CHAPTER 6

# Data Analyses : Examination of viability under current uncertainties

## 6.1 Introduction

This section examines project viability of the IPPs under current scenario relating to fuel policy and, wholesale and retail power market. It studies firstly, Background and implication of change in fuel policy (coal) on project viability and competitiveness, secondly, implication of barriers in retail market on project viability and finally overall viability gap for the IPPs in terms of cost of generation and expected revenue under certain options. Qualitative data collected through various interviews analyses through framework analysis, project cash flow analysis was used for examining project viability under various options and real option theory and transaction cost quantification for barrier analysis and its impact on project viability.

## 6.2 Fuel Policy Change & its Impact

It was noticed (vide Chapter 5) that there has been a significant policy change in respect of supply of coal to upcoming power plants. This section traces the reasons for introducing such policy change and assesses its impact on viability of projects undertaken by IPPs. Interviews were carried out with Developers/ Consultants/ Policy makers/ Bankers to capture their expert views and then moving on to carry out a quantitative analysis based on data obtained from a representative IPP.

### 6.2.1 **Interview**

Depth interviews were conducted with 5 renowned Developers (IPPs), 2 leading Consultants in power sector, one Industry Association, 1 renowned Banker, 2 senior Policy makers and one Ex-CMD of largest Government coal producing company (CIL) to appreciate and understand the framework / background of changes in fuel policy.

The interviews and subsequent analyses were conducted following "Framework Analytic Approach" (Ritchie & Spencer, 1994). Transcriptions were made and interesting segments of texts were highlighted. These text responses were read through to look for patterns and/or themes emanating. Themes and responses were charted.

***Table 6-1: Interview Chart IV - Impact of Fuel Policy change***

| Respondent | Responses | | Recurrent themes & emerging issues | Mapping & Interpretation |
|---|---|---|---|---|
| | Has there been a policy change | Nature of Impact | | |
| Developer 1 | Yes | • Concessional coal as promised by MOC through LOA denied by adding special restrictive clauses at a later date<br>• Concessional coal not to be supplied for short term & medium term power sale<br>• Even long term power sale has to be with a Discom only for this coal to flow<br>• Absence of concessional coal would require imported coal<br>• Imported coal cost per heat value is much higher<br>• Discoms, due to low demand and their weak financials not willing to go for Long Term power purchase contracts<br>• LOA/ NCDP promised 100% supply, later brought down to 65%-75% only, even if there is a Long Term PPA | • New Coal Distribution Policy brought in the concept of LOA for confirming coal supply to prospective Developers | ***Open assurance of coal supply made conditional*** |

| Respondent | | Responses | | Recurrent themes & emerging issues | Mapping & Interpretation |
|---|---|---|---|---|---|
| Developer 2 | Yes | • Absence of concessional coal hugely impacts viability | | • Based on such LOAs investors took decision to invest | |
| Developer 3 | Yes | • Also, Long Term Bids are fraught with litigation & uncertainties | ***Generally in line with Developer-1*** | • LOAs did not have any restriction on type of power sale contract (short / medium/ long) to qualify for linkage coal | ***Eligibility criteria for concessional coal made restrictive*** |
| Developer 4 | Yes | • Apart from viability, imported coal/ e-auction coal transportation a major issue | | • Restrictions brought in | |
| Developer 5 | Yes | • Short term sales market does not justify running on market coal | | o only LTPPA holder to get coal | |
| Consultant 1 | Yes | • Similar to Developer 1 | | o Even that will be of a lower quantity than assured | |
| Consultant 2 | Yes | • Affected developers in a large way | | | |
| Industry Asscn 1 | Yes | • Large capacity will get stranded | | | |
| Banker | Yes | • Repayment will pose major challenge | | | |
| Policymaker 1 | Yes | • Major impact on Developers' viability | | | |
| Policymaker 2 | Yes | • This will effect for a short term till Long Term Bids are tried | | | |

| Respondent | | Responses | Recurrent themes & emerging issues | Mapping & Interpretation |
|---|---|---|---|---|
| CIL, Ex CMD | Yes | • Large impact on Developers | | |

