<div align="center">CHAPTER 3</div>

Research Methodology

3.1 Introduction

This section deals with methodology and design for conducting the research study. Researchers like R.Daft (Daft, 1995) stressed on selecting an appropriate design for the study. D. Grunow further corroborates and embellishes the same (Grunow, 1995). A number of scholars are of the view that the researcher may have multiple approaches to study the same problem (Hitt, Gimeno, & Hoskisson, 1998) and that the same research question can be answered by both Qualitative and Quantitative approaches (Burtunek, Bobko, & Venkataraman, 1993). While a few eminent researchers like S. Ackroyd (Ackroyd, 1996), (Ayer, 1959) (Schrag, 1992) advocates for quantitative approach, some others argue for leaning on a more qualitative approach (Jorgensen, 1989) and (Atkinson & Hammersley, 1994). It has thus been well-settled that various approaches are permissible in regard to constructing a research design. Combining two different approaches has also been recommended by a number of recent researchers (Johnson R. B., 2004) for complementary purposes. Mixed research methodology represents a general approach of research in which quantitative and qualitative characteristics are mixed in one overall study. The researcher may use the quantitative paradigm for one part of the study and also qualitative paradigm for addressing the other part. Mixed method has been accepted by a number of researchers (Onwuegbuzie, 2004) (Brewer, 1989), (Creswell, 2003), (Johnson R. B., 2004).

3.2 **Research focus**

Indian power sector has seen major policy changes in past few years. Significant private investment in power generation is on the verge of getting stranded as a result of unprecedented changes in relation to raw material and retail market transaction charge fixation policies. No specific academic literature is available to quantify the impact of such major policy reversal. In the wake of such policy uncertainties, it is also important to review the investment appraisal criteria used by the industry and applicability/ efficacy of Real Option Theory (ROT) in taking investment decisions. Though several well established investment appraisal techniques are available in literature, it is not covered in any academic literature to the best of knowledge of the researcher, how investment decisions are made in Indian power generation sector, what are the techniques used and whether such measures will be useful in taking investment decisions in an economy suffering from major policy changes. Also, to the best of the knowledge of the researcher, there is no academic literature to recommend the way forward in tackling the problem of creation of high value stranded assets in Indian power sector. This study seeks to address such gaps.

3.3 **Problem Statement**

Studies relating to burning viability issues for high value and large scale private investments recently made in the post reform Indian power generation industry which are on the verge of getting stranded today because of Government assurances not having been kept, are absent together with any analysis how to mainstream these assets.

3.4   Scope of Study

This study seeks to investigate the background and the reasons for creation of stranded thermal generation capacity in relation Indian power sector. It also tries to analyse the industry practice for undertaking investment decisions during uncertainty. Further, the study seeks to examine applicability of theory of investment appraisal techniques under current uncertainty in the context of Indian IPPs. Finally, it attempts to make recommendations on the future course of actions to be taken by the key stakeholders, also identified through this study.

3.5   Research Question:

In order to tackle the identified research problem, it is important to understand how investment decision for power sector is taken in India and whether ROT would help in taking investment decisions under such uncertainty. Also, there is a need to quantify the impact of policy change. Further, it is critical to evaluate / generate measures which can help avoid mass scale stranding of IPPs in India. The research questions framed are mentioned below:

1.   How investment decisions are made in uncertain situations for IPPs in India?
2.   How policy related uncertainty (coal and barrier in retail market) impacts viability of IPP's in India?
3.   Could ROT help under such circumstances?
4.   What actions can be taken now to mainstream stranded power project assets.

3.6 Nature of Research Questions

This study uses a mixed research methodology, combining qualitative and quantitative enquiries. This warrants integration of both qualitative and quantitative approaches (Tashakkori & Creswell, 2007). Separate qualitative and quantitative questions are therefore framed and later reinforced by specific mixed method question(s) which integrate(s) the outcome of other questions. (Creswell & Plano, 2007).

