that, SECI has organized a total of twelve rounds of auctions and the details of same are as under in **Table 1.6.**

Table 1.5 : Prevalent Feed In Tariffs Prior to Auctions

State/CERC	Order Date	FIT Rate	PPA Validity
CERC	28 Feb 2013	Rs 3.62- Rs 5.80/KWH	
MP	26 March 2013	Rs 5.92 (2013-14 to 2015-16)	25
Rajasthan	17 May 2013	Rs 5.12 to 5.73/KWH	25
Maharashtra	22 March 2013	Rs 3.88/KWH to Rs 5.81/KWH	13
Tamil Nadu	31 July 2012	Rs 3.51/KWH for 2 years	20
Gujarat	07 Jan 2013	Rs 4.13 /KWH(2012 TO 2016)	25
Andhra Pradesh	15 Nov 2012	Rs 4.70 /KWH(Till 31/3/2015)	25
Kerala	01 Jan 2013	Rs 4.77/KWH	13

Source: Own Compilation

Table 1.6 : Status of Various Wind Energy Auctions Held Till Date

Bids	Capacity (MW)	Tariff Rs/kWh	Winners	Present Status
SECI TI (Feb 2017)	1049.9	3.46	1.Mytrah Energy,(250 MW)2. Inox Wind(250 MW)3.Ostro Kutch Wind Pvt Ltd(250 MW)4.Green Infra, (249.9)5.Adani Green Energy(50)	425.9 MW commissioned. Fin Closure achieved for 624 MW
SECI TII (Oct 2017)	1000	2.65-2.65	1.ReNew Power (250)2.Orange Sironj,(200)3.Inox Wind (250) 4.Green Infra (250)5.Adani Green(50)	Scheduled commissioning date 03.05.19

TANGDECO (TN)	500	3.40	1.Leap Green Energy (250) 2.Regen Power Tech(200) 3. NLC India Ltd(50)	
GUVNL (Dec 2017)	500	2.44	1. Spring Energy Pvt Ltd (197.5) 2. K.P. Energy Ltd(30)	
SECI TIII (Feb 2018)	2000	2.45-2.45	1.Renew (400), 2.Green Infra(300), 3.Inox (200), 4.Torrent Power(499.8) 5.Adani(250)6.Alfanar(300)7.Beatm	Scheduled commissioning date 23.11.19
MSEDCL (Mah) (Mar 2018)	500	2.85	1.Adani Green Energy (75) 2. KCT Renewable Energy Private Limited(75 MW)	
SECI TIV (Apr 2018)	2000	2.51-2.52	1.Srijan Energy Systems (250MW)2.Spring Energy (300MW) 3.BLP Energy (285MW) 4.Betam Wind Energy (200MW) 5.Inox Wind (100MW) 6. Adani Green Energy (300MW).7. Mytrah Energy (300MW) 8.Renew Wind Energy	Scheduled commissioning date 28.02.20
SECI TV (Sep 2018)	1190	2.76-2.77	1.Torrent Power (115 megawatts), 2.Adani Green Energy (300 MW), 3. Alfanar (300 MW), 4.SITAC RE (300 MW), 5.Ecoren Energy (175 MW), 6.ReNew Power (10 MW)	Scheduled commissioning date 22.07.20
NTPC (Aug 2018)	1150	2.77-2.83	Scheduled commissioning date 13.07.20	

SECI T VI(Feb 2019)	1200	2.82	1.Torrent Power (115 MW), 2.Adani Green Energy (300 MW),3. Alfanar (300 MW), 4.SITAC RE (300 MW), 5.Ecoren Energy (175 MW),6.ReNew Power (MW)	
SECI T VII (May 2019)	480/ 1200	2.79-2.83	Engie ₹2.79 (200 MW),ReNew Power-₹2.81/kWh (50 MW) ,Sprng Energy ₹2.82 /kWh(100 MW) and Adani Green Energy ₹2.83/kWh (130 MW)	
SECI T VIII (June 2019)	550/ 1800	2.83-2.84	CLP India 2.83 (250.80 MW) ,Avikaran Energy 2.84 (190MW)	
SECI T IX (Mar 2020)	2500 MW ISTS	3.01-3.41	JSW Solar Rs 3.01(1000MW), Vena Energy Vidhyut Rs 3.17(160 MW) , Inox wind Infrastructure Rs 3.41(50 MW)	
SECI T X (Mar 2021)	750 MW	2.77-2.78	Adani Renewable Energy Rs 2.77(300MW), Ayana Renewable Power Rs 2.78 (300 MW), Evergreen Power Rs 2.78(100MW)	
SECI.T XI (Sep 2021)	1200 MW	2.69-2.70	Renew Power Rs 2.69 (300 MW) , Green Wind Infra Energy (180 MW) ,Adani Green Rs 2..70 (450 MW), Azure Power Rs 2.70 (150 MW), Anupawan Renewables (150 MW)	
SECI T XII (2022)	1200 MW	2.89-2.94	NTPC Renewables 200 MW @ Rs.2.89, DF Renewables 300 MW @ Rs.2.93 , JSW 300 MW @ Rs.2.94 , Torrent Power 300 @ Rs. 2.94 ,	

Source : (Kandpal & Dhingra, 2021; SECI, 2022)

The Wind Energy Electronic Reverse Auctions are conducted by SECI and subsequently PPAs are signed by SECI and the concerned SERCs. The auction procedure followed by SECI is as under in Table 1.7**:**

Table 1.7: Wind Energy Electronic Reverse Auctions Procedure

WIND ENERGY ELECTRONIC REVERSE AUCTIONS PROCEDURE	
Step-1 (Bid Submission)	Bidders have to submit both Techno-commercial bid and Financial bid together in response to this RfS online along with Documents to be submitted Offline (in Original)
	The Bidder will have to fill the Electronic Form provided at the TCIL portal as part of Technical and Commercial Bid and upload scanned documents
	Only a single tariff bid for all the Projects shall have to be filled online in the Electronic Form provided at the TCIL portal as part fo Financial Bid
Step-2 (Technical Bid Evaluation)	SECI will examine all the documents submitted by the Bidders and ascertain meeting of eligibility conditions prescribed in the RfS.
Step-3 (Financial Bid Evaluation)	In this step evaluations shall be done based on the "Tariff" quoted by the Bidders in the Electronic Form of Financial Bid. After this step, the shortlisted Bidders shall be invited for the Reverse Auction. Second Envelope (containing Tariff) of only those Bidders shall be opened whose technical bids are found to be qualified.
Step-4 (E – Reverse Auction)	The e-reverse auction is conducted on www.tcil-india-electronictender.com. by SECI to the eligible Shortlisted bidders
	After logging in , Bidders during the 15 minutes prior to start of reverse auction process, the respective tariff along with the total project capacity of the bidder shall be displayed on its window.
	The minimum decrement value for tariff shall be ₹ 0.01 per kWh. The bidder can mention its revised tariff which has to be at least 01 (one) paisa less than its current tariff. Bidders can only quote any value lower than their previous quoted tariff.
	During reverse auction, the bidder shall not have the option of changing the total project capacity while quoting tariff during reverse auction

Step-4 (E – Reverse Auction)	**In the bidder's bidding window, the following information can be viewed by the bidder:** **a. Its tariff as their initial start price and there after last quoted tariff along with project capacity for which the bidder is qualified;** **b. The list of all the bidders with their following details: Pseudo Identity, last quoted tariff and project capacity**
Step-5 (Selection of Successful Bidders)	The bidders are selected in the ascending order with lowest quoted tariff (being L1) till the total capacity (SE) is exhausted.
	The lowest quoting Bidder will be allotted its qualified project capacity and then, next higher Bidder will be allotted its qualified project capacity and so on, till the total project capacity (i.e. 2500 MW) is exhausted.
	The allocation of cumulative project capacity shall be closed at 2500 MW. However, in no case, shall the capacity of a single project selected under this RfS, be less than 50 MW.
	In case of a tie among two or more Bidders (i.e. their last quoted tariff being the same) they will be considered in the chronological order of their last bid with preference to be given to that Bidder who has quoted his last bid earlier than others.
Step-6(Issuance of LOAs)	At the end of selection process, a Letter of Award (LOA) will be issued to all the successful Bidders for each Project. In case Consortium being selected as successful Bidder, the LOA shall be issued to the Lead Member of the Consortium. LOAs shall be issued to the successful Bidders based on the preference order of substations as indicated by the Bidder in the covering letter.

1.5 BUSINESS PROBLEM

Wind Energy investments have been always driven by various policy instruments .However there has always been abrupt changes in the policies which have disrupted the growth of industry, exposed risks and created uncertainty for investors. Introduced in 1994, the AD scheme initially provided a rate of 100% depreciation, which was subsequently reduced to 80% in 2002. However, the scheme was revoked in March 2012. It was eventually reinstated in 2014 but experienced another reduction in the rate, this time to 40%, in 2016. In past, 70% of the new wind capacity has been added through AD route. GBI, which was introduced in 2009 was discontinued in 2012, and subsequently, was reintroduced in 2013 and finally discontinued in 2017. Due to the sudden discontinuation of the GBI and AD benefits, the yearly installation rate and the total installed capacity experienced a reduction from 3,168 MW in the fiscal year 2011-12 to 1,700 MW in the subsequent fiscal year of 2012-13. There has been poor implementation of RPOs as mandated by Central Govt by State Utilities and there is considerable variation in policies with respect to Banking, Wheeling and Third Party Sales among various states. In 2016-17 , Government

brought in reverse Auctions or Competitive Bidding in place of prevalent FiTs which along with withdrawal of GBI and reduction of AD to 40% again disrupted the market resulting in the dip in both commissioning and allotment of new projects in 2017 .There has been slow implementation of auctioned projects due to land acquisition issues and grid connection problems. With a deployment of only 35.128GW till Dec 2018 , India is far away from reaching its stated goal of 60 GW of Wind Energy Installation till 2022 (Niti Ayog, 2015)and to allow for the time required to commission wind projects, 20 GW of wind power projects must be auctioned within the next two years.

All the above points highlight that there has been no major review and analysis of policies which have been implemented and subsequently amended over a period of time which has led to sudden changes in major policies leading to uneven growth and negative impact on the wind energy sector in India, leading to a deployment of only 35.128GW till Dec 2018 despite being a priority focus area of government . Moreover, the recent Wind Energy auctions of GUVNL have seen tariffs plummet to as low as Rs 2.43 / MW , have raised concerns regarding the sustainability of such projects and the possibility of unsuccessful exeution leading to substantial risks. In order to secure a greater market share in India's thriving RE sector, companies may have disregarded caution and engaged in undercutting competition. Consequently, it is necessary to investigate the decision-making processes of firms and the various uncertainties and factors they consider while participating in SECI's auctions

1.6 BUSINESS PROBLEM STATEMENT

Erratic introduction and removal of incentives and change in policies by government has reduced the Sector growth and has led to opportunity losses for the Industry.

1.7 TOPIC AND PURPOSE

To further explore on business problem, an extensive literature review was conducted to understand the wind energy sector's evolution, growth, and

challenges in India and the status of the research on it with an aim to understand What is the historical background and evolution of the wind energy sector in India?. What are the significant themes defining knowledge area and boundaries of wind energy sector research in India? What is the impact of various government policies on the growth of wind energy in India? What are the challenges and barriers to the development of wind energy in India? What are the gaps and research paths ahead? Chapter 2 brings out literature review in detail.

1.8 POTENTIAL SIGNIFICANCE

Wind power stands as a crucial element in India's dedication towards reaching 500 GW of RE capacity by 2030 for sustainable development, in which 140 GW is being attributed to wind energy(Livemint, 2021). However , scientific research on the wind energy industry in India related to its evolution, growth, and challenges are very limited and are in a fragmented way. Indian wind energy sector has experienced a fluctuating landscape characterized by the implementation of significant incentives, followed by abrupt withdrawals and subsequent reintroductions. However, despite these developments, there is a scarcity of studies which assess efficacy of India's Wind Energy Policies. Additionally, no studies are currently available that specifically analyze the period between 2012 and 2018.

In addition , there are no studies on the sudden shift to the e reverse auction mechanism introduced in 2017 as well as on the types of uncertainties faced by firms during the auction process are not known . Also factors considered by firms during the during the bidding have also not been identified. This study helps in filling these knowledge gaps and especially emphasizing the importance of acknowledging and identifying the challenges arising from the implementation of wind energy e reverse auctions in India.

1.9 THESIS DISPOSITION

Thesis is presented with chapters on Introduction, Literature Review, and Research Design & Research Methodology. Subsequently findings and discussions on Research Objective1, findings and discussions on Research Objective-2 and Theoretical Contribution and Propositions of the results. Finally Conclusion to include areas of future research and limitations. The present chapter has examined the research's background and context.

Detailed literature review is presented in next chapter on Wind Energy Scenario in the India and world ,Challenges and Barriers to development of Wind Energy RE policy's effectiveness in India and World ,Wind Energy E Reverse Auctions in India as well as on the Behavioural theory of the firm as theoretical Premise and consolidated gaps in literature review were identified.

Thereafter, Initial Conceptual Constructs (ICC) & Sub-Constructs are derived from literature Overall, Chapter 2 brings out the methodology of how ICC and conceptual lens have been derived from literature by systematically categorising it. Subsequently analysing and synthesising the literature in a logical manner literature gaps have been arrived at .Research design and methodology have been discussed in Chapter 3. It includes sections of research objectives ,research questions, research approach, data collection method and data analysis strategy including a copy of complete Data Collection Protocol document for research objective 2.Chapter 4 discusses and presents results of research objective 1 & in Chapter 5 qualitative study on research objective 2 is presented and outcomes of data analysis are presented in detail. Further, Theoretical contribution an propositions developed are presented in detail Chapter 6 . Chapter 7 brings out the study's limitations and scope for future research, conclusion and significance of findings of this research.

1.10 CONCLUDING REMARKS

This chapter provided an overview and context. Wind power plays a paramount role in India's unwavering commitment towards achieving the sustainable development goal of 500 GW of RE capacity ,out of which wind energy accounting for a significant portion of 140 GW , by 2030.Wind Energy investments have been always driven by various policy instruments .However there has always been abrupt changes in the policies which have disrupted the growth of industry, exposed risks and created uncertainty for investors. Based on this background, business problem has been developed and presented in this chapter. This business problem leads further exploration on literature and In-depth literature review has been carried out .Problem statement for this research study has been formulated based on literature gap and business problem & presented in this chapter. In addition, this chapter elucidates the potential significance of this study as well as gives an overview of the thesis's overall framework and organization. Detailed literature review and theoretical framework/conceptual lens is brought out in next chapter.

CHAPTER-2

LITERATURE REVIEW

2.1 INTRODUCTION

Examination of the literature has been done in detail to gain insights into the development, expansion, and challenges encountered by the India's wind energy industry and the present status of research in this field. The literature review aims to understand what is the historical background and evolution of the wind energy sector in India? What are the significant themes defining knowledge area and boundaries of wind energy sector research in India? What is the impact of various government policies on the growth of wind energy in India? What are the challenges and barriers to the development of wind energy in India? What are the gaps and research paths ahead?

This chapter covers methodology adopted in review in Section 2.2. Details of Key Words used, Databases and journals explored in Section 2.3. Theme Based Literature Review have been covered in Section 2.4 which includes subsections related to Global and Indian Wind Energy Scenario. Policies and incentives as well as Challenges and Barriers to the growth of Wind Energy in India. Effectiveness of Indian and global RE Policies, effectiveness of India's Wind Energy Policies and reverse auctions of Wind Energy in India. Discussions and Inferences from the literature review have been brought out in section 2.5. Theoretical premise is covered in section 2.6 and gaps in theoretical premise in section 2.7 and finally consolidated gaps from the literature review have been brought out in Section 2.8. The outcome of this extensive literature review is the initial conceptual constructs.

2.2 LITERATURE REVIEW

Literature review has been carried out using methodology given by Creswell, (2009). An overview of the process is shown in Figure 2.1 and the sequence of steps is as follows:

- **Step-1 : Identifying Key Words**

  These keywords emerge by identifying a topic and doing preliminary readings on the same.

- **Step-2: Search Database and Journals Relate to Topic**

  With these key words in mind, the initial emphasis is placed on scrutinizing journals and books relevant to the subject matter, followed by a search of commonly reviewed computerized databases..

- **Step-3: Identify Articles related to topic and skim through them**

  The initial selection of articles is quickly reviewed, and those deemed essential to the topic are copied for further examination. Throughout this process, the objective is to determine whether the article or chapter will significantly enhance your comprehension of the literature.

- **Step-4: Identify Useful Articles and make Literature Map**

  Useful literature is identified and literature map is designed.

- **Step-5: Make Draft Summaries of relevant articles**
- Create preliminary summaries of the most pertinent articles, and then amalgamate these summaries into the final literature review that will be included in your proposal or research study.

- **Step-6: Structure Literature thematically or organize it by important concepts**

  Compile the literature review and arrange it thematically or structure it around key concepts.

- **Step-7 : Write summary of major themes and suggest how particular study further adds to the literature**

  Conclude the literature review with a summary of the primary themes and provide insights on how your specific study contributes to and enhances the existing body of literature.

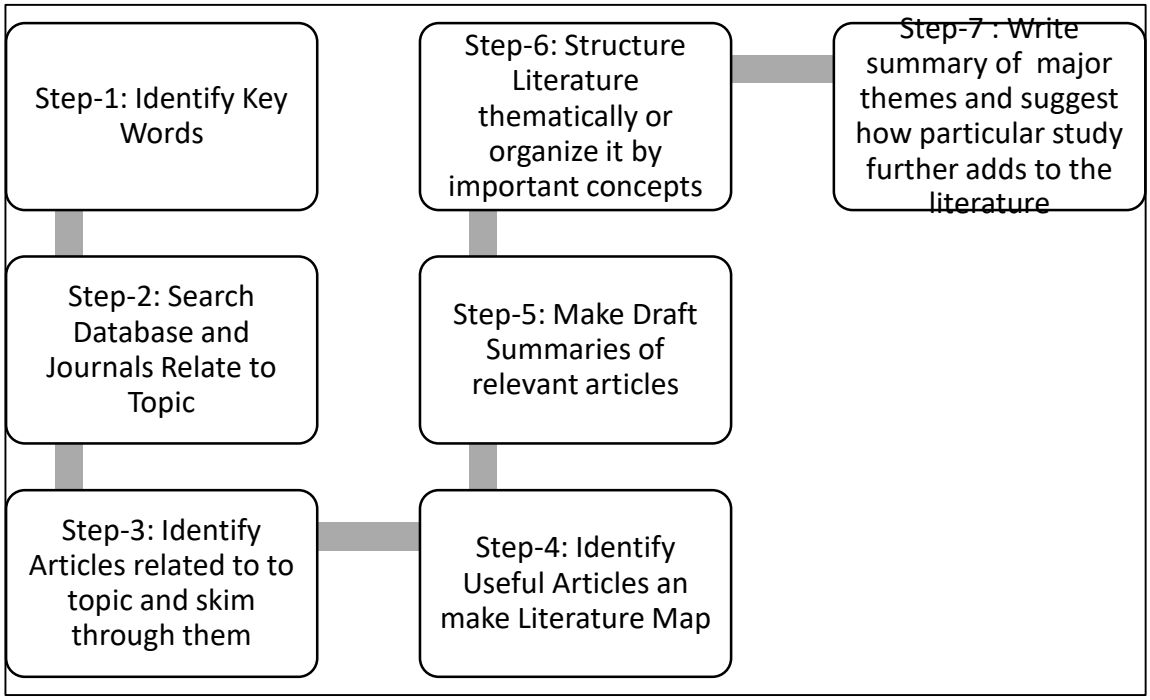

Figure 2.1 : Overview of Literature Review methodology

(Source : (Creswell, 2009))

The literature review process as mentioned above has been adapted and modified for carrying out the literature review for this research and is described in subsequent paragraphs.

2.2.1Formulation of problem

The literature review aims to understand what is the historical background and evolution of the wind energy sector in India? What are the significant themes defining knowledge area and boundaries of wind energy sector research in India? What is the impact of various government policies on the growth of wind

energy in India? What are the challenges and barriers to the development of wind energy in India? What are the gaps and research paths ahead?

2.2.2. Key Words used ,Databases explored and Journals studied

As is evident from above, developments in Wind Energy Sector in India started back in 80s, however complimentary developments in research especially related to management, policy and economic aspects has not occurred at the same pace. The available literature is primarily limited to overview studies on global and Indian Wind Energy industry. In addition to published research papers, studies, press releases, newspaper reports and orders were utilized to carry out literature review. The following Table 2.1 and Table 2.2 brings out the details of the same.

Table 2.1 : List of Key Words used and Databases Explored

Key Words Used	Databases
1. Wind Energy India	1. Scopus
2. Renewable Energy	2. Taylor & Francis
3. Wind Economics	3. Elsevier
4. Wind Farms	4. Wiley
5. Wind Sector	5. Jstor
6. Renewable Energy Policy India	6. Springer
7. Wind Energy Policy India	7.Google Scholar
8. Energy Policy	8. Researchgate
9. Wind Energy Management	
10. Energy Policy Effectiveness	
11. Renewable Energy Policy Effectiveness	
Key Words:7	**Databases :8**

Table 2.2 : List of Journals Explored

Journals Explored	Total
Renewable and Sustainable Energy Reviews(10), Clean Techn Environment Policy (01), Journal of Renewable and Sustainable Energy(04), Energy Sustainability Through Green Energy, Green Energy and Technology (01), Energy Policy(05), International Journal of Renewable Energy Research (01), Climate Policy Initiative(01), Carbon Balance and Management(01), Renewable Energy World(Magazine)(01), Journal of Wind Engineering and Industrial Aerodynamics(01), Energy Sources(02) , Wind Journal (01) , Wind Engineering(01), International Journal for Innovative Research in Science & Technology(01) , International Journal of Electrical and Electronics Engineers (01) , Journal of Renewable Energy (01) , International Research Journal of Engineering and Technology (IRJET) (01) , International Research Journal of Environment Sciences , Current Sustainable/Renewable Energy Reports (01), Book Globalization of Indian Industries, India Studies in Business and Economics (01), Book: Energy Security and Sustainability, Edition: First, Chapter: Renewable Energy Financing in India(01), NRDC international: INDIA(India environmental portal) (01) , The International Institute for Sustainable Development Published by the International Institute for Sustainable Development(01), Mytrah Energy (India) Limited Final Report (02), MPRA Paper No. 71211(01) , CSTEP, WFMS, and SSEF May, 2016 (01) , WinDForce/ MNRE/ Shakti Foundation/ C-STEP(31-2015)(01) , Ministry of New & Renewable Energy (Wind Energy Division) Reports(06), Energetica India(01), Crisil Insight(01), IRENA(03),IAEE(02), Indian Environmental Portal (01), INTERNATIONAL JOURNAL of RENEWABLE ENERGY RESEARCH(01),MPRA(02),Portland University(01), UNIGE(01), Tinbergen Institute (01), ARPN Journal of Engineering and Applied Science(01),Illinios University(01), Journal of Cleaner Production(01), Energy Procedia(01),NREL(02), Sustainability(01),	107

Uppsala University(01), Global Advanced Research Journal of Management and Business Studies(01),World Bank(01),Sustainable Energy(01),Renewable Energy(01), TERI(01) ,IPCC(02), Energy Research Centre of the Netherlands-(01),Econometrica(01),Operations Research/Informis(01), Cleveland State University(01)	

2.3 SEARCH OF LITERATURE

Due to the wide scope of the subject, the search of literature suggested following major themes emerged. This section will detail out the findings and inference from the literature review on major themes. Table 2.3 brings out the themes of literature review.

Table 2.3 : Themes of Literature Review

Themes	Justifications/Search Outlook
Wind energy scenario in the world	Obtain an understanding of the worldwide expansion and advancements in wind energy, along with the diverse array of policies enacted across the globe to promote its development.
Wind energy scenario in the India and challenges and barriers to development of wind energy in India	Comprehend the historical context and contemporary status of wind energy in India, as well as the obstacles and hurdles hindering its progress and growth.
Policies and incentives for the development of wind energy in India	Understand nature, development as well as current status of various policies for the growth of wind energy in India
Effectiveness of various RE policies in India and World	Understand the methodology used in assessing the effectiveness of various RE policies in various countries across the world

Effectiveness of various wind energy policies in India	Examine the research conducted and methodologies applied to evaluate the efficacy of different policies implemented in India to foster the growth and advancement of wind energy.
Wind Energy E Reverse Auctions in India	Gain insight into the auction process for wind energy in India, which firms won the auctions and what are factors considered in bidding?

Table 2.4 : Detailed Sub-distribution of articles related to Wind Energy Sector in India

Topic Area Study	Sub – Topic	Study
Wind Energy Scenario in the World	Wind Energy Scenario in the World	(Wind & Council, 2019),(Vries, 2003),(IRENA-GWEC, 2012),(IPCC, 2011)(Alves, Medeiros, Steiner, & Alves, 2018)
Wind Energy Scenario in the India and Challenges and Barriers to	Barriers and Challenges in growth of Wind Industry	(Kar & Sharma, 2015),(Rajsekhar, B., Van Hulle, F., Jansen, 1999),(Jagadeesh, 2000),(Singh, S., Bhatti, T. S., & Kothari, 2004),(Arul, 2015)(Mehra & Hossain, 2014),(Chaurasiya, Warudkar, & Ahmed, 2019),(Jagadeesh, 1999)

development of Wind Energy in India	Historical Developments, Background, current status and growth potential	(Singh & Parida ,2013), (Purohit & Purohit ,2009), (Kar, 2015), (Khare, Nema & Baredar, 2013), (Sangroya & Nayak ,2015), (Purohit & Michaelowa ,2007), (CSTEP, WFMS& SSEF ,2015), (Wind Denmark Report ,2013), (Hossain, Sharma, Mishra, Ansari, & Kishore,2016), (Gunjker, Deshmukh, & Jha,2016), (Gambhir & Thakur, 2019), (PwC & Mytrah ,2015),(Hossain, Swamy, Mishra & Sharma,2015).)(Ramachandra & Hegde,2017),(Kulkarni, Anil& Gowdar, 2016),(Jolly & Raven, 2015),(Singh Madhu and Singh Payal, 2014), (Sharma , Srivastava , Jha & Kumar , 2011), (GWEC (2016),(Parihar & Purohit, ,2017)(Kasisomayajula, , 2013), (Chauhan ,Agarwal & Suman , 2013), (Singh, Saini & Sood ,2016)(Kulkarni, Anil,& Gowdar, 2016), (Chakraborty, Sinha, Dutta & Biswas, 2011)(Bakhsh, Islam, Tabrez & Sharma,2011)(Shukla, & Biswal,2014)(Sitharthan, Swaminathan,Parthasarathy,2018) (Maurya, Khare & Bajpai,2015)
	Drivers of Wind Power	(Golait, N., Moharil, R. M., & Kulkarni, 2009)
	OffShore Wind Energy	(Kothari & Umashanker, 2012),(Arora, 2011)
licies and Incentives for the development	Policies	(Bayar, 2013a),(Jethani, 2016a),(MNRE, 2011),(Niti Ayog, 2015),(Chaudhary, Krishna, & Sagar, 2015),(MNRE, 2016),(IRENA-GWEC, 2012)

of Wind Energy in India	Off Shore Wind Energy Policy	(Hossain, Swamy, Mishra, & Sharma, 2015),(Mani, S., Dhingra, 2013)
Effectiveness of Various Wind Energy Policies in India	Policy Effectiveness	(V. K. Kathuria, 2016),(Sud, Sharma, Sharma, & Kitson, 2015),(Panse & Kathuria, 2016),(Sangroya & Nayak, 2015),(Rao & Kishore, 2009),(CRISIL, 2016)
Wind Auctions	Auctions	(Shrimali, Konda, Farooquee, & David, 2015),(CRISIL, 2017b),(SECI, 2016),(SECI, 2020),(SECI, 2018),(SECI, 2019)

2.3.1 Wind Energy Scenario in the World

The estimated technical potential for onshore wind energy worldwide is approximately 50,000 TWh per year (billion units per year). As for offshore wind energy, the technical potential ranges from 4,000 to 37,000 TWh per year.Wind energy policies worldwide can be categorized into three types: technological policies, which encompass research and development efforts; industrial policies, which aim to safeguard domestic industries; and market regulation policies.They can be also categorized into Demand Side or Supply Side. Major policies identified are Premium or Adder system, FiT, Tax Based Electricity Production Incentive , Auction or tendering System, Subsidies on investment, Tradable Green Certificate, RPOs, Government providing Concessionary Finance , Import Duty exemptions or concessions, Project Permitting Process, Guidelines for Project Location ,Grid Priority Access, Spot Market Trading ,Grid Code. The analysis of Literature on Wind Energy Scenario in the World is summarized in Table 2.5

Table 2.5 : Analysis of Literature on Wind Energy Scenario in the World

Themes	Literature	Significant Finding	Inference	Gaps
Wind Energy Scenario in the World	(GWEC, 2019),(IPCC,2011), (IRENA ,2013),(E.E. Cia Alves et al.,2019), (Vries ,2003)	• The overall global wind energy installed capacity in 2018 reached approximately 591 GW. • The global technical capacity for onshore wind energy is 50,000 terawatt-hours per year (or billion units per year). and technical potential for offshore wind energy range from 4000 to 37000 TWh/yr .	Close to 591 GWs of Wind Energy installed globally at the end of 2018.	There is a need for detailed studies specific to each country regarding the development, challenges, and barriers facing wind energy.
Wind Energy Scenario in the World		• The policies that have propelled the wind energy development and growth worldwide can be classified as under: technological policies (including research and development initiatives), industrial policies (offering protection to domestic industry), and market regulation policies. • They can be also categorized into Demand Side or Supply Side.	The global technical potential for wind energy including off- shore is estimated at 50,000 TWh/year (billion units per year), and between 4,000 to	Furthermore, there has been a lack of comparative analysis aimed at examining the impact of similar policies on the expansion of wind energy in various nations.

		• Major policies identified are Tendering System, FiT, Premium system, Project Sitting Guidelines, Spot Market Trading , Investment Subsidy ,Tax Credit, REC , Import Duty Concessions, RPOs, Project Permitting Process, Concessionary and easy access to finance from government agencies, Access to Grid on Priority, Grid Code, Tax Based Electricity Production Incentive	37,000 TWh/year respectively .	

2.3.2 Wind Energy Scenario in the India and Challenges and Barriers to Development of Wind Energy in India

The Wind Energy Scenario in the India and Challenges and Barriers to Development of Wind Energy in India has been covered as Sector Overview by most of the researchers. The existing literature generally adheres to a standard structure, commencing with an overview of the historical background of wind energy development in the country. This is followed by a brief examination of the prominent wind markets globally, along with India's positioning within them. Some researchers have also provided insights into the state-wise potential and installation status. Furthermore, the study encompasses a concise definition of various policy measures such as AD, GBI, RPOs, FiT, among others, while also elaborating on the barriers hindering the progress of wind energy development in the country.

In the early 1980s, the Indian government provided the initial impetus for wind energy development by establishing in 1981, CASE which was subsequently upgraded to the DNES in 1982. In 1992, the MNES was setup by government , later renamed as MNRE in 2006. Under this ministry, the IREDA was founded in 1987 as a financial institution with primary objective of promoting the extensive adoption of RE in India(Purohit & Purohit, 2009).A Wind Resource Assessment Program was started in 1985, encompassing projects for monitoring wind patterns and mapping complex terrains. It spanned 25 states and involved installation of over 600 stations(Jagadeesh, 2000).

India's potential for harnessing wind energy is approximately 480 GW, comprising onshore (102 GW) and offshore (350 GW) resources. There are currently 19 wind turbine manufacturers in India producing around 45 different models, with 11 of them having collaborations with foreign manufacturers. India currently possesses an annual wind turbine manufacturing capacity of approximately 4,000 MW, and there is the potential for expansion to reach 8,000 MW. India also exports wind turbines, engines, and mills to various countries, such as the USA, Australia, Brazil, China, and Europe(Kar & Sharma, 2015) . In a qualitative case study, Jolly and Raven(2015) highlighted the challenges faced by individuals and organizations involved in this process and highlights the significance of collective institutional entrepreneurship in leveraging their role. They divided the entire development period in three phases 1985 to 1995, 1995 to 2003 and 2003 to 2014. Major issues faced and identified solutions taken by various actors have been described. The authors recommend that in planning future wind energy development, it is essential to prioritize targeted support mechanisms while ensuring that they are gradually phased out once the necessary capability levels have been attained, thereby preventing adverse effects and discouraging rent-seeking activities by interest groups. Furthermore, adaptation to the dynamic global technological landscape and the resolution of

emerging conflicts among various stakeholders, along with proactive anticipation of potential future conflicts, are recommended.

Additionally, it is crucial to take into account the viewpoints of locals when embarking on projects. Most of the papers have highlighted the challenges or barriers in the growth of India's Wind Energy sector. Rajsekhar, B. et. al (1999)has highlighted various market barriers in1990slike the Wind Power Plants performance in both state and national levels has been low, with yearly averages of wind-power plants CUF remaining below 20%. This can be attributed to the present structure that provides tax incentives based on a percentage of the capital expenditure without any qualifying performance benchmarks set by any agency. Poor installation practices by misusing AD Policy constitute a significant contributing factor for poor operational efficiency of wind farms. Investment decisions for wind-power plants were made hastily around closing of the financial year to take advantage of tax breaks.

As a result, manufacturers of wind turbine were compelled to install wind-power plants hurriedly, compromising on both quality and performance. There was a significant increase in capital costs in the 1990s, and the phenomenon of 'goldplating', which was caused by the 100% depreciation facility, was the main contributing factor to this increase.

Singh and Parida, (2013) has highlighted technical and infrastructural challenges in the mid-1990s wherein wind turbine designs led to fluctuation in voltage thus reducing overall power quality and thus also giving a negative feedback on wind turbines. The limited availability of experts for service and maintenance of wind farms has also been highlighted by him.

Amin, (1999) has studied barriers of an institutional nature to the commercialisation of wind power, with a focus on the case of Gujarat.

He identified several major hurdles to growth of wind power, including poor wind power performance and low operating capacity factors, inadequate transmission and distribution of power, inadequate wind mapping ,inadequate

skills for operation and maintenance, installation of substandard second-hand turbines unsuitable for Indian conditions, as well as a complex and time-consuming clearance and financing process . Khare et al. (2013)have identified several obstacles that impede wind power's growth in the country, such as need to coordinate with multiple agencies for approval, the absence of a single comprehensive policy statement, and difficulties in financing the projects due to the high initial capital cost that must be funded over the project's lifespan. Also the R&D investments by private sector and GOI backed research projects are minimal. Arul, (2015) states that the primary challenge faced in wind energy's growth in India is the high interest rates, limited availability of debt financing, and the precarious financial condition of publicly-owned utilities. Additionally, the technical challenges include grid integration issues and the need to develop wind turbines that can operate in lower wind speed regimes, which are prevalent in many parts of India. NRDC and CEEW, (2014)highlighted that the main factor leading to reduced investments in the sector is the ambiguity surrounding AD ,GBI and other policies and incentives. Inadequate enforcement of RPO standards and uncertainty regarding the future of REC post-2017 have further diminished lenders' confidence in the REC mechanism. In addition, the elevated costs and limited accessibility of debt in India pose substantial obstacles to the expansion of wind power market, thereby escalating expenses associated with renewable energy projects. To address these challenges, the author recommends the adoption of strategies proven effective in global wind energy markets, such as the utilization of green bonds, establishment of clean energy development banks, and implementation of tax credits. These mechanisms can help alleviate the financial burden of WPDs and encourage more projects of wind energy.

Kar and Sharma, (2015)have identified that wind power in India confronts difficulties such as reduced capacity utilization, elevated costs, challenges related to evacuation and grid infrastructure, as well as power system

considerations which are comparable to challenges faced in global wind markets. They have also emphasized that greater regulatory involvement is necessary for the penetration of wind energy in various areas, including ensuring prompt tariff revisions, fixing of RPO targets, and monitoring the fulfilment of RPO commitments in a timely manner. In addition, the development of transmission infrastructure is crucial for grid power evacuation, and the issue of land availability remains contentious. The uneven distribution of wind resources has limited wind production and consumption to states with abundant wind resources. Literature on Wind Energy Scenario in the India and Challenges and Barriers to development of Wind Energy in India has been analysed and summarized in Table 2.6.

According to Chaurasiya et al. (2019)some significant hurdles in the advancement of wind powerin India are as under:-

- Insufficient evacuation and transmission infrastructure have hindered the development of promising wind energy sites in Rajasthan, Gujarat, and along the coastal areas of Tamil Nadu..
- The industry continues to grapple with the aftermath of the withdrawal of both AD and GBI. Furthermore, there have been frequent policy changes at the state level concerning open access, cross-subsidy surcharges, banking and wheeling regulations, and group captive arrangements.
- Several state nodal agencies are facing challenges in establishing and maintaining technical libraries, data banks, or information centres to gather and correlate data regarding wind energy potential.
- The process of land availability assessment, land conversion from agricultural to non-agricultural use, and obtaining clearance for protected areas is time-consuming and fraught with difficulties.
- Strict enforcement and effective monitoring of RPO compliance have been lacking, directly impacting the REC mechanism.

- Inadequate forecasting tools and grid management systems have posed operational challenges.
- Issues related to anti-corruption practices, commercial disputes, and legal proceedings under criminal or civil law, along with other integrity legislation, have had adverse effects on wind power projects. The lengthy legal proceedings often result in delays or project non-completion.
- Varying state laws and substantial differences in FiTs approved by SERCs have created uncertainty for investors and rendered certain wind energy projects economically unviable in specific Indian states.The supply chain issue plays a significant role in retarding the development of wind energy sector and the potential risk factors that may be the cause of crisis in supply chain are (1) delays and inflexibility of supply source, (2) systems information infrastructure breakdown, (3) procurement and exchange rate risk, (4) receivables and number of customers, (5) inventory holding cost, demand and supply uncertainty, (6) capacity, (7) service suppliers, (8) key component manufacturers, (9) procurement and environment."