**Sample Quotes:**

1. *"In 2007 there was a clear coal policy from the Government that coal requirement would be met in full. It was also mentioned that they may have to operate at PLF of 80-85%. The policy made it very clear that while other sectors had restrictions, power sector will not have any restrictions with regard to coal supply….*
2. *Linking coal allocation through long term PPA is wrong. Coal has to be given upfront before a project is taken up. You cannot put the cart before the horse."* – Policymaker

Through the Interview process and framework analysis it has been identified that the fuel related uncertainties are affecting viability, the same has also been dealt in detail in Chapter 5. Mapping & Interpretation of the interviews conducted involving multiple stakeholders corroborates the findings of Chapters 4 & 5.

***Table 6-2: Interview Chart V.Reasons for introducing policy change***

| **Respondent** | **Responses** | Recurrent themes & emerging issues | Mapping & Interpretation |
|---|---|---|---|
| Developer 1 | May be due to shortage in production of coal | | |
| Developer 2 | Domestic coal production fell short of demand | a) Government failed to match coal production level vis-à-vis their commitments | 1. Short production with respect to demand<br>2. To curb windfall gain of IPP by selling power at high rates in short term market |
| Developer 3 | Domestic coal production fell short of demand | b) Two key Ministries viz. Ministry of Coal and Ministry of Power did not seem to move in tandem | |
| Developer 4 | GOI promised more coal than producible | | |
| Developer 5 | Short production | | |
| Consultant 1 | Short production & High short term power price | | |
| Consultant 2 | Short coal production | | |
| Industry Assen 1 | Domestic coal production fell short of demand | | |
| Banker | Short coal production | | |
| Policymaker 1 | GOI promise based on anticipated production schedule, which did not materialize | | |
| Policymaker 2 | To curb windfall gain of the Developers by selling power at the short term market | | |
| CIL | MOP & MOC policies did not synchronise | | |

**Sample Quotes:**

1. "*Second is that in distribution what has happened was in 2009 we had power units mostly in the public sector and they had assured supply level. The new ones which mostly came in the period after 2009 also had to be given. But inadequacy of coal at that time was a constraint. Therefore the lesser level of supply was envisaged.*" … Policymaker
2. "*The huge gap in the perception of the policy makers in CIL's ability to meet coal demand in the country between 1990 (that is when it had all the blocks to itself) and 2007 (when it had lost at least 200 blocks), is the primary reason for the subsequent problem that we see for the IPPs. CIL("During this period when UI was allowed as a trading tool consciously, Short term market witnessed was very high prices. Fact remains that coal as a natural resource is scarce. Allocation of such scarce resource equitably in the society becomes a very important policy debate leading to some sort of a decision. There were some players in the market who reportedly made windfall profits."* – Policymaker

### 6.2.2 **Selection of a suitable IPP for quantifying impact of change**

a) Selection of an IPP for carrying out detailed analysis was made considering

i) Private ownership

ii) Location in a State where competition in power market exists

iii) Broadly equidistant from pithead and port

iv) In possession of Letter of Assurance issued by Coal India but unable to have coal due to Government restriction

v) Sufficiently advanced in construction stage

vi) Likelihood of getting information

b) Detailed information/ data/ reports from Developers was obtained with clarifications relating to analysing fuel sources available to a developer, pre and post changes on policy together with costs and associated challenges

c) Detailed information was obtained on fuel requirement / supply picture and electricity market situation.