3.7 Research Objectives:

The Research Gap, the Research Problem and the Research Questions are pointing towards understanding and identifying how investment decision taken in Indian power sector, what are the impacts of various policy decisions and if there is any possibility of undertaking suitable measures to avoid the problem of stranded capacity. With this in view the following three principal objectives for this research have been framed.

1. To identify investment appraisal criteria used by IPPs in India and Developers' views under current uncertainty in power generation in India

2. To study the impact of change in policy on viability of IPP in India. It is broken into:

    (a) To study implication of change in fuel policy (coal) on project viability.

    (b) To study implication of barriers in retail market on project viability.

    (c) To examine viability gaps for IPPs in terms of cost of generation and expected revenue and evaluate options

3. To Suggest framework for mainstreaming stranded IPPs

3.8   Research Framework Design

The following table would indicate the framework including sub-models involved.

Table 3-1: Methodology / Design

OBJECTIVE - 1	
To identify investment appraisal criteria used by IPPs and Developers' views under current uncertainty in power generation in India	1) Interview with developers/ investment bankers/ consultants / industry Associations on a) Appraisal criteria generally used b) Current uncertainties and implications c) Efficacy of ROT in the present context 2) Documentation following "Framework Analytic Approach" 3) Mapping & Interpretation
OBJECTIVE – 2(a)	
To study implication of change in fuel policy (coal) on project viability	1) Depth Interview with industry experts to trace background of change in policy and Critical analysis of coal supply framework in India 2) Mapping & Interpretation following 'Framework Analytic Appraisal' 3) Obtaining relevant data from developer and carrying out gap analysis 4) Analysis of significance of fuel cost – pre/post policy change
OBJECTIVE – 2b)	
To study implication of barriers in retail market on project viability / competitiveness	1)Depth interview with experts familiar with the issues involved and - a) Assessment of the current status of Indian Retail Power Market covering policy, regulation and tariff. b) Identification of barriers and Quantification 2)Examination of potential impact of barriers – loss of Competitiveness
OBJECTIVE – 2(c)	
To examine viability gaps for IPPs in terms of cost of generation and expected revenue and evaluate options	1) Selection of an IPP for carrying out analysis and Obtaining information from the IPP 2) Assessment of COG through financial models with likely market prices 3) Gap Analysis, Assess ROT Cost of Flexibility & Benefit if any under present situation
OBJECTIVE – 3	
To examine viability gaps for IPPs in terms of cost of generation and expected revenue and evaluate options	1) Interview with Experts covering Developers, Policy-makers, Regulators, coal suppliers, Legal professionals, leading Consultants 2) Generate mainstreaming ideas and Recommend - Issuewise & Stakeholder-wise options ahead

3.8.1   **Step By Step Design**

3.8.1.1   *OBJECTIVE - 1*

To identify investment appraisal criteria used by IPPs in India and Developers' views under current uncertainty in power generation in India

<u>STEP</u>

1) Depth interviews have been carried out following "Framework Approach" with 5 renowned developers including 1 large international investor, 3 leading Consultants in India, 1 Banker, 1 Industry Association.

2) Such interviews were conducted face to face with the aid of voice recorder by permission.   Data obtained through such interviews were analysed.

3) Patterns / Themes developed and charted

3.8.1.2   *OBJECTIVE -2(a)*

To study implication of change in fuel policy (coal) on project viability / Competitiveness

STEP – 1

For Objective 2(a), Depth interviews were carried out to appreciate and understand the framework / background of changes in fuel policy with eminent industry experts like Ex-Chairman, Central Electricity Authority, a senior official of Ministry of Coal, Ex-Chairman of Coal India, Ex-Chairman, State Bank of India and a critical analysis was carried out through literature survey covering coal sector in India, various policies and guidelines on fuel supply framework for new developers of power plants

STEP – 2

a)   Selection of an IPP for carrying out detailed analysis.