Table 2.6 : Analysis of Literature on Wind Energy Scenario in the India and Challenges and Barriers to development of Wind Energy in India

Themes	Literature	Significant Finding	Inference	Gaps
Wind Energy Scenario in the India and Challenges and Barriers to development of Wind Energy in India	(Kar & Sharma, 2015), (Rajsekhar, Van Hulle & Jansen,1999), (Jagadeesh, 2000), (Singh, S., Bhatti, T. S., & Kothari, 2004)(Arul,2015) (Mehra & Hossain,2015)(Jagadeesh , 1999) (Chaurasiya , Warudkar & Ahmed ,2019), (Singh & Parida ,2013), (Purohit & Purohit ,2009), (Kar, 2015), (Khare, Nema & Baredar, 2013), (Sangroya & Nayak ,2015),	Current installed wind energy capacity of **35128.83MW** (at year-end 2018) and government has established a target of RE generation capacity of 175 GW by 2022, with a specific target of 60 GW allocated to wind energy. There has been always dual mandate of central and state government in policy and regulatory framework, which has led to uneven development.	The primary obstacles have been the unpredictability of future of long term policies and incentives like AD and GBI, poor installation practices by misusing AD Policy had been a major challenge	The primary emphasis of most of the studies has been on providing a comprehensive overview of the sector, with a particular focus on the historical evolution, government policies and incentives

	(Purohit & Michaelowa ,2007), (CSTEP, WFMS& SSEF ,2015), (Wind Denmark Report ,2013), (Hossain, Sharma, Mishra, Ansari, & Kishore,2016), (Gunjker, Deshmukh, & Jha,2016), (Gambhir & Thakur, 2019), (PwC & Mytrah ,2015),(Hossain, Swamy, Mishra & Sharma, 2015).)(Ramachandra & Hegde,2017),	Uncertainty due to fluctuating introduction of incentives, followed by sudden withdrawals and subsequent reintroductions has been primary cause of reduced investments in wind energy in India. The uncertainties surrounding AD and GBI policies, have also contributed to this decline.	. In addition, Complicated and time consuming process of obtaining clearances and finance . Technically issues of grid integration, high cost of evacuation and grid integration, forecasting and scheduling as Poor transmissio n and distribution of power, lower capacity utilization	, as well as the obstacles and challenges impeding the growth of wind energy in India.No detailed analysis of policies and barriers has been carried out.
	(Kulkarni, Anil& Gowdar, 2016),(Jolly & Raven, 2015),(Singh Madhu and Singh Payal, 2014), (Sharma , Srivastava , Jha & Kumar , 2011), (GWEC (2016),(Parihar & Purohit, ,2017)(Kasisomayajula, , 2013), (Chauhan ,Agarwal & Suman , 2013), (Singh, Saini & Sood ,2016)(Kulkarni, Anil,& Gowdar, 2016),	Earlier poor installation practices by misusing AD Policy had been a major challenge .In addition, Complicated and time consuming process of obtaining clearances and finance , number of agencies for coordination and approval,		

	(Chakraborty, Sinha, Dutta & Biswas, 2011)(Bakhsh, Islam, Tabrez & Sharma,2011)(Shukla, & Biswal,2014)(Sitharthan, Swaminathan, Parthasarathy,2018) (Maurya, Khare & Bajpai,2015) , (Golait, Moharil, & Kulkarni ,2009), (Kothari & Umashanker ,2015) (Arora , 2011)	The absence of a unified and comprehensive policy statement, along with financing challenges, particularly due to the substantial initial burden of capital costs associated with wind energy projects, which must be financed over their lifespan, were the primary obstacles. Technically issues of grid integration, reduced capacity utilization , the high expenses associated with evacuation and grid integration, forecasting and scheduling as well modernisation of transmission networks, inadequate wind mapping , Poor transmission and distribution of power , poor operation and maintenance skills have hampered towards Wind Power's growth in the India.		

2.3.3 Policies and Incentives for the development of Wind Energy in India

All authors have touched upon the various incentives and schemes that government introduced to support the advancement in India's wind energy sector. Policies of AD,GBI, FiTs and RPOs find detailed mentions in nearly all the papers and other state level policies have been elaborated(V. K. Kathuria, 2016). In addition, recently introduced competitive bidding or auctions in Wind Energy have found mention in only one study paper by CRISIL, (2017b) ,however Shrimali et al. (2015) studied the auction methodology for complete RE domain in India**.** Rajsekhar, B. et al. (1999)has highlighted that during the 1990s, wind power equipment was eligible for 100% AD in the initial year of project commissioning. It was later changed to 80% in 2002. It was the most attractive financial incentive(Sud et al., 2015) . In the period until March 1996, when the corporate tax rate was 46% (now reduced to 35%), the option of AD for wind power plants provided substantial tax benefits for the project sponsors. This resulted in many decisions being made hastily towards when financial year was ending to take advantage of the tax incentives. As a consequence, manufacturers of wind turbine were often compelled to install wind power plants quickly, which sometimes led to a compromises in the quality and performance of the installations. Sud et al. (2015)research has shown that since the developers had no incentive to improve the efficiency of the system and generate more power, they failed to invest in cutting-edge technology for higher-capacity turbines to fully optimize the generation potential of the site. This lack of motivation also extended to local wind turbine companies and related entities, which did not prioritize improving their turbines' performance. Moreover, due to the scheme's focus on linking benefits to the project's initial capital cost without any subsequent monitoring, investors considered investments in wind power projects as a financial instrument rather than a genuine driver for renewable power development. Regrettably, this led to instances of fraudulent schemes where companies and individuals obtained tax

benefits without actually implementing any projects. The AD scheme incentivized capacity development rather than generation and didn't have any mechanism to monitor projects and penalize under-performance. The scheme was withdrawn on April 1, 2012.

Subsequently, The Ministry of Finance announced the reintroduction of the AD scheme from April 1, 2014(IREDA, 2014). The AD registration is presently available for all wind power projects who do not wish to avail benefit of GBI scheme of MNRE as both these schemes are mutually exclusive in manner. For projects commissioned after March 2017, the depreciation rates have been lowered to 40%(CRISIL, 2017b).

According to Bayar, (2013a) in 2009 ,for broadening the base of investors, the central government introduced GBIs of Rs. 0.50 per kwh for a period of 4 to 10 years, with a maximum limit of Rs. 100 lakhs per MW. This was done since the AD provision was not applicable to FDI. Between 2009 and 2011, the annual installations in the wind sector more than doubled.

However, the withdrawal of incentives in 2012 resulted in a 50% decline in capacity additions during fiscal year 2012, which may have prompted the scheme being reintroduced in April 2013. Nevertheless, the GBI was subsequently removed entirely in 2017. According to Bayar, (2013a)prior to the removal of GBI and AD in 2012-13, wind sector in India experienced "best of both worlds". As a result of these measures, the market witnessed the establishment of a depreciation market catering to a wide range of retail customers, along with the entry of large IPPs. However, once the incentives were phased out, the taxpayer segment of the market withdrew, leading to a shift in market dynamics with the majority of IPPs dominating the sector. Consequently, this shift caused a notable decline in overall investment levels.

An issue paper written by NRDC and CEEW, (2014)has pointed out that the implementation of the Electricity Act of 2003 brought forth obligatory RPOs aimed at fostering the adoption of clean energy sources like wind and solar

across different states. It requires a specified amount of electricity to be procured from RE sources, which can be accomplished through direct purchases via bilateral contracts or by utilizing the REC mechanism. According to Kar and Sharma, (2015)in 2010, government launched the REC program, introducing tradable certificates. Each wind REC (non-solar) certificate represents the production of 1 MWh of wind energy. Discoms, open access and captive consumers have the choice to buy wind RECs in order to meet their RPOs. However, according to Bayar, (2013a) ,RPO policy has not been substantially enforced. No state government has imposed penalties for failure to comply with the obligations, and at most, they have only issued notices to the discoms , due to which the market has not been effectively developed.

At the state level, several crucial policies have been formulated to encourage investments in the Wind Energy Sector. These policies include FiT, banking, third-party sale, open access transmission and wheeling charges.

Among these, FiT is widely regarded as the most significant policy mechanism for stimulating investment in this sector. FiT provides long-term contracts to Wind Energy producers, typically based on a pre-determined rate calculated by respective State Electricity Regulatory Commissions, taking into account the estimated cost of generation. Kathuria, (2016)assessed the effectiveness of FiT in in attracting FDI in eight Indian states which have maximum wind potential using panel data from 2004-05 to 2010-11. The findings suggest that higher FiT rates have played a role in attracting FDI to these states. Kar and Sharma, (2015) highlighted that many states strategically increased wind power tariffs by 2 to 15 percent, with the aim of attracting investments. As a result, wind power projects were redirected to lower wind density states, such as Rajasthan, MP and Maharashtra from high wind density states such as TN and Gujarat.Various incentives at both national and state levels have been highlighted by Kar & Sharma, (2015), including reductions in Customs Duty for wind power generation products like reduced value-added tax (VAT).

The wheeling charges for transmitting wind energy exhibit variation among states, with rates ranging from as low as 2 percent in Maharashtra and MP to 7.5 percent in West Bengal. In TN and Karnataka, the storage of banked energy is allowed, with 5 percent and 2 percent, respectively, of the total wind energy fed into the grid accessible within the same financial year. Maharashtra offers an 11 percent capital subsidy for the development of wind energy projects, while Rajasthan Offers low-interest soft loans that amount to one-third of the capital cost. To facilitate grid connectivity with planned wind farms, Green Cess fund was started in Maharashtra, utilizing a portion of its funds for infrastructure development. Investment in wind is encouraged by strong evacuation infrastructure. However, despite these incentives, authors note that India's RPO policy has not been significantly enforced, with no state government imposing penalties for noncompliance. Therefore, the market has not effectively taken off. On December 8, 2017, the MoP released guidelines for the implementation of competitive bidding process for procuring wind power. There is limited literature available on this topic in the Indian context. Shrimali et al. (2015)study focused on the Auction Mechanism used for the complete RE sector in India. Their research showed that auctions are typically recognized as a cost-effective and equitable method for allocating projects. However, the authors also identified various risks associated with auction design, such as off-taker risk, collusion, underbidding, completion risk, financial risk and technology risk. To address these risks and enhance the wind energy auction’s cost-efficiency and deployment effectiveness, authors recommended certain changes.

To improve cost effectiveness, authors proposed the idea of maintaining robust competition by aligning the auctioned capacity volume with the market's supply capability. In order to enhance deployment effectiveness, which is greatly influenced by risks related to completion and finances, the authors propose strengthening of transmission infrastructure through supportive policies and reduce off-taker risk by giving payment guarantees. They also suggest adopting

a approach of pay-as-bid tariff determination instead of requirement of matching lowest bid by selected bidders. Additionally, to address the risk of underbidding, the authors recommend incorporating rigorous penalties for project commissioning delays to further improve deployment effectiveness.

In relation to the particular context of wind energy in India, the authors propose commencing with auctions within a controlled environment. This entails identifying project sites, planning transmission infrastructure, and conducting comprehensive resource assessment studies prior to the bidding process.

After conducting a thorough analysis of ongoing auctions, CRISIL, (2017) concluded that the implementation of competitive bidding will result in reduced original equipment manufacturer (OEM) margins, phasing out of FiTs, and renegotiation of contracts for under-construction wind projects.

The introduction of competitive bidding will also lead to lower returns for both OEMs and developers. As a result, FiTs and other incentives such as GBI and AD are gradually phased out, it is anticipated that the market will witness consolidation towards independent power producers.

There is limited availability of literature on offshore wind energy in India, with only one research paper available on this topic(Mani & Dhingra, 2013).Mani and Dhingra, (2013) conducted a ground-breaking investigation in which they developed a logistic regression model to ascertain the log-odds of offshore wind energy expansion in India. Additionally, they identified a crucial set of variables that serve as the fundamental building blocks for offshore wind policy development.

They advised that Indian offshore wind energy policies should focus on legally binding payment policies, the setting up of a nodal agency, policies for RE technology parks and economic zones, a long-term policy intent (at least 10 years), specific and quota-based and quota policies for offshore wind energy. Kar,(2016) has briefly described the National Offshore Wind Energy Policy (NOWEP), formulated in Oct 2015 by Government of India. Kothari and

Umashanker,(2012)compare onshore and offshore wind projects and compile the initial measures that India is taking to promote offshore wind energy.Arora, (2011) in his article has also given the prospects of off shore wind energy and the related challenges in India.

IRENA-GWEC, (2012)brought out the historical development of the regulatory and policy framework for wind energy (1980-2011) in India. They divided the evolution in four phases , Phase 1 was demonstration of technology and R&D (1981-1990), Phase 2 is Institutionalisation and Economic liberalisation (1991-2000) , Phase 3 (2000-2008) is the enactment of the EA 2003 and the establishment of state-level tariff provisions, lastly Phase 4 (2009-2012) involving strengthening of the tariff scheme and introduction of new incentives . The paper identifies state and central government's dual mandate in policy and regulatory framework, issues of grid integration, forecasting and scheduling as well modernisation of transmission networks as major challenges towards Wind Power development in India.

Several critical factors which contributed to the growth ofwind energy in India have been identified by IRENA-GWEC, (2012). These include the early interest of entrepreneurs in investing ,efforts to localize the technology for Indian conditions, early institutional support from government, consistent tax benefits, the enactment of the EA 2003, and the establishment of RPOs backed by a national REC scheme. Furthermore, preliminary assistance from bilateral donor agencies and international development banks., along with incentives such as tax-based benefits and the transition to GBI, played vital roles in promoting the growth of the wind energy in India(IRENA-GWEC, 2012). Literature on policies and incentives for the development of wind energy in India have been summarized and analysed in Table 2.7.

Table 2.7 : Analysis of Literature on Policies and Incentives for the development of Wind Energy in India

Themes	Literature	Significant Finding	Inference	Gaps
Policies and Incentives for the development of Wind Energy in India	(Bayer,2013a), (MNRE,2016), (MNRE ,2011), (Niti Ayog,2015), (Jethani,2016), (Chaudhary , Krishna & Sagar , 2014),(IRENA , 2012), (Mani & Dhingra, ,2013), (MNRE, 2015)	• The evolution of various policies introduced for the development of wind energy at State and Central level can be divided in four phases : **Phase 1** was demonstration of technology and R&D **(1981-1990), Phase 2** is Economic liberalisation and institutionalisation **(1991-2000) , Phase 3** is the enactment of the Electricity Act and the establishment of state-level tariff provisions **(2000-2008), lastly Phase 4** involving strengthening of the tariff scheme and introduction of new incentives **(2009-2012)**.	AD, GBI policy have been main driver of Wind Energy Growth, however both have marked by abrupt changes.	Policies have been introduced , amended and removed constantly however no literature is available on the reasons for the changes in these policies
		• **AD** policy introduced in 1990s was the major driver of Wind Energy Installation, though the policy was primarily misused as its benefit was connected to only investments made initially. The investment scheme had limited appeal to a	RPOs though mandated by Centre have not been fully enforced by states. States have	

		select group of investors and was increasingly used as a tax tool rather than a means for promoting a sustainable industry. Additionally, the government was motivated by the immediate loss of tax revenue to discontinue the policy • The scheme underwent several revisions, including a reduction in the AD rate from 100% to 80%, complete withdrawal, reintroduction, and a further reduction in the AD rate to 40%. • The **GBI** scheme was launched concurrently with the AD scheme in 2009, offering investors the flexibility to choose between the two incentive programs. The GBI scheme was contingent on the actual power generated. However, the scheme was suspended in 2012 and later revived. The GBI scheme facilitated the shift from investment-based incentives to result-based incentives.	different policies with respect to Wheeling, Banking, Inter State Transmission Charges as well as Third Party Sales. Special Additional Duty (SAD)	

		• **RPOs** have been mandated by Electricity Act 2003, however the compliance to the same is negligible with no monitoring and enforcement. The REC mechanism was established in 2010 by the CERC. • CERC authorized the **trading of electricity through power exchanges** starting from June 2008. FiTs have also been put in place by various SERCs and have been major attraction for investment in particular state. • In 2017, Government moved from **FiTs to Competitive Bidding or Auctions** which has resulted in significant reduction in Prices for Discoms. • In addition to these, states have different policies with respect to **Wheeling, Banking, Inter State Transmission Charges as well as Third Party Sales. Special Additional Duty (SAD)** and other Exemptions have also been granted by MNRE to various parts used in Wind Energy Project Installations.		.

2.3.4 Effectiveness of RE Policies in India and the World

The effectiveness of various RE Policies in India and World has been summarised and analysed in Table 2.8

Table 2.8 : Analysis of the literature on the effectiveness of various RE Policies in India and World

Themes	Literature	Significant Finding	Inference	Gaps
Effectiveness of various RE Policies in India and World	(Puig,Morgan, Daniel & Trevor,2013) ,(IRENA ,2012), (IRENA,2014), (IAEE,2016),(GWEX/IRENA,2013), (Indian Environmental Portal,2012) ,(IAEE,2016),(Abotah Remal,2014), (Kahia M ,Kadria M & Aissa M ,2017),(Dijkgraaf E, Dorpb T and Maaslandc ,2014),(Delmas M & Montes-Sancho M. J. ,2011) ,	IRENA(2012) has identified five criteria for assessing policy effectiveness: effectiveness, efficiency, equity, institutional feasibility, and replicability . Each of these have further indicators which are used to assess performance. Hawila, Lucas, and Ferroukhi, (2013) segments analysis into four fundamental criteria, which encompass: 1. Effectiveness 2. Efficiency 3. Equity 4. Institutional feasibility. A Policy Effectiveness Indicator (PEI) has been established. Sangroya and Nayak(2015) employed for econometric analysis Fixed Effect Panel Data Modeling, utilizing state-level data from 6 Indian states spanning the period from 2001 to 2011.	In most of the cases to evaluate RE polices across the world Econometrics methods and Panel Data techniques have been used. which include OLS Model, FE & RE Tests.	RE Policies as a whole have been tested and policies related Wind , Solar etc have not been tested separately.

	(Menz F.C. & Vachon S ,2006), (Bolkesjøa, Eltviga & Nygaarda,2014),(NREL ,2008) , (Nicolini M,Porcheri S & Tavonic M ,2017) (Mahmure, Selam, Fırat, Kara & Özel ,2015) , (Kok S,2015), (Warbroek B,2013), (Kilinc-Ata,2015), (Thapar S, Sharma S & Verma A,2016)(Sangroya & Nayak(2015)	Remal , (2014) implemented the hierarchical decision model to establish a comprehensive framework for assessing the policy.Schmid ,(2011) analyzes the influence of the EA of 2003, the Tariff Policy of 2006, and the implementation of FiTs and minimum quotas for clean electricity procurement on the progress of RE power in nine Indian states from 2001 to 2009. The analysis employs econometric techniques to assess the impact of these policies. Kilin-Ata,(2015) introduces a conceptual framework and utilizes qualitative analysis to explore the structural elements shaping investors' decision-making procedures.Furthermore, it explores the relationship between RE policies and investments in UK, Turkey and Nigeria through a case study.		Econom etric and Panel techniqu es is the most common methodo logy used and only limited studies are based on Case Study Methodo logy.

2.3.5 Effectiveness of Various Wind Energy Policies in India

There has been a limited effort by scholars to evaluate the effectiveness of National and State-level policies aimed at promoting Wind and other Renewable Energy in India. Schmid, (2011)evaluated the effectiveness of various RE promotion policies in India. It examined the impact on the growth of RE power in 09 Indian states from 2001 to 2009 of the EA 2003, Tariff Policy 2006, FiTs and minimum quotas for sourcing clean electricity. According to the study, the implementation of minimum RPOs, had a significant and positive effect on the development of RE power, and private sector investment was found to be a driving force behind this development. However, the study discovered that the implementation of FiTs did not exhibit a significant positive correlation with the progress of renewable energy power.

Benecke and Elisabeth, (2011) did a study on the states of TN and Kerala and found that the current position of RE in these states is determined by the nature of government policies and power positions. Using a stakeholder network analysis, the study identified various factors that either facilitate or impede the growth of wind energy in the two states. According to the study, Kerala, being more energy secure, has comparatively less motivation to promote RE technologies in contrast to TN. As a result, Kerala has not attracted any FDI in the RE sector.

Rao and Kishore, (2009)using the theory of innovation diffusion conducted a study on the development of wind power technology in the Indian states of TN, AP, Maharashtra, and Gujarat. To determine the diffusion parameters, a mixed influence diffusion model, specifically the Bass model, was utilized, utilizing state-level data on the cumulative installed wind power capacity. Additionally, a composite policy index was calculated, incorporating factors such as land availability, preferential tariffs, wheeling and banking, third party sales and state-specific incentives.

A strong association between the composite policy index and ranking of diffusion parameters was established in the study, indicating a significant link between the adoption of wind power technology and effectiveness of policy measures.

.Jagadeesh, (2000b)utilizing the case study approach, examined the underlying causes behind the surge and subsequent decline of windfarm activity in TN and AP during the 1990s. The research delves into an analysis of the influential factors that contributed to this fluctuation, with a specific emphasis on the significance of institutions. By scrutinizing the effectiveness of various government initiatives in promoting and disseminating wind energy within these two states, as well as identifying financial, technical, transactional, and institutional barriers, this study seeks to shed light on the obstacles that hinder the widespread adoption of wind energy.

The case study findings highlight the significance of incentives, such as depreciation, tax holidays, and customs and excise duty reliefs, in sustaining the momentum of wind projects. The research suggests that these incentives should be continued for an extended period until the wind projects can attain self-sufficiency and overcome the aforementioned barriers.

Additionally, the study recommends creating a Wind Fund, establishing co-operative wind farms, setting up wind estates, linking generation to incentives for optimal production, promoting reliable water pumping windmills and wind battery chargers for small-scale applications, and other measures for the rapid growth of wind energy.

Rajsekhar, B. et al. (1999)examined the Indian wind energy programme to analyze the factors behind the slowdown of new wind power installations, despite its significant impact. The study utilized a case study approach to identify the policy, institutional, and technical factors that led to this stagnation. According to the author's findings, capital incentives emerged as a pivotal factor

in driving the promotion and development of wind energy generation, especially during the program's early stages.

Kathuria,(2016)conducted an investigation into the possible relationship between the level of FDI attracted to the sector in each state and the implementation of state-level FiT policies for wind energy. To account for potential influencing factors, control variables such as energy deficit, per capita income, manufacturing share, grid connectivity and unmet resourcewere defined. The Spearman correlation matrix was utilized to assess the correlations between various control variables using pooled OLS on data from all states. The findings reveal a positive association between a higher adoption of FiT policies and an increased influx of FDI in a state.

Panse and Kathuria, (2016)investigated the potential impact of state-level wind energy policies, such as Wheeling Charges (% of Energy), Banking Facility (Months), Feed-in-tariff (FIT) (Rs/kWh), and RPO (% of total procurement of power from a utility), on the installed capacity of the state. The study incorporated annual data spanning 19 years of wind power installation across seven states to analyze the installed capacity and employed a Fixed Effect Model with Market Size, Demand for Power, and Geographical Potential as Control Variables.

The study found that favourable policies contribute to the deployment of wind energy. Irrespective of the inclusion or exclusion of control variables, also the Policy Index positively influenced the adoption and implementation of wind power, thereby confirming the greater role of states in promoting its deployment. Based on analysis, there is a clear recommendation to implement these policies as a means to initiate the widespread adoption of wind power. The papers evaluating the efficacy of different government policies regarding wind energy have been accurately summarized by Panse & Kathuria, (2016) , that summary along with other papers has been is highlighted as under in Table-**2.9**:-

Table 2.9: Summary of Literature Assessing the Effectiveness of State Policies in Development of Wind Energy in India

Author	Year	Indicator for Investment	Proposed method/Model	Country (Time Period)	Significant Variables
Panse and Kathuria	2016	Installed Capacity	Panel Data Techniques -Fixed Effect and Random Effect Models	India (7 States)(1993-2012)(19 years)	State Policies like Wheeling Charges, Banking Facility FIT ,RPOs
Kathuria	2016	FDI in Wind	Random Effects Covariance Decomposition	India (Eight States) (2004-2011)	State Policies
Schimd	2011	Installed Capacity	OLS	India(Nine States) (2001-2009)	Tariff Policy, RPO
Rao and Kishore	2009	Installed capacity	Theory of diffusion of innovation, mixed influence diffusion model (Bass model)	TN, AP, Maharashtra and Gujarat	Land availability, preferential tariffs, wheeling and banking, Third Party Sales (TPS) and state specific incentives
Benecke	2008	Installed Capacity	Case Study	India(TN & Kerela) (upto 2008)	Pro activeness of govt, Industry Culture, Power Shortage
Jagadeesh	2000	Installed Capacity	Case Study	India (TN & AP) (Till 1999)	Adequate Regional Power Stations , Production Based Incentives

There have been only three studies conducted on the major central level policies - AD and GBI. A study conducted by CRISIL, (2016) and commissioned by MNRE concludes that the GBI scheme has yielded favourable outcomes for the wind power sector. Over time, it has transitioned effectively from being an incentive tied to investment to a goal focused on outcomes and generation, leading to enhanced wind CUF levels. By the conclusion of 2015-16, the share of GBI-based projects in the total wind project installations experienced a significant increase, rising from 3% in 2010-11 to 30%., accounting for nearly 54% of the total investments.

The process of the implementation of GBI scheme is efficient, straightforward, and entirely web-based, making it effective and time-efficient. However, the study identified that discoms are hesitant in wind power procurement , primarily attributed to their fragile financial condition as the major challenge facing the wind sector. To address this, it recommends the development of suitable mechanisms that support discoms to procure wind power leveraging GBI. This will help in ensuring timely payments . Additionally, the study suggests incentivizing utilities to meet RPO targets. Also a procurement-based incentive should be introduced which willstate utilities wind power's purchasing cost.

The Case Study of AD by Sud et al. (2015)has brought attention to the shortcomings of the scheme concerning long-term generation efficiencies. It emphasizes that the AD was solely connected to the project's initial capital cost, lacks provisions for penalizing underperformance. Another limitation identified was its limited or no applicability to large foreign investors and independent power producers. The benefit of tax depreciation was limited profits generated within India and to entities with profits in the parent business, excluding other potential participants. The study has recommended some key policy lessons such as the importance of linking incentives to performance and the need for monitoring. It also emphasized the need for policies that appeal to all investors and highlighted the significance of wider infrastructure since the grid

infrastructure would not be able to help continued addition to capacity without further investment.

In their study, Shrimali et al. (2017)employed the technique of OLS regression to assess the influence on the generation efficiency of wind power plants of policies of AD and GBI. Approximately 40 wind plants were analyzed, revealing that Wind power plants established through the GBI scheme exhibited an average PLF that surpassed those established under the AD Scheme by at least 3 percentage points. The study's findings are underscored by the consistent impact of policies on PLF.

Based on these results, the study suggests that GBI should be prioritized as a policy option over AD. Alternatively, if AD is to be continued, modifications should be carried out for ensuring accountability of RE project developers and address power plant performance. One proposed modification is to extend the period of AD beyond the present approach where it applies only in the first year. This would promote sustained performance of power plants. Additionally, the study recommends that governments explore a blended policy approach that combines elements of AD and GBI. Such a blended policy would leverage the cost-effectiveness and deployment of AD while capitalizing on the effectiveness in wind power generation of GBI scheme.

Literature on effectiveness of various wind energy policies in India has been analysed and summarized in Table 2.10 below.

Table 2.10 : Analysis of Literature on Effectiveness of Various Wind Energy Policies in India

Themes	Literature	Significant Finding	Inference	Gaps
Effectiveness of Various Wind Energy Policies in India	(Kathuria,2016), (Sud, Sharma, & Kitson,2015), (Panse & Kathuria,2016),(Sangroya & Nayak,2014),(Rao & Kishore ,2009) (Schmid ,2011), (CRISIL,2016)	**Only limited studies** have been carried out to assess the effectiveness of the various policies implemented for the development of wind energy. A composite Policy Index has been created with Indicator of investment primarily been Installed Capacity (as Dependent Variable) and State level Policies like Wheeling Charges, Banking Facility, FIT ,RPOs (as Control Variable) have been tested using Econometric panel data techniques like **FE and RE Modelsas well as** Covariance Decomposition, OLS, Theory of diffusion of innovation, mixed influence diffusion model (Bass model). No study on the impact of auctions has been carried out.All the studies cover a period till 2012. The impact of implementing the EA of 2003 and the Tariff Policy of 2006 has also been empirically tested by Schmid,(2011)	Only State specific policies have been tested ,Panel Data Techniques -FE and RE Models, OLS, Theory of diffusion of innovation, mixed influence diffusion model (Bass model) and Case Study Approach have been used.	Despite the introduction of significant incentives, sudden withdrawals, and subsequent reintroductions, There are restricted quantity of studies available that have comprehensively assessed the effectiveness of Wind Energy Policies in India.

		Based on results, almost all the papers have concluded that favourable policy facilitates deployment of wind energy. Wind power deployment is consistently influenced in a positive manner by the Policy Index, thus affirming the state's important role in fostering the widespread adoption of wind energy.		The sector has experienced fluctuations due to these policy dynamics, emphasizing the need for more extensive research in evaluating the impact and efficacy of such policies.. No study is available of the period 2012 to 2018. In addition , No study is there on the auction mechanism introduced in 2017.

2.3.6 Wind Energy Auctions in India

Since 2017, SECI has conducted 6 rounds of auctions, with bids reaching a record low of Rs 2.43/MW. The shift from FiT to auction-based allocation was made to promote greater competition and more accurate price discovery. However, finding a delicate equilibrium between low prices and financially sustainable projects is crucial, as unprofitable ventures can lead to a decline in wind generation, possibly leading to troubled loans and breached contracts. Also land acquisition and grid integration are major problems in timely completion of already auctioned projects and most of them are behind schedule. Literature on reverse auctions of Wind Energy in India has been analysed and summarized in Table 2.11.

Table 2.11 : Analysis of Literature on Wind Energy Auctions in India

Themes	Literature	Significant Finding	Inference	Gaps
Wind Energy Auctions in India	(Shrimali , Konda , Farooquee & David ,2015),(CRISIL,2017), (Shrimali Nelson, Goel , Konda & Kumar,2012) (Ravindran ,2013), (Kathuria	Since 2017, the SECI has conducted six tranches of auctions, with bids reaching as low as Rs 2.43/MW. The transition from feed-in tariffs to auction-based allocation of wind capacity was introduced with the aim of promoting competition and enhancing price discovery. Nevertheless, it is of utmost importance to strike a balance between achieving low pricing and ensuring the financial sustainability of projects , as projects that are financially	Greater assurance in terms of receivables and certainty regarding prices due to the 25 years PPAs being signed with SECI. However, there is a apprehension that companies may do unviable or underbidding for competing by undercutting rivals to gain a larger market share can pose significant risks. Also low tariffs may lead to consolidation and moving out of smaller	No literature related to shift to auction mechanism and efficacy of the same is available. All inputs drawn are from the Newspaper reports and information available on

	,Ray & Bhangaonkar, 2015), (Spratt , Dong & Krishna , 2014)	unviable may result in reduced wind generation, distressed loans, and breached contracts. Also land acquisition and grid integration are major problems in timely completion of already auctioned projects	players and those for just tax breaks. Also many of projects which were auctioned are behind schedule due to challenges related to grid integration and land acquisition	SECI website and RFPs.

2.4 DISCUSSION AND INFERENCES

The literature on Wind Energy Policy sheds light on the progressive establishment and the formulation of India's Wind Energy Policy and Regulatory Framework. AD policy was initially the most significant and attractive financial incentive. Unfortunately, this policy rewarded the development of capacity over generation, making it like a financial instrument which investors used to avail tax benefits. Due to the lack of subsequent project monitoring, there was insufficient motivation to improve system efficiency and maximize power generation. At its inception, the program provided a full 100% AD advantage for capital equipment investments during the initial year of setup.. However, this percentage was subsequently reduced to 80% and further lowered to 40% in 2016. Since its introduction in 2009, the GBI of Rs 0.50 per KWh, spanning a duration of 4 to 10 years, attracted a broader investor base for FDI and fostered Wind Energy development in India. Unfortunately, this policy has been discontinued since 2017.

To support wind, solar, and other clean energy sources, the Electricity Act of 2003 mandated RPOs for states. Additionally, in 2010, the Indian government introduced the REC, further bolstering the RE sector. But the effective execution of India's RPO policy has remained elusive and market has not

effectively kicked off as no state government has imposed penalties on discoms. States also have different policies with respect to Wheeling, Banking, Inter State Transmission Charges as well as Third Party Sales, Special Additional Duty (SAD) ,Though with considerable variation across states,FiTs Policy was in vogue till 2017 when Government introduced competitive bidding or auctions.

A scarcity of research studies exists that evaluate the efficacy of different policies related to wind energy. Studies by Rajsekhar, B. et al. (1999) and Jagadeesh, (2000b)concluded that during the nascent stage of Wind Energy development in the 1990s, capital incentives such as AD, tax holidays and exemptions from customs and excise duties have played a crucial role in providing the necessary momentum.

Panse and Kathuria, (2016)concluded that state level wind power polices like Banking Facility (Months), Wheeling Charges (% of Energy),FiT(Rs/kWh), RPOs (% of total procurement of power from a utility) exert an impact on the installed capacity of wind power within the state. An increase in the FiT also corresponds to a higher influx of FDI into the state. In addition, Benecke and Elisabeth, (2011)concluded that states having higher energy security are not promoting Wind Energy .

The Case Study of AD by Sud et al. (2015)revealed that scheme was pivotal in fostering the wind energy's growth in India, but it lacked focus on long-term generation efficiencies and had limitations for large IPPs and foreign investors. The study emphasized the importance of linking incentives to performance and monitoring project performance.

CRISIL, (2016)highlights that the GBI scheme has been successful in promoting the growth of the wind power sector by moving from investment-based incentives to outcomes/generation-based objectives. This has increased the CUF of wind power. In addition, the study recommends that utilities be encouraged to meet RPO targets and to assist states in lowering the cost of

buying wind power a procurement-based incentive should be created. In summary, it can be inferred that all policies and incentives have made a positive contribution to the growth and expansion of wind energy in India. Shrimali et al. (2017)reached the conclusion that wind power plants established through the GBI scheme have a higher average Plant Load Factor (PLF) than those established through the AD scheme. As a result, a blended policy that combines AD and GBI has been proposed in the study.

The limited literature on Wind Farm Economics and Financial Mechanisms brings out the necessity of empirically establishing Cost Function to compute the cost of Wind generated electricity and comparing it with price achieved through auctions, thus determining the sustainability of the Industry. Also the in depth study and implications of various financial mechanisms like Private Equity Funding, IPOs ,Green Bonds, , Mezzannine Finance , Debt Repayment by Pooling Wind Farm Assets, Non-Recourse Financing etc. in vogue in India is required.

In addition through Sector Overview, various challenges or barriers to the growth and development of the Wind Energy Sector in the Country have got highlighted. In 1990s, poor installation practices or the phenomenon of 'goldplating', by misusing AD Policy had been the major barrier for development of Wind Energy. In addition, wind turbine technology was also evolving, inadequate power network transmission and distribution., inadequate wind mapping, lack of service and maintenance experts, process of obtaining clearances being intricate and time-consuming and finance were other major hurdles. Currently, the wind power industry in India is encountering a myriad of challenges like low capacity utilization, costly evacuation, inadequate grid infrastructure, difficulties with grid integration, high interest rates, limited availability of debt financing, and poor financial conditions of state-owned utilities. In addition, obtaining land for wind power projects can be time-

consuming and challenging, especially when converting agricultural land to non-agricultural use or obtaining clearance for protected areas.

The uneven distribution of wind resources poses a limitation on wind production and consumption, primarily restricting them to states with abundant wind resources. Furthermore, the development of wind turbines capable of operating effectively in regions with lower wind speeds poses a significant technical challenge. In terms of policy, uncertainty around long-term policies, frequent changes in the incentives and poor implementation of RPOs remain a big challenge.

2.4.1 THEORETICAL PREMISE

- The Behavioural theory of the firm (BTF) is a multifaceted framework .It is based on theories from various fields such as economics, sociology, business administration ,management. It aims to address questions regarding behaviour of firms in the marketplace and the factors that shape inter-firm relationships. Essentially, the BTF is a composite of diverse theories from the fields of business and management that collectively enhance our comprehension of the nature of firms.
- Behavioural Theory of Firm encompasses the following :The Functions of the Executive(Barnard ,1938) , Administrative Behavior**(**Simon ,1947) , Organizations (March & Simon ,1958):,A Behavioral Theory of the Firm (Cyert & March ,1963), ,Models of Bounded Rationality (Simon ,1982). The key concepts of Behavioral Theory of Firm have been summarized in Table 2.12 and literature review related to decision making in firms has been given in Table 2.13

Table 2.12 : Key concepts in Behavioural Theory of the Firm

Key concepts in **Behavioural Theory of the Firm**	Bounded Rationality, Problemistic Search, Coalition or the dominant coalition, Standard Operating Procedures, Slack Search ,Organisational Slack, Satisficing Behaviour, Coalition, Multiple goals , Decision Making Behaviour
A Behavioural Theory of the Firm begins withfour commitments (Barros, 2010; Chand, n.d.; "The Cyert and March Theory of Firm | Firm depends on the demand of the members of the coalition," n.d.)	1. **Concentrate on a limited set of crucial economic choices undertaken by the company**. Initially, these decisions revolved around pricing and output, while later they encompassed internal allocation and market strategy. 2. **Create models of the firm that emphasize processes and procedures**. Initially, these decisions revolved around pricing and output, while later they encompassed internal allocation and market strategy. 3. **Establish strong connections between models of the firm and real-world business organizations by aligning them closely with empirical observations of both decision outputs and process structures**. The models were intended to be grounded in explicit observations of firms while being subject to empirical testing against the actual behaviour of discernible companies. 4. **Formulate a theory that possesses broader applicability beyond the specific firms under examination**.
	• Theory delves into the complex dynamics of decision-making within a sizeable multiproduct organization functioning in an imperfect interests**,** where ownership is separate from management, and uncertainty prevails. In this context, distinct groups within the firm have their own unique goals and demands. • The goals of a firm are contingent upon the demands put forth by its coalition members. These demands, in turn, are shaped by an array of

	factors, including past achievements, expectations, and the performance of other groups within the same or competing firms. As time progresses, the demands of different coalition groups continuously evolve. Since the resources available to the firm at any given point are limited, not all demands can be met by top management. Therefore, a persistent bargaining process occurs among the various coalition members, leading to inevitable conflict. • market.. According to this perspective, the firm can be perceived as a coalition of groups comprising diverse and occasionally conflicting • **The decision-making process entailed in carrying out the management's established objectives (Goals of the Firm: Satisficing Behaviour)** • The objectives of a firm, as well as those of individual members or specific coalition groups, are framed as aspiration levels rather than rigid maximization constraints. According to behavioural theories, The core objective of a firm is to attain a commendable overall performance, guided by the defined aspirational goals and not exclusively focusing on maximizing profits, sales, or other metrics. This perspective portrays a firm as a satisficing organization, prioritizing a balanced approach rather than solely pursuing maximum gains like a maximizing entrepreneur. The Simon gave concept of 'bounded rationality' to explain the satisficing behaviour of large corporations in the behavioural theory.
	• This theory explicitly recognizes that in the present business landscape, top management assumes the role of fulfilling the entrepreneurial function, consisting of individuals with time constraints, not clear information, and limited computational abilities. Consequently, it becomes impractical for them to assess all possible options and select the one that maximizes profits or any other desired outcome. Instead, they

	narrow down their focus to a few alternatives and choose the 'best' option within the confines of their constrained resources and consequently operate with 'bounded rationality'. • **Uncertainty and the Environment of the Firm** o They differentiate between market uncertainty and uncertainty related to competitors' reactions. o Market uncertainty pertains to the potential for shifts in customer preferences or alterations in production methods, which are inherent in any market structure. While search activities and information-gathering can alleviate some of this uncertainty, it cannot be entirely eliminated. In light of market uncertainty, managerial firms tend to avoid long-term planning and instead focus on the short-term. As per the behavioural theory, a firm only considers the immediate future and neglects the long-term repercussions of short-term decisions. Uncertainty coming up from competitors' actions and reactions, known as oligopolistic interdependence, by positing that incumbent firms have established a type of implicit collusion. The firm is believed to 'negotiate' with its competitors in some way to mitigate uncertainty. o The short-term perspective put forth in one aspect of the theory is inconsistent with investment decisions, which inherently require long-term considerations and must factor in anticipated future demand and competitors' responses.
The Functions of the Executive (Barnard, 1938)	**Organization's indispensable function** includes facilitating communication, fostering cohesiveness, preserving the stability of authority, promoting independent decision-making ,sense of personal integrity and self-respect. Barnard, (1938)argues that effective collaboration within or through formal organizations is not the typical state, but rather an uncommon occurrence.