***Table 6-3: Interview Chart VI Parameters of Policy Change as obtained from selected Developer***

| | **Pre Policy Change** | **Post Policy Change** |
|---|---|---|
| Fuel source | Linkage coal | Market coal |
| Quantity assurance of linkage coal | 100% | Even for LTPPA holder 65% to 75% |
| Criteria for concessional coal | No restriction once linkage granted | Restricted clause – only LTPPAs with Discoms to get concessional coal |
| Fuel cost | Low | High |
| Fuel Transportation | No major challenge, being linkage | Major challenge considering port infrastructure and internal haulage |
| Power Exchange price | Over Rs.7/- | Around Rs.2/- |
| LT power sale outlook | Bids to be floated by Discoms, some were seen also | Practically no new bid |

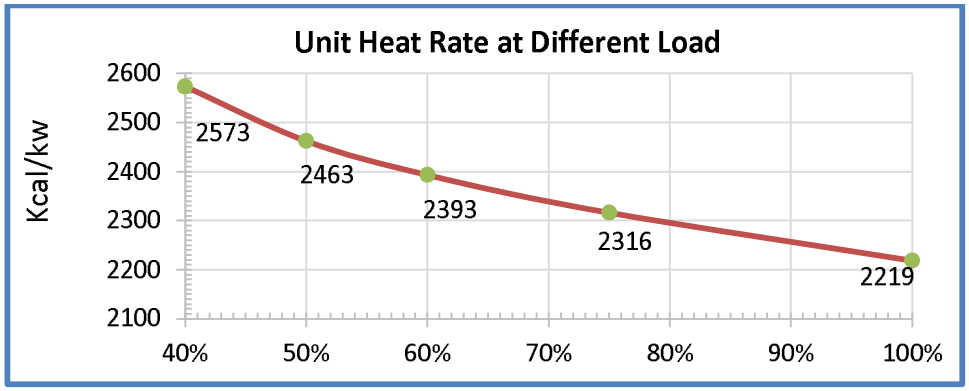
### 6.2.3 **Cost of Power Generation by midscale IPPs**

Cost of power generation includes broadly two parts – fixed and variable. While the fixed part primarily reflects the cost of building the system plus non-fuel operating cost, variable part reflects the fuel cost. Power Economists sometimes advocate for one more part to be termed as 'Semifixed' which is not strictly agnostic to the Plant Capacity Utilisation or level of output but its variability also is not significant. An example of such Semifixed cost would be certain items of maintenance cost.[43]

[43] "Fixed (or overhead) costs are those which do not vary with changes in output; variable costs are those which fluctuate as output rises or falls.
Fixed costs, such as investment costs and other overheads, remain constant (or relatively so) in total over a given period, but vary per unit. On the other hand, variable costs remain relatively constant per unit but vary in total."

A coal fired thermal generating station converts energy contained in the fuel to electricity at a rate called heat rate. This connotes the conversion efficiency. Lower heat rate signifies lesser fuel to produce one unit of electrical energy hence higher thermal efficiency. Plant support levels have significant effect on its thermal efficiencies; it is usually more efficient at higher load level (graph below). Further, for operating below 45% of rated output, oil support becomes necessary to stabilise the flame in the boiler.

***Figure 6-1: Unit Heat Rate at Different Load***




*Source: Manufacturer's data*

Coal cost contributes significantly to the overall cost of generation. "Linkage" coal on a heat value basis works out much cheaper than market coal. Currently there are only two options for obtaining market coal – e-auction and imported route. E-auction will require the developer to pay premium and hence by definition it is costlier than notified coal. Although import coal economics will depend on global factors, it is seen that even at the current low price level of import, considering the intermediate sea and railway freight, it is much costlier option.

The following table illustrates[44]:

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"Fixed costs per unit decline as production expands, (although they remain constant in total), which variable costs increase or decrease in total as production rises or falls (while they remain constant per unit)." – Energy Pricing – Economics and Principles by R.L.Conkling, Springer, 2011

[44] Above data reflects current position and is obtained from an IPP situated in the State of Maharashtra. Linkage coal source is SECL. For arriving at Rs./Heat Value, Delivered Gross Calorific Value for the respective options have been considered.