i)	Private ownership
ii)	Location in a State where competition in power market exists
iii)	Broadly equidistant from pithead and port
iv)	Targeted for commissioning shortly
v)	In possession of Letter of Assurance issued by Coal India but unable to have coal due to Government restriction
vi)	Sufficiently advanced in construction stage
vii)	Likelihood of getting information

b)   Obtaining detailed information/ data/ reports from Developers and carrying out Depth interviews for clarifications relating to analysing fuel sources available to a developer, pre and post changes on policy together with costs and associated challenges

c)   Carrying out enquiries

i)	Checking fuel requirement
ii)	Mapping with LOA quantity
iii)	Possibility of obtaining fuel from other sources if there is a gap
iv)	Inland freight / sea freight / fuel price issues
v)	Assumption of calorific value

STEP - 3

Carrying out gap analysis pre and post changes in fuel policy change

3.8.1.3   OBJECTIVE -2(b)

To study implication of barriers in retail market on project viability.

STEP - 1

Conducting Depth Interview with experts familiar with the issues involved on current status of Indian Retail Market for barrier identification and Assessment made of the current status of the Indian Retail Power Market covering policies, regulations and applicable tariff charges

STEP - 2

1) Identification & Quantification of barriers by analysis of data/ information obtained through depth interviews.

2) Identification of other issues influencing open access in retail market by analysis of data/ information obtained through depth interviews.

STEP -3

Examination of potential impact of barriers – loss of competitiveness

3.8.1.4   OBJECTIVE -2(c)

To examine viability gaps for IPPs in terms of cost of generation and expected revenue and evaluate options

STEP – 1

1) Selection of an IPP for carrying out analysis.

(a)	Private ownership
(b)	Location in a State where competition in power market exists
(c)	Broadly equidistant from pithead and port
(d)	Targeted for commissioning shortly
(e)	In possession of Letter of Assurance issued by Coal India but unable to have coal due to Government restriction

> (f)   Sufficiently advanced in construction stage
>
> (g)   Likelihood of getting information

STEP - 2

2)   Obtaining information from the IPP on

> (a)   Capacity
>
> (b)   Location
>
> (c)   Distance from domestic coal source and port
>
> (d)   Latest project cost
>
> (e)   Unit size
>
> (f)   Likely thermal efficiency
>
> (g)   Likely secondary oil consumption rate
>
> (h)   Source of coal, pre and post policy changes
>
> (i)   Auxiliary consumption
>
> (j)   Expected return
>
> (k)   Likely Operation & Maintenance expenditure

STEP - 3

Interview with identified Developer to generate options

STEP - 4

Analysis of market prices discovered in Power Exchanges

STEP - 5

Assessment of Cost of generation - Preparation of financial model at various capacity utilization factors to arrive at cost of generation under various scenarios with year-wise fixed and variable costs

STEP - 6

1)   Analyse options

2)   Gap Analysis - cost of generation and expected revenue

3)   Assess ROT Cost of Flexibility/ Benefit, if any

3.8.1.5   OBJECTIVE – 3

Suggest framework for mainstreaming stranded IPPs options

STEP:

1) Interview with Experts covering Developers, Policy-makers, Regulators, coal suppliers, Legal professionals, leading Consultants

2) Generate mainstreaming options and Recommend - Issuewise & Stakeholderwise actions ahead

3.9   Paradigm selected for current research

A research paradigm is described as "the set of common beliefs and arguments shared between scientists about how problems should be understood and addressed" (Kuhn, 1962).

This research follows Pragmatic Paradigm which is considered as the right fit for a mixed research (Tashakkori & Teddlie, 2003) and (Patton, 1990). Research Paradigms (Guba, 1990) are identified through their ontology, epistemology, approach and methodology. Pragmatic paradigm answers these as follows:

a) Ontology (What is reality)	In unpredictable and new situations, reality is continuously changing
b) Epistemology (how can I know reality)	Select a method which solves problems – "The best method is the one that solves problems"
c) Theoretical perspective (what approach is to be taken)	Not committed to any single system of philosophy and reality
d) Methodology (what procedure can be used)	Mixed methods (Qualitative and Quantitative)

Key characteristics of Pragmatic Paradigm (Johnson R. B., 2004) are as follows:

- It is a middle ground between philosophical dogmatisms and skepticism
- It rejects traditional dualisms
- It recognizes the existence and importance of the natural or physical world as well as the emergent social and psychological world that includes subjective thoughts
- It shows a high regard for the reality of and influence of the inner world of human experience in action
- Human inquiry is viewed as being analogous to experimental and scientific inquiry and tries out things to see what works, what solves problems and what helps to survive.
- Prefers action to philosophizing (pragmatism is, in a sense an anti-philosophy).