	Informal Organization. According to Barnard, informal organizations serve as a mechanism to preserve an individual's personality in the face of certain impacts of formal organizations that can cause personality fragmentation. **Incentives**. Barnard (1938) notes that incentives play a critical role in formal organizations, and insufficient incentives can result in dissolution, unwarranted shifts in organizational objectives, or breakdowns in cooperation. Incentives can take various forms, including material inducements, personal benefits, nonmaterial inducements such as recognition, status, and personal influence, as well as desirable working conditions or idealized gains. **Authority**. In a formal organization, authority refers to the quality of a communication or directive that leads a recipient to accept and follow such instructions.According to Barnard (1938) ,within each individual, there exists a spectrum of behaviour wherein orders are acquiesced to without deliberate scrutiny of their authority. This spectrum is commonly referred to as the "zone of indifference."He argues that using authority correctly can help maintain morale, develop competence, and preserve the authority itself. He presented a holistic perspective on the organization, conceptualizing it as a dynamic system comprising various elements. He introduced a psychological theory that elucidates the intricacies of motivation and behaviour, a sociological theory that underscores the significance of intricate interconnections and cooperation, and an ideology that ardently advocates for meritocracy. Together, these components form a comprehensive framework for understanding and analyzing organizational dynamics.
Administrative Behaviour (H. A. Simon, 1947)	◆ Simon contends that decision-making serves as the core facet of an organization, asserting that it should be grounded in the principles and psychology of social choice. He highlights three pivotal roles undertaken by the organization to underscore his argument:

	• Organizations shape and influence individuals' habits, moulding their behaviours and routines. • Organizations serve as avenues for wielding authority and exerting influence over others, providing a structured framework for power dynamics. • Organizations wield substantial influence over the communication flow, influencing the dissemination and exchange of information within their realms. ◆ Organizational behaviour is the theory of intended and bounded rationality. ◆ Organizations facilitate stable and predictable expectations among their members, ensuring a sense of order and understanding within the group. ◆ Within organizations, members often engage in a decision-making process known as "satisficing," where they aim for satisfactory outcomes rather than optimal ones. This approach involves utilizing simple rules of thumb or organizational routines as guiding principles for decision-making. They represent established patterns of behaviour and decision-making within the organizational context.
	◆ **Simon proposed several mechanisms of organizational influence which include:** • Division of work among members • Establishment of standard operating procedures • Transmission of decisions through authority • Provision of formal and informal communication channels • Training and development of members to promote certain values and behaviours**.**
Organizations (March & Simon, 1958)	**March and Simon, (1958) behavioural model consists of the following essential steps:**

	• As the individual's satisfaction declines, they will engage in a greater search for alternative programs. • With increased search efforts, the anticipated value of the reward correspondingly increases. • As the anticipated value of the reward rises, the individual's satisfaction also increases. • As the anticipated reward's value increases, the individual's aspiration level also elevates. • As level of aspiration rises, the individual's satisfaction decreases. **Organizational Rewards**. They argue that a decision-making model that does not account for economic incentives is not an effective predictor for most humans. According to their assertion, an organization that rewards seniority in its promotion scheme will exhibit lower productivity compared to one that links promotion to a measure of productivity. **Conflict in Organizations by a Bargaining Outcome**. In its original form, game theory was not significantly superior to neoclassical economic theory in accurately forecasting the result of a negotiation scenario. However, Game theory furnished a framework for identifying a multitude of potential outcomes. **Performance Programs**. They suggest that in some situations, the search and decision-making processes are truncated. In extreme cases, an external stimulus can trigger a sophisticated and structured set of responses from the organization without delay. This set of responses is known as a performance program. **Communication and Coordination**. Improving the efficiency of communication is a key strategy to enhance an organization's tolerance for interdependence. One effective method for achieving this is to develop systems that allow the transmission of vast amounts of information using fewer symbols.

	Organization Structure and the Boundaries of Rationality. They propose that due to the inherent limitations of human cognitive abilities, rational behaviour necessitates the utilization of simplified models. This is particularly crucial when addressing the intricate problems encountered by individuals and organizations. By employing these simplified models, essential problem features can be captured while disregarding excessive complexities, enabling a more manageable and effective decision-making process.
Organizations (March & Simon, 1958)	These simplifications are characterized by several key features: • Instead of optimizing, decision-makers aim to satisfice, meaning they choose an option that is satisfactory rather than trying to find the best possible solution. • Alternatives and consequences are discovered through sequential search processes. • Organizations and individuals develop repertoires of action programs, which serve as the alternatives of choice for recurring situations. • In structure of organizations, action programs can be implemented semi-independently, exhibiting loose coupling among them. This approach, focusing on addressing one thing at a time, is vital for fostering adaptive behaviour within organizations. It allows for flexibility and agility in navigating dynamic environments, contributing to the overall effectiveness of the organizational structure.The structure of an organization encompasses the relatively stable aspects of behaviour patterns that change slowly over time. March and Simon , (1958) propose that if behaviour within organizations is intentionally rational, then there should be aspects of consistent behaviour that either reflect adjustments to relatively stable environmental factors or are controlled by learning programs in the adaptation process.. According to them, much of an

	organization's inertia can be attributed to sunk costs, which include both economic and psychological factors. •
	In the period of 1947-1958, the development of management theory progressed from Simon's work in 1947 to March and Simon's work in 1958. Compared to Simon's earlier work, March and Simon's theory offers a profound insight into the challenges organizations face when dealing with environments of varying complexities. It highlights the importance of adapting internal decision-making processes to account for these variations. In certain environments, the level of complexity becomes overwhelming for organizations to handle unless they impose constraints on the amount of information they process. This recognition underscores the significance of balancing information overload with the need for efficient and effective decision-making within organizational contexts.
A Behavioural Theory of the Firm (March & Cyert, 1963)	◆ **Four research commitments:** – Concentrate on a limited number of critical economic decisions undertaken by the company;e – Construct models of the firm that emphasize the process; – Forge a strong connection between the firm models and empirical observations; – Develop theories with wider applicability beyond the firms being studied. ◆ **March and Cyert ,(1963) propose two major organizing devices**: ◆ **A set of variable concepts** : organizational goals, organizational expectations, organizational choice, and organizational control. ◆ **A set of relational concepts**.: Quasi Resolution of Conflict; Uncertainty Avoidance; Problemistic Search; and Organizational Learning

A Behavioural Theory of the Firm (March & Cyert, 1963)	◆ Organizations are perceived as comprising multiple coalitions, and the management's responsibility lies in attaining a **Quasi-Resolution of Conflict and Uncertainty Avoidance**. In this context, when a problem arises or an existing routine is absent, the pursuit of a solution through **Problemistic Search** is often regarded as motivated, characterized by simplicity, and influenced by biases. These biases can reflect unresolved conflicts within the organization, shaping the decision-making process.
Organizations (March & Simon, 1958)	These simplifications are characterized by several key features: • Instead of optimizing, decision-makers aim to satisfice, meaning they choose an option that is satisfactory rather than trying to find the best possible solution. • Alternatives and consequences are discovered through sequential search processes. • Organizations and individuals develop repertoires of action programs, which serve as the alternatives of choice for recurring situations. • In structure of organizations, action programs can be implemented semi-independently, exhibiting loose coupling among them. This approach, focusing on addressing one thing at a time, is vital for fostering adaptive behaviour within organizations. It allows for flexibility and agility in navigating dynamic environments, contributing to the overall effectiveness of the organizational structure.The structure of an organization encompasses the relatively stable aspects of behaviour patterns that change slowly over time. March and Simon , (1958) propose that if behaviour within organizations is intentionally rational, then there should be elements of stable behaviour that either represent adaptations to relatively stable environmental factors or do thelearning programs govern the process of adaptation. According to them, much of an organization's inertia can be attributed to sunk costs, which include both economic and psychological factors.

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A behavioural Theory of the Firm(March & Cyert, 1963)	◆ **Four research commitments:** – Concentrate on a select set of crucial economic choices made by the company.; – Construct models of the firm that emphasize the process; – Establish a close relationship between the models of the firm and empirical observations; – Develop theories with wider applicability beyond the firms being studied. ◆ **March and Cyert ,(1963) propose two major organizing devices**: ◆ **A set of variable concepts** : organizational goals, organizational expectations, organizational choice, and organizational control. ◆ **A set of relational concepts**.: Quasi Resolution of Conflict; Uncertainty Avoidance; Problemistic Search; and Organizational Learning
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	simplicity, and influenced by biases. These biases can reflect unresolved conflicts within the organization, shaping the decision-making process.
Models of Bounded Rationality (Herbert. A. Simon, 1990)	**Theory of Bounded Rationality**. ➢ Simon,(1990) posits that rationality, in its conventional definition within the social sciences, pertains to behaviour that aligns with achieving specific objectives while operating within the limitations of certain constraints. Theories suggesting substantial constraints stemming from individuals' limitations as information processors fall into the category of bounded rationality theories. ➢ A decision-making process based on satisficing can often be transformed into an optimizing procedure by implementing a guideline for the ideal search duration or, equivalently, a rule for setting the aspiration level optimally. **From Substantive to Procedural Rationality**. ➢ Simon ,(1990) introduces the terms "substantive rationality" and "procedural rationality" to distinguish between the concepts of rationality in economics and psychology, respectively. Substantive rationality pertains to behaviour that aligns with achieving specific goals while operating within given constraints. Significantly, according to this definition, the rationality of behaviour depends solely on the actors with respect to their objectives. Beyond that, rational behaviour is entirely shaped by the characteristics of the environment within which it manifests, given these goals. ◆ **Substantive Rationality**: ➢ Refers to behaviour that is appropriate for achieving given goals within the constraints of the situation. ➢ In the economic perspective, rational behaviour is exclusively influenced by the characteristics of the environment. ➢ once goals have been established..

	◆ **Procedural Rationality**: ➢ Focuses on finding efficient computational procedures for solving problems, as seen in the traveling-salesman problem in operations research. ➢ This search for better heuristics is considered by Simon to be the essence of intelligence.

Table 2.13 : Literature Review related to Decision Making During Auctions

Literature	Key Points/ Inference
(Milgrom & Weber, 1982) (Capen, Clapp, & Campbell, 1971), (Bowman & Moskowitz, 2001) ,(Walsh, 1995),(Oren & Williams, 1975), (Tversky & Kahneman, 1974)(Sunil Sharma, 2015)	• Bidding decisions involve high levels of uncertainty and risk. Companies are advised to conduct both strategic and financial analyses to inform their decisions. The financial analysis should take into account all known cost factors, while the strategic analysis should focus on assessing potential uncertainties.(Bowman & Moskowitz, 2001). • Under conditions of high uncertainty, managers have been known to consider fewer options and prefer heuristics(Walsh, 1995). • In situations where the ultimate value of the bid is uncertain, the winning bidder commonly assigns a higher value to the prize than it might actually be worth. Hence, in any bidding scenario, the company that wins the bid is more likely to be the one that overestimates the true worth of the object to be acquired, while losing bids for objects it undervalues. (Oren & Williams, 1975). • Organizational decisions in such situations are likely to be prone to biases (Tversky & Kahneman, 1974). Bidders who make impartial estimates of asset value are more likely to be unsatisfied with the value of what they acquire, particularly if the competition is intense. This is because they will tend to win auctions in which their estimate was too optimistic and lose those in which it was too pessimistic.

	• A bidder must treat his estimate as more optimistic upon learning that his bid won does not depend upon significant assumptions about symmetry, estimating biases , bidding strategies or auction type(Oren & Williams, 1975). • The literature highlights that the bidding decisions are highly uncertain and risky in nature .The final bid is based on the collective assessment of techno-economic factors ,operational capabilities, fiscal commitments Strategic consideration ,Competitor analysis and consideration of various kinds uncertainties cognitively by the bidders.

2.5 GAPS IN THEOROTICAL PREMISE

- The existing literature has paid minimal focus to the influence of the environment on theoutput decisions and pricing, goal-setting process ,as well as the threat posed by potential new entrants and regulatory requirements.
- Impact of Routines which have been adopted for uncertainty avoidance in the Decision Making process is required to be further studied.
- The impact of satisficing behaviour and bounded rationality in decision making adopted in uncertain conditions needs to be studied.
- Further studies can examine and identify the various intra organizational as well as external factor impacting the decision making behaviour of the firm.

2.6 CONSOLIDATED GAPS FROM THE LITERATURE REVIEW

Table 2.14 brings out the consolidated gaps from the literature review.

Table 2.14 : Consolidated gaps from the Literature Review

Theme	Gaps
Wind Energy Scenario in the World	Requirement for a detailed country specific studies on the development, challenges and barriers in wind energy development. Also ,no comparative analysis of effect of similar policies on the growth of wind energy in two different countries has been carried out.
Wind Energy Scenario in the India and Challenges and Barriers to development of Wind Energy in India	The majority of the studies have concentrated on providing a Sector Overview, which includes a thorough examination of the historical progress, government policies and incentives implemented, as well as the obstacles and barriers encountered in the expansion of wind energy in India. No detailed analysis of policies and barriers has been carried out.
Policies and Incentives for the development of Wind Energy in India	Policies wereintroduced, amended and removed constantly however no literature is available on the reasons for the changes in these policies.
Effectiveness of various Renewable Energy (RE) Policies in India and World	Renewable Energy Policies as a whole have been tested and policies related Wind and Solar have not been tested separately.

Effectiveness of Various Wind Energy Policies in India	While the wind energy sector in India has experienced notable incentives, abrupt withdrawals, and subsequent reinstatements, there has been a limited number of studies evaluating the efficacy of wind energy policies in the nation. No study is available of the period 2012 to 2018. In addition, No study is there on the auction mechanism introduced in 2017.
Wind Energy Auctions in India	No literature related to shift to auction mechanism and efficacy of the same for wind energy in India is available. All inputs drawn are from the Newspaper reports and information available on SECI website and RFPs. The types of Uncertainties faced by firms during the auction process are not known as well as factors considered by firms during the bidding are also not identified
Theoretical Premise	• The existing literature has paid scant attention to how the environment impacts the goal-setting process, as well as pricing and output decisions, and does not address the potential threat from new entrants and the regulatory procedures they face. • Impact of routines which have been adopted for uncertainty avoidance in the decision making process is required to be further studied. • Impact of satisficing behaviour and bounded rationality in decision making adopted in uncertain conditions needs to be studied. • Further studies can examine and identify the various intra organizational as well as external factors impacting the decision making behaviour of the firm.

2.7 CONCLUDING REMARKS

Literature review has been conducted to comprehend the development, expansion, barriers faced by the wind energy sector in India, and the present state of research on the subject. The review covers the historical development of India's wind energy sector, the influence of various government policies on its expansion, the obstacles and barriers obstructing its advancement, and the status along with the challenges associated with wind energy e-reverse auctions. The review also identifies and examines theoretical foundations, highlighting literature gaps. Consequently, this comprehensive review serves as the foundation for the initial conceptual constructs discussed in the subsequent chapter. Next chapter discusses research design & research methodology followed in this study.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1. INTRODUCTION

This chapter gives detailed explanation of the research design and methodology employed in the conducted study, providing a comprehensive overview of the approach taken in the research. The research design creates a coherent link between the empirical data, the initial research inquiries, and, ultimately, the conclusions derived from the research investigation. It outlines the systematic approach taken to ensure a coherent and meaningful progression from data collection to the final outcomes of the study (Yin, 2003). It focuses on different scientific paradigms, scientific methodologies, research approaches, methods, strategies, and data collection techniques. Following this, in section 3.2, the research problem, research questions, and research objectives are introduced.

Section 3.3 discusses the quantitative and qualitative research methodology and offers insight into the reasoning and methodology that guided the choice of the research strategy used to tackle the research questions. Additionally, it delves into the specific methods employed in conducting the research and outlines the data analysis strategy.

Section 3.4 discusses research methodology for Research Objective 1 including data sources. Section 3.5 explains research methodology for Research Objective 2 encompassing the discussions on the data collection methods utilized, the data analysis strategy employed, and examines the utilization of the Data Collection Protocol (DCP) during the data collection process. Furthermore, it presents the complete protocol document that was used in this research study. Section 3.6 delves into the quality of empirical research, focusing on four tests that are pertinent to qualitative research methods, namely construct validity, internal validity, external validity, and reliability, as outlined by Yin, (2003). Following this discussion, the text concludes with section 3.7.

3.2 RESEARCH PROBLEM, RESEARCH QUESTION AND RESEARCH OBJECTIVES

Based on literature review carried out in previous chapter ,Research Problem, Research Question and Research Objectives have been identified and are discussed below

3.2.1 Research Problem

Although the Wind Energy Auctions have started since 2017, the type of uncertainties faced by firms and their responses during the decision making process of bidding in Wind Energy Auctions is not knownAdditionally, there is insufficient understanding regarding the factors that firms take into account when placing bids.

3.2.2 Research Questions

RQ1: Have the various State Polices for Development of Wind Energy Industry in India been Effective?

RQ 2(a): What has been the role of Central government policies of AD and GBI in the development of Wind Energy in India?

RQ 2(b): What are the various uncertainties faced by firms and their response in the Decision making process for Bidding in Wind Energy Auctions in India ? What are the factors considered in making Bidding decisions in Wind Energy Auctions?

3.2.3 Research Objectives:

RO1 (a) : To assess the effectiveness of state level policies in development of wind energy in 7 select Indian states.

RO2 (a): To assess the effectiveness of Central Government Policies of AD and GBI in development of wind energy in India

RO2(b): To identify the uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions and identify the factors considered in the same.

3.3 RESEARCH METHODOLOGY

Social science research encompasses various categorizations of research methods. Among them, two primary research methodologies are commonly distinguished: Quantitative Research and Qualitative Research. Quantitative research is generally employed to verify or test a theory or hypothesis, whereas qualitative research is utilized to comprehend concepts, thoughts, and experiences. Quantitative data provides an overview, while qualitative data adds specifics and can lend a human element to survey findings. Both the research methodologies have been discussed in detail ahead

3.3.1 Quantitative Research Methodology

The use of "Quantitative" research methods is suitable when the research question necessitates "factual" data, and variables can be clearly defined and isolated. Additionally, Quantitative methods are often favoured when it is possible to establish links between variables to formulate hypotheses before collecting data. They are particularly suitable for investigating well-defined, precise, and unambiguous questions or problems. This preference arises from the ability of quantitative approaches to provide structured and numerical data, facilitating rigorous analysis and statistical inference.(Hammarberg, Kirkman, & Lacey, 2016). The quantitative method commences with a theory's test, followed by the identification of relationships among variables, and ultimately formulates them in the form of questions/hypotheses. This approach utilizes tools like surveys and experiments to gain an understanding of natural phenomena in research within the field of natural sciences.

The quantitative approach involves utilization of data that can be converted into statistical information or numerical data to outline the problem. Within this method, the analysis focuses on defined variables, such as attitudes, opinions, and behaviours, within a broader sample population in order to derive conclusive results. It relies on quantifiable data to establish factual evidence and identify

various research patterns. Quantitative research often utilizes structured data collection methods such as systematic observations, paper surveys, mobile surveys, online polls, face-to-face interviews, telephone interviews, longitudinal studies, website interceptors, online surveys and kiosk surveys (Carol, 2016)**.**

3.3.2 Qualitative Research Methodology

"Qualitative" methods are utilized to explore questions pertaining to experience, meaning, and perspective, frequently from the viewpoint of the participants involved. These types of data are typically not easily quantifiable or measurable. These techniques encompass "small-group discussions" to delve into beliefs, attitudes, and normative behavioural concepts. "Semi-structured interviews" are employed to collect opinions on specific topics or in the context of key informants, it serves the purpose of acquiring fundamental information or institutional viewpoints. "In-depth interviews" are utilized to gain valuable insights into an experience, event or condition from an individual perspective. Lastly, "analysis of texts and documents," such as reports of government in media or websites,, is conducted to extract information about publicly available or personal knowledge(Hammarberg et al., 2016).By delving deeper into issues, the qualitative approach enables analysis to uncover fresh perspectives and individual viewpoints(Carol, 2016)**.**

Case study research, action research, and ethnography are examples of qualitative research methods (Ritchie & Lewis, 2003). Qualitative researchers have a distinct focus on understanding the context of the research problem and the participants' settings. This necessitates researchers personally gathering information by immersing themselves in the problem context. By doing so, they can draw upon their findings and their own experiences and backgrounds to make interpretations. The researchers' expertise and background aid in organizing these interpretations(Denzin & Lincoln, 2005). This method enables researchers to thoroughly examine the problem by understanding the perspectives of individuals and the social and cultural context in which they

exist. It provides a deeper understanding of the problem by considering the nuances and intricacies of the people and their environment(Myers, 1997).

In this methodology, the research problem is explored by analyzing patterns and relationships within dialogue, archival documents, workplace diagrams, and other relevant sources. A key strength of qualitative research lies in its inductive approach, which allows for a deeper understanding of specific circumstances or individuals. This method places emphasis on the richness of words and narratives, rather than relying solely on numerical data (Maxwell, 1996).

3.4 DETAILED RESEARCH METHODOLOGY FOR RESEARCH QUESTION 1

3.4.1 RQ1 :Have the various State Polices for Development of Wind Energy Industry in India been Effective?

The research question is descriptive and relationship based therefore quantitative research method has been chosen as under in Table 3.1:-

Table 3.1 : Research Objective - 1

Research Objective-1	**To assess the effectiveness of state level policies in development of wind energy in select 7 Indian states for 16 Years (2003 to 2018).**
Research Type	Descriptive
Research Approaches	Quantitative
Data Type	Secondary
Data Sources	MNRE, SERC, IREDA,News Reports, IWTMA,CWET,NIWE,Niti Ayog,
Variables	**Dependent Variable** • Annual Installation of wind energy **Control Variable** State has RPO Incentive(**RPO**) , State has FIT Incentive(**FIT**) ,Banking(**Bank**),Wheeling(**Wheel**),State allows Third Party Sales(**TPS**),Per Capita GDP of States (**GDP**),Annual Population of states (in Lakhs) (**Pop**),Gross potential of wind energy in every state(**WP**)
Sample Size	• 15 Years Historical data(2003-2018) • 7 Windy States(Rajasthan, Gujarat, Tamil Nadu, Maharashtra, MP, Karnataka)
Research Tool	Econometric Modelling Techniques will be used

3.4.2 Data and Research Methodology

The research utilizes annual data from 2003 to 2018, encompassing a period of analysis for seven Indian states. It employs panel data methods to assess and estimate the impact of different policy variableson installation capacity of wind energy in the Indian states has been employed. The panel regression technique allows us to control for the heterogeneity across the states due to the diverse socioeconomic conditions. We estimate the following equation using the fixed effects (FE) regression method.

$$Y_{it} = \alpha_i + \beta X_{it} + + \gamma Z_{it} + \varepsilon_{it} \quad (1)$$

where, Y_{it} representsthe cumulative installed capacity of wind energy in India in a given year.,X_{it} represents the policy variables namely, RPO, FiT, wheeling charge and energy banking facility , it also includes the control variables such as per capita income and the level of industrialization (measured through the manufacturing share) in the respective states. α_i is the differential intercept term which captures the heterogeneity across the states and ε_{it} is the random error term.

The FE model eliminates the time-invariant state specific factors. The heterogeneity across the states are captured by the differential intercept term. As a test of robustness, we use alternative estimation methods such as FGLS method, FE regression with PCSE and D-K standard errors. Cross-sectional dependence (CD) is a major problem in panel datasets. Typically, The spatial correlation in panel model disturbances arises from unobserved common factors. Overlooking cross-sectional correlation when estimating panel models can result in significantly biased statistical outcomes. In order to assess the presence of cross-sectional dependence in our dataset, we utilize the CD test. The null hypothesis of the CD test posits that the residuals exhibit no cross-sectional correlation, while the alternative hypothesis assumes the presence of spatial dependence (Pesaran, 2004). The use of D-K standard errors is highly suitable in the presence of cross-sectional dependence.

The standard errors employed in this analysis are robust to heteroscedasticity and capable of accommodating various cross-sectional and temporal dependence patterns. This flexibility is particularly advantageous when dealing with an expanded time dimension.. (John C. Driscoll & Kraay, 1998).

The FGLS method enables estimation when AR(1) autocorrelation exists within panels, as well as cross-sectional correlation and heteroskedasticity across panels. Since our dataset consists of 7 panels and 16 years (the time dimension

exceeds the number of cross-sections) and are balanced panels, the FGLS and PCSE are expected to produce consistent estimates.We have obtained the data from various Central and State government websites and reports. The precise definitions of the variables and the data source are given in Table 3.2 .

Table 3.2: Definition of Variables

Variable	**Definition**	**Data Source**
FiT	FiT rate denotes the specific price at which electricity generated from wind power can be sold by an operator. State Electricity Regulatory Commissions (SERCs) determine a levelized tariff by estimating the cost of power generation and accounting for annual escalation throughout the plant's lifespan. Subsequently, they extend long-term contracts to WPDs.(Jethani, 2016b; Panse & Kathuria, 2016). The FiT rates in effect before implementation of auctions in the fiscal year 2016-17ranged from Rs 3.82 to Rs 5.76.(Jethani, 2016b). FiTs prevalent in the states yearwise were identified and taken for computation.	Own Compilation from various Central and State Govt websites.
Energy Banking	Energy banking is an important factor as it provides the wind energy developers a mechanism to utilize their excess generation and avail financial benefits. With this provision, Captive wind power generators possess the authority to sell any excess power they generate to discoms. Within the designated banking period, WPDs can inject the electricity generated by their windmills into the state grid while concurrently drawing power for their own captive consumption.(Vijayakumar, 2020). Typically, any surplus electricity generated by the Wind	

	Energy Generator is integrated into the grid. WEGs can then use the remaining units at their convenience within the next 12 months by drawing it from the grid. Energy banking policies vary significantly between different states. Across different states, varying regulations exist regarding energy banking. In specific states, energy banking is allowed year-round without any limitations on the amount of power that can be stored.	
Energy Banking	However, in other states, certain limitations exist regarding the quantity and duration for which energy can be banked. It is important to mention that certain states prohibit energy banking altogether under their regulations(Panse & Kathuria, 2016). Banking has been taken as Dummy variable with the year in which the Policy was present in the state has been taken as 1 and when policy was not there taken as 0.	
Wheeling Charge	The wheeling charge represents the expenses borne by the energy producer for transmitting power to the designated utility. Usually, these costs are represented as a percentage of the overall energy transmitted. In certain states, there may also be additional charges levied for transmission losses that occur during the energy transmission process. There is also considerable variation in the wheeling charges applied across the states. This variable has also been taken as dummy	

RPO	RPO is a mechanism that imposes a requirement on entities to secure a specific percentage of their electricity from RE sources . This percentage is determined based on the total amount of electricity consumed by these entities. This requirement was established as part of the EA 2003 and the National Tariff Policy 2006(MNRE, n.d.) .RPOs are divided into two categories: Solar and Non-Solar RPOs. While some states have established RPO targets, poor enforcement has hindered the effective implementation of this mechanism. (Bayar, 2013b). In order to achieve stricter enforcement of RPOs, the MNRE established the RPO Monitoring Cell in 2018, and the Ministry of Power (MoP) has established RPO trajectory targets through the year 2022(Vartika, 2018) .	
Installed Wind Capacity	It pertains to the cumulative capacity of wind power generation. that has been established or deployed within a specific region or system. It represents the maximum potential output of electricity that can be generated by wind turbines in respective states in MW.	(IWTMA, 2021; NIWE, 2015)
Per Capita Income	Gross state domestic product (GSDP) per capita. It is an indicator of economic development and measures the market size.	(RBI, 2020b)

Manufacturing Share	Manufacturing share in GSDP.	Handbook of Statistics on Indian States by RBI (RBI, 2020a)

3.5 DETAILED RESEARCH METHODOLOGY FOR RESEARCH QUESTION 2

During the research process, the researcher identifies a practical problem and then conducts a systematic study to fully explore and understand its nature (Creswell, 2009; Maxwell, 1996). The research questions and research design are formulated with the purpose of systematically comprehending the problem under investigation. Subsequently, existing theories pertinent to the problem statement are examined and incorporated through a theory development methodology. Derived from established theory, a "conceptual framework" is formulated to scrutinize the issue at hand. The empirical research design and data analysis approach are subsequently crafted, guided by this conceptual framework and the research questions. Following this, data collection commences, adhering to the prescribed methodology delineated in the research study.The collected data is analyzed using the conceptual lens framework, and the outcomes of the data analysis constitute the findings of the research study. These findings have the potential to extend existing theory and contribute to a better understanding of the problem, ultimately leading to the formulation of specific recommendations.

This study utilizes a qualitative approach to examine and analyze the gathered data. The analysis is facilitated by utilizing Nvivo software, which aids in organizing, categorizing, and drawing insights from the qualitative data. Research Methodology is described as under in **Fig 3.1**.

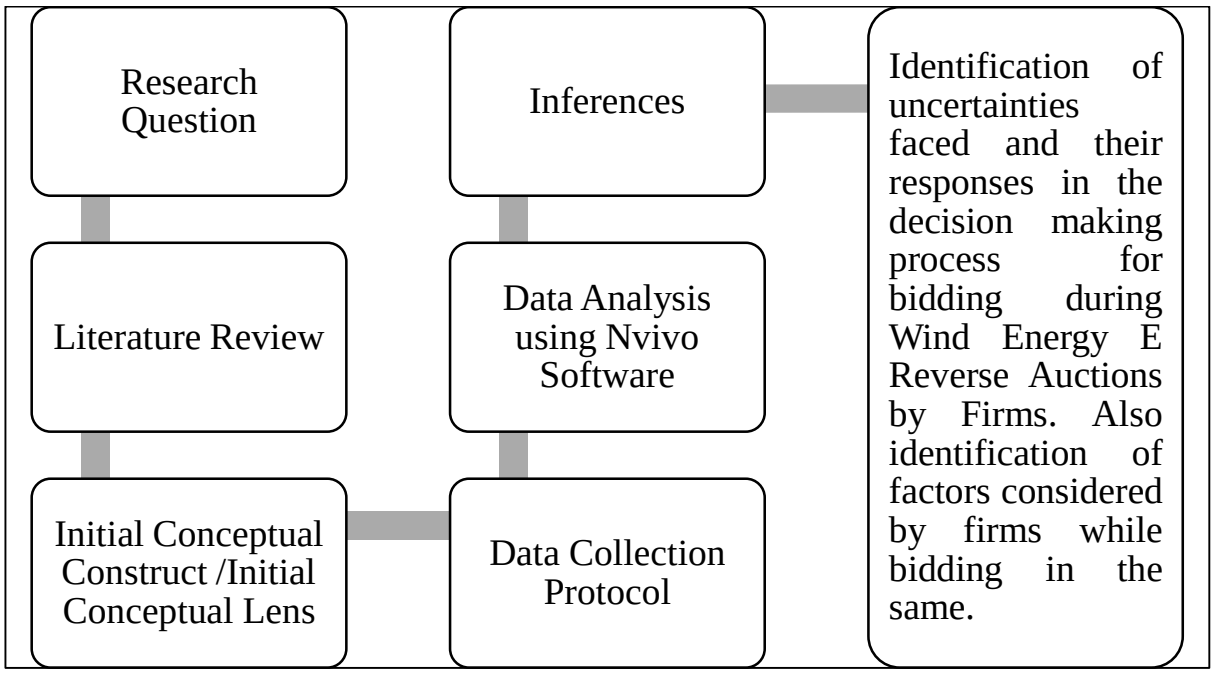

Figure 3.1 : Research Methodology for Qualitative Study

(Source :(Creswell, 2009; Maxwell, 1996; Yin, 2003)**)**

3.5.1 RQ 2(a): What has been the role of Central government policies of AD and GBI in the development of Wind Energy in India?

The research questions in this study are of an exploratory nature, Hence, the qualitative research method has been selected as the appropriate approach (Maxwell, 1996; Yin, 2003).The research Objective 2(a) has been described in Table 3.3

Table 3.3 : Research Objective 2(a)

Research Objective-2(a)	**To assess the effectiveness of Central Polices of AD and GBI in the growth of Wind Energy in India**
Research Purpose	To understand and assess the effectiveness of Central Polices of AD and GBI in the growth of Wind Energy in India.
Research Type	Descriptive
Research Approaches	Qualitative
Data Type	Primary and Secondary
Data Sources	Semi Structured Interviews, , MNRE, SERC, IREDA, News Reports, IWTMA, Niti Ayog, SECI
Sample Size	Top Management and Business Development personnel from various firms which have on Wind Auctions like Adani Green, JSW, , Aayana, Suzlon, Sembcorp. In addition journalists working in field of RE and SECI officials
Research Tool	**Qualitative**

3.5.2 RQ 2(b): What are the various uncertainties faced by firms and their response in the Decision Making process for Bidding in Wind Energy Auctions in India ? What are the factors considered in making Bidding decisions in Wind Energy Auctions?

Research questions are exploratory in nature (Maxwell, 1996; Yin, 2003), therefore the Qualitative research method has been chosen for this study. Research Objective 2(b) has been described in Table 3.4

Table 3.4 : Research Objective 2(b)

Research Objective-2(b)	To identify the uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions and identify the factors considered in the same
Research Purpose	To understand the uncertainties faced and their responses in the decision making process for bidding during Wind Energy Auctions by Firms. The study also sought to identify the factors considered by firms while bidding in Auctions.
Research Type	Descriptive
Research Approaches	Qualitative
Data Type	Primary and Secondary
Data Sources	Semi Structured Interviews, Company Reports, MNRE, SERC, IREDA, News Reports, IWTMA, Niti Ayog,
Sample Size	Top Management and Business Development personnel from various firms which have on Wind Auctions like Adani Green, JSW, , Arayana, Suzlon, Sembcorp. In addition journalists working in field of RE and SECI officials
Research Tool	**Qualitative**

3.5.3 Initial Conceptual Construct/ Initial Conceptual Lens

Initial Conceptual Constructs were identified through Literature Review and are described in **Table 3.5** as under.