***Table 6-4:***

| **Type of Coal** | **Delivered Cost of Heat Value** | | |
|---|---|---|---|
| | Rs./GCal | % | |
| Linkage Coal | 755 | 100 | |
| E-auction | 872 | 116 | |
| Imported Coal | 1000 | 132 | 32% higher |

***Table 6-5:***

| Type of Coal | Cost Sent Out | |
|---|---|---|
| Linkage Coal | 189 | Pre |
| E-auction | 218 | |
| Imported Coal | 250 | Post policy change |

***Table 6-6: Additional Cost of Generation (Sent Out)- Impact of Fuel Policy Change***

| Capacity Utilisation Factor | % | 30% | 60% | 80% | 100% |
|---|---|---|---|---|---|
| With linkage coal | P/U | 189 | 189 | 189 | 189 |
| With imported coal | P/U | 250 | 250 | 250 | 250 |
| Generation | MU | 1577 | 3154 | 4205 | 5256 |
| Sent Out | MU | 1435 | 2870 | 3827 | 4783 |
| Additional impact per year for using imported coal instead of linkage | Rs.Cr. | 88 | 175 | 233 | 292 |
| Simple 25 year impact | Rs.Cr. | 2200 | 4375 | 5825 | 7300 |

It is thus evident that the impact of Fuel Policy change is very significant creating additional and large viability gap.

| | *Landed Cost* | *Delivered GCV* |
|---|---|---|
| | *Rs./ Tonne* | *kCal/kg* |
| *Price of linkage coal* | *2800* | *3705* |
| *Price of E-auction coal* | *2876* | *3300* |
| *Price of imported coal* | *5055* | *5050* |

### 6.2.4 Findings on Fuel Policy change and impact

a) Open assurance to supply coal became conditional
b) Eligibility criteria of concessional coal became highly restrictive
c) Financial impact of fuel policy reversal is significant – makes projects financially unviable
d) Fuel policy change was perhaps introduced with an objective to control likely IPP profit by selling at high rates in Power Exchanges as was prevailing then

## 6.3 Identification of Barriers in Retail Market & Implication on viability/ competition

Almost all the interviewees indicated that Retail Market issues are posing major problem for the investors. This section seeks to identify the barriers present therein and having identified the barriers influencing access to retail market by the IPPs it examines the potential impact of such barriers in loss of competitiveness for the IPPs. Depth interviews were conducted 5 renowned Developers (IPPs), leading Consultants in power sector, one Industry Association, 2 Traders, 1 Energy Lawyer and 3 Policy makers to capture their views on current status of Indian Retail Market for Barrier identification. The interviews and subsequent analyses were conducted following "Framework Analytic Approach" (Ritchie & Spencer, 1994). Transcriptions were made and interesting segments of texts were highlighted. These text responses were read through to look for patterns and/or themes emanating. Themes and responses were charted.

Table 6-7: Interview Chart VII. Impact of Barriers

| Themes | Respondent | Response | Recurrent Themes & Emerging Issues | Mapping & Interpretation |
|---|---|---|---|---|
| | | | | |
| ***Barriers for retail transaction*** | Developer 1 | 1. High Wheeling charge & Loss<br>2. High Transmission Charge<br>3. High Cross subsidy surcharge | Retail market replete with high access charges | ***High Wheeling charge & Loss*** |
| | Developer 2 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | ***High Transmission Charge*** |
| | Developer 3 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | ***High Cross subsidy surcharge*** |
| | Developer 4 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | ***High Wheeling charge*** |
| | Consultant 1 | 1. High Wheeling charge & Loss<br>2. High Transmission Charge<br>3. High Cross subsidy surcharge | | ***High Cross subsidy surcharge*** |
| | Consultant 2 | 1. High Wheeling charge & Loss<br>2. High Transmission Charge<br>3. High Cross subsidy surcharge | | |

| Themes | Respondent | Response | Recurrent Themes & Emerging Issues | Mapping & Interpretation |
|---|---|---|---|---|
| | Industry Assn 1 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | |
| | Trader 1 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | |
| | Trader 2 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | |
| | Policymaker 1 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | |
| | Policymaker 3 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | |
| | Energy Lawyer 1 | 1. High Wheeling charge<br>2. High Cross subsidy surcharge | | |
| | Energy Lawyer 2 | High charges in a number of heads | | |
| **Impact on Competitive-ness** | Developer 1 | Yes to a high degree<br>Complex open access procedure | State Governments do not seem to be aligned with the concept of competition in Retail Market | ***Yes to a high degree*** |
| | Developer 2 | Yes to a high degree<br>Adverse direction by State Government | Procedures also are not amenable to quick actions | ▪ ***Complex open access procedure*** |
| | Developer 3 | Yes to a high degree.<br>Procedure for open access entirely left to Discom's interpretation | | ▪ ***Adverse direction by State Government*** |