3.10 Rationale of study

While the latest comprehensive statute on electricity business, Electricity Act 2003, provides special thrust on generation capacity addition and private investment, certain key policies like Government fuel policy and policy on development of power market do not seem to work in tandem with the objectives of the Act. Large generation capacity was recently created by private investors on the basis of specific Government assurance on coal supply and retail market creation for power. New restrictive conditions have suddenly been imposed by the Government instrumentalities throwing fuel supply for these plants into deep uncertainty.

The other objectives of 2003 Act like developing retail market and introducing competition in the said market are yet to materialize on ground. This, along with the change in the fuel policy, inadequate power demand and sharp fall in prices in the wholesale market is leading to stranding of large-scale private

capacity created. These are highly capital intensive projects involving significant public finance.

Over Rs.2,50,000 crore worth of new assets are currently in jeopardy in India. Time is of essence and immediate actions are necessary to avoid large scale stranding of assets which is likely to have a serious fall-out for the public financial institutions. It is imperative to study the background of these assets and their current viability issues so as to enable immediate actions to be taken for mainstreaming such high value assets and to the best of knowledge of the researcher it is not covered in any academic literature.

3.11 Data collection / Analysis methodology

3.11.1 Sources of Data

Secondary information related to national experience are given as References and include sources of Central Electricity Regulatory Commission, Central Electricity Authority, Power Grid Corporation, State Electricity Regulatory Commissions, Forum of Regulators, India, Planning Commission, India, Orders issued by Appellate Tribunals for Electricity, India, Orders issued by High Courts & Supreme Courts, Competition Commission of India, National Load Despatch Centre, India, Regional & State Load Despatch Centres, Books, Reports and Journals, Acts, Rules, Regulations and Policies, The Energy & Resources Institute (TERI), Prayas (Energy Group) Pune, India, ASCI, Hyderabad, India, Coal India Limited and its Subsidiaries, Railway Authorities, State Transmission and Distribution Utilities, Generation companies including IPPs, Federation of Indian Chambers of Commerce & Industry (FICCI), Confederation of Indian Industry (CII) Other relevant websites/ books/ journals/ papers/reports/documents/ online databases publicly available and shown in the References section. Also, this research uses data (shared privately by the interviewees with their permission).

3.11.2 Collection and Analyses of Qualitative Data:

"Framework Analysis" provides a step-by-step process for framing questions and qualitative data collection through interviews (Ritchie & Spencer, 1994). This methodology covers a five-step process shown below:

1) Familiarization
2) Identifying thematic framework
3) Indexing
4) Charting
5) Mapping and interpretation

The methodology suggests preparation of transcriptions and identification of interesting segments of texts. The methodology also advocates for identification of recurrent themes and patterns and charting thereof.

3.11.3 Quantitative technique

Quantitative techniques used in the research include the following:

1. Mathematical model development considering operating and financial parameters of coal based thermal power generating station,

2. Scenario analysis for various combinations of input cost / input mix, output price, capacity utilisation ("options", also referred as MSOs and SSOs in the research) and various levels of transaction costs, and

3. Computation of Net Present Value (NPV) to arrive at the project viability, using Discounting Rate as notified by the Central Electricity Regulatory Commission, Cash in-flow from operation under various scenarios / options, and cash out-flow in form of initial project cost. NPV was not computed when project

unviability was apparent from magnitude of operating cash out-flows.

3.11.4 Depth Interview - Methodology

The Depth Interviews were carried out following 'Framework Analytic Approach:" (Ritchie & Spencer, 1994). This methodology covers a five-step process.