Table 3.5 : Initial Conceptual Construct

Constructs	Inference	Sub Constructs
AD	AD is a tax-saving scheme that, as an accounting concept, increasing the depreciation of assets during the early years of their useful life. This approach was deemed appropriate during the early phases of wind power development, when the technology was in its infancy and confronted substantial uncertainties. Nevertheless, it inadvertently cultivated a culture where investors could enjoy substantial benefits while taking minimal risks. Many investors misused the scheme, making investment decisions for wind-power plants at short notice solely to avail of tax breaks. As a consequence, there was a rush in the installation of wind power plants, which resulted in compromised quality and performance. Additionally, ineffective wind installations obstructed potential sites with favourable wind conditions. In order to address these issues, the initial AD scheme was modified to 80% in 2002 and eventually phased out completely by April 1, 2012. Subsequently, the AD scheme was reinstated in 2014, albeit with reduced depreciation rates of 40% for projects commissioned after March 2017(CRISIL, 2017a; IRENA-GWEC, 2012; Rajsekhar et al., 1999).	• Tax Benefit • Early stages of Wind Industry • Poor Installations • Misutilization of scheme
Tariff Revision and Renegotiation of PPAs	These actions have adversely affected investor confidence and underscore insufficient coordination between the state and central governments . Similarly, the Gujarat government cancelled and reissued several tenders due to high tariffs cited in bids, and directed	• Insufficient coordination between states ,MNRE and SECI has been observed. There is a

	developers to lower their tariffs in bids, subsequently failing to allocate projects to those who complied(Chandrasekaran, 2019b; Saurabh, 2019; K. Singh, 2019).	lack of binding directives from MNRE to the states. • Cancellation of auctions due to high tariff bids/ directions by states for reducing tariffs.
Discoms in Duress	A significant number of state power distribution companies (Discoms) are grappling with a considerable debt burden, which compels them to curtail their electricity purchases and struggle to fulfill their RPOs. Additionally, they frequently delay payments to WPDs, resulting in substantial outstanding dues that can range from 3 to 18 months. This precarious financial situation of the WPDs is compounded by the need to cover ongoing operational expenses while also servicing their debts, including interest payments(Sood, Bhansali, & Rao, 2019).	• Debt Ridden Discoms • Discoms not fulfilling RPOs. • Non-payment of timely dues by DISCOMs to WPDs

GBI	AD was not applicable for foreign direct investors ,thus in order to diversify the investment pool by attracting large IPPs and encourage FDI, as well as to incentivize generation, stimulate capacity expansion, and enhance efficiency in installations, the central Government introduced the GBI scheme in December 2009. Under this scheme, a reward of Rs. 0.50 per KWh of electricity generation was provided for a duration ranging from 4 to 10 years, with a maximum limit of Rs. 100 lakhs per MW(CRISIL, 2016). Between 2009 and 2011, investors were provided with the flexibility to choose between the AD or GBI, based on their individual suitability. This was the golden period for investors and it led to a doubling of annual installations. In an arbitrary move in 2012, both were removed , which resulted in a 50% drop in capacity additions. The scheme was reintroduced in April 2013 (Bayar, 2013b)**.** Subsequently, post the introduction of e-reverse auction mechanism, GBI has been removed entirely from 2017. The GBI scheme was launched during a period when the renewable energy sector was struggling with poor efficiency levels, and it not only successfully addressed this issue but also ensured an increase in investments. The GBI scheme addressed the limitations of the AD scheme. As a result, the percentage of wind projects based on the GBI scheme increased from 3% in 2010-11 to 30% in 2015-16.(CRISIL, 2016).	• The scheme was designed to attract foreign direct investment (FDI) and encourage large independent power producers (IPPs). • The scheme expanded the investment base by facilitating the participation of large independent power producers (IPPs). • GBI aims to reward generation, boost capacity addition and promote efficiency in installations • The GBI scheme addressed the limitations of the AD scheme

Land Issues	State laws govern the use of land and the process of obtaining approval for installing Wind Turbine Generators involves Multiple state government agencies, including Local Bodies, Panchayats, Revenue, Forest, and Agriculture Departments, are involved in the process. There are three types of land that can be used for this purpose: Revenue Land, Forest Land, and Private Land. However, different states have varying policies and procedures regarding land acquisition and allotment. While the government owns Revenue and Forest Land, individuals can lease them by paying statutory fees. On the other hand, Private Land belongs to individuals, and before purchasing it, they need to obtain a Non-Agricultural (NA) use permit from the government. ("Wind Energy Land Acquisition Challenges and Solutions," 2018).MNRE has increased the timeframe for land acquisition from seven months to eighteen months to support Wind Power Developers (WPDs) operating in states where the process of land acquisition is usually more time-consuming. (Ministry of New and Renewable Energy, 2020).	• Windy sites scarce. • Land is a state subject and land availability rates, policies wrt agriculture land are varied across states. • WPDs prefer buying land to create long term assets instead of leasing. • Permissions/Approvals required for converting Agriculture land to Non Agriculture. • The timeline for land acquisition typically ranges from seven to eighteen months. • Involvement of many entities at local village , district and state government levels
Land Issues	Efforts have been exerted at all levels to expedite the land acquisition process for wind projects. However, due to the involvement of multiple entities, the entire process remains highly intricate and time-consuming. Consequently, acquiring land for such projects typically requires a minimum of six to nine months. The increasing size of wind power projects, covering	• Land-ceiling limits. • Grid Infrastructure for power evacuation • NOC requirement • Delay in issuing NOC by MoD

	hundreds of acres, has created a high demand for land. However, certain states, including TN and Karnataka, restrict the amount of land that can be used for wind projects. Furthermore, WPDs must comply with an additional requirement of obtaining clearance and a NOC from the MoD and Civil Aviation if their land is situated within a 20-kilometer radius of an Air Force Station. Delays in obtaining these permissions have been observed in Gujarat due to inadequate procedures. (Sood et al., 2019). SECI has collaborated with the Ministry of Defence to expedite the clearance of pending applications for NOCs from WPDs (Swain, 2019).	
Issues with WPDs and OEMs	Suzlon Energy Ltd. is currently grappling with financial challenges attributed to its debt burden, Inox Wind has reported financial losses, and furthermore, Corporate Insolvency Resolution Proceedings have been initiated against Reagan Powertech (Chandrasekaran, 2019a). The well-known German wind energy firm, Senvion, has also filed for insolvency(Radowitz, 2019) . eld significant positions in the market, providing Wind Turbine Generators (WTGs) to approximately 25% of the market share. Consequently, the decreased competition among OEMs has resulted in higher WTG prices, affecting the returns of WPDs(Sood et al., 2019).	• Aggressive developers quoting low prices in order to capture a larger market share and capacity may find themselves burdened with heavy debt, potentially leading to non-performing assets (NPAs). • Forward Integration or Reverse Integration between OEMs/WPDs.

Issues with WPDs and OEMs	As wind power tariffs continue to decline, there is a potential shift in the operational execution model of OEMs. It is expected that developers will gradually take on a larger portion of project-related activities internally to reduce costs. Additionally, a possible trend is the forward-integration of OEMs, leveraging their advantageous position with access to manufacturing capabilities and favourable wind sites . The trend is evident in recent competitive bidding processes, where notable equipment suppliers like Inox, Gamesa, and Regen Powertech have participated by bidding for their own capacity.	•
Financing Problems	The RE sector is currently experiencing uncertainties, specifically concerning land acquisition and power evacuation, as well as delays or non-payment by discoms to RE developers has noteworthy consequences for financial institutions. The combination of reduced tariffs and existing operational and implementation risks linked to projects is making the debt unviable. (Saluja, 2018). NBFCs involved in financing wind projects are now cautious about these risks. They are requesting lower Debt-Equity ratios, corporate guarantees to mitigate potential contractual defaults, and incorporating penal interest clauses for project delays. Additionally, they are imposing high early repayment charges as a means of safeguarding their investments(Sood et al. 2019).	• The overall approach of financial institutions • Debt-to-equity ratios, corporate assurances to handle contractual defaults, penalty clauses for project delays, and substantial charges for early repayment.

Operations and Maintenance (O&M)	The maintenance of not only the machine but also of the line and substations are beyond the generator's scope. The availability of spare parts is very specific to OEMs. This excessive dependence of Wind Power Developers on OEMs for O&M functions ,leads to critical down time especially in case of OEMs which are not doing well ("Overcoming O&M Challenges," 2021).	• Link/Dependence between WPDS and OEMs. • O&M functions performed by OEMs and critical delays.
Financial Eligibility Criteria	I. Net Worth: a. he Bidding Company or Consortium must possess a net worth equal to or greater than Rs. 1.24 Crores per MW of the specified capacity. II. Liquidity: The Bidding Company or Consortium must meet, at least one of the following criteria must be satisfied: a. Achieving a minimum annual turnover of Rs. 60 lakhs per MW of the designated capacity in the preceding financial year. b. The Bidding Company or Consortium must demonstrate internal resource generation capability, represented by a PBDIT of at least Rs. 12 Lakhs/MW of the quoted capacity. c. The Bidding Company or Consortium must possess An initial approval letter from lending institutions or banks, pledging a Line of Credit of a minimum of Rs. 15 Lakhs per MW of the specified capacity to cover the project's working capital needs. III. Financial Closure: The Project Developer is required to verify the finalization of 100% of the Financing Arrangements for the Projects within 7 months from the PPA's Effective Date .	• Net-worth Criteria • Liquidity Criteria • Financial Closure Criteria

E Reverse Auction Mechanism and its suitability as a procedure	Techno Commercial Bids and Financial Bids are submitted online. Bidders are shortlisted by SECI and subsequently only their Financial Bids are opened. Only bidders which are lesser than the ceiling tariff are invited for participating in e-reverse auction process .The selection of bidders is based on the bidder with the lowest tariff quote (L1) being awarded the qualified capacity, followed by the next highest bidder (in ascending order) being awarded qualified capacity until the capacity is fully allocated. (Kandpal & Dhingra, 2021). An e-bid is held on electronic platform with every bid visible to all players, while the closed bid is submitted physically in sealed envelope. There has been demand from industry for conventional bidding in wake of falling tariffs and creating Level playing field for SMEs specifically to take part in the wind energy programme(Business Standard, 2018).	• Direct Auctions verses Reverse Auctions which is more suitable. • Suitability of Reverse Auction Procedure • Capacity Auctioned sufficient or not. • Limit /Qualified Capacity for winner (L1) and subsequent allocation • Pipeline Visibility wrt planned capacity in future auctions
Bidding Strategy , Uncertainties and Biases during e reverse auctions	The Overall bidding decisions in all kind of auctions are highly uncertain and risky in nature. The final bid is based on the collective assessment of techno-economic factors, operational capabilities, fiscal commitments Strategic consideration, Competitor analysis and consideration of various kinds uncertainties cognitively by the bidders. In additions, bidders have to make decision within the 8 min window and for that they have to make certain pre-assumptions and take certain calls. Information uncertainty is highest in auctions and Request for Proposal(RFP) is the most representative	• Bidding decisions in e-reverse auctions prone to any biases. • Assumptions made while bidding. • Bidding strategies employed by WPDs. • Information uncertainty • Participation of other WPDs affect the bidding behaviour

	information available to the bidders during the bidding stage. But still some critical information voids faced by WPDs prior to bidding. As the auctions are masked , so no bidder is aware of which other WPDs are participating in the auctions.	• Competitor Analysis

3.5.4. Initial Conceptual Lens were defined using Initial Conceptual Construct and the same is described as under in **Fig** 3.2

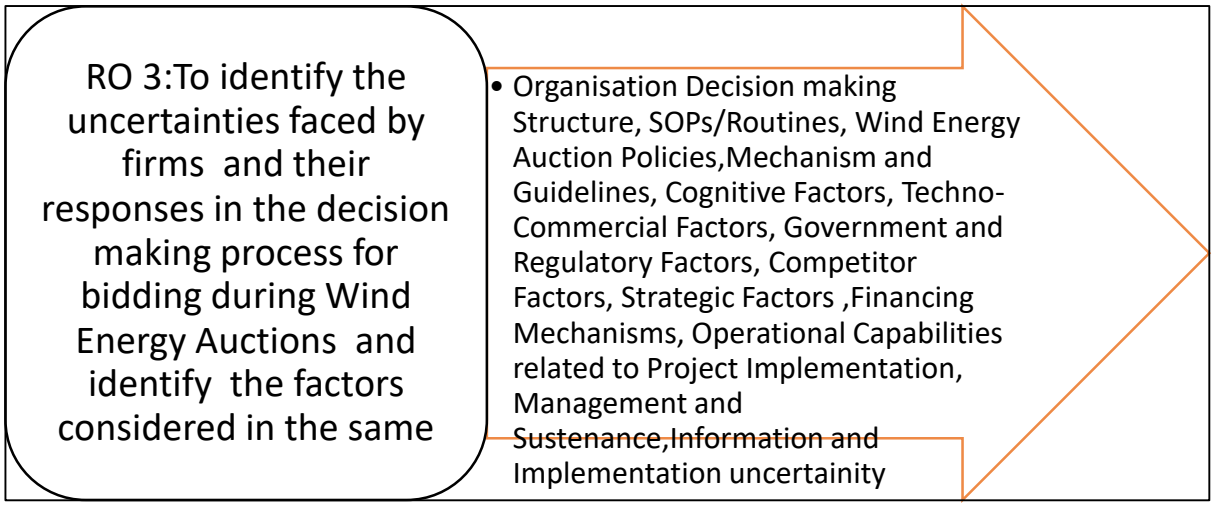

Figure 3.2 : Initial Conceptual Lens

3.5.5. Data Collection

A qualitative methodology was utilized to analyze the data gathered from a sample of 13 industry professionals who are either at Senior Management, Business Development level of Wind Power Developers who had experience in participating Wind Energy e-reverse auctions as well as few senior officers of Government who are dealing with wind auctions. In addition certain journalists who are covering Wind Energy Sector were also included .Purposive sampling was employed to select 13 professionals from diverse firms, levels, and backgrounds as outlined in Table 3.3, To gain a comprehensive grasp of the research question. Interviews were conducted until the point of theoretical

saturation was reached, employing a qualitative approach to analyze the collected data.

Table 3.6 : Profile of Interviewees

Type	Level	Profiles
Industry	General Manager –(Business Development)/COO/AVP(Business Development)/ Finance Controller(07)	All were having experience of more than 10 years in Wind Energy Industry, directly or indirectly linked with Looking after Bidding and Commercial activities
Academic	Professor (01)	Expert in Power and RE Sector Policy
RE Consultant	Vice President (01) With State Govt (01)	• Prominent Green Energy Consultant Firm • Earlier with MP State Govt
Industry Watchers	Journalist(01)	Covering RE Sector(experience around 5 years)
Government	Director & Middle Level Manager(02)	Directly handling Wind Power E Reverse Auctions

3.5.6. Data Collection Protocol

A data collection protocol consisting of a detailed questionnaire was prepared as discussed below and on the basis of same, semi-structured interviews were undertaken. The participants were presented with the questions to understand the uncertainties faced and their responses in the decision making process for bidding during Wind Energy Auctions by Firms as well as tries to identify the factors considered by firms while bidding in Auctions. In addition, the objective of this study is to investigate the following research questions :-

(a) What were the factors which have been driving the growth of wind energy in the country?

(b) Effectiveness of Central Polices of AD and GBI in the growth of wind energy in India and How has other the state government policies related to wind energy have impacted the growth of wind energy in India?

Data Collection Protocol is presented as App to this chapter.

3.5.7 Data Analysis

The main purpose of a qualitative investigation is to systematically analyze data in order to interpret and present findings. The primary obstacle in data analysis lies in interpreting vast datasets, minimizing information overload, recognizing meaningful patterns, and creating a framework to effectively convey the insights derived from the data (Patton, 1990). In this research, The basis of data analysis rests upon the researcher's interpretations and description of phenomena. These interpretations are inherently subjective, as they are influenced by the experiences of the individuals involved within a specific context. This particular approach can be classified as a modified form of grounded theory(Locke, 2001; Charmaz, 2006).

The data collected was analyzed using the process outlined in Figure 3.3. Firstly, the interviews were coded and transcribed, with responses collated into separate sheets for each research question. Next, the transcripts were cleaned to remove special characters, numbers, and spaces, and uniformity was ensured across files. Firstly, stop words were defined, and subsequently, the transcripts were imported into NVivo for analysis. A word cloud was created to extract the primary content, followed by thematic and sentiment analysis using autocode. To ensure thematic convergence in the interview data, a combination of text mining and qualitative content analysis methods were employed. Main Steps and timeline of Data Collection has been elaborated in Table 3.7

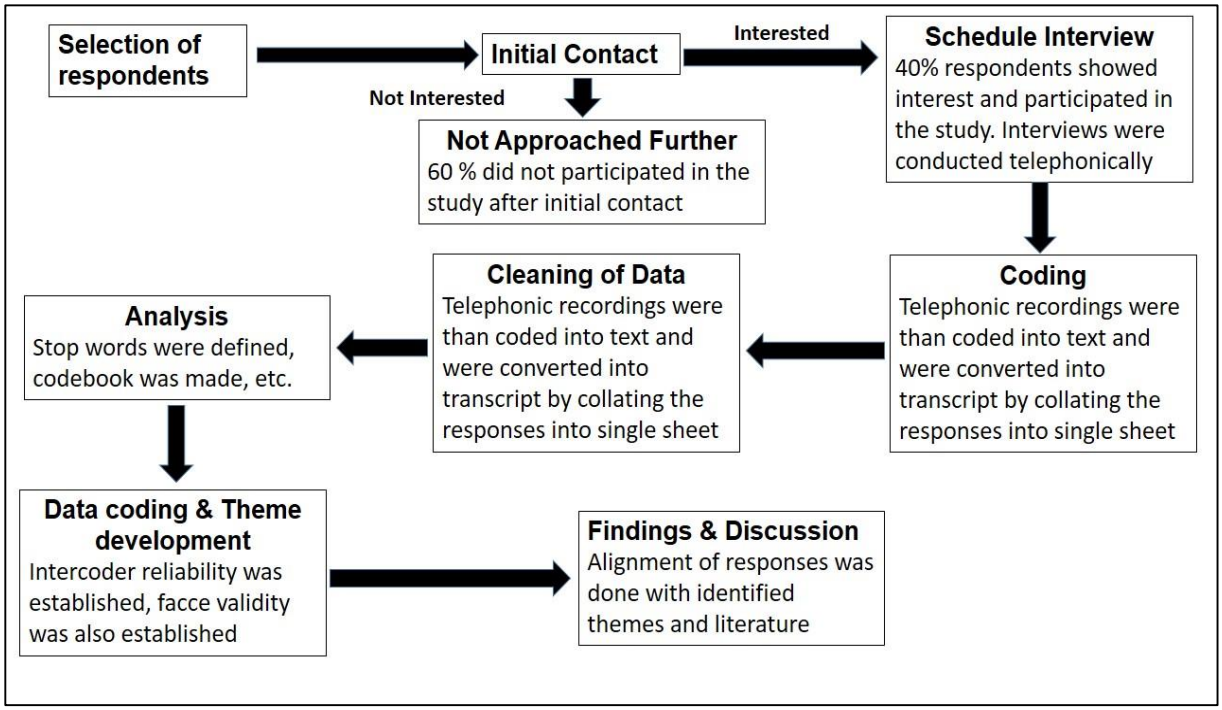

Figure 3.3 : Data Analysis Procedure

Table 3.7 : Main Steps and timeline of Data Collection

Steps in Data Collection	**Timeline**
Development of Data Collection Protocol , Review and Finalisation of Data Collection Protocol	Sep 2021 to Jan 2022
Initial Contact and Arrangements	Feb 2022 to Apr 2022
Data Collection Interviews	Apr 2022 to JuL 2022
Documentation	Aug 2022
Coding and Analysis	
Review for Validity	Sep 2022 to Nov 2022
Additional Data Collection	
Findings and Discussion	
Total Interview	14

3.6 CONCLUDING REMARKS

In this chapter, the research objectives and questions were introduced, which were formulated based on the problem statement of this study. Then a comprehensive explanation of the overall approach and rationale for this research by elucidating the research methods and study in a logical sequence was provided. In this research study , first research question is studied based on quantitative research The basis for this research study is based on interpretative paradigm, inductive based qualitative research approach, and qualitative research strategy. Further, data collection method is discussed in detail in this chapter.

Data collection was done majorly with the help of methods semi-structured interviews using Data Collection protocol, participant observation, site visits, and collection of documentary evidences. Interview data was transcribed and subsequently analyzed using Nvivo software. This chapter provides a thorough discussion of the data analysis strategy, including within-case and cross-case analyses. Data Collection protocol is presented in the last section. Next chapter describes study on Research Objective 1 which has a detail empirical analysis to estimate the impact of different policy variables on installation capacity of wind energy based on annual data for seven Indian states for the period 2003–2018 using panel regression techniques

CHAPTER 4

DATA ANALYSIS-I

4.1 INTRODUCTION

Detailed empirical analysis to estimate the influence of different policy variables on installation capacity of wind energy based on annual data for seven Indian states for the period 2003–2018 using panel regression techniques in this chapter. In section 4.2 ,Data and research methodology to include definition of variables , data collection and panel data analysis techniques has been discussed. Results are discussed in Section 4**.3.** Section 4.4 highlights comparison with other similar studies identified in literature review and finally conclusion and policy implication is discussed in Section 4.5.

4.2 DATA AND RESEARCH METHODOLOGY

The study is based on empirical analysis of annual data from 2003 to 2018 for seven Indian states. Panel data methods to estimate the impact of different policy variables on installation capacity of wind energy in the Indian states has been employed. The panel regression technique allows us to control for the heterogeneity across the states due to the diverse socioeconomic conditions. We estimate the following equation using the FE and RE regressions results and Hausman test to determine which test is more suitable.

$$Y_{it} = \alpha_i + \beta X_{it} + +\gamma Z_{it} + \varepsilon_{it} \quad (1)$$

where, Y_{it} represents the cumulative installation capacity of wind energy in India in year ,X_{it} represents the policy variables namely, RPO, FiT, wheeling charge and banking facility , it also includes the control variables such as per capita income and the level of industrialization(measured through the

manufacturing share) in the respective states. α_i is the differential intercept term which captures the heterogeneity across the states and ε_{it} is the random error term.

The FE model eliminates the time-invariant state specific factors. The heterogeneity across the states are captured by the differential intercept term. As a means of verifying the reliability and robustness of our results, we apply alternative estimation techniques including the feasible generalized least squares (FGLS) method, fixed effects regression with PCSE and D-Kstandard errors. Cross-sectional dependence (CD) is a major problem in panel datasets. Typically, the spatial correlation in the disturbances of panel models arises because of unobserved common factors.

Neglecting the correlation between cross-sectional units in estimating panel models may result in highly biased statistical outcomes. To verify the existence of cross-sectional correlation in our data set, we perform the CD test proposed by Pesaran, (2004). The null hypothesis of this test presumes that the residuals have no cross-sectional correlation, while the alternative hypothesis assumes the presence of spatial dependence. When cross-sectional dependence is present, the John C. Driscoll & Kraay, (1998)standard errors are more appropriate. The D-K standard errors employed in this analysis are robust against various types of cross-sectional and temporal dependence., particularly when the time dimension is significant and also homoscedasticity-consistent.

The FGLS method enables estimation even when there is first-order autocorrelation within panels, as well as cross-sectional correlation and heteroskedasticity across panels. Since our dataset consists of 7 panels and 16 years and are balanced panels, the FGLS and PCSE are expected to produce consistent estimates.

We have obtained the data from various Central and State government websites and reports.

The precise definitions of the variables and the source of data are given in Table 4.1 .

Table 4.1: Definition of Variables

Variable	Definition	Data Source
FiT	FiT rate denotes the specific price at which electricity generated from wind power can be sold by an operator. State Electricity Regulatory Commissions (SERCs) determine a levelized tariff by estimating the cost of power generation and accounting for annual escalation throughout the plant's lifespan. Subsequently, they extend long-term contracts to producers of wind energy. (Jethani, 2016b; Panse & Kathuria, 2016). The FiT rates in effect prior to the introduction of auctions in 2016-17 ranged from Rs 3.82 to Rs 5.76(Jethani, 2016b). FiTs prevalent in the states yearwise were identified and taken for computation.	Own Compilation from various Central and State Govt websites.
Energy Banking	Energy banking is an important factor as it provides the wind energy developers a mechanism to utilize their excess generation and avail financial benefits. Under this provision, Captive Wind Power generators are granted authorization to sell any excess power they generate to distribution companies. Within the designated banking period, wind power producers have the ability to inject the electricity generated by their windmills into the state grid while simultaneously drawing power for their own captive use(Vijayakumar, 2020). Typically, any surplus electricity generated by	

	the Wind Energy Generator is integrated into the grid. WEGs can then use the remaining units at their convenience within the next 12 months by drawing it from the grid. Energy banking policies vary significantly between different states. Across different states, varying regulations exist regarding energy banking. Certain states allow unrestricted energy banking throughout the year, with no limitations imposed on the quantity of power that can be stored. However, in other states, there exist limitations on both the quantity and duration for which energy can be stored through banking. It is important to mention that certain states have regulations that do not allow energy banking whatsoever(Panse & Kathuria, 2016). Banking has been taken as Dummy variable with the year in which the Policy was present in the state has been taken as 1 and when policy was not there taken as 0.	
Wheeling Charge	The wheeling charge represents the expenses borne by the energy producer for transmitting power to the designated utility. These costs are typically expressed as a percentage of the total energy transmitted. In certain states, there may also be additional charges levied for transmission losses that occur during the energy transmission process. There is also considerable variation in the wheeling charges applied across the states. This variable has also been taken as dummy	

RPO	RPO is a mechanism that imposes a requirement on obligated entities to procure a specified percentage of their electricity from renewable energy sources. This percentage is determined based on the total amount of electricity consumed by these entities. This requirement was established as part of the Electricity Act 2003 and the National Tariff Policy 2006(MNRE, n.d.) .RPOs are divided into two categories: Solar and Non-Solar RPOs. While some states have established RPO targets, poor enforcement has hindered the effective implementation of this mechanism. (Bayar, 2013b). In order to achieve stricter enforcement of RPOs, the MNRE established the RPO Monitoring Cell in 2018, and the Ministry of Power (MoP) has established RPO trajectory targets through the year 2022(Vartika, 2018) .	
Installed Wind Capacity	It refers to the total amount of wind power generation capacity that has been established or deployed within a specific region or system. It represents the maximum potential output of electricity that can be generated by wind turbines in respective states in MW.	(IWTMA, 2021; NIWE, 2015)
Per Capita Income	Gross state domestic product (GSDP) per capita. It is an indicator of economic development and measures the market size.	(RBI, 2020b)
Manufacturing Share	Manufacturing share in GSDP.	Handbook of Statistics on Indian States by RBI (RBI, 2020a)

4.3. DISCUSSION OF RESULTS

Table 4.2 presents the descriptive statistics of the variables utilized in the regression analysis. As it is evident from the summary statistics, the installation capacity varies across the states and over time. Similarly, the policy variables such as RPO and FIT are found to have significant variation between the states. However, the level of economic development, as measured by per capita income and the level of industrialization, has shown relatively low variation across the states. Table 4.3 presents Fixed-effects and random-effects regressions results and Hausman test .The Hausman test result suggests that the RE model is efficient. However, the Hausman test cannot be applied to regressions with robust standard errors. As heteroscedasticity may be a problem in our dataset and there is cross-section dependence in the data we prefer FE regression with D-K standard errors.At the outset, we present the FE regression results. The results are shown in Table 4.4 . First, we estimate the pooled model without considering the state heterogeneity. The results indicate that FIT, wheeling charge and per capita income are significant determinants of installation capacity. However, when the state fixed effects are taken into consideration, wheeling charge has become statistically insignificant. The FE regression suggests that FIT and per capita income have significant positive impact on wind installation capacity. Since the conventional FE model does not adequately address cross-sectional dependence and temporal correlation, we test estimate the model using methods that are robust against these problems. The Pesaran's CD test (shown in Table 4.5) rejects the null hypothesis of spatial independence which justifies the use regression with D-K standard errors and PCSEs. Table 4.6 shows the results from regression with D-K standard errors.Sensitivity Analysis i.e. results from FGLS and P-W PCSEs Regressions has been elaborated in table 4.7 and table 4.8 gives results of pairwise correlations. . The results suggest that the policy variable – FIT has significant positive impact on

wind installation across states. The economic growth is found to be a significant predictor of installation capacity .

To be more precise, this analysis uncovers a direct positive relationship between economic growth and the adoption of wind energy.Our results suggest that both FIT and economic growth are the robust determinants of wind energy installation across the Indian states. Our findings are robust across different methods of estimation and use of control variables.

Table 4.2:Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln installation capacity	112	7.136	1.405	3.144	9.096
RPO	112	4.905	3.431	0	13
FiT	112	3.878	0.920	2.250	5.920
Wheeling charge	112	0.482	0.502	0	1
Energy banking facility	112	0.732	0.445	0	1
Ln per capita income	112	11.037	0.698	9.568	12.267
Ln manufacturing share	105	2.747	0.376	2.112	3.466

Note: Ln denotes natural logarithm of the variable.

Table 4.3: Fixed-effects and Random-effects regressions results

	Dependent variable: Annual installation capacity			
	FE	RE	FE	RE
Cumulative installation capacity	0.132**	0.070**	0.129**	0.069**
	(0.064)	(0.028)	(0.064)	(0.028)
Feed-in-tariff	128.460*	82.528*	125.226*	84.222*
	(66.046)	(48.699)	(66.445)	(48.865)
RPO	-0.101	-7.328	-0.003	-6.640
	(17.419)	(16.988)	(17.495)	(17.066)
Wheeling charge	134.240	131.812	137.740	131.764
	(106.876)	(94.000)	(107.219)	(94.385)
Banking facility	-73.389	-18.814	-73.222	-24.136
	(121.611)	(112.054)	(122.234)	(112.217)
Growth of gross state domestic product	24.538**	24.414**		
	(11.699)	(11.826)		
Growth of per capita income			20.579*	20.629*
			(10.676)	(10.720)
Growth of per capita power consumption	3.754	2.197	4.378	2.861
	(5.859)	(5.976)	(5.849)	(5.955)
Share of manufacturing in GSDP	31.941	12.594	34.029	13.749
	(23.871)	(10.410)	(23.860)	(10.360)
Per capita availability of power	-1.587***	-0.198	-1.624***	-0.215
	(0.590)	(0.229)	(0.593)	(0.229)
Female literacy rate	31.418	-6.440	33.305	-6.780
	(37.632)	(9.127)	(37.784)	(9.156)
Constant	-1783.083	-12.544	-1830.870	63.030
	(2020.862)	(451.898)	(2029.166)	(448.221)
Number of observations	98	98	98	98
R-sq (within)	0.229	0.165	0.223	0.159
Hausman Test (Chi2 Test)		**10.9**		**10.71**
(Prob>chi2)		0.282		0.296

Note: * p<.10 ** p<.05 *** p<.01. Standard errors are shown in parentheses.

Table 4.4: FE Baseline regression results (FE Model)

	Dependent variable: Ln installation capacity			
	Pooled regression		Fixed effects regression	
	Model 1	Model 2	Model 3	Model 4
RPO	0.022	0.061	-0.009	-0.010
	(0.044)	(0.038)	(0.021)	(0.021)
FiT	0.011	0.204**	0.299***	0.283***
	(0.096)	(0.091)	(0.077)	(0.081)
Wheeling charge	-0.277*	-0.284*	-0.217	-0.186
	(0.163)	(0.166)	(0.144)	(0.154)
Energy banking facility	0.012	0.079	0.073	0.080
	(0.193)	(0.212)	(0.099)	(0.110)
Ln per capita income	1.686***	1.277***	1.337***	1.290***
	(0.195)	(0.180)	(0.139)	(0.156)
Ln manufacturing share		1.040***		-0.067
		(0.200)		(0.473)
Constant	-11.502***	-10.824***	-9.708***	-9.014***
	(2.025)	(1.836)	(1.319)	(2.153)
State fixed effects	No	No	Yes	Yes
No. of observations	112	105	112	105
No. of states	7	7	7	7
R-squared	0.701	0.739	0.920	0.913

Note: * p<.10, ** p<.05, *** p<.01. Robust standard errors are shown in parentheses.

Table 4.5: Average correlation coefficients and Pesaran (2004) CD test results

Variable	**CD-test**	p-value	corr	abs(corr)
Ln installation capacity	16.49	0.000	0.929	0.929
RPO	11.64	0.000	0.656	0.656
Fit	11.68	0.000	0.658	0.658
Ln per capita income	17.69	0.000	0.997	0.997
Ln manufacturing share	4.85	0.000	0.273	0.576

Note: The CD test results for the two variables – wheeling charge and energy banking facility are not available as they are binary variables.

Table 4.6:Results from regression with Driscoll-Kraay standard errors

	Dependent variable: Ln installation capacity			
	Pooled regression		Fixed effects regression	
	Model 1	Model 2	Model 1	Model 2
RPO	0.022	0.061	-0.009	-0.010
	(0.059)	(0.041)	(0.021)	(0.020)
FiT	0.011	0.204**	0.299***	0.283**
	(0.129)	(0.092)	(0.080)	(0.099)
Wheeling charge	-0.277	-0.284*	-0.217	-0.186
	(0.186)	(0.137)	(0.145)	(0.131)
Energy banking facility	0.012	0.079	0.073	0.080
	(0.158)	(0.243)	(0.064)	(0.071)
Ln per capita income	1.686***	1.277***	1.337***	1.290***
	(0.166)	(0.111)	(0.128)	(0.126)
Ln manufacturing share		1.040***		-0.067
		(0.348)		(0.582)
Constant	-11.502***	-10.824***	-9.708***	-9.014***
	(1.705)	(1.223)	(1.138)	(1.715)
State fixed effects	No	No	Yes	Yes
Number of observations	112	105	112	105
R-squared	0.701	0.739	0.920	0.913

Note: ** p<.05, *** p<.01. Driscoll-Kraay standard errors are shown in parentheses.Maximum lag is 1.

Table 4.7: Sensitivity Analysis (Results from FGLS and P-W PCSEs Regressions)

	Dependent variable: Ln installation capacity						
	FGLS regression				P-W regression with panel corrected SEs		
	Model 1	Model 2	Model 3		Model 1	Model 2	Model 3
RPO	-0.001	0.0002	0.001		-0.003	-0.0001	0.002
	(0.010)	(0.004)	(0.004)		(0.013)	(0.012)	(0.012)
FiT	0.090**	0.109***	0.111***		0.113**	0.162***	0.161***
	(0.035)	(0.030)	(0.028)		(0.055)	(0.057)	(0.058)
Wheeling charge	-0.001	-0.012	-0.048		-0.025	-0.060	-0.049
	(0.065)	(0.047)	(0.048)		(0.091)	(0.089)	(0.091)
Energy banking facility	-0.025	-0.034	0.010		0.020	0.028	0.047
	(0.064)	(0.048)	(0.049)		(0.094)	(0.090)	(0.089)
Ln per capita income	1.577***	1.583***	1.505***		1.612***	1.477***	1.432***
	(0.085)	(0.060)	(0.060)		(0.111)	(0.092)	(0.094)
Ln manufacturing share			0.108				0.119
			(0.103)				(0.246)
Constant	10.674***	11.760***	11.335***		11.211***	10.674***	10.482***
	(0.912)	(0.665)	(0.782)		(1.204)	(0.934)	(1.222)
State fixed effects	No	Yes	Yes		No	Yes	Yes

Number of observations	112	112	105		112	112	105
Number of groups	7	7	7		7	7	7
Time periods	16	16	15		16	16	15
R-squared					0.939	0.951	0.958
Wald chi2	**508.09**	**1376.50**	**1169.91**		**328.15**	**697.13**	**664.83**
Prob > chi2	**0.000**	**0.000**	**0.000**		**0.000**	**0.000**	**0.000**

Note: ** p<.05, *** p<.01. Standard errors are shown in parentheses. FGLS denotes feasible generalized least squares regression and P-W (PCSEs) is Prais-Winsten regression with panels corrected standard errors (PCSEs). Panels are assumed to be correlated and autocorrelation is panel-specific AR(1).

Table 4.8: Pairwise correlations

Sl. No.	Variables	1	2	3	4	5	6	7
1	Ln Installation capacity	1.000						
2	RPO	0.628***	1.000					
3	FiT	0.466***	0.465***	1.000				
4	Wheeling charge	0.365***	0.496***	0.071	1.000			
5	Energy banking facility	0.439***	0.334***	0.365***	0.463***	1.000		
6	Ln Per capita income)	0.833***	0.737***	0.524***	0.518***	0.549***	1.000	
7	Ln Manufacturing share)	0.344***	-0.044	-0.330***	0.138	0.027	0.183*	1.000

Note: *** p<0.01, ** p<0.05, * p<0.1. Ln denotes natural logarithm of the variable.

4.4 COMPARISON WITH OTHER STUDIES

In this paper we have concluded both FIT and economic growth are the robust determinants of wind energy installation across the Indian states. Among the major studies carried out on the effectiveness of policies in the growth of Wind Energy or increase in FDI in Wind Energy by Rao Kishore, (2009), V. Kathuria, Ray, & Bhangaonkar, (2015) and Panse and Kathuria, (2016) didn't study effect of individual policies but created a policy index and concluded that overall favourable supporting policies i.e. lower wheeling charges ,higher FiT , open access, banking facilities facilitate deployment of wind energy and increase in FDI for the same. According to Schmid, (2011) ,the introduction of RPOs has had a notable and meaningful effect on the advancement of RE.

Thus it can be concluded that our results are in the same lines as that of these studies which have emphasized the significance of policy in the growth and progress of wind energy. However, the results are contrary to the findings of Thapar et al. (2018) in which policy variables such as FiT and RPO did not have a significant impact. However, As a result of the study, it was determined that the current wind capacity and its proportion relative to the total generation capacity are significant factors that influence the outcome.

4.5 CONCLUSION AND POLICY IMPLICATIONS

Wind Power in India has grown significantly, from less than 1 GW in 2000 to 40.4 GW in 2022. However, the sector has faced challenges due to the introduction and withdrawal of various policies, as well as significant variation in promotion policies across different states. Furthermore, there has been limited research conducted to evaluate the effectiveness of various central and state-level wind energy policies. This study brings out that both FIT and economic growth are the robust determinants of wind energy installation across the Indian states. In a significant policy shift, the government abandoned all other incentives and adopted a competitive bidding or auction mechanism for wind energy in 2017. This change has resulted in improved transparency and

guaranteed power purchase, as well as a significant reduction in tariffs from Rs 5.92/MW to Rs 2.77/MW – Rs 2.83/MW. However, the auction mechanism has posed several challenges to the sector, particularly with respect to the timely implementation of projects, with many projects running behind schedule . This has also led to significant drop in annual wind installations in the country . Thus, it can be concluded that India still needs support policy mechanisms and growth of wind energy over a period of time across all states was primarily due to favourable FiT policy.

The need of proper studies on the likely challenges arising due to introduction of any new policy and comparison with existing policies is required to be carried out. The paper suggests various directions for future research. First and most important is comparative study between the competitive bidding or auctions mechanism and FiT and other support mechanisms and policies. The challenges arising out of implementation of auction mechanism in wind energy is another area to work on. Furthermore, another future area of work could be to study the influence of state-level policies on the growth of alternative RE sources, such as solar or biomass.

CHAPTER- 5

DATA ANALYSIS-II

5.1 INTRODUCTION

This chapter presents in detail a qualitative approach using Nvivo software to examine and assess the effectiveness of Central Polices of AD and GBI in the growth of Wind Energy Industry in India as well as identifying the uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions identify the factors considered in the same. Research Methodology based on Qualitative approach has been discussed in section 5.2 .Section 5.3 brings out Initial Conceptual Constructs which were identified through Literature Review and Initial Conceptual Lens . Section 5.4 brings out Data Collection procedure . Section 5.5 and Section 5.6 brings out Data Analysis and Findings respectively. Section 5.7 describes inferences based on the analysis carried out using NVIVO software. Section 5.8 describes data analysis using Gioia methodology and Qualitative Associated Network(QAN) design for RO-2 on Research Objective is elaborated in Section 5.9 and section 5.10. gives conclusion .

5.2 RESEARCH METHODOLOGY

The research objective identified as per previous chapter are as under and Research Methodology is described as under in Fig 5.1.