| Themes | Respondent | Response | Recurrent Themes & Emerging Issues | Mapping & Interpretation |
|---|---|---|---|---|
| | Developer 4 | Yes to a high degree.<br>Discoms create major procedural hurdles | | ▪***High Stand by tariff etc*** |
| | Consultant 1 | Yes to a high degree.<br>1. State Government direction against open access<br>2. Discoms allowing open access only on holidays<br>3. Demand high standby tariff | | |
| | Consultant 2 | Yes to a high degree | | |
| | Industry Assn 1 | Yes to a high degree | | |
| | Trader 1 | Yes to a high degree.<br>Demand high standby tariff | | |
| | Trader 2 | Yes to a high degree<br>State Government direction against open access | | |
| | Policymaker 1 | Yes to a high degree<br>State Government direction against open access | | |
| | Policymaker 3 | Yes to a high degree<br>1. State Government direction against open access<br>2. Procedure fraught with "interpretation by Discoms". | | |

| Themes | Respondent | Response | Recurrent Themes & Emerging Issues | Mapping & Interpretation |
|---|---|---|---|---|
| | Energy Lawyer 1 | Yes to a high degree<br>Retail market development is a distant dream | | |
| | Energy Lawyer 2 | Yes to a high degree<br>Unlikely to open in 3 / 4 years' time | | |

Sample Quotes:

1. *"Having said that, whatever is the competition which the Act 2003 tried to introduce, that could not happen basically because - (a) we could not set up a robust mechanism for that and (b) the Discoms being in a monopoly situation tried to resist it and did not let it happen. This happened I think all across the country. The issue of cross subsidy surcharge - kept at such a level that it became totally unproductive or prohibitive for the open access user and so this was a real barrier to open access. In UP we tried to do recently bringing in wheeling charge and cross subsidy at such a level that it became a win-win situation for the discoms and open access consumers/ users. That did not happen and in spite of the fact that we gave same cross subsidy, the discoms still did not let go of their "creamy customers". But it is my firm belief that if you want to introduce competition, if you want improve performance of the discoms, the open access has to be used, has to be permitted and unless we do that the competition at the retail end will never come to the sector."* – Policymaker

Through the Interview process and framework analysis it has been earlier identified (in Chapter 4) that the market related uncertainties are affecting viability, the same has also been dealt in detail in Chapter 5. Mapping & Interpretation of the interviews conducted involving multiple stakeholders corroborates the findings of Chapters 4 & 5.