1) **Familiarization** – This is an initial process through which the researcher gets familiar with the transcripts of interviews together with any notes and observations. Thus the researcher gains a grip on the collected data and attempts to be aware of any patter, recurrent themes and ideas.

2) **Identifying thematic framework -** This comes subsequent to the familiarization process when the researcher is able to recognise the emerging themes or issues in the gathered data. This identification of thematic framework involves application of mind, logic and intuition by the researcher.

3) **Indexing** – The researcher identifies segments of data constituting "theme or themes".

4) **Charting** – Specific segments of data indexed are then converted to charts according to the themes

5) **Mapping and interpretation** – The fifth and final step entails analysis of the issues and their characteristics featuring in the charts. The researcher is well aware of the aim of this analysis "defining concepts, mapping range and nature of phenomena, creating typologies, finding associations, providing explanations, and developing strategies" (Ritchie & Spencer, 1994).

3.11.5 **Key Features of Framework Analytic Approach**

Key Features of Framework Analytic Approach are as follows:

(a)   Grounded or generative (original Accounts/ observation)

(b)   Dynamic (open to change/ amendment)

(c)   Systematic (methodical treatment)

(d)   Comprehensive (full review of material)

(e)   Enables easy retrieval (original textual material)

(f)   Allows between- and within-case analysis (allows associations)

(g)   Accessible to others (can be judged by others also)

3.11.6 **Interviews conducted**

1.   Interviews were conducted face to face with the aid of voice recorder by permission. Data obtained through such interviews were then analysed.

Table 3-2: Areas covered by the Interviews

OBJECTIVE 1	1. Investment appraisal criteria used during investment 2. Major Uncertainties 3. Could Application of Real Option Theory have helped?
OBJECTIVE 2(A)	1. Fuel Policy change 2. Reasons for introducing policy change 3. Salient Fuel Info - Pre & Post Change
OBJECTIVE 2(B)	Barriers in Retail Market
OBJECTIVE 2(C)	1. Project Details 2. Assessing ROT Benefits & Cost of Flexibility – Conversion Option
OBJECTIVE 3	1. Coal availability issues 2. Contracting Issue 3. Access to Retail Market / Retail Market Development 4. Financing & Policy Issues

2.   Transcriptions were duly made and data collection stopped when the researcher thought no new material or new ideas / indexes/ codes are being generated.

3. Each transcript/ response material was thoroughly read and re-read to become familiar with the whole data / information set.

4. Interesting segments of texts were highlighted. These text responses were read through to look for patterns and/or themes emanating.

5. Recurrent themes and emerging issues were identified. Themes and responses were charted.

6. Thematic charts were then used for interpreting the qualitative data obtained through Depth Interviews.

List of experts is given under Appendix – 2.

3.11.7 Interview Questions:

Depth interviews and subsequent analyses were conducted on broadly four categories :

- **Contextual,**
- **Diagnostic,**
- **Evaluative, and**
- **Strategic**

Table 3-3: Category-wise Sample Interview Questions

Category	Connotations	Illustrative Queries
CONTEXTUAL	What exists	*What investment appraisal criteria was used ?*
DIAGNOSTIC	Causes of what exists	*What were the causes for fuel policy change ?*
EVALUATIVE	Effectiveness of what exists	*What are issues influencing open access in retail market and extent thereof?*
STRATEGIC	Identifying new policies/ plan/ action for improvement	*What should be done now to address the stranded IPP problem*

Interviews began with broad questions but went on to discover issues and sub-issues immersed in the original query – cues and prompts were advanced to

navigate the interview towards the goal / objective gathering more in depth or detailed information / data set.

3.11.8 Tools used:

1) Interview on Voice recorder, then transcribed and analysed.
2) Data have been tabulated and represented through various charts to examine the problem areas.
3) Financial models

3.12 Conclusion

This section discussed existing methods of Research Methodology and enumerated the methods followed for this study.   By identifying gaps in existing research and formulating questions thereon, it systematically builds up the research objective and concludes with the key techniques involved.

With this background in context, the next sections will seek to deal with Power Sector and Data Analysis.