RO 2(a) : To assess the effectiveness of Central Polices of AD and GBI in the growth of Wind Energy Industry in India

RO 2(b) : To identify the uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions and identify the factors considered in the same

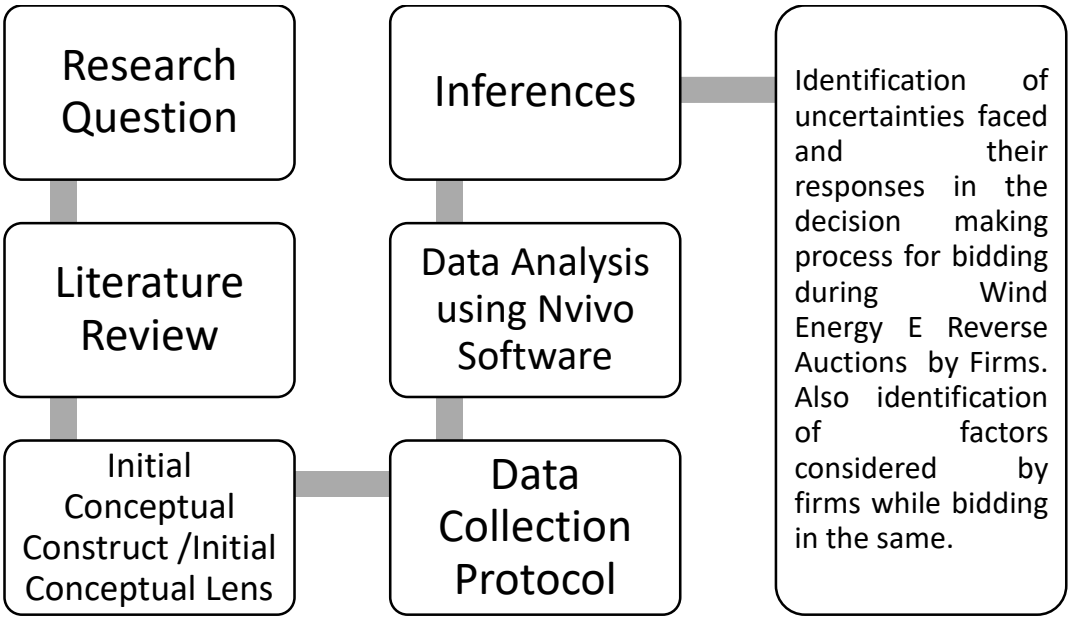

Figure 5.1 : Research Methodology for Qualitative Study

5.3 INITIAL CONCEPTUAL CONSTRUCT AND INITIAL CONCEPTUAL LENS

5.3.1. Initial Conceptual Constructs were identified through Literature Review and are described in **Table 5.1** as under

Table 5.1 : Initial Conceptual Construct

Constructs	Inference	Sub Constructs
AD	AD is a tax-saving scheme and as an accounting concept, it leads to an increase in asset depreciation during the early years of their useful life. The scheme was deemed suitable for the initial phases of wind power development, characterized by less mature and more uncertain technology. However, it inadvertently fostered a culture where investors enjoyed substantial benefits while assuming minimal risks.They	• Tax Benefit • Early stages of Wind Industry • Poor Installations • Misutilization of scheme

	misutilized the scheme as most wind-power plant investment decisions were taken at short notice with a single aim of availing tax breaks. This rush led to hastily installed wind power plants, which in turn compromised their quality and performance. It also resulted in the ineffective utilization of windy sites due to suboptimal wind installations. Consequently, the initial AD rate was raised to 80% in 2002, only to be completely discontinued on April 1, 2012. Although the AD scheme was reintroduced in 2014, depreciation rates were subsequently reduced to 40% for projects commissioned after March 2017.(CRISIL, 2017a; IRENA-GWEC, 2012; Rajsekhar et al., 1999)**.**	
GBI	AD was not applicable for foreign direct investors (FDI),thus to broaden the investment base through entry of large IPPs and attract FDI as well as to reward generation, boost capacity addition and promote efficiency in installations , the central Government introduced the GBI scheme in December 2009. The scheme provided an incentive of Rs. 0.50 per KWh of generation for a period of 4 to 10 years, with a cap of Rs. 100 lakhs per MW(CRISIL, 2016).	• Scheme for large IPPs and attract FDI • Scheme broadened the investment base through entry of large IPPs
GBI	The period between 2009 to 2011, investors had the option of either choosing GBI or AD based on their suitability. This was the golden period for investors and it led to a doubling of annual	• GBI aims to reward generation, boost capacity

	installations. In an arbitrary move in 2012, both AD and GBI were removed , which resulted in a 50% drop in capacity additions. The scheme was reintroduced in April 2013 (Bayar, 2013b). Subsequently, post the introduction of e-reverse auction mechanism, GBI has been removed entirely from 2017. The GBI scheme was launched when the sector was struggling with poor efficiency levels and which it was not only able to successfully address but also ensured increase in investments .It overcame the drawbacks of the AD scheme. The percentage of GBI-based projects in the overall wind projects increased from 3% in 2010-11 to 30% in 2015-16 (CRISIL, 2016).	addition and promote efficiency in installations • GBI overcame the drawbacks of the AD scheme.
Discoms in Duress	Nearly all state power distribution companies (Discoms) are burdened with debt. This compels them to curtail their electricity procurement, leading to non-compliance with their RPO mandates. Additionally, they frequently delay payments to WPDs, resulting in outstanding dues spanning from 3 to 18 months. This precarious situation places significant financial strain on WPDs, who must also cover the daily operational expenses of their facilities while servicing their debt with interest (Sood et al., 2019).	• Debt Ridden Discoms • Discoms not fulfilling RPOs. • Non-payment of timely dues by DISCOMs to WPDs

Transmission Infrastructure Availability	The Infrastructure required for Power Evacuation and Transmission is inadequate to hold the capacity planned through the reverse auctions resulting in delay in operationalisation of a number of tasks. Wind projects are required to be completed in 18 months of signing of the PPA, however Grid infrastructure takes about five years to become operational (Koshy, 2019). In some cases, the substations to which the projects can be connected as per RfS issued are yet to be awarded for construction (Chandrasekaran, 2019a).	• Power Evacuation and Transmission Infrastructure is inadequate • Grid infrastructure takes about 5 years to become operational and Wind Power Plants get operationalized in 18 months.
Transmission Infrastructure Availability	Also the WPDs opt for best wind sites using the free Inter State Transmission System (ISTS) Connectivity Scheme, however, this happens in isolation as SECI and Central Transmission Utility, which are responsible for developing corresponding evacuation and transmission infrastructure, are unaware of the proposed sites (Mishra, 2018).	Lack of coordination between Wind Power Developers ,SECI and Central Transmission Utility, wrt selection of sites and development of corresponding evacuation and transmission infrastructure.
Tariff Revision and	In spite of clear policies and procedures issued by MNRE, there has been arbitrariness shown by a	• Arbitrary renegotiation of

Renegotiation of PPAs	number of state governments, especially in matters of renegotiation of tariffs under existing PPAs. The new government of Andhra Pradesh (AP) has attempted to renegotiate old contracts citing malpractices in the earlier process and had even resorted to reduction in off-take by state utilities in the existing projects (Singh, 2019; Chandrasekran, 2019b). This takes down the investor sentiment and shows lack of coordination between states and central government. The Gujarat government due high tariff cited in bids, had also cancelled and reissued a number of tenders. Developers were also directed to cut the tariff in bids and subsequently Government did not allocate projects to them when they passed up to oblige (Saurabh, 2019)	old contracts by some states • Reduction in off-take by state utilities in the existing projects • Lack of coordination between states and MNRE (SECI).No binding directions from MNRE for States. • Cancellation of auctions due to high tariff bids/ directions by states for reducing tariffs.
Land Issues	The land is a state subject with various state government agencies like Local bodies, Panchayats, Revenue, Forest and Agriculture Departments being involved in giving approvals to procure/ lease the land. The various land types for Wind Turbine Generator installation are Revenue Land, Forest Land and Private Land. Land purchase and allotment related policies vary from	• Windy sites scarce. • Land is a state subject and land availability rates, policies wrt agriculture

	state to state. Revenue land and forest land are owned by government and are provided on lease basis upon payment of statutory charges. Private land is owned by individuals and is required to be purchased by taking Non-Agricultural (NA) use permit from the government ("Wind Energy Land Acquisition Challenges and Solutions", 2018). To help WPDs in states where land acquisition takes longer time, MNRE extended the timeline for land acquisition seven months to eighteen months (MNRE, 2019). In spite of many efforts at all levels to fasten up the process of land acquisition for wind projects, the involvement of so many entities makes the entire process highly cumbersome and time-consuming, wherein it takes minimum six to nine months to procure land.Land requirement for Wind Power Projects is high due to increasing size of projects, spanning over several hundred acres. However, certain states like TN and Karnataka impose land-ceiling limits on Wind Projects (Sood et al., 2019). A mandatory requirement for all the WPDs is to get clearance and No Objection Certificate (NOC) from Ministry of Defence and Civil Aviation if land is located within 20 kms of such Air Force Station. Such cases have been seen in Gujarat wherein permissions have taken very long as the procedures had not been set down properly (Sood et al., 2019).SECI has now coordinated with	land are varied across states. • WPDs prefer buying land to create long term assets instead of leasing. • Permissions/Approvals required for converting Agriculture land to Non Agriculture. • Timeline for land acquisition seven months to eighteen months • Involvement of many entities at local village , district and state government levels. Land-ceiling limits. • Grid Infrastructure for power evacuation

	Ministry of Defence for expeditious clearing of applications of WPDs pending with them for NOCs (Swain, 2019).	• NOC requirement. Delay in issuing NOC by MoD
Operations and Maintenance (O&M)	The maintenance of not only the machine but also of the line and substations are beyond the generator's scope. The availability of spare parts is very specific to OEMs. This excessive dependence of Wind Power Developers on OEMs for O&M functions ,leads to critical down time especially in case of OEMs which are not doing well ("Overcoming O&M Challenges," 2021).	• Link/Dependence between WPDS and OEMs. • O&M functions performed by OEMs and critical delays.
Issues with WPDs and OEMs	The margins of both developers and original equipment manufacturers (OEMs) has reduced considerably since the introduction of auction mechanism. The WPDs had an Internal Rate of Return (IRR) of around 18-20 percent in FiT regime, which has roughly cut down to around 9 percent in projects allocated through auctions. The entry of bigger and global players is contributing to greater integration. Smaller companies with limited finance options are not able to raise enough cash to compete in the auction and is overall restricting their growth, leading them to exit the industry altogether. At present the winners of most of the auction have been large entities. Nevertheless, with tariffs touching as low as Rs 2.44 /KWH, there is a concern of sustainability at such low quotes and there may be a case where	• The margins of both developers and original equipment manufacturers (OEMs) has reduced. • The WPDs had an Internal Rate of Return (IRR) of around 18-20 percent in FiT regime, which has roughly cut down to around 9 percent in projects

	aggressive developers in order to seize more market share and capacity, may get entrapped in a heavy debt cycle, leading to a situation of non-performing assets (NPAs) (“Achieving 60 GW”, 2018). The capex of wind power projects dropped 10-15 percent since the transition to auctions. Suzlon Energy Ltd. is battling debt troubles and Inox Wind has reported losses. The Corporate Insolvency resolution proceedings have been taken up against Reagan Powertech (Chandrasekaran, 2019d). The German Wind Energy giant, Senvion, has also filed for insolvency (Radowitz, 2019). These OEMs were major market actors and were supplying Wind Turbine Generators (WTG) to approximately 25% of the market. This has resulted in reduction in competition among OEMs and prices of WTG has gone upwards, thus touching on the returns of WPDs (Sood et al., 2019).Due to reduced tariffs, it is probable that the operational model for wind power execution by OEMs will undergo a transformation. Developers may increasingly take on more project-related tasks internally to reduce expenses. Additionally, a potential trend could involve the forward integration of OEMs, as they are well-positioned with access to desirable wind sites and manufacturing capabilities. This trend is illustrated by recent competitive bidding	allocated through auctions. • The entry of bigger and global players • Smaller companies with limited finance options • low quotes ,aggressive developers in order to seize more market share and capacity, may get entrapped in a heavy debt cycle, leading to a situation of non-performing assets (NPAs). • Forward Integration or Reverse Integration between OEMs/WPDs.

	processes that have attracted major equipment suppliers like Inox, Gamesa, and Regen Powertech, who have themselves submitted bids for capacity.	
Financing Problems	The uncertainties in the renewable energy sector, especially related to land acquisition and power evacuation along with delayed or non-payment by discoms to clean energy developers as a whole, is affecting the overall behaviour of the financial institutions as the lower tariffs along with already existing operational and implementation risks around projects makes the debt unsustainable (Saluja, 2018). Non-Banking Financial Companies who are into financing wind projects are also vary of these risks and now ask for lower Debt-Equity ratios, corporate guarantees for any contractual defaults and are putting penal interests clause for delays in project along with high early repayment charges (Sood et.al, 2019).	• Overall behaviour of the financial institutions • Debt-Equity ratios, corporate guarantees for any contractual defaults and are putting penal interests clause for delays in project along with high early repayment charges
Financial Eligibility Criteria	I. Net-worth: The cumulative net-worth of the Bidding Company or Consortium must be equal to or exceed Rs. 1.24 Crores per MW of the quoted capacity. II. Liquidity: To ensure that the Bidder has adequate resources to manage the fund requirements for the Project, the Bidder must demonstrate at least one of the following parameters: a. Minimum annual turnover of Rs. 60	• Net-worth Criteria • Liquidity Criteria • Financial Closure Criteria

	lakhs per MW of the quoted capacity during the preceding financial year. b. Internal resource generation capability, represented as Profit Before Depreciation, Interest, and Taxes (PBDIT), with a minimum amount of Rs. 12 Lakhs per MW of the quoted capacity. c. An in-principle sanction letter from lending institutions/banks of the Bidder, committing to a Line of Credit for a minimum amount of Rs. 15 Lakhs per MW of the quoted capacity to meet the project's working capital requirement. III. Financial Closure: The Project Developer must confirm the completion of 100% of the Financing Arrangements for the Projects within 7 months from the Effective Date of the PPA. This confirmation should include a loan sanction letter for the debt component, a Board Resolution for equity contribution, and evidence of sufficient equity availability in the company.	
E Reverse Auction Mechanism and its suitability as a procedure	Techno Commercial Bids and Financial Bids are submitted online. Bidders are shortlisted by SECI and subsequently only their Financial Bids are opened. Only bidders which are lesser than the ceiling tariff are invited for participating in ereverse auction process .Selection of bidders is done based on bidder quoting lowest tariff (L1) getting qualified capacity and then the next highest bidder (in ascending order) getting qualified capacity , till the capacity is	• Direct Auctions verses Reverse Auctions which is more suitable. • Suitability of Reverse Auction Procedure • Capacity Auctioned sufficient or not.

	exhausted.(Kandpal and Dhingra, 2021) An e-bid is held on electronic platform with every bid visible to all players, while the closed bid is submitted physically in sealed envelope. There has been demand from industry for conventional bidding in wake of falling tariffs and creating Level playing field for SMEs specifically to take part in the wind energy programme.((Business Standard, 2018)	• Limit /Qualified Capacity for winner (L1) and subsequent allocation • Pipeline Visibility wrt planned capacity in future auctions
Bidding Strategy , Uncertainties and Biases during e reverse auctions	The Overall bidding decisions in all kind of auctions are highly uncertain and risky in nature. The final bid is based on the collective assessment of techno-economic factors, operational capabilities, fiscal commitments Strategic consideration, Competitor analysis and consideration of various kinds uncertainties cognitively by the bidders. In additions, bidders have to make decision within the 8 min window and for that they have to make certain pre- assumptions and take certain calls. Information uncertainty is highest in auctions and Request for Proposal(RFP) is the most representative information available to the bidders during the bidding stage. But still some critical information voids faced by WPDs prior to bidding.	• Bidding decisions in e-reverse auctions prone to any biases. • Assumptions made while bidding. • Bidding strategies employed by WPDs. • Information uncertainty • Participation of other WPDs affect the bidding behaviour

	As the auctions are masked , so no bidder is aware of which other WPDs are participating in the auctions.	• Competitor Analysis

5.3.2. Initial Conceptual Lens were defined using Initial Conceptual Construct and the same is described as under in **Figure**5.2

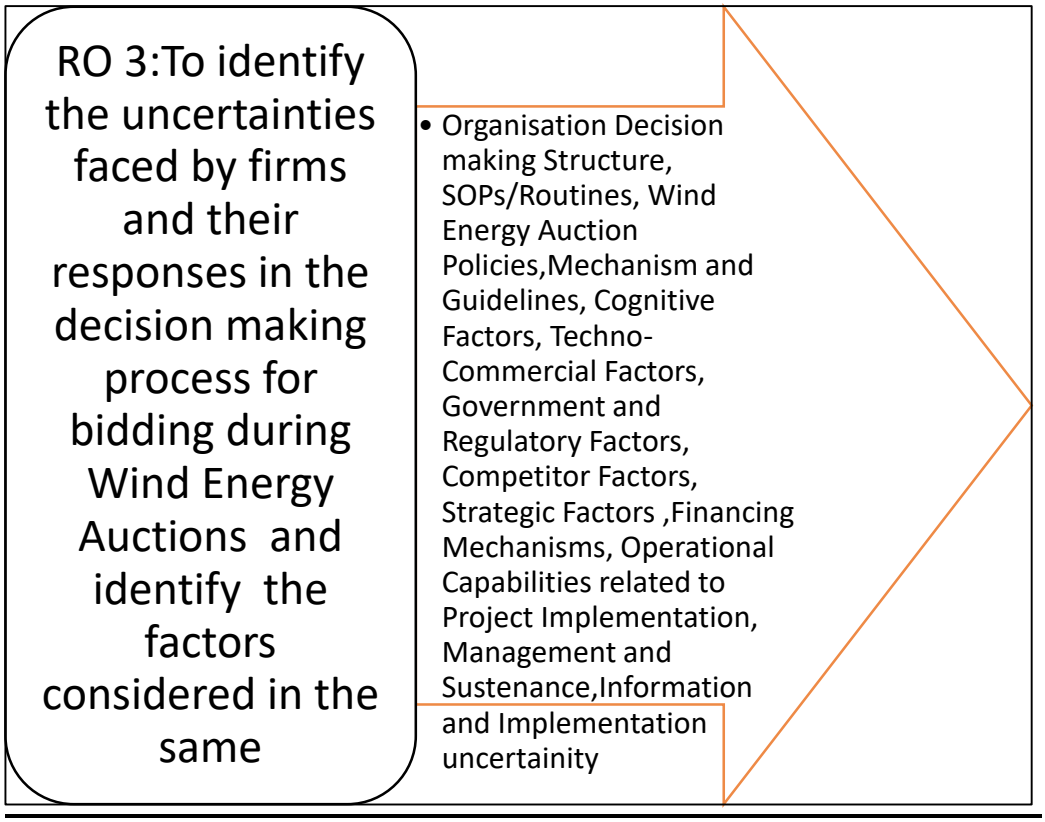

Figure 5.2 : Initial Conceptual Lens

5.4. DATA COLLECTION

The study employs a qualitative methodology to analyze the data gathered from a sample of 13 professionals who are either at Senior Management, Business Development level of Wind Power Developers who had experience in participating Wind Energy e reverse auctions as well as few senior officers of Government who are dealing with wind auctions. In addition certain journalists who are covering Wind Energy Sector were also included. These professionals were selected using purposive sampling from diverse firms, levels, and backgrounds, as outlined in Table 5.2, to gain a comprehensive perspective on the research questions. Interviews were conducted until theoretical saturation was achieved.

Table 5.2 : Profile of Interviewees

Type	Level	Profiles
Industry	General Manager –(Business Development)/COO/Associate Vice President(Business Development)/Finance Controller(07)	All were having experience of more than 10 years in Wind Energy Industry, directly or indirectly linked with Looking after Bidding and Commercial activities
Academic	Professor (01)	Expert in Power and RE Sector Policy
RE Consultant	Vice President (01) With State Govt (01)	• Prominent Green Energy Consultant Firm • Earlier with MP State Govt
Industry Watchers	Journalist(01)	Covering RE Sector(experience around 5 years)
Government	Director & Middle Level Manager(02)	Directly handling Wind Power E Reverse Auctions

A data collection protocol consisting of a detailed questionnaire was prepared as per Appx A and on the basis of same, semi-structured interviews were conducted .The respondents were asked to understand the uncertainties faced and their responses in the decision making process for bidding during Wind Energy Auctions by Firms as well as tries to identify the factors considered by firms while bidding in Auctions. In addition , study tries to answer the undermentioned research question :-

(a) What were the factors which have been driving the growth of wind energy in the country?

(b) Effectiveness of Central Polices of AD and GBI in the growth of wind energy in India and How has other the state government policies related to wind energy have impacted the growth of wind energy in India?

5.5 DATA ANALYSIS

The data analysis process, as depicted in Figure 5.3, and elaborated below was executed . A combination of text mining and qualitative content analysis was employed to demonstrate thematic convergence in the data derived from the interview transcripts.

- Initial Coding: The interviews were transcribed and coded into text, with responses consolidated into separate response sheets for each research question.
- Data Cleaning: Special characters, numeric values, and spaces were removed from the transcripts, ensuring uniformity across files.
- Stop Words: Stop words were defined and applied to the transcripts.
- NVivo Analysis: The cleaned transcripts were imported into NVivo for analysis.
- Word Cloud Generation: Word clouds were generated to extract key content from the analysis.
- Thematic and Sentiment Analysis: Thematic and sentiment analysis were conducted using autocode features.

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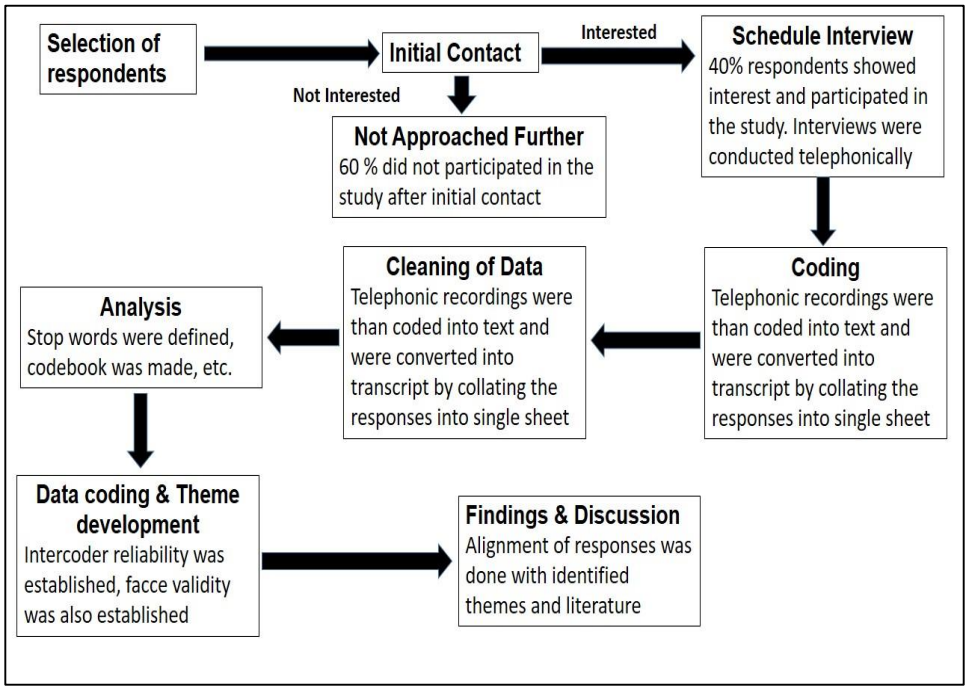


Figure 5.3 : Data Analysis Procedure

5.6. FINDINGS

The examination of the participants' answers reveals the following categories that can be delineated.

5.6.1 Historical factors that led to the growth of wind energy industry in India

This part identifies the various historical factors that led to the growth of wind energy industry in India by analysing the data collected from various stakeholders. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in **Figure 5.4.** The word cloud depicts that GBI and AD are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents . Sentiment analysis was performed on the first question, which indicated that respondents harboured a moderately positive / very positive sentiment which indicates that the policy initiatives and support by government has had positive impact on the growth of wind energy industry in India. Thematic analysis of the

question indicated Wind Policy as having positive impact on development of Wind Energy growth in India. The majority of the responses were centred on that various tax benefits, policy initiatives like AD and later GBI were main drivers of the growth of wind energy in India historically .

SENTIMENT	PERCENTAGE
1 : Very negative	0%
2 : Moderately negative	0%
3 : Moderately positive	73.74%
4 : Very positive	26.26%

Codes	Coding References
1 : finance	2
2 : mechanism	3
3 : policy	4
4 : power	2
5 : tax	2
6 : wind	6

Figure 5.4 : Word Cloud ,Sentiment Analysis and Codes for Historial Factors for growth of Wind Energy in India

"AD benefit was given which was main driver ,RPOs were also introduced , so obviously policy push was there Regulators gave attractive tariff. Developers were concerned with returns only so if you get returns . AD ,GBI & RPO were main things"-

-Respondent-1

"I think one is the biggest driver is the climate finance, okay, that has been, I think one of the key grow key driver because a lot of clean finance money is available, and then they are looking for avenues and Indian wind sector makes up for a great story for this. So that's one of the key driver".

“And then suddenly the next big driver is the government policies, especially AD and GBI the enabling policies and the push that the government has had on the sectors since beginning that has also helped.”

-Respondent-2

“ Wind Sector mature much before solar and that is primarily attributed to domestic manufacturing capability that was developed long ago.Secondly it was also due to the conducive tax rebates i.e AD that was available to the investors

“AD concept allowed wind turbines to be installed in a massive number. At that time there was no biding mechanism , therefore projects were set up on FiT mechanism basis. That was considered to be a more generous mechanism compared to the competitive market we are seeing right now. “

-Respondent-3

“The historical factors which have led to the growth of wind energy in India has been subsidies, tax reliefs , customs duty exemptions provided by the government in 1990s . AD policy was main driver as it provided significant tax benefit to the wind power developers.”

-Respondent-4

“Ease of land and FITs drove wind installations in India. The government wanted to create a significant wind energy production capacity and for the sector to gain traction, hence FITs were introduced”

“AD & GBI helped but made the sector dependent on subsidies. Classic example is the case of SUZLON, India's largest wind energy producer at a point in time”.

There are 2-3 factors that can be counted. “Earlier it was on account of captive consumption, where the grid cost is higher than any energy you use.

“Till 2015-16 every state was very keen to harness wind energy and solar energy.

There were 2-3 reasons One was that States were taxing it heavily so states were getting good returns , lot of employment opportunities."

"There was a real pull from captive consumers and IPPs and states were very happy. They didn't bother about which state is charging what, some were charging Rs 4, some were Rs 5.Renewable Energy was very fast to commission and on the return side also it was giving returns of 20-25 %. AD and some other govt incentive schemes were there which made investments very very lucrative."

"In 2008 , government wanted to transform the business from AD to pure IPPs, so GBI was introduced .Govt wanted to expand the market from 1.5 to 2.GW Captive had limited scope and it was not scalable. They wanted more business so they introduced IPPs. Benefits of AD they partially offset through GBI."

-Respondent-6

From the interview observations and wind energy experts' point of view, certain inferences as discussed ahead can be drawn. The historical factors which have led to the growth of wind energy in India has been subsidies, tax reliefs , customs duty exemptions provided by the government in 1990s . AD policy was main driver as it provided significant tax benefit to the wind power developers.
To further expand the wind energy market to IPPs and attract Foreign investors , benefits of AD were partially offset through GBI.Till 2015-16 every state was very keen to harness wind energy and solar energy as states were benefitting from taxes as well as it was providing lot of employment opportunities. Currently, climate finance is also one of the drivers of wind energy in India .

5.6.2 Impact of AD and GBI as well as various other government policies on the growth of wind energy in India

This part identifies the impact and effectiveness of the role of central government policies of AD and GBI as well as role the state level policies of FiT, RPOs, Banking and Wheeling in Indian wind energy industry's growth. Analysis of data collected from various stakeholders was done on the basis of strategy described in the **Section 5.5**. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in **Figure 5 .5.**

The word cloud depicts that GBI , AD and RPOs are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents .Sentiment analysis indicated that a moderately positive sentiment harboured by the respondents whichindicates that the ADand GBI as well as the state level policies have had positive impact on the Wind Energy's growth in India.

On carrying out Thematic analysis ,it is indicated that the policy push of government especially the policies of AD and GBI being main reasons for growth and development of wind energy in India.

Code	Coding References
1 : central government	2
2 : developers	2
3 : policies	2
4 : requirement	2
5 : sense	2
6 : state	2
7 : tariff	2
8 : wind	3

SENTIMENT	PERCENTAGE
1 : Very negative	15.63%
2 : Moderately negative	33.04%
3 : Moderately positive	35.71%
4 : Very positive	15.63%

Fig 5.5 : Word Cloud ,Sentiment Analysis and Codes on Impact of AD and GBI on the growth of wind energy in India

"AD benefit was given which was main driver ,RPOs were also introduced , so obviously policy push was there Regulators gave attractive tariff. Developers were concerned with returns only so if you get returns . AD ,GBI & RPO were main things."

"All state regulators have implemented RPOs , but they may or may not match the central government targets both in terms of quantum as well as in terms of duration. Challenge is implementation."

-Respondent 1

" I think these policies , whether it was AD or GBI ,they were kind of incentivizing the development. In pure economic terms, the power generated

was still costly, even at the tariff price of five rupees or five and half rupees it was not sustainable until unless you get these kind of incentives. So AD helped."

"Today, when we say that there is a good amount of ecosystem that has been built in . But overall that ecosystem has been developed because those incentives were available, the benefit of AD was that it was able to reach to even the non-core investors as well."

" In Tamil Nadu you will see that even the smaller machines ,bigger machines, a much different kind of an ecosystem over there. Even you would find wind turbine repair shops also in some areas where these two fifty kilowatts machines used to get installed. And at that time, these kind of incentives were needed, otherwise we would not have been reaching the level where it is today."

" G B I was kind of an initiative which was then to bring the economics at par between people who are doing. Because the tariffs used to be fixed and so within that tariff now, either you have AD benefit or you can have GBI benefit. So GBI was for more for the pure play FIIs or the IPP who are developing projects and who do not have any requirement for AD. It was, just to make it attractive for them"

-Respondent 2

" RPOs were announced by the centre but the states had the power to define their own RPOs. Their commissions had the power to modify the RPOs allotted by the Centre Gov."

"So till 2016-17, RE tariffs were considerably higher than coal based thermal tariffs. So Discoms were in a considerable dilemma to either honour the national RPOs or keep the financial health of RPOs sound. RPO on paper is stringent requirement but ground reality is that it is not a penal requirement. Commissions have power to levy some penalty but it is not being enforced. So now states have awakened to the scenario where RE is cheaper than the thermal and it makes commercial sense as well environmental sense but intermittency and other things also play up and they cannot totally go green."

“GBI played out really well. It helped wind as well as small scale solar rooftop. The scheme was to incentivize investors via a subsidy to invest in India.”
“Banking and wheeling again are a major aspect controlled by states”.

-Respondent 3

“May be AD benefited a lot of investors in terms of tax benefits but didn’t really resulted in capacity addition.”

“GBI was an add on , whatever projects that were coming to threshold, GBI pushed them ahead. GBI has now been phased out. To an extent AD is also passe with only 40% across all sectors.”

“Wheeling and Banking regulations doesn’t work for Discoms per se but definitely benefit commercial and industrial (C & I) customers.”
“since last couple of years is that discoms are trying to ween off the benefits or positives of the things, making it more stringent. Some of the states have started to withdraw the banking regulations,”

-Respondent 4

“AD & GBI helped but made the sector dependent on subsidies. Classic example is the case of SUZLON, India's largest wind energy producer at a point in time”

-Respondent 5

“AD and some other govt incentive schemes were there which made investments very very lucrative. These are some the of the reasons which have unlocked the market in our country.”

“Govt wanted more business so they introduced GBI for IPPs. Benefits of AD they partially offset through GBI.”

“RPO did not help in the growth of wind energy . It is there on paper but there is no enforcement.”

“ Banking is very good for captive but not for IPPs, that is why it has led to growth of captive and third party sales. Banking is also being taken out or is becoming restrictive in nature”.

-Respondent 6

From the interview observations and wind energy experts' point of view, inferences as discussed ahead can be drawn. The entire wind energy industry ecosystem has been developed because incentives like AD and GBI were available. AD benefit was the main driver of wind energy investments in India. It enabled even non-core investors to invest in the sector. It unlocked the Indian wind market. RPOs have been implemented by the state regulators , but they may or may not match the central government targets both in terms of quantum as well as in terms of duration. RPO on paper is stringent requirement but ground reality is that it is not a penal requirement. Commissions have power to levy some penalty but it is not being enforced. GBI attracted FIIs or the IPP who are developing projects and who do not have any requirement for AD. GBI has now been phased out and AD is also passe with only 40% across all sectors. Banking and wheeling are controlled by states. Banking is very good for captive but not for IPPs, that is why it has led to growth of captive and third party sales.

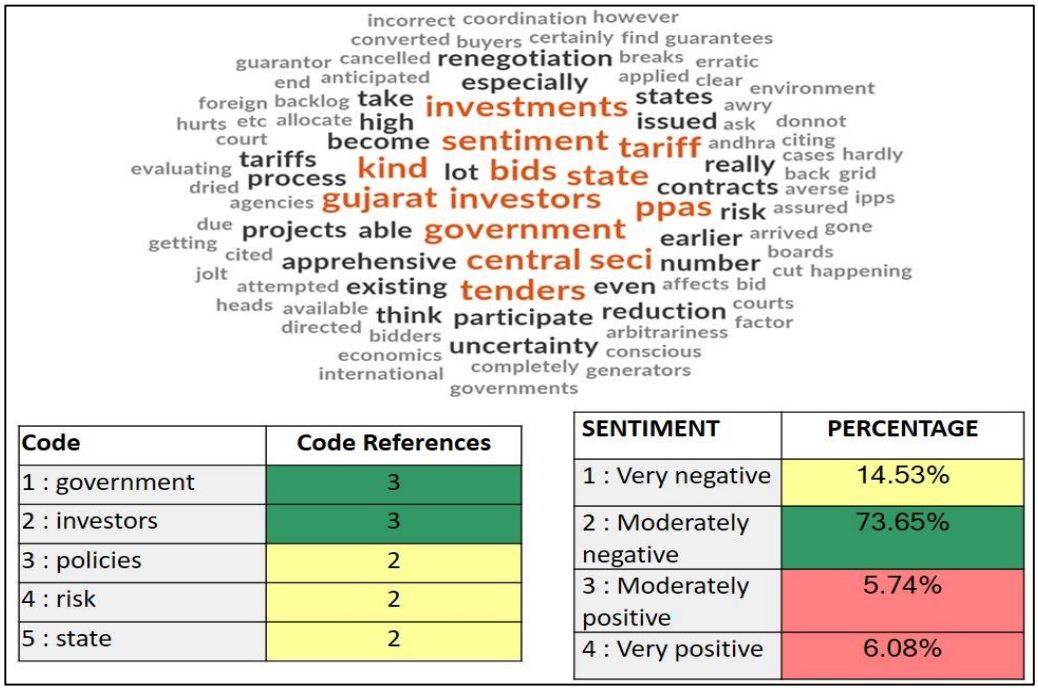
5.6.3 Adequacy of Power Evacuation and Transmission Infrastructure

This section of the data analysis will cover the status of adequacy of Power Evacuation and Transmission Infrastructure. Analysis of data collected from various stakeholders was done on the basis of strategy described in the Section 8.4. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.6 .

The word cloud depicts that words Transmission, infrastructure , power , SECI and Projects are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents

Sentiment analysis indicated that a moderately negative sentiment harboured by the respondents which indicates that respondents believe that the Power Evacuation and Transmission Infrastructure is not adequate for the Wind Power Developers.

On carrying out Thematic analysis ,it is indicated that there is a requirement of power evacuation and transmission infrastructure. The majority of the responses were centered on mismatch between intended project locations and transmission grid infrastructure availability also the difference between gestation period of wind project development and transmission infrastructure development.



Code	Code References
1 : government	3
2 : investors	3
3 : policies	2
4 : risk	2
5 : state	2

SENTIMENT	PERCENTAGE
1 : Very negative	14.53%
2 : Moderately negative	73.65%
3 : Moderately positive	5.74%
4 : Very positive	6.08%

Figure 5.6 : Word Cloud ,Sentiment Analysis and Codes on the Adequacy of Power Evacuation and Transmission Infrastructure

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories and focussed codes that have emerged out from interview data have been illustrated in Table- 5.3 . Selected quotations from the interviews are listed below:

"Where we have land available but substations are not there and where there are substations there is no land available"

" Transmission infrastructure takes 4-5 years and wind solar take 2.5 years. Definitely gap is there in Transmission Infrastructure development and Wind solar Development. Also wind is in pockets. Where wind is there but Transmission Infrastructure not there may be availability on the overall basis".

-Respondent 1

"I think transmission has been an issue, and as you rightly said that because of the different gestation period."

"There are a couple of solutions which also identified

"One is that either you do a region based kind of a bid and that this particular bid will be allocated to a particular Substation. But then again, that kind of defeats the purpose of your competitive building, right".

"Our C T U has been very transparent in sharing that what kind of infrastructure that they are developing and its timeline. Accordingly, now it is up to the developers to do their own diligence and then figure out. If there is a delay that happens from the initially projected timelines . So that is something that I think right now, also, the government or SECI allows you to get time extension for that period, which is kind of that you are not being penalized for when the mistake is not yours".

" But the problem is that I would also have already committed my capital. I would have drawn fund from my lenders and I would have started paying interest on to it. Similarly, if I have taken my equity. That also has a cost, and I have invested my fund then, and if my returns do not start , then there is a problem, so that becomes a challenge".

"I would like that first, government would create an infrastructure and then ask me to bid. But it's not the status right now."

-Respondent 2

"Transmission infrastructure plays a major role especially when we say about Inter State Power Transmission. Biggest point of impact of SECI was Inter State Transfer of power. Now eastern states, which didn't have good RE resources, they were able to procure RE and meet their RPO."

"Govt rolled out a comprehensive plan of matching proposed transmission infrastructure with RE potential."

"To enable that certain regulatory changes were carried out to reduce the gestation period from 4-5 years to 2-3 years. RE capacities timeline also govt has extended to 24 months".

" Currently the concept is that WPDs are intimate about the proposed commissioning date of transmission system, so that they can plan their procurement accordingly and they can minimize the IDC".

"That is the synergy SECI is trying to do and is one of the most important factor for WPDs in auctions. SECI also gives a list of substations where we want new projects to come up. Since SECI works in tandem with CTU , powergrid, we decide the substations where we need fresh capacities to be installed. This also gives existing capacities to augument themselves".

-Respondent 3

"3 – 4 years is a bare minimum considering the complexity in terms of ROW and other things. You do get an extension if transmission things are not ready but you cannot plan your investments on that basis."

-Respondent 4

"Entire process of availing transmission infrastructure has been made easy, coordination between agencies has become better; but the Green Energy Corridor is not yet complete and Indian transmission infrastructure cannot take full load of intermittent wind power being generated".

"Transmission infra availability is of paramount importance. In case of transmission infrastructure (substations) being far away leads to extra cost as developers will have to set up infra, till the substation for export of power generated"

-Respondent 5

"I think that connectivity infrastructure is insufficient and there is huge challenge in the transmission infrastructure. No coordination is their between SECI and IPPs. Since the reverse auctions came into play everything is on the head of IPPs. They are running from pillar to post to get inputs for advance

planning in terms of infrastructure availability, searching and procuring land . OEMs now have stopped giving turnkey solutions and they sell only turbines now, rest of the things is on the head of IPPs".

"It is not very tough task but a clarity is required from MoP on what kind of and where transmission infrastructure will come up".

"Though transparency in terms of transmission infrastructure planning is much more now but whether it materialises or not you cannot say".