### 6.3.1 **Retail Market Development – Current Position**

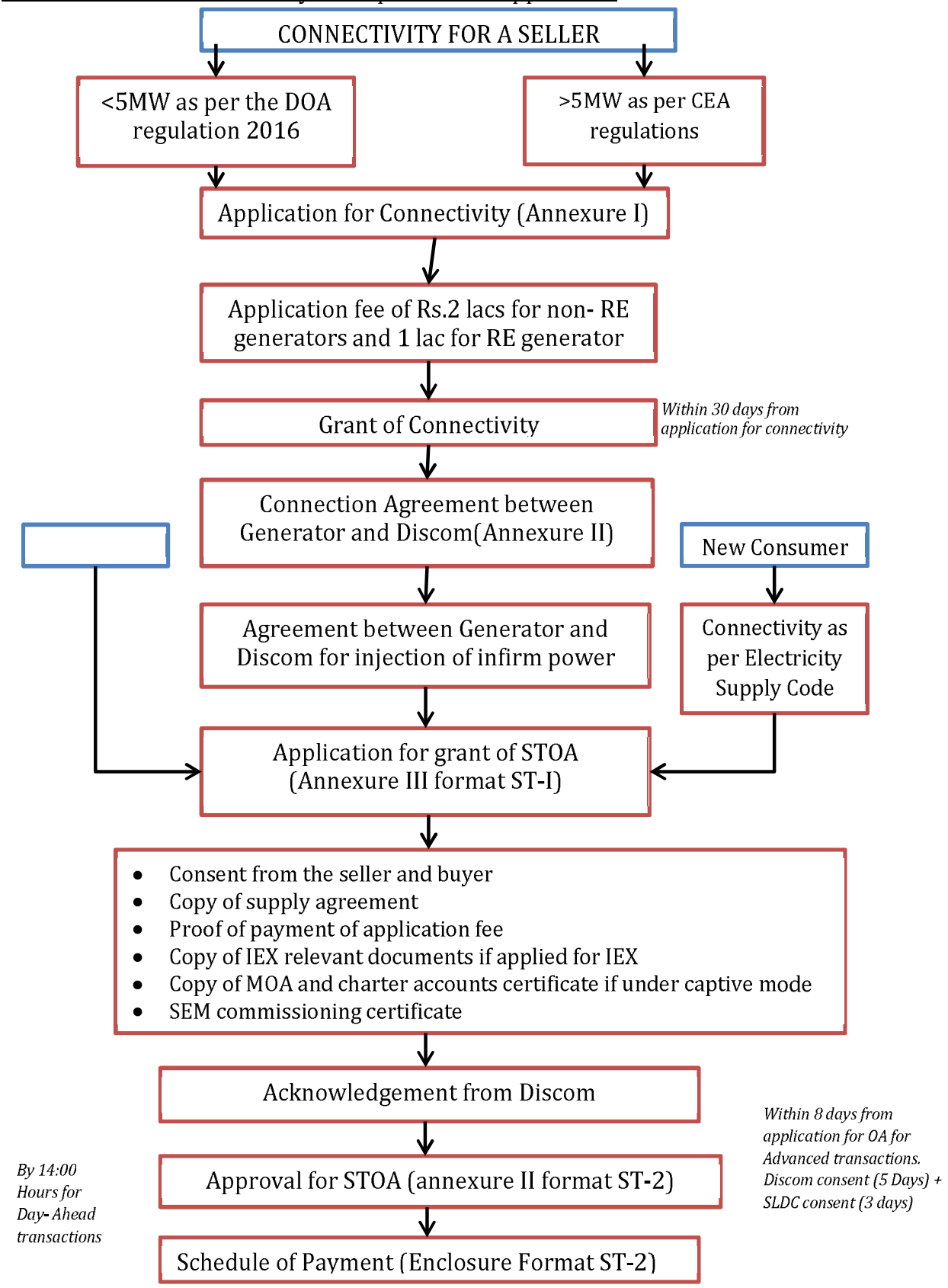
Since Indian Constitution places electricity as a concurrent subject, intra-state power sector issues are governed by State policies and State Electricity Regulatory Commissions. Electricity Act 2003 provides that the Discoms (the carriage provider) shall provide non-discriminatory open access to any generating company for reaching end-consumer on payment of certain charges and surcharges as determined by State Commissions. Through such provision of open access, the law seeks to balance the rights of the consumer to procure power from a source of his choice, and the interest of the Distribution Licensee (Appellate Tribunal of Electricity Judgement, 2014). Apart from ensuring freedom to the consumer, the provision forces Discom to improve their performance so that the consumer do not migrate to other suppliers. A consumer whose maximum power to be made available at any time exceeds 1 MW (Sec.42 of 2003 Act), has earned a right to open access from early 2009. Such open access shall be subject to payment of the following charges determined by the State Commission.

(1) Wheeling or network charge

(2) Cross-subsidy surcharge

(3) A surcharge on wheeling, if necessary.