-Respondent 6

From the interview observations and wind energy experts' point of view, inferences as discussed ahead can be drawn. There is mismatch between land availability and presence of corresponding substations. Also there is a gap between transmission infrastructure development and Wind Solar project development, as both have different gestation periods, it takes 4-5 years for Transmission Infrastructure and 18-24 months for Wind Project development.

Central Transmission Utility in coordination with MoP and SECI is transparent and shares that what kind of infrastructure that is getting developed , its location and proposed commissioning date in order to assist the WPDs to do their due diligence and plan their projects ensure their IDC is minimized. The delay in transmission infrastructure development leads to losses for WPDs due to commitment of capital and payment of Interest During Construction due to delayed returns. SECI supports WPDs in case of delay in transmission infrastructure development by giving time line extensions and no penalties are put.

Table 5.3 : Constructs ,Sub-constructs, Categories & Focussed Codes on the Adequacy of Power Evacuation and Transmission Infrastructure

Constructs	Sub Constructs	Categories	Focused Code
Transmission Infrastructure Availability	Power Evacuation and Transmission Infrastructure is inadequate	**Inadequacy of Power Evacuation and Transmission Infrastructure**	Requirement of Wind Projects by WPDs based on Transmission infrastructure availability
	Grid infrastructure takes about five years to become operational and Wind Power Plants get operationalized in 18 months		Power Infrastructure and Wind Power Project development gestation period mismatch
	Lack of coordination between Wind Power Developers ,SECI and Central Transmission Utility, wrt selection of sites and development of corresponding evacuation and transmission infrastructure.		Transparency by MoP and SECI on the proposed transmission infrastructure development

5.6.4 Tariff Revision and Renegotiation of PPAs by State Governments and Utilities

Despite the clear policies and procedures issued by MNRE, several state governments, particularly in the context of renegotiating tariffs within existing PPAs, have demonstrated a degree of arbitrariness. This section of the data analysis will cover the status of adequacy of Power Evacuation and Transmission Infrastructure. Analysis of data collected from various stakeholders was done on the basis of strategy described in the **Sectionv5.4**.

The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in **Figure 5.7 .**

Code	Code References
1 : government	3
2 : investors	3
3 : policies	2
4 : risk	2
5 : state	2

SENTIMENT	PERCENTAGE
1 : Very negative	14.53%
2 : Moderately negative	73.65%
3 : Moderately positive	5.74%
4 : Very positive	6.08%

Figure 5.7 : Word Cloud ,Sentiment Analysis and Codes on Tariff Revision and Renegotiation of PPAs by State Governments

The word cloud depicts that words sentiment, investor, PPAs, state, government are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents

Sentiment analysis on the question, indicates a moderately and very negative sentiment harboured by the respondents. This is indicative of the fact that Tariff

Revision and Renegotiation of PPAs by State Governments have had negative impact on the investors.

On carrying out Thematic analysis ,it is indicated that PPAs are sacrosanct, renegotiation of PPAs is legally incorrect and should not be carried out . This reduces investor sentiment in state as well as also affects the overall outlook towards the sector and makes them more apprehensive.

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories and focused codes that have emerged out from interview data have been illustrated in Table- 5.4 . Selected quotations from the interviews are listed below:

"Any kind of Uncertainty reduces investor sentiment , outside investors boards become more apprehensive and ask for more guarantees."

"Yes cases on reduction in offtake also keep on happening, though not on central grid"

-Respondent 1

"All this has made all the wind generators very conscious about evaluating the bid opportunities. It is certainly a factor. Earlier off- taker risk profile it didn't use to matter. But now , I think people have become risk averse and hardly few players participate who think that they will be able to manage the risks."

"the kind of uncertainties are much lesser when you participate with the central agencies." "However, even with SECI also, there is a problem because a lot of bids are not getting converted into P P A. There is a lot of backlog available where they are not able to find it buyers at the back end"

-Respondent 2

"It was rightly taken to courts and process was struck on. This resulted policy uncertainty and was severe jolt to the investors especially foreign investors as this kind of environment they ha never anticipated. But that is specific to state but in SECIs this thing has not arrived as SECI is the off take

guarantor an there is no question of revisiting the tariff at all. And that ay SECI tenders are assured but states tenders and their participation and bids showed that uncertainty" .

-Respondent 3

"International investors were really apprehensive about that. But IPPs really don't applied breaks on their investments".

"Gujarat also did it but Gujarat has its own set of bidders . They have also been quite erratic, they have issued terminated contracts, renegotiated tariffs etc. but investments there have not dried out."

-Respondent 4

"It shakes investor sentiment in investments in state as well as also affects the overall outlook towards the sector"

-Respondent 5

"Renegotiation of PPAs is legally incorrect. High Court has restored the status and in my

opinion PPAs are sacrosanct an should not violated. It hurts the investor sentiment"

-Respondent 6

From the interview observations and wind energy experts' point of view, inferences as discussed ahead can be drawn. PPAs are sacrosanct and should not violated and Renegotiation of PPAs is legally incorrect. Any kind of Uncertainty reduces investor sentiment in state as well as also affects the overall outlook towards the sector and makes them more apprehensive. Cases of reduction in off take have also happened at state levels and limited participation in state tenders implies WPDs now consider off- taker risk profile and are vary in certain states. The kind of uncertainties are much lesser in central auctions as SECI is the Off Take guarantor and no revisiting or renegotiation of tariffs happens.

Table 5.4: Constructs ,Sub-constructs, Categories & Focussed Codes on Tariff Revision and Renegotiation of PPAs by State Governments

Constructs	Sub Constructs	Categories	Focused Code
Tariff Revision and Renegotiation of PPAs	Arbitrary renegotiation of old contracts by some states	**Renegotiation of PPAs**	PPA renegotiation legally incorrect
	Reduction in off-take by state utilities in the existing projects		Off-take reduction
	Lack of coordination between states and MNRE (SECI).No binding directions from MNRE for States.		No coordination between States and SECI
	Cancellation of auctions due to high tariff bids/ directions by states for reducing tariffs.		Sanctity of auctions to be maintained

5.6.5 Discoms in Duress

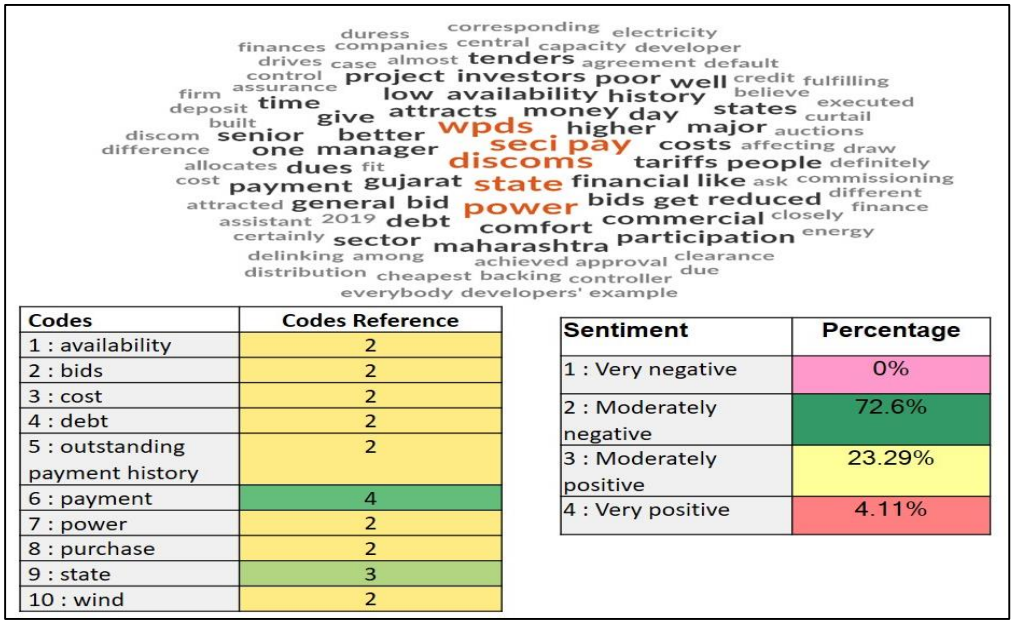
Almost all state power distribution companies (Discoms) are debt ridden. This drives them to limit their electricity purchases and not fulfilling their RPO obligations. They also do not pay timely dues to WPDs .This section of the data analysis will cover the status of state discoms and challenges faced by WPDs due to the same. Analysis of data collected from various stakeholders was done on the basis of strategy described in the Section 5.4. The Word Cloud ,

Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.8 .

The word cloud depicts that words State Discoms, Payment, SECI, financial are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents.

Sentiment analysis on the question, indicates a moderately negative sentiment harboured by the respondents. This is indicative of the fact that poor financial health of discoms leads to negative sentiment of WPDs towards them.

On carrying out Thematic analysis ,it is indicated that WPDs consider poor financial state of discoms as an important factor which leads to reduced participation in state bids and higher tariff prices in bids.



Codes	Codes Reference
1 : availability	2
2 : bids	2
3 : cost	2
4 : debt	2
5 : outstanding payment history	2
6 : payment	4
7 : power	2
8 : purchase	2
9 : state	3
10 : wind	2

Sentiment	Percentage
1 : Very negative	0%
2 : Moderately negative	72.6%
3 : Moderately positive	23.29%
4 : Very positive	4.11%

Figure 5.8 : Word Cloud ,Sentiment Analysis and Codes on Discoms in Duress

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories and focussed codes that have emerged out from interview data have been illustrated in Table- 5.5 . Selected quotations from the interviews are listed below:

"In FiT regime, wherein like price had gone as high as 5+. As it is much higher than their power purchase cost so definitely they show resistance through different ways and means. Like sometimes they will give money late, some curtail, some approval issues negotiate."

-Respondent 1

"People are pricing poor financial state of discoms in as well. One is a lack of participation and the second is the reduced participation in state bids. And when you have a reduced participants and then certainly bid prices are likely to rise"

-Respondent 2

"It impacts in state specific tenders and not in SECI tenders. Gujarat for example attracts very low tariffs because of its outstanding payment history. Maharashtra attracts higher tariffs,the major difference is the bids is due to the payment history of the discoms."

"For WPDs, whatever bid is received is reflection off SECI's paying capacity... By this delinking, SECI has secure their PPAs and have achieved substantial low tariffs."

-Respondent 3

"Today everybody takes the comfort of SECI being intermediary. There are three levels of payments assurance that have been built. One is the tri-partie agreement between SECI, WPDs and State Discoms , so in case of any default they can take from the central pool of funds that RBI allocates to the states. SECI also tends to give you a Line of Credit.Third is that they ask you your money of Rs 5 Lakh per MW, which WPDs deposit on commissioning of the projects."

-Respondent 4

"DISCOMs want to procure the cheapest and sell to be profitable and this costs the wind sector its speed of growth. Their weak financial strength

leads to non-clearance of dues on time, thereby affecting the developers' finances (higher interests to pay to lenders).

-Respondent 5

"Most of them are poor, but investors do believe that these discoms have backing and control of state governments and sooner or later they will pay the money. That's the kind of comfort people draw.Point is that they are not going to be liquidated ".

"In terms of wind resource availability and corresponding land availability Gujarat is among top and better than Maharashtra and other states. Discom health is also very good and they pay you in time. All investors get attracted. Gujarat is better ,in way that I you won the project then PPA will be signed immediately and the project will get executed ".

-Respondent 6

Table 5.5: Constructs ,Sub-constructs, Categories & Focussed Codes on Discoms in Duress

Constructs	Sub Constructs	Categories	Focused Code
Discoms in Duress	Debt Ridden Discoms	**Discoms poor financial health**	Poor financial health of discoms
	Discoms not fulfilling RPOs		RPOs commitment not fulfilled by states
	Non-payment of timely dues by DISCOMs to WPDs		Lack of monitoring and implementation of RPOs
			Poor payment history by State discoms

From the interview observations and wind energy experts' point of view, inferences as discussed ahead can be drawn. The weak financial strength of Discoms leads to non-clearance of dues on time, thereby affecting the

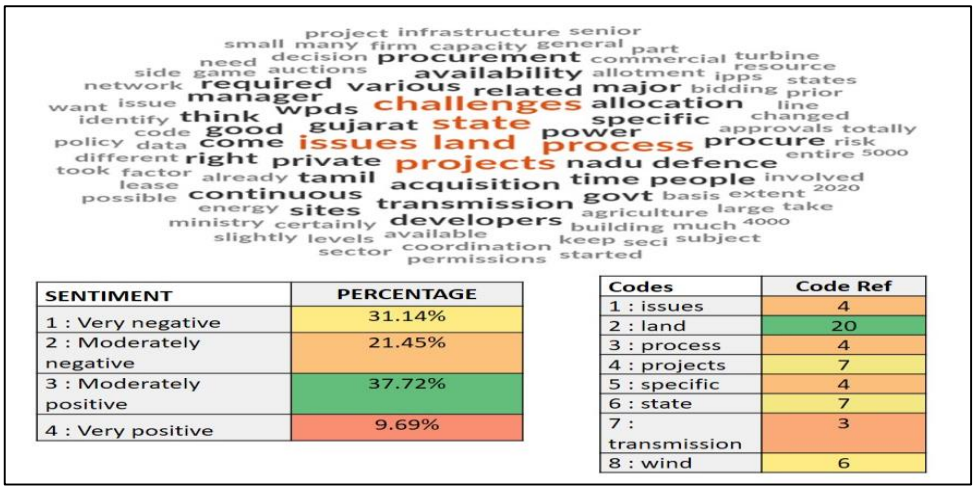
developers' finances (higher interests to pay to lenders). If Discoms health is good and then they do payments timely and investors get attracted. WPDs consider poor financial state of discoms in as important factor which leads to reduced participation in state bids and higher tariff prices in bids.

Discoms with good financial strength and good payment history like Gujarat attract very low tariffs .State auctions also lead to immediate signing of PPAs unlike that of SECI where it takes nearly 6 months .On the other hand certain discoms like Maharashtra with poor payment history attracts higher tariffs. Now all WPDs prefer central tenders by SECI as three levels of payments assurance have been built in. One is the tri-partie agreement between SECI, WPDs and State Discoms , so in case of any default WPDs can take from the central pool of funds that RBI allocates to the states. SECI also tends to give you a Line of Credit. Third is that they ask WPDs money (Rs 5 Lakh per MW), which WPDs deposit on commissioning of the projects.

5.6.6 Land Issues

The land is a state subject and Land purchase and allotment related policies vary from state to state .In spite of many efforts at all levels to fasten up the process of land acquisition for wind projects, the involvement of so many entities makes the entire process highly cumbersome and time-consuming. This section of the data analysis will cover the challenges related to land acquisition by WPDs. Analysis of data collected from various stakeholders was done on the basis of strategy described in the Section 5.4. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.9 . The word cloud depicts that words land issues, acquisition, state , challenges, Gujarat , Tamil Nadu are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents. Sentiment analysis on the question indicates that approximately 50% either very negative or moderately negative sentiment harboured by the respondents. This is indicative of the fact that challenges related to land issues leads to negative

sentiment of WPDs towards them.On carrying out Thematic analysis , it is indicated that that land and transmission infrastructure are interlinked and cannot be considered in isolation. In addition, Land is a state subject and challenges are all state specific.



SENTIMENT	PERCENTAGE
1 : Very negative	31.14%
2 : Moderately negative	21.45%
3 : Moderately positive	37.72%
4 : Very positive	9.69%

Codes	Code Ref
1 : issues	4
2 : land	20
3 : process	4
4 : projects	7
5 : specific	4
6 : state	7
7 : transmission	3
8 : wind	6

Figure 5.9 : Word Cloud ,Sentiment Analysis and Codes on Land Issues

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories and focussed codes that have emerged out from interview data have been illustrated in Table- 5.6. Selected quotations from the interviews are listed below:

"Land being a state subject challenges will always be there and state specific. Firms want to set up project where there is good wind/ resource availability but then there are issues with transmission infrastructure like substation will not come up there. We cannot consider transmission and land in isolation."

-Respondent 1

" if you have to do any kind of industrial activity, land becomes a very critical aspect of it, and you have to be ready to take this specific risk. I think people have learned to manage this risk. Certainly, there are different challenges in each state, however, wind is slightly easier as compared to the solar, you need a continuous parcel of land. In wind the challenges come, predominantly onto

the right of way related issues for the transmission line because the transmission line network is a bit more distributed and slightly spread out and then it is not within a specific boundary."

" On the land ceiling , I think all states have now started working to ease the issues."

"So on the land side, certainly there are challenges, but that is part of the game, right, if you are in the game. Then you have to learn to live with it, and if you keep on the business person, I would not say that land would be a specific challenge for me."

"But on the permission side, the permissions were not articulate enough initially. Now a lot more understanding has been reached, even this defence NOC which became a much bigger issue, and now I think that the defence ministry people have worked out now"

-Respondent 2

"Land issues are there , that is a given factor. But good thing is that over a period of time developers have learnt from their mistakes and now developers have a very strong network of land liasioning people or middle men. Land bank creation is a continuous process of large WPDs. Earlier there was a sequential process of first winning a bid and then searching a land, but then that would have been feasible for small capacity say 50 MW but now where average projects are 300 MW , finding land in such a small time span of one year is not possible"

"But Gujarat changed its wasteland policy which resulted in a spanner in almost 5 tranches of bidding. So it was a major blow .Though no correlation could be derived that they kept good windy sites for themselves and they also didn't want power supply to be transferred to other states and they wanted to consume that power. And land allocation took 9-11 months from scratch and led to halting of work on 4000-5000 MW capacity. It was a major legal issue and WPDs could not be helped by time extension also. SECI had to simplify the

process through various levels. In 2020, the policy change they started issuing land approvals etc."

"Tamil Nadu changed their building code and as per that wind projects were required to adhere to a building code. As per that they were suppose to take additional land for each wind turbine on footprint basis. So that as totally different and it is totally private land driven state and there is lot of land mafia. So considering that land tie up with the low tariffs achieved was not possible"

"There govt took a generic call to resolve the issues as 99 percent projects were likely to be set up in Gujarat and Tamil Nadu."

-Respondent 3

"Coordination by SECI for land availability with state governments is Sadly No, what they did only for Gujarat was that the projects that are allocated till the Tranche 5 , they get the land allocation. That was the only intervention they did , otherwise they really don't intervene in state matters."

"Yes that is as a practice our firm does identify /earmark/procure land parcels prior to bidding. As your biggest uncertainty is your resource. Costs and other things are primarily flattish or you can say minor variations . To that extent, IPPs tend to identify sites where the data is available to an extent and move forward in creating land banks."

"Right now the preference for setting up of win projects is in Karnataka. Tamil Nadu is exhausted , sites have dried out and evacuation infrastructure has to be expanded. Now these are the two constraints with Tamil Nadu. Gujarat you know already the state regulations which prevent land procurement.MP has lowest wind potential. Only state that is left out are Maharashtra and Karnataka".

-Respondent 4

"Land availability & acquisition can sway the decision in terms of YES/NO being provided for project execution"

"As most of the land which was easily available has already been utilized and now farmers/owners need to be courted in better way with higher prices and other guarantees , thus making it tough to set up large projects; and this in turn is having a ripple effect of stagnating the entire sector.

-Respondent 5

"Now days most of the projects are happening on private land. Due to complex procedures and bureaucratic delays most of the projects in last 2 years have come up on private land. And allotment of govt land is not being considered much of a factor."

"IPPs keep on acquiring land as a continuous process as well as at times procure land post allocation of projects in auctions."

-Respondent 6

From the interview observations and wind energy experts' point of view, inferences as discussed can be drawn. Land and Transmission infrastructure are interlinked and cannot be considered in isolation. WPDs want to set up project where there is good wind/ resource availability but there are issues with transmission and evacuation infrastructure like substation will not come up there. Land is a state subject and state specific challenges will always be there. WPDs have faced challenges in Tamil Nadu and Gujarat due to change in states land policy. Right now the preference for setting up of wind projects is in Karnataka. The challenges and risks with land related issue in wind is same as that with any other industry in India. All Industrial players have to be ready to take this specific risk . Overall WPDs have learned to manage this risk. However, initially the permissions were not articulate enough and now a lot more understanding has been reached at all levels. The defence NOC issue has also been resolved and a smooth procedure has been established by Ministry of Defence and bank creation is a continuous process of large WPDs. Now days most of the projects are happening on private land. There is no coordination by SECI for land availability with state governments.

Table 5.6 : Constructs ,Sub-constructs, Categories & Focussed Codes on Land Issues

Constructs	Sub Constructs	Categories	Focused Code
Land Issues	Windy sites scarce.	**Challenges in land acquisition**	Corresponding Power evacuation infrastructure availability at the Wind Resource available sites
	Grid Infrastructure for power evacuation		
	Land is a state subject and land availability rates, policies wrt agriculture land are varied across states.		State specific challenges in land acquisition in terms of wasteland and agricultural land policies and getting permissions
	Permissions/Approvals required for converting Agriculture land to Non Agriculture.		
	Timeline for land acquisition seven months to eighteen months		
	Involvement of many entities at local village , district and state government levels		
	Land-ceiling limits.		
	WPDs prefer buying land to create long term assets instead of leasing		WPDs buying private land and create land pool
	NOC requirement		

	Delay in issuing NOC by MoD		Smooth procedure for NOC from MoD

5.6.7 Issues with OEM and WPD

The margins of both developers and OEMs has reduced considerably since the introduction of auction mechanism. This section of the data analysis will cover the challenges faced by both OEMs and WPDs. Analysis of data collected from various stakeholders was done on the basis of strategy described in the Section 5.4. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.10.

The word cloud depicts that words financial, risk, price, OEMs, WPDs, auctions are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents. Sentiment analysis indicated that approximately 60% either very negative or moderately negative sentiment harboured by the respondents. This is indicative of the fact that OEMs and WPDs are facing challenges which are negatively affecting the Wind Energy Industry in India. Thematic analysis of the question indicated that respondents think that profile of WPDs is siting to large bigger players, liquidity is available and no forward or reverse integration between WPDs and OEMs is happening.

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories and focussed codes that have emerged out from interview data have been illustrated in Table- 5.7

Codes	Code References
1 : auction	3
2 : bidding	3
3 : debt	3
4 : developer	2
5 : equity side	2
6 : extensions	2
7 : finance	2
8 : good amount	2
9 : infrastructure	2
10 : line	2
11 : margins	2
12 : players	5
13 : price	2
14 : profiles	2
15 : project	3
16 : rate	2
17 : risk	6
18 : sector	2
19 : side	5
20 : sizes	2
21 : tariff	2
22 : technological	3
23 : transmission	2

Sentiment	Percentage
1 : Very negative	25.2%
2 : Moderately negative	40.32%
3 : Moderately positive	28.65%
4 : Very positive	5.84%

Figure 5.10 : Word Cloud ,Sentiment Analysis and Codes on Issues with OEM and WPD

. Selected quotations from the interviews are listed below:

"Liquidity is not a challenge. Green Finance is an open tap, only terms and condition vary and competitive terms obviously bigger the brand easier it is to get the financing. Foreign funding is there".

"No likely forward or reverse integration happening between OEMs and WPDs . OEMs are also cutting down their risks".

"Any new player who comes will do aggressive bidding to secure market share and there is possibility that they make certain calls which don't turn out the way it was wanted".

-Respondent -1

"So I think once this regime change happened from FIT to bids, it also changed the profile of generators or the developers who are participating also changed a bit."

“Now it's competitively fought and suddenly whoever is the best or to have the least cost of capital, wins. So it's more of a cost of capital play now because on the efficiency side everybody is at par.”

“the bidder profile has changed. The game is no longer for the smaller players, and that's why even the sizes the project sizes are also becoming big, so now everybody participate for 300 MW to 600 MW size, and that is something which not everybody can take on. or like it's like a single project is an outlay of 2500 crores and upwards, so that that makes a difference”.

“No integration or consolidation between OEMs is happening because I think the risk profiles are very different . Right from the land, evacuation risk or infrastructure risk, all are OEM risks. Now because they don't have enough margins left, that risk transfer is happening”.

“a lot of OEMs are not in a good financial health also right now because of this reduced margin ,which is impacting the overall scene”.

“as a wind developer, I would not like to take on the risk of O E M because it is a very specific technology play from the O E M perspective, you have to be very strong on the technology. And secondly, it's a play of a working capital churn and securing orders timely”.

“ However, as I mentioned that the good amount of money is available to our climate finance and with that liquidity, there is a deployment pressure on to everyone. Though we cannot ignore these risks ,still after factoring in these risks ,there are good amount of growth prospects available also.”

-Respondent -2

“The problem is with reduced rate of return say from 18 to 9 percent, which is the biggest pain point.”

“This requires some inventive modelling of projects both in terms of financial and technical aspects. So technical innovativeness is not possible as there is no new technological breakthrough possible. Only thing that has happened is that turbine size has increased, which is one reason for drastic tariff

reduction. Now as we have hit a technological plateau , so OEMs have been force to reduce their margins"

"Problem with the wind sector is that it is highly oligopolies sector (small number of players)".

"SECI is also in touch with financial institutions and we get a first hand account of their perspective. They have not objected to auction mechanism".

" Projects which today are becoming NPAs are not due low discovered tariff but due to mismanagement of WPDs".

"SECI has given them support in terms of time extensions etc. Of cource SECI cannot revisit the tariff but SECI has allowed them enough extensions to ensure a willing party to complete the project."

-Respondent -3

" Initially when the whole transition happened to competitive bidding, then that was the time when whole wind industry was going through a turmoil, suzlon ,senvion etc. you name anybody, nobody had orders because FiT was phased out "

"When this happened OEM had a huge inventory, so what they did was that they sold it at through away price, they innovated backed the WPDs and gave it at a price linked to their auction tariff".

So If your auction price is Rs 3 then X is your turbine price, if its Rs 2.50 then Y is your turbine price.

"Now the winds changed, OEMs or turbine makers started to dictate the price.

OEMs financial situation started becoming very bad and every management made a decision that if we will do business we will do it profitably otherwise will not do.

Now OEMs are now dictating the price. Now IPPs (Independent Power Producers) are at risk. This is the reason you saw the Complete U Turn in whole

tariff. So WPDs have to bear the brunt. Earlier the margins were totally on OEMs now pressure is on WPDs ".

"Smaller companies have already been pulled out of market".

"Backward integration Adani is trying , one is the deal with Alphanar is done. Some more are trying. Issue is more than technical, IPPs dont have overall wherewithal to run that business".

"Financial institutions can be divided into two parts, some which can be divided in equity side and some on debt side. Debt Side they are very very risk averse, they ensure availability of transmission infrastructure , you should have acquired 70-80 % of land , ROW of transmission line should be in your pocket"

"On equity side there is huge money that is waiting to be deployed". "RE is only thing that is attracting the green finance as well as the volume game of India"

" If we just summarize the factors considered by Financial institutions in providing funding:

- Good Resource Data. Mast data of a reasonable time frame. Third party validated.
- Your contracts and other things should have been finalized
- Atleast 80% percent of land should be in your control.
- Transmission line ROW should be in control.
- Take some comfort at sponsor level. Like assess the performance for one year. If project fails then money will be returned.
- They also see how strong is your parent in terms of balance sheet as you have to backstop something like for a unit MW is Rs 2400 crore "

" As regards to Operation and Maintenance ,Issue is that you get married to the OEM product you buy and that has been a challenge in the industry. As of now WPDs are doing spares agreement with OEM and ensure the spares are available."

"Slowly wind has become a playground only for bigger players with deep pockets who have the wherewithal to get less interest rates from the international market to execute projects in India".

-Respondent -4

"No integration between IPPs and OEMs is happening, however the deal size has become more".IRR is getting down as there are utility players like Torrent, Tata Power, JSW, Adani , so there IRR requirement is 2% lower than the overall IRR. Another reason is that the cost of capital of these utilities and to say NTPC also is less than 5%, so they are happy at 10-11% IRR. This is driving own the IRR".

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"But OEMs have not reduced the price, they have realised that why should they take a loss".

"Earlier they were taking future costs , like steel will become lower. But since last 1-2 years there is no decrease in the Commodity cost, Forex Cost , Interest Cost ,Fuel costs . All have gone up. They are clear that reductions in prices is not that sharp as was 3 years back."

"Aggressive developers, by quoting low bids, in order to seize more market share and capacity is happening especially in solar, as everyone was believing that the solar prices are going to go down, but in last 7-8 months we have realised that the trend is reversed".

Earlier it was 3 times of biding capacity bidders were bidding, now it is 1.5 to 2. Now everyone's interest level is going down as they are thinking how will the project get executed.

"Financial institutions have limited opportunity and off take , so they are keen on RE projects especially for these reasons; Project can be complete in 18-24 months, so the risk for the project is very less. However they have started keeping a check on what is Good Client and Bad client."

" Good Client is what you can say is Tata Power, Adani etc where there will be more lenders available and on the other hand for a smaller or mid size , there would be lesser lenders available ."

Difference in what is interest costs will also come down for good clients types of customers. So the lenders are comfortable because by ensuring this, not much has gone as NPAs. Thus they have limited opportunity and they don't have an issue with RE finance.

" With regards to Operation and Maintenance ,Challenge is their in case of OEMs which have gone down like Regentech, Wind Power , there is challenge in running the machines, but what we have learnt from Market is that they have gone for Third Party Maintenance".

As what we see is that independent players may come down from Europe and start doing this kind of stuff.

"There may be a maintenance related challenge in short term but in medium and long term, there should not be any maintenance related challenge. I don't see machines going down due to OEMs."

-Respondent -6

Table 5.7 : Constructs ,Sub-constructs, Categories & Focussed Codes on issues with OEM and WPDs

Financing Problems	Overall behaviour of the financial institutions	**Availability of Green Finance**	Easy availability of Green Finance on equity side
	Debt-Equity ratios, corporate guarantees for any contractual defaults and are putting penal interests clause for delays in project along with high early repayment charges		Due Diligence by Financial Companies for Debt funding
Operations and Maintenance (O&M)	Link/Dependence between WPDS and OEMs.	**Operations and Maintenance**	Dependence of WPDs on OEMs for maintenance
	O&M functions performed by OEMs and critical delays.		

From the interview observations and wind energy experts' point of view, inferences discussed as ahead can be drawn. Green Finance is available easily and equity side there is huge money that is waiting to be deployed Liquidity is not a challenge for wind energy sector. Financers on debt side are very risk averse and , they ensure availability of transmission infrastructure, acquisition of 70-80 % of land , ROW of transmission line acquired. Introduction of auctions has also changed the profile of WPDs small companies increasingly finding it difficult to participate in the auctions. Auctions are fiercely fought

and WPDs with least cost of capital wins as technically all are at par and small players increasingly finding it difficult to participate in the auctions.

No likely forward or reverse integration happening between OEMs and WPDs as the risk profiles of both are very different .OEMs are not in good financial health and WPDs don't want to take on risks off OEMs as they are purely technologically oriented and IPPs don't have overall wherewithal to run that business. Any new player who comes will do aggressive bidding to secure market share and there is possibility that they make certain calls which don't turn out the way it was wanted.

5.6.8 Net worth Criteria and other Terms and Conditions of RfS

This section of the data analysis will cover the adequacy of Net Worth criteria and other terms and conditions of RfS issued for wind projects . Analysis of data collected from various stakeholders was done on the basis of strategy described in the Section 5.4. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.11 **.**

The word cloud depicts that words good, financial ,adequate, criteria ,enough auctions are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents. Sentiment analysis indicated that 75% moderately negative sentiment harboured by the respondents. Thematic analysis of the question indicated that respondents think that WPDs consider terms and conditions as adequate.

SENTIMENT	PERCENTAGE
1 : Very negative	0%
2 : Moderately negative	74.58%
3 : Moderately positive	0%
4 : Very positive	25.42%

Figure 5.11 : Word Cloud ,Sentiment Analysis on Net worth Criteria in RfS

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories an sub-constructs that have emerged out from interview data have been illustrated in Table- 5.8 . Selected quotations from the interviews are listed below:

"Bidding criteria Networth etc in RfS is OK. It is mapped based on the project cost. It is standard."

-Respondent 1

"It is not a problem for any major player but definitely can be issue for smaller players or those with limited funding. It is good also as if some ones financial health is good, he will definitely complete the project."

-Respondent 2

"In my opinion BGs should be higher. These requirements are OK and developers are comfortable with that. Good part is that there is no technical QR like with regards to history of projects done etc, so effectively entry barriers are very low. Investor who has no history in wind but is cash rich can participate in auctions as no installation history is asked. Financial QR is what they ask for and there financial engineering plays a critical role like how cheap they secure their funding."

-Respondent 3

"I think they are adequate"

-Respondent 4

"Immaterial, they don't matter at all for serious players."

-Respondent 6

Table 5.8 : Constructs ,Sub-constructs, Categories & Focussed Codes on Net worth Criteria in RfS

Constructs	Sub Constructs	Categories	Focused Code
Financial Eligibility Criteria	Net-worth Criteria	**Financial Eligibility Criteria**	**Net Worth Criteria**
	Liquidity Criteria		
	Financial Closure Criteria		

From the interview observations and wind energy experts' point of view, inference can be drawn that Net worth and other related criteria in RfS are adequate and is accepted in the Industry.

5.6.9 E Reverse Auctions as a Procedure

This section of the data analysis will cover the adequacy of e reverse auctions as a procedure which are conducted by SECI. Analysis of data collected from various stakeholders was done on the basis of strategy described in the Section 5.4. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.12 .

The word cloud depicts that words price, bid , auctions, closed, tendering are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents. Sentiment analysis on the question indicated that, 55% very negative and moderately negative sentiment harboured by the respondents, which shows that WPDs are not satisfied with e reverse auctions.

On carrying out Thematic analysis, it indicated that respondents think that WPDs are facing challenges in e reverse auctions and want to migrate to closed bid or conventional single tendering system.

CODES	CODE REFERENCE
1 : auctions	7
2 : bid	11
3 : generation	3
4 : single bid	3
5 : state	3
6 : tendering system	3
7 : wind	2

SENTIMENT	PERCENTAGE
1 : Very negative	31.66%
2 : Moderately negative	27.61%
3 : Moderately positive	22.68%
4 : Very positive	18.05%

Fig 5.12 : Word Cloud ,Sentiment Analysis and Codes on E Reverse Auctions as a Procedure

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories an sub-constructs that have emerged out from interview data have been illustrated in Table- 5.9 . Selected quotations from the interviews are listed below:

" It is hyper competitive and if I have to make a suggestion than Closed bid is good enough. As such the market is competitive and lot of players. E Reverse auction is good for government as you get more low bids, however it may lead sometimes to ultra low tariff and bids may not come or unviable bidders come into play. E reverse auction is suitable only when there is limited competition."

-Respondent -1

" So on the e-reverse auction, from the philosophy wise or from the procurement methodology for a government institution, I find it as most efficient way of pricing discovery and it's a completely transparent and fiercely fought and fiercely competitive process."

" But whoever has participated in auctions based on their own risk assessment of the project, they have participated, and they have quoted a price. Okay, whether they got it or not, once they got the project, then it should be respected, which has not been happening. Post E R A negotiations have also happened sometime The bids that are we are mentioning that the bids are getting cancelled because saying that they have discovered a slightly higher price".

"when you are having a competitive process, it is bound to be favouring all the large players or the global players or the players who are having least cost of capital."

"For the smaller size projects, we would be not having the reverse auction option, and then it would be falling under a different scheme, but then that burden will have to be borne by the government because then they are trying to facilitate the growth of the segment, so it's a cost of growing that sector".

" But biggest issue in this is that electricity doesn't have any attribute."

-Respondent -2

" Minimum project size is 50 MW and if a bidder is quoting for 300MW then tariffs are bound to be different due to economies of scale. Then so called smaller bidder is forced to cut down on its margins. That is one aspect, which can be considered as a negative point for auctions."

" So you cannot do away with biding as it is mandated under an act, so going back to FiT would not be feasible at this stage as FiT doesn't requires bidding."

" In FiT mechanism, tariffs re determined by state commissions and any one who wants to setup a plant can set up the plant, it has to get certain approvals

but biggest issue is that there is no biding involved, so it is highly subjective and prone to biases and corruption."

" What WPDs are suggesting is simple bidding and they don't want reverse auctions which is also followed in other sectors."

"Problem with Wind Sector is that wind rich states donot want to procure power from SECI. Gujarat and Maharashtra are doing tenders on their own. Karnataka is totally RE surplus. TN has also achieved its RPO. MP sometimes it procures from SECI sometimes it does its own tendering."

" States also would want auctions in addition to SECI. Auctions are now tried and tested and have benefitted lot of stakeholders."

" If Pipeline Visibility is there then it will be advantage for investors and many countries do that. In govt or SECIs perception this strategy leads to less tariff . And other countries which display procurement trajectory , their off take is also assured. Here states have their choice to take or forgo whatever the capacity is offered by SECI. SECI also may not be able to bring out the trajectory as they are not sure at what speed they will be able to sell the power."

-Respondent -3

" Auction has been good for the discoms, they are able to discover unrealistic tariffs , sign PPAs .Actual realisation on ground has not happened , from process and other things it is all well and good."

" Government cannot be blamed for anything and its more of WPDs to be blamed as at one point it was capital that was chasing and they made unrealistic bids to capture market share but when they wanted to put in on ground the reality was completely different,"

"E-auctions or greediness to capture the market has led to tariffs falling below competitive or sustainable prices. Unnecessary competition created by these e-reverse auctions has led to poor installations on ground.WPDs who took it with that aggression to capture market share are all bleeding."

“Auctions as a principle as good for the procurer but WPDs themselves created the competition “

“ Pipeline Visibility is important. In case of Gujarat bids there is certainty that the project will kick off and we will be able to deploy in certain time frame and generating returns. WPDs who are in a hurry to deploy go slightly aggressive in state bid especially Gujarat.So if I win any project then SECI will take its own sweet time for finding the off taker DISCOM and accordingly a PPA will be signed , it may take months sometimes .In Gujarat auctions delay in PPA doesn’t happens as they themselves are buyers.”

“As an WPD I cannot say that don’t do auctions as question will come what is the best way to discover best price. And second question would be that whatever best price you are telling is suitable for discoms. It is a tough situation as India is always a price sensitive market. If normal bid is there than there can be cartelisation.”

“ For a small scale(MSME) people this is not the sector to be in. They can be in Value chain but not on the WPDs side”.

“From WPD perspective they should always link it to inflation like roads. Like if commodity prices increase or there is inflation then there is adjustment linked in Toll prices etc. Interest rate and revenue will get adjusted accordingly and their would be some level of certainty built in.”

-Respondent -4

“ For e reverse auctions we have to understand is that most of the e reverse auctions have L1+2% Clause that needs to be removed out because if e reverse auction is there, then if some bidder has quoted an abnormally low figure , then other bidders should not be asked to match up to with +- 2% of the same.”

“they don’t tell how many auctions will happen so quarterly . They also see , wait and say demand is more then they put up an auction. No pipeline visibility of future auctions is there.”

“Immediate signing of PPAs on culmination of auctions ,max within 1 month. At present it takes more than 6 months also in certain cases”

“I think government is trying to introduce back the system of close bid , but still it is not there because they have tasted the success of e reverse auctions by pitching all clients against each other. If introduced, it will be good for the industry.

-Respondent -6

“ In terms of viability auctions tend to get unscientific because people take it on their ego and in that 2-3 min window you have to decide the next best price”.

“ Reverse auctions if they are not good then the alternate options that we are left with is the old tendering process.”

“SECI has already started the process, they are no longer talking about plain vanilla wind/ plain vanilla solar.”

“Earlier auctions if you see, put your assets anywhere, produce whatever you can and based on that you can bid. Today the world as changed radically, where we are defining capacity, we are defining the generation profile which is required to be delivered at the point. Lot of hybrid wind, solar and battery storage options are coming up.”

“ If we eliminate auctions, then we can have simple tender L1 base mechanism.”

“reverse auctions are considered they may move to plain vanilla L1 centric scheme where you bid for a project and also a generation profile and you put your price ,and whoso ever is most efficient will end up getting the bid.”

“In all big infra projects, utility projects, smart metering projects, L2 & L3 will be asked to match the L1 and once you match the order will be split. This is the current operating procedure in most of the infrastructure projects which are being carried out by government authorities”.

-Respondent -8

" There have been lot of speculations only of this nature that L+2% clause which has been put may lead to some bidder quoting very low price, may be reckless or in an attempt to capture the market and forcing other bidders to follow the same but nothing of the sort has happened related to reckless bidding since the last three years it is going on"

" You have to understand that those who are quoting have to meet the minimum requirement of 20% of the project cost as net worth,so point is that he will not be that reckless and all are serious players on this and when you bid and you are not completing then penalties are there. So these are speculative things only and they never happen."

"Earlier the maximum upper limit for signing of PPAs was 6 months .However we found that even that was crossing, because states are also waiting for the rates and in advance they are not giving any concurrence in advance. Also If the rates are high then they do a rethink on the concurrence , thus sometimes it takes more time".

"SECI has to work slowly towards requirement of discoms i.e. what discoms need. Simply doing stand alone wind and solar tenders will not going to solve the issue. If discoms want power at different instances and different time blocks then we have to create tenders accordingly and we will be able to launch such type of tenders soon".

"if we issue tenders and conclude auctions but still not able to sell further to discoms in that timeframe then the pipeline has no meaning as I cannot issue another tender till one is sold out. As
rates are moving so fast that further selling is very difficult".

-Respondent -9

From the interview observations and wind energy experts' point of view, inferences as discussed ahead can be drawn. E-reverse auction is the most efficient way of pricing discovery and it's a completely transparent and fiercely fought and fiercely competitive process .E reverse auction is suitable only when

there is limited competition and favours all the large players or the players who are having least cost of capital. However, In terms of viability auctions tend to get unscientific because people take it on their ego and decision on the next best price has to be taken within net 2-3 min. In addition, in an attempt to capture market some bidder have quoted ultra low tariffs leading to unnecessary competition has been created and has led to poor installations on ground. WPDs want better pipeline visibility of projects for better planning , timely signing of PPAs and removal of the clause of matching the L1 bid price within 2% range (L1 +2%) in a particular auction as it disrupts the financial planning of bidders

especially if L1 has quoted unrealistically low prices . E reverse auctions have to only continue then plain vanilla stand alone wind and solar tenders may not be suitable. In future it will be a mix of solar, wind and storage

Table 5.9 :Constructs ,Sub-constructs, Categories & Focussed Codes on E Reverse Auction as a Procedure

Constructs	Sub Constructs	Categories	Focused Code
E Reverse Auction Mechanism and its suitability as a procedure	Direct Auctions verses Reverse Auctions which is more suitable	**Efficacy of E Reverse Auctions**	Closed single bid tender system versus e-reverse auction mechanism for Wind sector
	Suitability of Reverse Auction Procedure		Clause for matching L1 bid within +2%
	Capacity Auctioned sufficient or not		Combined capacity allocation for wind , solar and storage in auctions
	Limit /Qualified Capacity for winner (L1) and subsequent allocation		Specific timeline for Signing of PPAs
	Pipeline Visibility wrt planned capacity in future auctions		Pipeline visibility of planned future auctions

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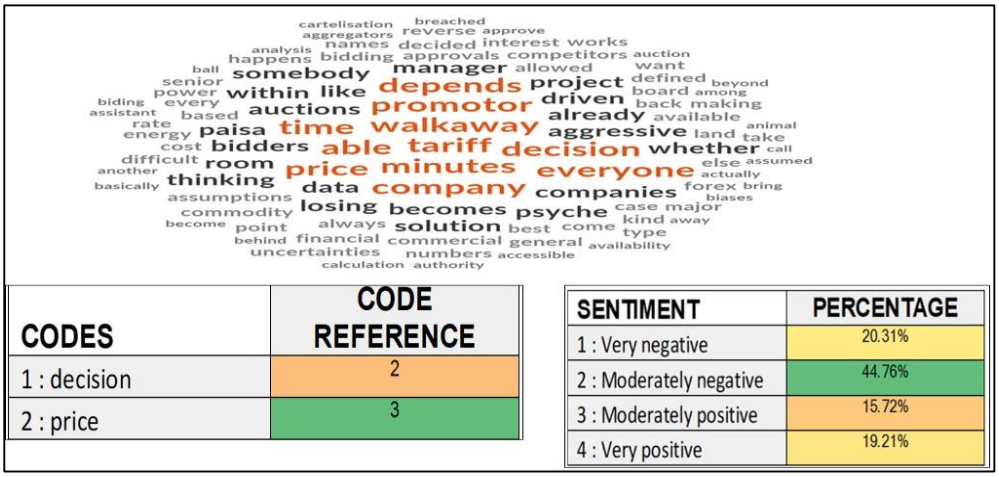
5.6.10 Bidding Strategies, Uncertainties , Biases

This section of the data analysis will try to identify the bidding strategies followed by WPDs and the kind of uncertainties biases faced by them and how they handle the same. Analysis of data The

collected from various stakeholders was done on the basis of strategy described in the Section 5.4. The Word Cloud , Sentiment Analysis and Codes generated through Nvivo Software are given in Figure 5.13 .

word cloud depicts that words walkaway tariff, promotor, minutes are highlighted and mentioned more by the respondents thus indicative of the trend and importance of the same among the respondents. Sentiment analysis indicated that 65% have negative or moderately negative sentiment harboured by the respondents. Thematic analysis of the question brought out two critical themes of Price and decision .



CODES	CODE REFERENCE
1 : decision	2
2 : price	3

SENTIMENT	PERCENTAGE
1 : Very negative	20.31%
2 : Moderately negative	44.76%
3 : Moderately positive	15.72%
4 : Very positive	19.21%

Figure 5.13 : Word Cloud ,Sentiment Analysis and Codes Bidding Strategies , Uncertainties , Biases

The Constructs and sub-constructs as identified from literature review and subsequent comparison with categories an sub-constructs that have emerged out from interview data have been illustrated in Table- 5.10 . Selected quotations from the interviews are listed below:

" Mindset, u decide your float, pretty disciplined bidders, we will not go below our floor. We would want to get above that but rarely it happens ".

“ All bidders have same data. Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues are major uncertainties” .

-Respondent 1

“reverse auctions bring out the animal instincts of everyone”.

“ now you have 8 minutes to make decision within those 8 minutes, it's humanly impossible. Rework all your assumptions and this 8 minutes keeps on as with every change, there is another 8 minutes”.

“So obviously when you enter into a room, you come with a walk away tariff and a best case tariff and then you try to close an secure the project which is within there walkaway limit”.

“ options are driven by basically where the decision making is in that room, Suppose their walk away tariff has been breached and If they have to go back to their board then it becomes very difficult. Because within that short 8 minutes time. You cannot go back and get any fresh approvals. So that, that is one of the dynamics”

“Then the very principal factor behind this reverse auction psyche is that at that point of time, you would simply say that this is the one paisa that I'm losing”.

“If somebody has uh, if I am at 2,70, for example, somebody has quoted 2.69. And if I have to become L1 , I have to quote 2.68. So I was already at 2.70 ,so now this is about this incremental 2 paisa i'm losing, visa a vis, I am getting a project. So the above calculation is based on whether that marginal cost that you are losing and so whether you have started initially at 3.75 or 3.50 and you have come a long way to 2.70. At that point , your psyche would say that now it is only about this 2 paisa, you can get this project”.

“ I think for all the prudent players, what they do is that they have a fixed walk away tariff that this is price that we will go in and beyond that I don't have a mandate,”

" But when you are working with an Indian promoter driven companies, then it becomes a different ball game because the decision authority is sitting in that board room, then it becomes very difficult. And then the other psyche that plays out is that uh when you start thinking that if someone else is able to do it this rate, right? The market is same for everyone, there is same type of financing that is available to everyone., if somebody else is able to do it at this rate. Even today, I may not have the solution. But if they have the solution at this particular number, I should also be able to figure out something, so that's kind of a forward thinking , cumulative type of thinking and the leap of faith people take and then it's not more than the scientific, It's more of a psychology subject ".

-Respondent 2

"They are allowed see the tariff without seeing the names. If names of competitors are allowed than it may lead to cartelisation. In RE sector it is quite simple and it is assumed that all information is available to everyone."

-Respondent 3

"Bidding price is determine purely by how aggressive are we to win and that depends on our investment decisions. Actually it happens this way that whether you want to win this bid or not and do you have equivalent opportunity at hand if you lose."

" Walkaway tariff is defined, but what is the walkaway, is it really aggressive or conservative, that is always determined by company's position at that time."

" There is always a lower cut off defined but how low you can go below that depends on what is the status and financial strength of the company at that time".

"The approvals for decision making in between those 8 min is already taken.All that is what best you can do and what worst you can do is already decided."

"If promoter driven company is there and promoter is easily accessible, and company would have decided that they would take it any cost."

In case of big companies, they don't tend to approve that, we do is that we relax certain assumptions like if management is willing to underwrite them , we work on revise numbers and it works.

"Promoter companies just ask the promoter about situation and it more depends on the whims of promoter."

"Competitor Analysis everybody does, who will be aggressive, who all are likely to participate.In auctions It persist more to who all are competitors and what is their walk away, that you should have data either through past pattern, their recent interactions. Data can be collected from multiple channels like land aggregators. It is a judgemental call, but if you are able to get to those numbers then it works."

-Respondent 4

"Among the uncertainties faced by bidders, Most important is the commodity price , also Interest like in every three months it changes and third is Forex which impacts heavily on solar pricing".

" Bidding Strategy depends on how your financial guy sees on what kind of commodity price, interest and Forex as well as How superior or inferior your site is

From the interview observations and wind energy experts' point of view, inferences as discussed ahead can be drawn. Bidders are disciplined, a floor price or lower cutoff is set and they seldom go below that as they don't have a mandate. Bidding price or cut off price is determined by doing calculations on assumptions and by how aggressive WPD is to win and do they have equivalent opportunity at hand if you lose. The assumptions are based on what kind of commodity price, interest and Forex rates as well as how superior or inferior their site is are taken into consideration by financial head in company. In the available 8 minutes for decision making, reworking assumptions is not possible

nor seeking approvals. The approvals for decision making in between those 8 min is already taken. The main psychological factors in auctions are forward thinking , cumulative type of thinking and Leap of faith.

All bidders have same data. Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues ,commodity price and Forex and Interest rates are major uncertainties. all WPDs do competitor analysis at their level by using all available data and information, analysing past pattern , their recent interactions, collecting data from different channels like land aggregators etc.

Table 5.10:Constructs ,Sub-constructs, Categories & Focussed Codes on Bidding Strategy

Constructs	Sub Constructs	Categories	Focused Code
Bidding Strategy , Uncertainties and Biases during e reverse auctions	Bidding decisions in e-reverse auctions prone to any biases	**Bidding Strategy , Uncertainties and Biases during e reverse auctions**	Fixed preapproved walkaway tariff by senior management
	Assumptions made while bidding		Disciplined bidding based on assumptions and planning
	Bidding strategies employed by WPDs		Psychological factors in auctions
	Information uncertainty		Aggressive bidding by Indian Promoter driven firm
	Participation of other WPDs affect the bidding behaviour		Competitor Analysis and information gathering
	Competitor Analysis		

5.7. INFERENCES BASED ON THE ANALYSIS CARRIED OUT USING NVIVO SOFTWARE

Inferences based on the analysis carried out using NVIVO are discussed and summarised ahead. The analysis shows that subsidies, tax reliefs, customs duty exemptions provided by the government in 1990s have been the historical factors which have led to the growth of wind energy in India and among these AD and later GBI were main drivers. Currently, climate finance is also one of the drivers of wind energy in India . There is mismatch between availability of suitable land for wind projects and presence of corresponding substations. Also there is a gap between transmission infrastructure development and Wind Solar project development, as both have different gestation periods. Though ,SECI supports WPDs in case of delay in transmission infrastructure development by giving time line extensions and no penalties are put , but overall transmission infrastructure availability remains a big challenge for WPDs.

Renegotiation of PPAs and reduction of off-take is legally incorrect and leads to uncertainty, which further reduces investor sentiment in state as well as also affects the overall outlook towards the sector and makes them more apprehensive. The kind of uncertainties are much lesser in central auctions as SECI is the offtake guarantor and no revisiting or renegotiation of tariffs happens.

Land and Transmission infrastructure are interlinked and cannot be considered in isolation. WPDs want to set up project where there is good wind resource availability but there are issues with transmission and evacuation infrastructure like substation will not come up there. Land is a state subject and state specific challenges will always be there. The challenges and risks with land related issues in wind is same as that with any other industry in India. All Industrial players have to be ready to take this specific risk . Overall WPDs have learned to manage this risk. The weak financial strength of Discoms is also a major challenge for WPDs as it leads to non-clearance of dues on time, thereby

affecting the developers' finances (higher interests to pay to lenders). Therefore ,now all WPDs prefer central tenders by SECI as multiple levels of payments assurance have been built in.

This is indicative of the fact that OEMs and WPDs are facing challenges which are negatively affecting the Wind Energy Industry in India and profile of WPDs is shifting to large bigger players, liquidity is available and no forward or reverse integration between WPDs and OEMs is happening.

Also Green Finance is available easily and Liquidity is not a challenge for wind energy sector. However, introduction of auctions has also changed the profile of WPDs and smaller companies are increasingly finding it difficult to participate in the auctions. No likely forward or reverse integration happening between OEMs and WPDs as the risk profiles of both are very different .OEMs are not in good financial health and WPDs don't want to take on risks of OEMs as they are purely technologically oriented and IPPs don't have overall wherewithal to run that business . Inferences from study bring out that E-reverse auction is the most efficient way of pricing discovery and it's a completely transparent and fiercely fought and competitive process .However ,E reverse auction is suitable only when there is limited competition and favours all the large players or the players who are having least cost of capital and WPDs are facing challenges in e reverse auctions and want to migrate to closed bid or conventional single tendering system.

As per WPDs there is a requirement of pipeline visibility of projects for better planning , timely signing of PPAs and removal of the clause of matching the L1 bid price within 2% range (L1 +2%) in a particular auction as it disrupts the financial planning of bidders especially if L1 has quoted unrealistically low prices . In addition there is a requirement of hybrid or a mix of solar,wind and storage instead of plain vanilla wind energy auctions

The analysis on the biding strategies adopted by WPDs shows that Bidders are disciplined, a floor price or lower cutoff is set and they seldom go below that as

they don’t have a mandate. Bidding price or cut off price is determined by doing calculations on pre-researched assumptions and by how aggressive WPD is to win and do they have equivalent opportunity at hand if they lose.

The main psychological factors in auctions are forward thinking, cumulative type of thinking and Leap of faith. Land availability, suppliers constraints, transmission infrastructure, ROW issues, commodity price and forex and interest rates are major uncertainties faced by WPDs. All WPDs do competitor analysis at their level by using all available data and information, analysing past pattern , their recent interactions, collecting data from different channels like land aggregators etc.

5.8. DATA ANALYSIS USING GIOIA METHODOLOGY

The Gioia Methodology (GM) is a qualitative approach that employs a systematic research methodology to develop grounded theories. It follows a structured process consisting of three key stages:**Data Analysis**: The process involves generating analytical codes and categories that are structured within a data framework. This framework encompasses 1st-order codes (centred on the informants), 2nd-order themes (centred on theory), and overarching dimensions.

Grounded Theoretical Model Development: Constant comparison of data across informants and over time to develop a grounded theoretical model. This process involves examining the data thoroughly and drawing comparisons to identify patterns, connections, and emerging theories.

Presentation of Findings: The study's findings are conveyed through a comprehensive narrative grounded in the data. This presentation commonly relies on 2nd-order themes and consolidated dimensions, frequently referencing 1st-order quotations from the informants. This narrative provides a comprehensive and coherent account of the research findings.

Overall, the Gioia Methodology offers a more disciplined approach to evidence gathering and data coding, aligning with the standards applied to qualitative research. It utilizes an inferential process that combines both induction and

abduction, enabling the generation of novel theoretical insights. By employing the GM, researchers can develop "best explanations" or "creative hypotheses" related to the phenomenon under investigation.(Gehman et al., 2018; Gioia, Corley, & Hamilton, 2012; Glaser & Reay, 2019; Hassan & Pandey, 2020; Magnan & Gioia, 2022).

Data Structure based on the Gioia Methodology is as per Figure 14 ahead:-

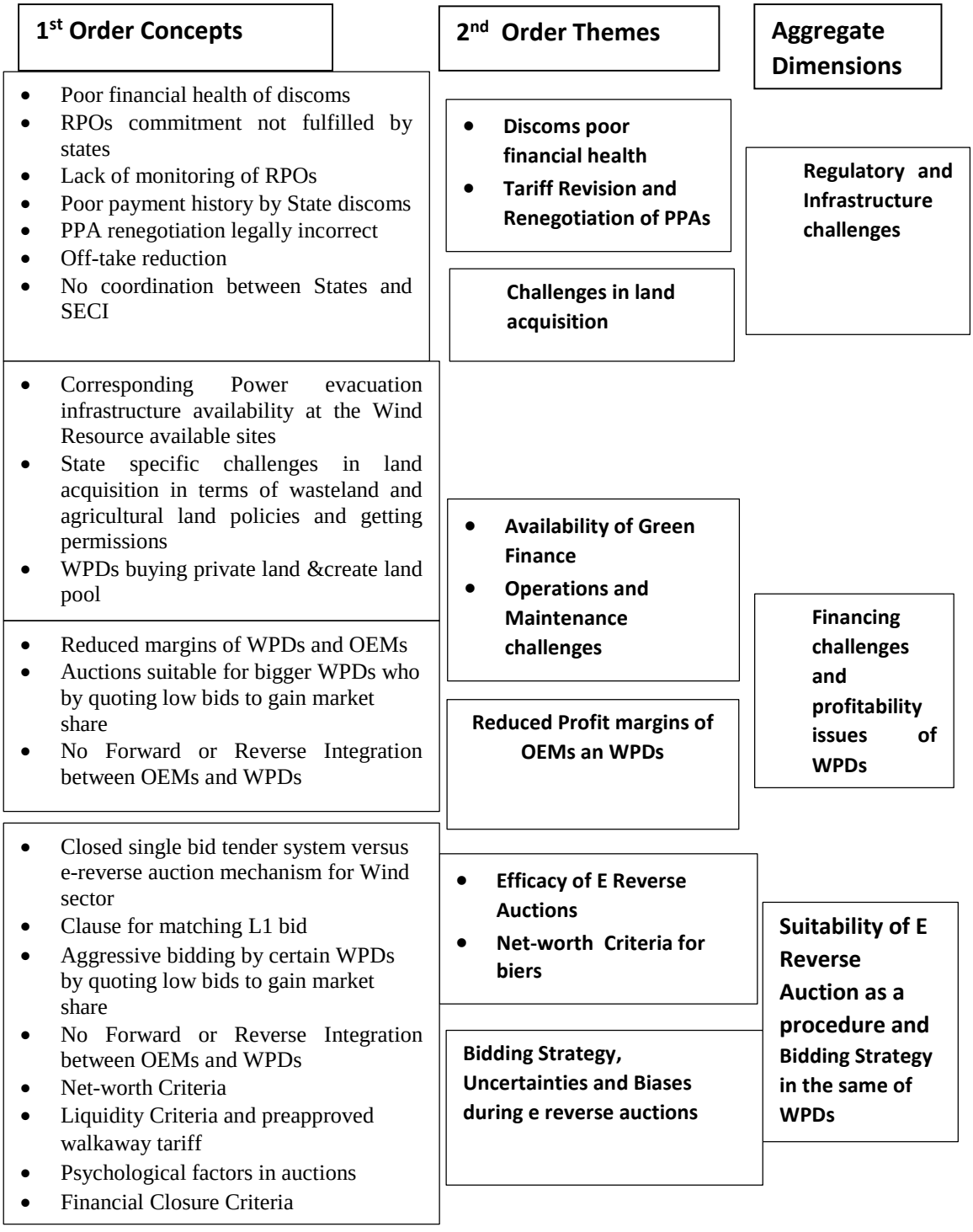


Figure 5.14 : Data Structure based on the Gioia Methodology

5.9. QUALITATIVE ASSOCIATED NETWORK(QAN) DESIGN FOR RO-2

5.9.1 QAN design for RO2(a)

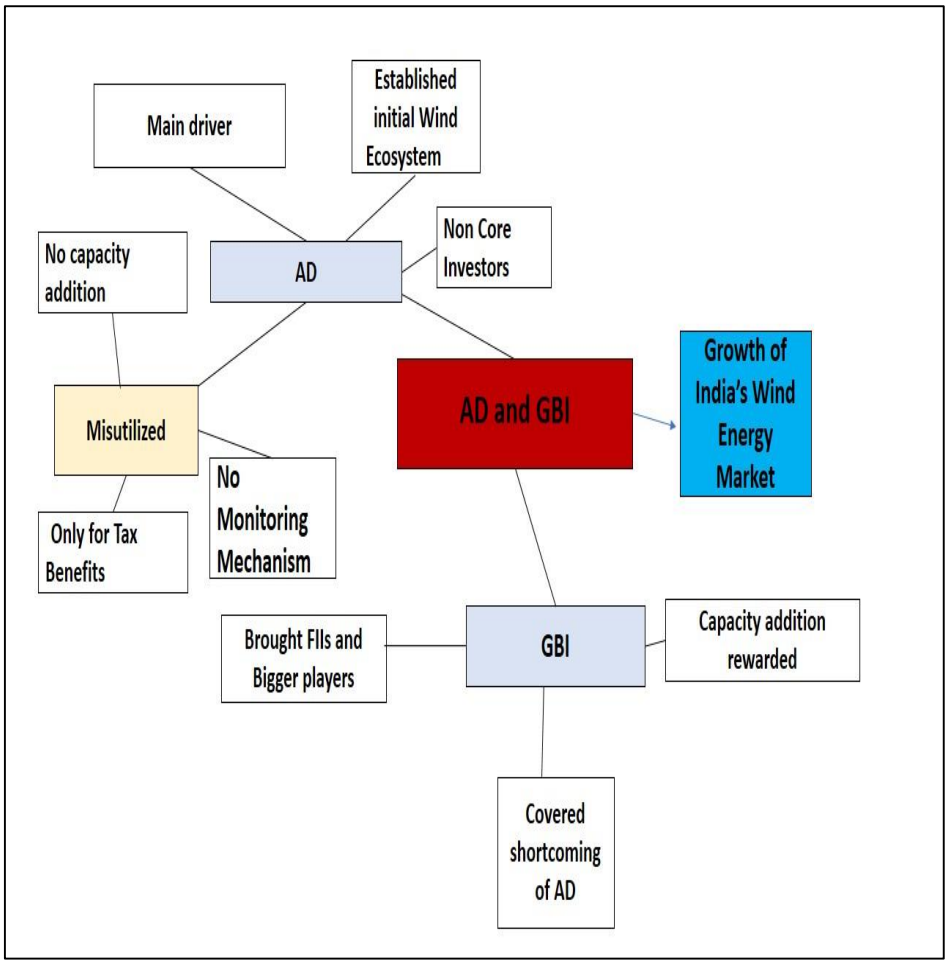


Figure 5.15 : QAN for role of AD and GBI in the growth of Wind Energy in India

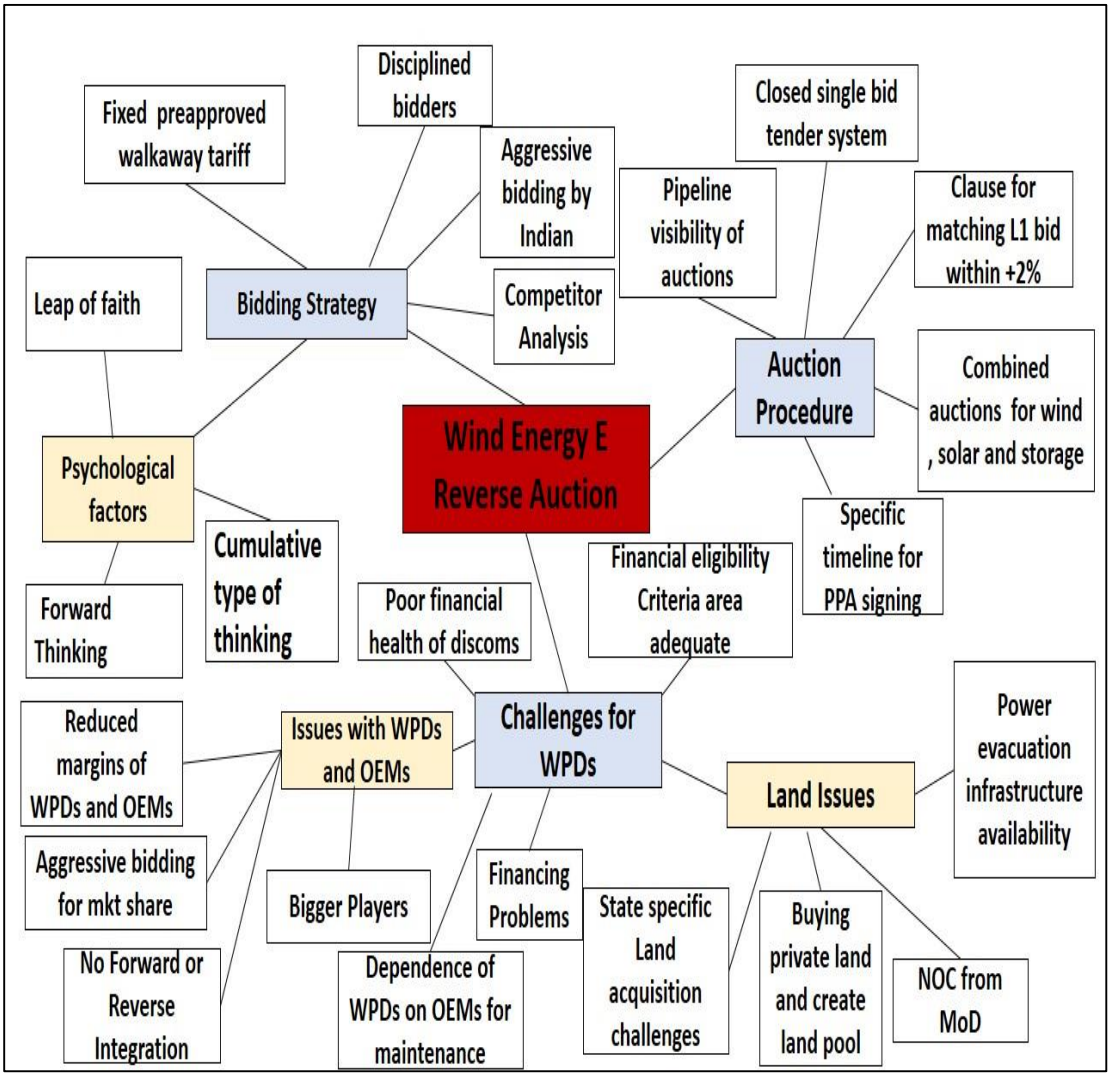


Figure 5.16 : QAN for uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions

5.10 VALIDITY AND RELIABILITY OF RESEARCH

Evaluation of quality of research carried out is one of the most critical aspect of any study. When assessing the quality of a research study, several tests are commonly employed, including tests for Construct Validity, Internal Validity, External Validity, and Reliability. These tests serve as important criteria for evaluating the robustness and credibility of the research findings (Yin, 2003).These tests are discussed ahead.

5.10.1 Construct Validity

Construct validity refers to the process of establishing the appropriate measures or indicators for the concepts under study. It involves ensuring that the selected measures effectively capture and represent the underlying theoretical constructs being investigated (Yin, 2003). Ensuring accurate measurement of selected concepts is essential for maintaining construct validity. One approach to address potential issues in construct validity is through data triangulation, which involves gathering evidence from multiple sources. By utilizing data triangulation, researchers can mitigate the risk of relying solely on one source of evidence and enhance the overall robustness and validity of the findings. Yin, (2003)provides insights on data triangulation ,emphasizing that gathering evidence from multiple sources essentially offers multiple perspectives on the same phenomenon. According to Eisenhardt, (1989) , "data triangulation ensures stronger substantiation of constructs and hypotheses" . One of the significant strengths of the qualitative case study approach lies in its ability to integrate various sources (Rossman & Wilson, 1985; Yin, 2003).

The current study utilizes a variety of diverse sources for data collection, including interviews, documents, the company's website, intranet, observations, and artifacts. Transcriptions of interviews and field observations are integrated into the data analysis process. By incorporating multiple sources of data, this approach strengthens the construct validity of the study by offering a broader range of perspectives on the phenomena being investigated. To ensure

transparency and traceability, a chain of evidence approach is employed. This approach enables an external observer to trace the path of evidence from the initial research questions to the conclusions drawn from the qualitative study. By employing the chain of evidence approach, the study maintains rigor and allows for a clear understanding of how the data supports the research findings. As advocated by Yin, (2003), The qualitative study reports undergo a rigorous review process by the key informants involved in the research. Additionally, the feedback from the study participants is carefully incorporated into the final reports. To enhance the construct validity of the research, a two-level analysis is conducted, consisting of both conceptual and detailed analysis of the data. This analytical approach allows for a comprehensive examination of the data, enabling the triangulation of perspectives on the same data set. By employing theory triangulation, the research benefits from the integration of multiple viewpoints and interpretations, resulting in a more robust understanding of the phenomena under investigation.

The incorporation of key informants' reviews, participants' feedback, and the two-level analysis contributes to the overall construct validity of the research findings (Patton, 1990). The details of triangulations are presented in the below given **Table 5.11**.

Table 5.11 : Data Evidences for Data Triangulation

Concepts	Categories	Evidence Type	Details of evidences
Issues with WPDs and OEMs	Reduced margins of WPDs and OEMs	Interviews; Internet Documents and reports ; Informal Discussion	Audio records & field notes of interviews;
	Auctions suitable for bigger and global players only		
	Aggressive bidding by certain WPDs by quoting low bids to gain market share		
	Aggressive bidding by certain WPDs by quoting low bids to gain market share		
Financing Problems	Easy availability of Green Finance on equity side	Interviews; Internet Documents and reports ; Informal Discussion	Audio records & field notes of interviews;
	Due Diligence by Financial Companies for Debt funding		
Operations and Maintenance (O&M)	Dependence of WPDs on OEMs for maintenance	Interviews; Internet Documents and reports ; Informal Discussion	Audio records & field notes of interviews;
Land Issues	Corresponding Power evacuation infrastructure availability at the Wind Resource available sites	Interviews; Internet Documents and reports ;	Audio records & field notes of interview;

	State specific challenges in land acquisition in terms of wasteland and agricultural land policies and getting permissions	Informal Discussion	
Land Issues	WPDs buying private land and create land pool		
	Smooth procedure for NOC from MoD		
	RPOs commitment not fulfilled by states		
	Lack of monitoring and implementation of RPOs		
	Poor payment history by State discoms		
	WPDs buying private land and create land pool		
Financial Eligibility Criteria	Net Worth Criteria	Interviews; Internet Documents and reports ; Informal Discussion	Audio records & field notes of interview;
E Reverse Auction Mechanism and its	Closed single bid tender system versus e-reverse auction mechanism for Wind sector		
	Clause for matching L1 bid within +2%		

suitability as a procedure	Combined capacity allocation for wind , solar and storage in auctions		
	Specific timeline for Signing of PPAs		
	Pipeline visibility of planned future auctions		
Discoms in Duress	Poor financial health of discoms	Interviews; Internet Documents and reports ; Informal Discussion	Audio records & field notes of interview; field notes
Bidding Strategy , Uncertainties and Biases during e reverse auctions	Fixed preapproved walkaway tariff by senior management	Interviews; Internet Documents and reports ; Informal Discussion	Audio records & field notes of interview;
	Disciplined bidding based on assumptions and planning		
	Psychological factors in auctions		
	Aggressive bidding by Indian Promoter driven firm		
	Competitor Analysis and information gathering		

5.10.2 Internal Validity

Internal validity involves establishing causal relationships between conditions in a manner that accurately distinguishes true relationships from false ones. It is crucial to differentiate and identify the genuine cause-and-effect connections among variables while minimizing the influence of confounding factors or alternative explanations. Internal validity ensures that the observed relationships within the study accurately reflect the true causal relationships between the conditions being investigated (Yin, 2003).

Internal validity is susceptible to two types of problems. The first problem arises from the need to make inferences based on the study findings, as researchers are unable to directly observe the events in question on every occasion. The second problem involves spurious effects, where there may be additional confounding factors not accounted for in the research model.To ensure internal validity in this research, a variety of methods are employed to address these potential issues. These methods are implemented to mitigate the limitations associated with making inferences and to minimize the impact of spurious effects. By employing these strategies, the research aims to enhance the internal validity of the findings and provide more robust and accurate interpretations of the observed relationships. In this study, two methods have been employed for triangulation. Firstly, theory triangulation perspectives were applied to the same dataset. Data were examined from various viewpoints during within-case analysis, including both conceptual and detailed levels of analysis. Secondly, key participants were asked to review and provide feedback on the reports, with their comments subsequently incorporated into the final report. These two methods were utilized to enhance our comprehension and interpretation of processes that can be described as causal relationships between concepts, where one concept (a 'cause') leads to another concept (an 'effect'). (Patton, 1990).

5.10.3 External Validity

The generalizability of research study findings can be established by defining the domain of the study, which is referred to as external validity (Yin, 2003). To strengthen the generalization of research findings, a multiple case study strategy is employed. Following the replication logic in case studies, the research incorporates the design of multiple case studies and conducts cross-case analysis as a crucial step.This approach is akin to the use of experiments, where researchers generalize theories by replicating experiments across different contexts (Yin, 2003). External validity is addressed by employing the replication logic in the selection of studies. In case studies, analytical generalization is relied upon, whereby the findings are extended to broader contexts or populations based on analytical insights and patterns derived from the multiple cases analysed (Eisenhardt, 1989; Yin, 2003). In contrast to experimental hypothesis-testing research that involves statistical generalization, case studies do not necessitate multiple replications. Research findings can be deemed valid even after a single application of replication logic (Yin, 2003).

5.10.4 Reliability

The reliability test is employed to address the errors and biases inherent in the research study. By repeating the operations of the study, particularly the data collection procedures, the reliability test aims to produce consistent results (Yin, 2003). Put differently, if another researcher were to replicate the same data collection procedures as the initial researcher, they would arrive at identical outcomes and conclusions. To maintain consistency in the application of data collection and analysis procedures, multiple methods are employed in this research. Firstly, the Data Collection Protocol is employed as a guiding tool throughout the research process. This protocol serves as a crucial method in enhancing the reliability of the case study research by providing clear instructions and guidelines for the investigator to follow. It facilitates a standardized and consistent approach to conducting the research, reducing the

potential for inconsistencies or variations in data collection and analysis(Yin, 2003). The protocol utilized in this research encompasses not only interview questions but also procedures and general rules that dictate the conduct of interviews. By incorporating such a protocol, consistency is ensured in the areas covered within individual cases as well as across different cases. Furthermore, interviews are recorded and transcribed meticulously to capture all the data, facilitating independent data analysis by other researchers. This practice enhances transparency and allows for the verification of findings by enabling other researchers to examine the raw data.In addition, the utilization of NVIVO software assists the researcher in undertaking a systematic and consistent analysis of the qualitative data. This software aids in organizing and analyzing the data in a structured manner, enabling efficient exploration of themes, patterns, and connections within the dataset. By employing these methods, including the protocol for interviews, meticulous recording and transcription of interviews, and the use of NVIVO software, the research ensures rigorous and reliable analysis of the qualitative data, promoting the robustness of the study's findings. (Weitzman, 2000)and enhanced the research's reliability since the procedures can be replicated. (Yin, 2003). Fourth, field notes have been recorded and subsequently transcribed for future reference.

5.11 CONCLUDING REMARKS

Research Objective 2 has been analysed using a qualitative approach through Nvivo software in this chapter . Further Qualitative Associated Network(QAN) design for the same has been developed as well as Data Analysis using Gioia Methodology has been carried out. Inferences have been drawn using features of Nvivo software mainly Word cloud which was generated from individual questions based transcripts of interviews followed by thematic and sentiment analysis using the feature of auto code . Further for each question ,based on the inferences and Initial Conceptual Constructs , additional Categories and focussed codes were created.The analysis shows that subsidies, tax reliefs,

customs duty exemptions provided by the government majorly AD and later GBI have which have led to the growth of wind energy in India . The analysis on the biding strategies adopted by WPDs shows that Bidders are disciplined, a floor price or lower cut-off is set and they seldom go below that as they don't have a mandate. Bidding price or cut off price is determined by doing calculations on pre researched assumptions and by how aggressive WPD is to win and do they have equivalent opportunity at hand if you lose. The main psychological factors in auctions are forward thinking, cumulative type of thinking and Leap of faith. Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues, commodity price and Forex and Interest rates are major uncertainties faced by WPDs.

All WPDs do competitor analysis at their level by using all available data and information, analysing past pattern , their recent interactions, collecting data from different channels like land aggregators etc.This chapter also brings out the methodology adopted to test the quality of research. The same has been tested using Construct Validity, Internal Validity, External Validity, and Reliability test. For construct validity, Triangulation technique which combines different sources of evidence in a single study is used . To ensure reliability and consistency , Data Collection Protocol has been used , in addition , interviews are recorded and transcribed to capture all the data , field notes have been taken and systematic and consistent analysis has been done using NVIVIO software .

CHAPTER -6

THEORITICAL CONTRIBUTION AND PROPOSITIONS

6.1 INTRODUCTION

This chapter summarises the discusses the contributions of this research to theory in detail in section 6.2. Propositions which form the basis for scientific research and help in evaluating the validity of a research study (Avan & White, 2001) have been brought out in Section 6.3 of the study .

6.2. THEORITICAL CONTRIBUTION

6.2.1. The research is based on the theoretical premise of Behavioural Theory of Firm and three main constructs of Satisficing Behavior , Bounded Rationality and decision making during uncertainity were studied. The main facets of the same are elaborated as under in Table 7.1:-

Table 6.1 : Key Points/ Inference from Literature Review aligned with Responses from Interviewees

Area of Theoretical Study	Key Points/ Inference from Literature Review	Responses from Interviewees
Decision Making During Auctions	The literature highlights that the bidding decisions are highly uncertain and risky in nature .The final bid is based on the collective assessment of techno-economic factors ,operational capabilities, fiscal commitments Strategic consideration ,Competitor analysis and consideration of various kinds uncertainties cognitively by the bidders.	"All bidders have same data. Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues are major uncertainties." • **Respondent 1** "In RE sector it is quite simple and it is assumed that all information is available to everyone." • **Respondent 3**

		"Competitor Analysis everybody does, who will be aggressive, and who all are likely to participate. In auctions it persist more to who all are competitors and what is their walk away tariff, that you should have data either through past pattern or their recent interactions. Data can be collected from multiple channels like land aggregators. It is a judgemental call, but if you are able to get to those numbers then it works. Except 1-2 bidders, you always come to know who all are participating. Rest is all where you can go upto and where your competitors can." • **Respondent-4**

Behavioural Theory of Firm(developed by Cyert and March) (Barros, 2010; Chand, n.d.; "The Cyert and March Theory of Firm | Firm depends on the demand of the members of the coalition," n.d.)	▪ Focuses on scrutinizing the decision-making process within a sizable multi-product firm functioning in an imperfect market marked by uncertainty. ▪ **Satisficing Behaviour** ▪ Real firms often seek satisficing outcomes rather than maximizing their results, as is the case with entrepreneurs. ▪ Certain groups may opt for "good enough" accomplishments rather than relentlessly pursuing the best possible outcome. • **Bounded Rationality** Supports the rationale behind the satisficing behaviour exhibited by large corporate firms. ▪ Bounded rationality implies making prudent decisions within specific circumstances. ▪ The goals are finally decided by the top management and approved, normally, by the board of directors. ▪ As a behaviour of 'bounded' rationality, as opposed to	**Satisficing Behaviour & Bounded Rationality** "Mindset, u decide your float, pretty disciplined bidders, we will not go below our floor. We would want to get above that but rarely it happens." • **Respondent 1** "so I think for all the prudent players, what they do is that they have a fixed walk away tariff that this is price that we will go in and beyond that I don't have a mandate" "My role as a bid manager is to convince my management that *bus hog gaya*, stick to limits**."** • **Respondent 2** "There is always a lower cut off defined but how low you can go below that depends on what is the status and financial strength of the company at that time" **Respondent 4** **Decision Making**

	‘global’ rationality of the entrepreneur-firm of the traditional theory.	“The approvals for decision making in between those 8 min is already taken. All that is what best you can do and what worst you can do is already decided.” • **Respondent 4** **<u>Decision Making</u>** “ options are driven by basically where the decision making is in that room, Suppose their walkaway tariff has been breached and If they have to go back to their board then it becomes very difficult. Because within that short 8 minutes time. You cannot go back and get any fresh approvals. So that, that is one of the dynamics” • **Respondent 2**

Behavioural Theory of Firm(developed by Cyert and March) (Barros, 2010; Chand, n.d.; "The Cyert and March Theory of Firm | Firm depends on the demand of the members of the coalition," n.d.)	▪ **The process of decision making** In the model, organizational goals are established by top management. However, the implementation of these goals relies on decision-making processes at two levels: the top management level and the lower management levels When evaluating proposals from various departments, the approval process incorporates financial measures to assess the availability of necessary funds within the available resources. Additionally, an improvement measure is employed to evaluate whether the proposal contributes to enhancing the overall health of the organization. These measures serve as crucial criteria in the decision-making process for determining the feasibility and impact of the proposed initiatives The traditional theory of the firm portrayed the entrepreneur as an individual endowed with boundless and effortless access	**Decision Making** "The approvals for decision making in between those 8 min is already taken. All that is what best you can do and what worst you can do is already decided." • **Respondent 4** " options are driven by basically where the decision making is in that room, Suppose their walkaway tariff has been breached and If they have to go back to their board then it becomes very difficult. Because within that short 8 minutes time. You cannot go back and get any fresh approvals. So that, that is one of the dynamics" • **Respondent 2** **Traditional Theory of Firm** " But when you are working with an Indian promoter driven companies, then it becomes a different ball game because the decision

	to information, limitless computational prowess, and an abundance of time at their disposal. Entrepreneur aims at maximizing their results. .	authority is sitting in that board room, then it becomes very difficult. And then the other psyche that plays out is that uh when you start thinking that if someone else is able to do it this rate, right? The market is same for everyone, there is same type of financing that is available to everyone. If somebody else is able to do it at this rate." ▪ **Respondent 2** "If promoter driven company is there and promoter is easily accessible, and company would have decided that they would take it any cost. Promoter companies just ask the promoter about situation and it more depends on the whims of promoter." • **Respondent -4**

6.2.2. The major theoretical contribution of the research are as under:-

- This Research shows what are the various uncertainties faced by firms and their response in the Decision Making process for Bidding in Wind Energy Auctions in India and What are the factors considered in making Bidding decisions in Wind Energy Auctions.
- Satisficing Behaviour, Bounded Rationality and Decision Making under uncertain conditions are the key concepts of Behavioural Theory of Firm which have been studied during the research in relation with the research question.
- The analysis of responses received during the study confirm that WPDs are show Bounded Rationality and Satisficing Behaviour while bidding during auctions. A predecided lower cut off or walk away tariff is arrived at prior to biding . All WPDs are rational and disciplined investors and the predecided walk away tariff is seldom breached.
- The Decision making with regards to walk away tariff is carried out by making assumptions considering all information available by top management or board. The short period of 8 minute for decision making during auctions is too short for reworking assumptions and going back to board for fresh approvals. Therefore bidders show rational and satisficing behaviour based on decision made by senior management.
- The study also confirms the irrational behviour by promotor / entreprenuer driven firms where in decision making is irrational , assumptions or decisions on bidding prices can be reworked during bidding based on whims/decisions of the promotor as well as due to their easy accessibility or presence during auctions .

6.2.3 The linkage between theoretical contributions to existing knowledge in literature has been highlighted in Table 6.2 below.

Table 6.2 : Relationship between existing Literature and Theoretical Contribution made by research

Key Points from Theoretical Premise (Section 2.4 refers)	**Related Theoretical Contribution**
Goals of the Firm: Satisficing Behaviour. The objectives of a firm, as well as those of individual members or specific coalition groups, are framed as aspiration levels rather than rigid maximization constraints. According to behavioural theories, the core objective of a firm is to attain a commendable overall performance, guided by the defined aspirational goals and not exclusively focusing on maximizing profits, sales, or other metrics.	Satisficing Behaviour , Bounded Rationality and Decision Making under uncertain conditions are the key concepts of Behavioural Theory of Firm which have been studied during the research in relation with the research question.
Goals of the Firm: Satisficing Behaviour. This perspective portrays **a firm as a satisficing organization**, prioritizing a balanced approach rather than solely pursuing maximum gains like a maximizing entrepreneur. **The Simon gave concept of 'bounded rationality' to explain the satisficing behaviour of large corporations in the behavioural theory**. This theory explicitly recognizes that in the present business landscape, the entrepreneurial function is fulfilled by the top management, consisting of individuals with time constraints, not clear information, and limited computational abilities. Consequently, it becomes impractical	The analysis of responses received during the study confirm that WPDs are show Bounded Rationality and Satisficing Behaviour while bidding during auctions. A predecided lower cut off or walk away tariff is arrived at prior to biding . All WPDs are rational and disciplined investors and the predecided walk away tariff is seldom breached.

for them to assess all possible options and select the one that maximizes profits or any other desired outcome. Instead, they narrow down their focus to a few alternatives and choose the 'best' option within the confines of their constrained resources and consequently operate with 'bounded rationality'.	
Bidding decisions involve **high levels of uncertainty and risk**. Companies are advised to conduct both strategic and financial analyses to as basis of their decisions. The financial analysis should take into account all known cost factors, while the strategic analysis should focus on assessing potential uncertainties (Bowman & Moskowitz, 2001). **Under conditions of high uncertainty**, managers have been known to consider fewer options and prefer heuristics(Walsh, 1995).	This Research shows what are the various uncertainties faced by firms and their response in the Decision Making process for Bidding in Wind Energy Auctions in India and What are the factors considered in making Bidding decisions in Wind Energy Auctions.
Organizational decisions in such situations are likely to be prone to biases (Tversky & Kahneman, 1974). Bidders who make impartial estimates of asset value are more likely to be unsatisfied with the value of what they acquire, particularly if the competition is intense. This is because they will tend to win auctions in which their estimate was too optimistic and lose those in which it was too pessimistic.	The Decision making with regards walk away tariff is carried out by making assumptions considering all information available by top management or board. The short period of 8 minute for decision making during auctions is too short for reworking assumptions and going back to board for fresh approvals. Therefore bidders show rational and satisficing behaviour

A bidder must treat his estimate as more optimistic upon learning that his bid won does not depend upon significant assumptions about symmetry, estimating biases , bidding strategies or auction type(Oren & Williams, 1975).	based on decision made by senior management. The study also confirms the irrational behviour by promotor / entreprenuer driven firms where in decision making is irrational , assumptions or decisions on bidding prices can be reworked during bidding based on whims/decisions of the promotor as well as due to their easy accessibility or presence during auctions

6.3 PROPOSITIONS

6.3.1. A proposition, similar to a hypothesis, serves the purpose of proposing a connection between two concepts in situations where experimental verification is not feasible. Propositions play a vital role in addressing internal validity as they provide information about the precision of definitions, measurements, associations, and confounding factors considered in the research. They contribute to the establishment of a strong internal validity by ensuring careful consideration of various factors that may influence the research. On the other hand, propositions also form the basis for deductive inferences, thereby influencing external validity(Avan & White, 2001).Based on these inferences following propositions are made with regard to:

- The effectiveness of Central Government Policies of AD and GBI.
- The uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy E Reverse Auctions and identify the factors considered in the same.

6.3.2. ***The effectiveness of Central Government Policies of*** *AD and GBI***:-**

P 1: **The entire wind energy industry ecosystem has most likely been developed because incentives of AD and GBI were available.**

- Evidence has been found that AD benefit was most likely the main driver of wind energy investments in India and unlocked the Indian wind market. It enabled even non-core investors to invest in the sector as it provided significant tax benefit to the wind power developers. It.
- Evidence has also been found that as there was no monitoring mechanism, therefore real capacity addition didn't happen and AD scheme was misutilised and investments were made to avail tax benefits.

P2: **GBI scheme was introduced most likely to remove the drawbacks of AD scheme and expand market to IPPs and FDI**

- Evidence has been found that most likely government introduced GBI to expand the wind energy market to IIPs and FDI. GBI was based on generation of electricity so also overcame the drawbacks of AD .
- Evidence has been found that most likely GBI gave thrust to sector by attracting Foreign Investors
- Evidence has also been found that wind installations doubled during the period 2010 to 2012 most likely because both AD and GBI policies were there for investors during the period.

6.3.3. ***The uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy E Reverse Auctions and identify the factors considered in the same.***

P 1 : **Power Evacuation and Transmission infrastructure availability is one of the Critical Factor most likely affecting Wind Power Developers**

- Evidence has been found that there is a mismatch between land availability with wind potential and transmission infrastructure which likely results in cost overruns and delays for WPDs.
- Evidence suggest that in case of nearest transmission infrastructure (substations) are far away than that also most likely leads to extra cost as developers will have to set up infrastructure, till the substation for export of power generated.
- Evidence also suggests that there is a gap between transmission infrastructure development and Wind Solar project development, as both have different gestation periods, it takes 4-5 years for transmission infrastructure and 18-24 months for wind project development

- Evidence also suggests that the delay in transmission infrastructure development leads to losses for WPDs due to commitment of capital and payment of Interest During Construction (IDC) due to delayed returns.
- Evidence suggests that Central Transmission Utility in coordination with MoP and SECI is transparent and shares that what kind of infrastructure that is getting developed , its location and proposed commissioning date in order to assist the WPDs to do their due diligence and plan their projects ensure their IDC is minimized.
- Evidence suggests that most SECI works in tandem with CTU , powergrid and decides where the substations where fresh capacities need to be installed and where existing capacities are required to be augmented and most likely supports the WPDs by sharing this information with them as well as by giving them time line extensions without penalty in case of delay in transmission infrastructure development

P 2: Tariff Revision and Renegotiation of PPAs by State Governments and Utilities most likely affects sentiments of WPDs and Foreign investors

- Evidence suggests that PPA renegotiation and tariff revision by State Governments and Utilities most likely creates uncertain environment for business and further affects the overall outlook towards the sector and makes WPDs and investors more apprehensive.
- Evidence has also come to light that renegotiation of PPAs is legally incorrect and it most likely leads to limited participation in state tenders as WPDs now consider off- taker risk profile and are vary of investing in certain states.

P 3 : Poor Financial health of state Discoms is most likely an important factor which leads to reduced participation in state bids ,higher tariff prices in bids and overall reduced investments in states.

- Evidence suggests that nearly all Discoms have weak financial strength, which most likely leads to non-clearance of timely dues, thereby affecting the developer's finances as they have higher interests to pay to lenders.
- Evidence also suggests that WPDs consider poor financial state of discoms in as important factor which most likely leads to reduced participation in state bids and higher tariff prices in bids. Discoms with good financial strength and good payment history like Gujarat attractvery low tariffs . On the other hand certain discoms like Maharashtra with poor payment history attracts higher tariffs.
- Evidence also suggest that most likely all WPDs prefer central tenders by SECI as three levels of payments assurance have been built in . Firstly, a tri-partie agreement between SECI, WPDs and State Discoms , so in case of any default WPDs can take from the central pool of funds that RBI allocates to the states. SECI also gives a Line of Credit to WPDs Third is that they ask WPDs money (Rs 5 Lakh per MW), which WPDs deposit on commissioning of the projects.

P 4 : Challenges in Land acquisitions is a most likely an important factor for WPDs in decision making for e reverse auctions.

- Evidence suggests that land and transmission infrastructure are interlinked and cannot be considered in isolation and most likely WPDs want to set up project where there is good wind/ resource availability but there are issues with transmission and evacuation infrastructure like substation will not come up there.
- Evidence further suggest that land is a state subject most likely state specific challenges related to in land policy related to ceiling limits, conversion of

waste or agriculture land to non agriculture land , time delays in and multiple levels of approvals affect the investment decisions of WPDs.

- Evidence also suggests that land acquisition related challenges in wind sector are most likely similar to any other industry in India and WPDs have to be ready to take and manage this specific risk .
- Earlier the permissions were not articulate enough and now a lot more understanding has been reached at all levels.
- Evidence suggests that most likely there is no coordination by SECI for land availability with state governments
- Evidence also suggests that most likely issue of NOC from defence authorities has also been resolved and a smooth procedure has been established by Ministry of Defence to give NOC.
- Evidence further suggests that most likely WPDs are also preferring setting up projects on private land. For WPDs , biggest uncertainty is wind resource and the associated land, therefore most likely land bank creation is now a continuous process of large WPDs.

P5 : Green finance is easily available to WPDs most likely liquidity is not a challenge for the Wind Industry.

- Evidence suggests that Green Finance is available easily and most likely Liquidity is not a challenge for wind energy sector on equity side.
- Evidence also suggests that most likely Financers on debt side are very risk averse and they ensure availability of transmission infrastructure, acquisition of 70-80 % of land , ROW of transmission line acquired prior to sanctioning funds.

P 6 : **Profile of WPDs is also most probably changing to large players**

- Evidence suggests that introduction of auctions has changed the profile of WPDs likely to large players as auctions are competitive and WPDs with least cost of capital wins as technically all are at par .

P 7 : No Forward or Reverse Integration is likely to happen between OEMs and WPDs.

- Evidence suggest that there is no likely forward or reverse integration happening between OEMs and WPDs as the risk profiles of both are very different. OEMs are not in good financial health and WPDs don't want to take on risks off OEMs as they are purely technologically oriented and WPDs don't have overall wherewithal to run that business.

P 8 : New players or players with funds are likely to do aggressive bidding to secure market share.

- Evidence suggest that new players or players with funds are likely to do aggressive bidding to secure market share.
- Evidence also suggest that there is possibility that they may quote ultra-low tariff in bids which may not sustainable.

P 9 : **Net worth and other eligibility criteria in RfS are likely adequate** .

- Evidence suggests that Net worth and other eligibility criteria in RfS are adequate and are likely accepted in the Industry.

P 10: **E- Reverse Auction Mechanism is likely most transparent and efficient procedure for price discovery in wind energy sector for government in India.**

- Evidence suggests that e-reverse auctions, from the philosophy wise or from the procurement methodology for a government institution, is likely the most efficient way of price discovery
- Evidence also suggest that e reverse auctions are also completely transparent and fiercely fought and process is quite competitive.
- Evidence further suggests that FiT mechanism, which was used earlier and in which tariffs are determined by state commissions and anyone who wants to setup a plant can set up the plant by getting certain approvals was likely to be highly subjective and prone to biases and corruption .

- Evidence also suggests that auctions are likely to be overall good for the discoms as they have been able to discover very low tariffs. In addition , evidence has also come light that not only central governments but state governments also now want auctions.
- Evidence further suggests that e reverse auctions are likely to be suitable only when there is limited competition.

P 11: Favouring large players, leading to unscientific decision making, creating unnecessary competition, delay in signing PPAs and matching L1 within +2% clause and no pipeline visibility of future auctions are likely challenges related to E Reverse Auctions

- Evidence suggests that in terms of project viability auctions likely tend to get unscientific because people take it on their ego and decision on the next best price has to be taken within 2-3 min , which is too short a time to rework on assumptions.
- Evidence suggests that e reverse auction being a competitive process, it favours all the large players or the global players or the players who are having least cost of capital.
- Evidence further suggests that e reverse auctions are likely to be suitable only when there is limited competition
- Evidence also suggests that in greediness to capture market share by some bidders in e- reverse auctions likely sometimes lead to ultra-low tariffs ,falling below competitive or sustainable prices. Unnecessary competition has been created and has led to poor installations on ground.
- Evidence also suggests that as electricity doesn't have any attribute. It doesn't have a physical attribute, implies Rs 2 per unit electricity is also same as Rs 4 per unit electricity. Therefore it is likely that the varied prices received in auctions cannot confirm the real state of the sector and sustainable tariff.

- Evidence suggests that as no off-take is assured through State Discoms and for better tariff discovery SECI does not give pipeline visibility of auctions, which if allowed is likely to help in better planning by WPDs.
- Evidence also suggest that the clause of matching the L1 bid price within 2% range (L1 +2%) in a particular auction likely disrupts the financial planning of bidders especially if L1 has quoted unrealistically low prices.

- Evidence suggest that delay of more than 6 months at times in signing PPAs post winning of auctions likely leads to economics of project planning by WPDs based on quoted tariffs go haywire.

P 12 : Pipeline visibility of auctions , immediate signing of PPAs and discontinuation of matching L1+2% clause are likely to support and help WPDs/

- Evidence suggests that pipeline visibility of auctions for next 6 months is likely to help WPDs in better planning and preparation. However, SECI is unable to do the same due to no guaranteed buyers.
- Evidence suggest that delay of more than 6 months at times in signing PPAs post winning of auctions likely leads to economics of project planning by WPDs based on quoted tariffs go haywire.
- Evidence also suggest that the clause of matching the L1 bid price within 2% range (L1 +2%) in a particular auction likely disrupts the financial planning of bidders especially if L1 has quoted unrealistically low prices. But same is requirement of discoms as they don't want to buy electricity at varied prices from same auctions.

P 13 : Simple L-1 Based Closed single tender mechanism can be likely suitable replacement of e reverse auctions

- Evidence suggests thataccording to most WPDs , wind energy market presently is hyper competitive, with lots of players , simple L-1 closed bid

based tendering mechanism is likely to be suitable in place of e-reverse auction mechanism .

- Evidence also suggests that the mechanism followed in all other big infrastructure projects, utility projects, smart metering projects by government, wherein L2 & L3 are asked to match the L1 and the order is split accordingly can likely be replicated in wind energy sector as well
- Evidence further suggests that If e reverse auctions have to only continue then plain vanilla stand alone wind and solar tenders may not be suitable and in future there should likely be a mix of solar,wind and storage auctions.

P 14 : Bidders are disciplined and are likely to stick to predefined lower cut off price for auctions .

- Evidence suggest that bidders are disciplined, a floor price or lower cut off is set and they are seldom likely to go below that as they don't have a mandate **.**
- Evidence further suggests that Bidding price or cut off price is likely to be determined by doing calculations on assumptions and by how aggressive WPD is to win and do they have equivalent opportunity at hand if you lose. The assumptions are likely to be based on what kind of commodity price, interest and Forex rates as well as how superior or inferior their site is are taken into consideration by financial head in company.
- Evidence further suggests that aggressive or conservative cut off floor price is always likely to be determined by company's position at that time. Financial advisors are likely to see on what kind of commodity price, interest and Forex as well as how superior or inferior your site is before advising pricing strategy.
- Evidence suggests that in all likelihood in the available 8 minutes for decision making, reworking assumptions is not possible nor seeking

approvals. The approvals for decision making in between those 8 min is already taken.

- Evidence also suggest that in Indian promoter driven companies auction strategy differs and the pre-decided walk away tariff is often likely to be breached as the decision maker is either sitting in auctionsor is easily available**.** The main factors considered in these cases are likely that the market is same for everyone, there is same type of financing available to everyone, if somebody else is able to do it at this rate, then they should also be able to do that as well as if others have the solution at this particular price, then they should also be able to figure out something.
- Evidence further suggests that the main psychological factors in auctions are likely to be forward thinking ,cumulative type of thinking and Leap of faith

P 15 : Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues ,commodity price and Forex and Interest rates are likely major uncertainties face by WPDs while bidding in e reverse auctions .

- Evidence suggests that all bidders are likely to have same data.
- Evidence further suggests that Land Availability, Suppliers constraints, Transmission infrastructure, ROW issues ,commodity price and Forex and Interest rates are major uncertainties

P 16 : All WPDs participating in e reverse auctions are likely to do Competitor Analysis

- Evidence suggests that participating WPDs are allowed see the tariff without seeing the names of competitors and names of competitors are not divulged to avoid cartelisation
- Evidence further suggests that still all WPDs are likely to do competitor analysis at their level by using all available data and information, analysing

past pattern , their recent interactions, collecting data from different channels like land aggregators etc.

CHAPTER -7

CONCLUSIONS

7.1 INTRODUCTION

This chapter provides a concise overview of the findings and outcomes of the research study. Section 7.2 offers a summary of the research, highlighting key findings. The chapter concludes with a discussion of the research's limitations and scope for future research in Sections 7.3 and 7.4.

7.2 SUMMARY OF FINDINGS AND SIGNIFICANCE OF RESEARCH

In pursuit of the objectives of this research study, research questions have been formulated. The subsequent section presents a summary of the findings pertaining to these research questions.

- Wind energy is ideal for India to provide a clean, reliable, and steady electricity supply to meet its rising energy demand.
- The study brings out that AD ,GBI and other tax benefits were the main driver of wind energy investments in India and they all unlocked the Indian wind market.
- State level policies like FiT, RPOs, Wheeling and Banking also had a positive impact in the growth and development of wind energy in respective states.
- However, migration to reverse energy auctions in 2016 has led to certain challenges for WPDs and actual capacity realization of projects on ground has not happened.
- Study identifies various challenges and the uncertainties faced by WPDs due to e reverse auctions and also brings out the biding strategies followed by various firms, factors considered by them in biding.
- Study brings out that the e reverse auctions of wind energy in India are the right way forward as it leads to better transparency and right price

discovery, however the supporting environment, both in terms of policy and infrastructure is yet to be achieved.

- This has resulted in some auctions being undersubscribed as well as most of the previously auctioned projects being held up at implementation stage.
- There is a need for a holistic review of the policy, taking lessons from the problems faced currently by WPDs and accordingly amending the terms of reference.
- Most of the issues faced are directly or indirectly linked to land acquisition, transmission, and grid access bottlenecks which should be addressed with alacrity, with close coordination between the Centre, State and WPDs. This will guarantee easy and timely land acquisition and fast development of transmission infrastructure(Kandpal & Dhingra, 2021).
- The study also recommends pipeline visibility of auctions, faster signing of PPAs and wind-solar hybrid auctions as the way forward. Alternatively single tender closed bid system can be introduced. By ensuring these surely India can achieve the goal of 140 GW of wind energy by 2030 and march towards achieving its overall win potential of 302 GW.
- Between 2016 and 2022, wind energy capacity addition has grown at a CAGR of about 5 percent. To meet the target of 140 GW wind energy capacity by 2030 and to achieve the overall potential of 302 GW, the growth rate in capacity addition has to triple.(Powell, Sati, & Tomar, 2022)

7.3 LIMITATIONS

The conclusions presented in this research are drawn from in-depth interviews conducted with key stakeholders from the wind energy industry in India. These conclusions are derived through the application of a qualitative interpretive approach as the research methodology for this study. It is important to note that this approach is often considered subjective and may have limited generalizability. In this research, the factors considered by firms in the bidding process and the uncertainties they face are primarily based on the perceptions of the interviewees, which can be subjective in nature. To mitigate the subjectivity associated with interview data, additional evidence was collected from external sources. By incorporating information from external sources, the research aims to enhance the objectivity and reliability of the findings. While the findings of this research provide valuable insights into the wind energy industry in India, it is important to acknowledge the limitations in terms of subjectivity and generalizability. The research findings should be interpreted within the context of the specific stakeholders interviewed and the qualitative nature of the study methodology(Creswell, 2009; Eisenhardt, 1989; Klein & Myers, 1999; Yin, 2003). Further e reverse auctions process for wind energy is also evolving with various combinations like integrate wind solar and storage auctions being introduced and overall factors considered in the same may change based on market dynamics.

7.4 AREAS OF FUTURE STUDY

he progress of wind energy development is shaped by various factors, including policies, as well as economic, social, and infrastructural elements such as energy demand, RPO mandates, consumer tariffs, wind power grid integration, and road network. These factors warrant a comprehensive examination and study(Thapar et al., 2018). Offshore wind energy potential surpasses that of onshore locations, with many regions in western India offering favorable conditions for low wind farming. However, offshore wind energy remains an

underexplored domain. Research efforts should focus on assessing the effectiveness of the National Offshore Wind Energy Policy, its current status, and the obstacles and facilitators for offshore wind energy expansion.Additionally, exploring the strategies, competitiveness, and business models adopted by various companies in the wind energy sector represents a valuable niche for research. Furthermore, there is a pressing need to examine and compare policies, growth drivers, and challenges within the wind and solar sectors in India, as well as comparing the Indian wind sector with that of other countries.

Moreover, India plans to add 10 GW of capacity through hybrid projects that combine wind turbines with solar panels, yet there is currently a dearth of research in this area(R. K. Singh, 2021). The sustainibility and efficacy of hybrid auctions (Wind-Solar) as well as the strategy, business models and challenges for WPDs/ RE Developers also required to be studied.

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Appx A

DATA COLLECTION PROTOCOL

A. INTRODUCTION

A1. India, with a total installed wind power capacity of 40.4 GW, is fourth largest wind producer in the world . Accelerated Depreciation (AD) and Generation Based Incentives (GBI) as central govt policy mechanisms supported the initial growth, these were complemented by state level policies like feed-in-tariff, wheeling charges, banking, third party sale and open access transmission. Of these, many studies have identified state specific feed-in-tariff (FiT) as the most important policy mechanism which accelerated investment in Wind Energy in respective states.

But the sudden transition to reverse auction mechanism in 2016 brought a big disruption in the market and the regime is yet to be stabilised. Till now 9 tranches of auctions have been conducted by Solar Energy Corporation of India (SECI) and 06 by various states. Switch to an auction-based allocation of wind capacity from Feed-in -tariff has been done to encourage more competition and better price discovery. However, most of the projects allocated through auctions are behind schedule and many tenders have gone undersubscribed.There are numerous challenges especially related to land acquisition, grid infrastructure availability and low price bids by competing firms as well as financial and operational risks being faced by firms. All this makes it imperative to study how firms are finding the right balance between low pricing and fin viable projects as Fin unviable projects will lead to reduced wind generation, potentially distressed loans and contracts not honoured. In addition, what are the other uncertainties which the firms face during the decision making process in auctions and their response to these uncertainties? Also, what are the other factors being considered by firms during the bidding process? Therefore, this Data Collection Protocol has been prepared to study and identify these

uncertainties and strategic decision-making factors considered in bidding during Wind Energy Auctions and actions taken to mitigate these uncertainties.

A2. Purpose of Data Collection Protocol

A **Data Collection Protocol** is a document that contains the questionnaire (instrument) for data collection as well as the procedures and general rules to be followed in using the protocol. The purpose of this data collection Protocol is to understand the uncertainties faced and their responses in the decision making process for bidding during Wind Energy Auctions by Firms. The study also tries to identify the factors considered by firms while bidding in Auctions. In addition study tries to answer the undermentioned additional questions:-

(a) What were the factors which have been driving the growth of wind energy in the country? What are the barriers to the growth of wind energy in the country?

(b) How has the various state and central government policies related to wind energy have impacted the growth of wind energy in India?

(c) How has the various state and central government policies related to wind energy have benefited the wind power developers in India?

B. **Data Collection Procedures**

B1. Names of the firms to be visited/studied, including contact persons

The proposed list of employees who will be contacted for interview along with the location & contact details is also prepared.

B2. **Data Collection Plan**

Data Collection from the employees of the two Wind Power firms will be done in the calendar year 2022.

The data collection will be done by a semi-structured interview with an individual employee using the Data Collection Protocol.

B3. **Expected preparation prior to data collection**

1. Intimate the employee regarding the interview schedule & get his permission well in time.

2. Prepare with interview tool kit such as questionnaire, interview recording format, audio recorder etc.

C. Interview Guide

This document serves as a guideline specifying the type of questions in conducting interviews for this study **"**To identify the uncertainties faced by firms and their responses in the decision-making process for bidding during Wind Energy Auctions and identify the factors considered in the same".

These constructs will be used for validity purposes during the interview.

Documentary evidence if any will be identified during the interview & the same will be recorded.

Q1. Description of the Interviewee

Q 1.1 General

1. Name :
2. Company:
3. Designation:
4. Location:
5. Experience:
6. Date:

Q 1.2. Responsibilities & their Roles relevant to the decision making process while bidding in wind energy reverse auctions:

Q 2. Historical factors and impact of various government policies which lead to the growth of Wind Energy in India

This section of the interview aims to identify the factors which have been driving the growth of wind energy in the country as well as Impact of various state and central government policies related to wind energy on the growth of wind energy in India and how these policies have benefitted the wind power developers.

Q 2.1. What are the historical factors which have led to the growth of wind energy in India?

Q 2.2. What has been the role of central government policies of Accelerated Depreciation (AD) and Generation Based Incentive (GBI) in the development and growth of Wind Energy in India? Was AD policy misutilized or used only for availing tax benefits and it didn't lead to any significant capacity addition initially? Which state policy among FiT, RPO, Wheeling and Banking has been most effective in attracting wind power investments in the states?

Q 3. Identifying the uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions and identifying the factors considered in the same.

This is the main research question which this case study intends to find out by identifying the uncertainties faced by firms and their responses in the decision making process for bidding during Wind Energy Auctions and ascertaining the factors considered in the same.

Q 3.1. Transmission Infrastructure Availability.

Can you explain the adequacy of Power Evacuation and Transmission Infrastructure and its relationship with wind capacity being auctioned and participation of WPDs in these auctions? What are the challenges in seeking permissions for utilizing existing Power Evacuation and Transmission infrastructure available? What are your views on planning adequacy of Grid infrastructure and wind power plants since both have different gestation periods (5 years and 18 months)? Also what is the status of Coordination between Wind Power Developers, SECI and Central Transmission Utility, wrt selection of sites and development of corresponding evacuation and transmission infrastructure?

Q 3.2. Tariff Revision and Renegotiation of PPAs by State Governments and Utilities.

Q 3.2 There have been cases of arbitrary renegotiation of old contracts by some states, cases of reduction in off-take by state utilities in the existing project as well as case of cancellation of auctions due to high tariff bids as well as directions by states for reducing tariffs .How does this factor affect the investor

sentiment as well as decision making process of bidders while bidding or of participation in the auctions conducted by those states ? Are WPDs apprehensive of participating in auctions and investing in certain states where issues related to these have happened?

3.3 Discoms in Duress

Q 3.3 How much the poor financial health of discoms plays the role in the decision-making process of WPDs in the auctions? Are bid prices remain same or higher for states with poor payment history and weak credit profiles such as Maharashtra and for states such as Gujarat with good payment history and good credit profiles, for sites with similar wind densities? Are tariff prices expected to be lower for allocations under the central schemes, and vary from state to state based on their payment history and credit profile of State Discoms?

Q 3.4.Land Issues.

Q 3.4 Land is a state subject and land availability, policies & rates varies from state to state . How much the challenges in purchasing land, getting required permissions and other delays in land acquisition affect bidding decisions?How does variation in state polices related to land rates , land allocation and lack of coordination between central and state governments affects your decision making? Do Wind Power Developers identify /earmark/procure land parcels prior to bidding in auctions or start searching for land post winning auctions? Does No Objection Certificate (NOC) required to be obtained from Ministry of Defence and Civil Aviation in some cases affect your decision making?

3.5. Issues with WPDs and OEMs

Q 3.5. The low rates achieved in auctions seems to have affected or will reduce the margins of both WPDs and original equipment manufacturers (OEMs). What will be the affect of these reduced margins on the bidding behaviour of WPDs?Will this affect the participation of smaller companies that have limited financing options? Will it lead to the entry of bigger and global players as well as more consolidation and integration between IPPs, OEMs and WPDs? Is

there a likelihood of aggressive developers, by quoting low bids, in order to seize more market share and capacity, may get entrapped in a heavy debt cycle, leading to a situation of non-performing assets (NPAs)? What are the critical factors considered by Financial Institutions in providing finance to WPDs? Is there is likelihood of shift in operational wind power execution model expected for OEMs and Developers with either Forward or Reverse Integration happening? Is excessive dependence of Wind Power Developers on OEMs for O&M functions as well as the availability of spares leading to critical downtime and affecting the functioning of Wind Power projects especially in the case of OEMs that are not doing well?

3.6. Bidding Strategies employed by WPDs, types of Uncertainties faced by bidders during auctions and are bidders prone to any biases

Q 3.6. What are the kind of bidding strategies employed by WPDs while bidding in e-reverse auctions? What is are the kind of uncertainties involved in bidding in e- reverse wind energy auctions? Are biding decisions in e-reverse auctions prone to any biases and are assumptions made while bidding?**.**

3.7. <u>E- Reverse Auction Mechanism and its suitability as a procedure</u>.

Techno-Commercial Bids and Financial Bids are submitted online. Bidders are shortlisted by SECI and subsequently, only their Financial Bids are opened. Only bidders which are lesser than the ceiling tariff are invited for participating in e- reverse auction process. Selection of bidders is done based on bidder quoting lowest tariff (L1) getting qualified capacity and then the next highest bidder (in ascending order) getting qualified capacity, till the capacity is exhausted. An e-bid is held on the electronic platform with every bid visible to all players, while the closed bid is submitted physically in sealed envelope.

Q 3.7 Is e- reverse auctions suitable for wind energy auctions as a procedure or conventional bidding would be better for the auctions? Do the wind energy reverse auctions help in the long-term development of competitive markets ?Are e-reverse auctions suitable for SMEs? Will pipeline visibility of projects help in

making bidding decisions during auctions? What are the challenges faced by bidders in the e-reverse auctions and any recommendations on any alternate methodology or to improve the auction process?

3.8. **Net-worth, Liquidity Requirements and Financial Closure.** The general terms and conditions related to networth, liquidity and financial closure as per RfS issued by SECI are as under:-

(a) The cumulative net-worth of the Bidding Company or Consortium together should be equal to or greater than **Rs. 1.24 Crores per MW** of the quoted capacity.

(b) In order to ascertain that the Bidder has sufficient means to manage the fund requirements for the Project, the Bidder shall be required to demonstrate at least one of the following parameters:

(c) A minimum annual turnover of **Rs. 60 lakhs/MW** of the quoted capacity during the previous financial year

(d) Internal resource generation capability, in the form of Profit Before Depreciation Interest and Taxes (PBDIT) for a minimum amount of **Rs. 12 Lakhs/MW** of the quoted capacity,

(e) In-principle sanction letter from the lending institutions/banks of the Bidder, committing a Line of Credit for a minimum amount of **Rs. 15 Lakhs/MW** of the quoted capacity, towards meeting the working capital requirement of the project

(f) **Financial Closure**.

The Project Developer is required to report tie-up of 100% of the Financing Arrangements for the Projects within 7 months from the Effective Date of the PPA in the form of loan sanction letter for debt component, Board Resolution for equity contribution and availability of sufficient equity in the company.

Q 3.8 Are the above mentioned terms and conditions related to Net-worth, Liquidity Requirements and Financial Closure adequate and do these criteria

impact the decision making of WPDs in the bidding process for wind energy auctions?

RESEARCH PAPERS PUBLISHED

(a)	Migrating **to Reverse Auction Mechanisms in Wind Energy sector: Status and challenges**	Energy Policy 156 (2021)-112352
		Impact Factor 7.576
		ABDC- A, SSCI, Scopus
		https://doi.org/10.1016/j.enpol.2021.112352
(b)	**An Overview of wind energy finance in India and the way ahead**	Oil, Energy and Gas Quarterly ((Volume 72, Issue 1)-Sep 2023)
		ABDC- C ,Scopus , UGC CARE
(c)	**Green Hydrogen in India: Status and the Way Ahead**	YMER(Volume 21 , Issue 12 (Dec, 2022)
		Impact Factor **5.7**
		Scopus, UGC CARE Group -II
		https://ymerdigital.com/uploads/YMER2112M7.pdf
(d)	**Wind Energy Policies in India and the Way Ahead**	Water and Energy International (Volume :65 , Issue :4 -2022)
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