Process Flow for Connectivity and Open Access Application [45]




[45] State Regulatory Commissions statutorily prescribe Regulations on Open Access and Charges. This

Developers allege that such process on Open Access is riddled with "Interpretation" by Distribution Company and for thwarting competition, they often resort to coercion on many grounds. Having entered into "lion and the lamb contract", Developers / open access consumers have little bargaining power. Further it is reported that certain state Governments are considering to impose high electricity duty on power purchases by consumers through open access transactions.[46]

### 6.3.2 Quantification of Barriers

***Table 6-8:Short Term Open Access Charges for 11 KV Industrial Consumer***

Paise/Unit

| | Effective STU* Charge | Applicable STU Loss** | Effective Wheeling Charge** | Applicable Wheeling Loss | Cross Subsidy Surcharge |
|---|---|---|---|---|---|
| Uttar Pradesh | 19 | 3.59% | 50 | 8.00% | 53 |
| Maharashtra | 30 | 3.89% | 83 | 9.00% | 149 |
| Odisha | 7 | 3.75% | 80 | 8.00% | 79 |
| Andhra Pradesh | 20 | 4.02% | 31 | 7.47% | 239 |
| Gujarat | 23 | 4.00% | 16 | 10.00% | 145 |
| Punjab | 21 | 2.50% | 117 | 7.78% | 85 |
| Tamil Nadu | 21 | 1.94% | 20 | 4.34% | 332 |
| Karnataka | 8 | 3.47% | 15 | 3.68% | 86 |
| Rajasthan | 23 | 4.10% | 37 | 12.60% | 5# |
| West Bengal | 11 | 3.40% | 191 | 8.00% | 126 |

Load Factor considered 60% for Transmission charge computation

* State Transmission Utility – a statutory body for developing and maintaining intra-state transmission network

** Whenever power flows through a network, some amount of energy is lost in transit primarily due to generation of heat. In order to account for such loss, quantum of deliverable energy at the receiving end is adjusted by a figure of normative loss, determined by the State Commission.

\# Rajasthan has imposed another 100 Paise/Unit charge as addl charge from open access customers from May 2016.

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chart is based on MERC (Distribution Open Access Regulations), 2016 in Maharashtra.

To address smoothening of open access procedure CERC has recently mooted a proposal for forming national open access registry. Source: CERC Staff Paper on National Open access Registry.

[46] The government would increase electricity duty on sale of power from captive plants to ease the burden. It has already revised electricity duty to Rs 1.20 a unit from 30 paise, he added. The government also plans to impost electricity duty on power purchases, especially by industrial units through open access transactions.
The government hopes to mobilise Rs 800 crore annually through this route. – Business Standard dated 24.5.2016.

***Table 6-9: Long Term Open Access Charges for 11 KV Industrial Consumer***

Paise/Unit

| | Effective STU Charge | Applicable STU Loss | Effective Wheeling Charge | Applicable Wheeling Loss | Cross Subsidy Surcharge |
|---|---|---|---|---|---|
| Uttar Pradesh | 19 | 3.59% | 50 | 8.00% | 53 |
| Maharashtra | 51 | 3.89% | 83 | 9.00% | 149 |
| Odisha | 28 | 3.75% | 80 | 8.00% | 79 |
| Andhra Pradesh | 20 | 4.02% | 31 | 7.47% | 239 |
| Gujarat | 23 | 4.00% | 16 | 10.00% | 145 |
| Punjab | 18 | 2.50% | 117 | 7.78% | 85 |
| Tamil Nadu | 21 | 1.94% | 20 | 4.34% | 332 |
| Karnataka | 32 | 3.47% | 15 | 3.68% | 86 |
| Rajasthan | 38 | 4.10% | 37 | 12.60% | 5 |
| West Bengal | 43 | 3.40% | 191 | 8.00% | 126 |

### 6.3.3 **Identification of Other Issues**

Since retail tariff structure prevalent in India is skewed and significant cross subsidy takes place amongst categories, Distribution Companies do not want to lose their large customers through open access. Apart from high charges leviable for open access as above, Discoms alleged to thwart the process often on the following grounds:

1. Transmission constraint
2. Delay in processing the application
3. Imposing Section 11 of Electricity Act 2003[47]

[47] "**Section 11. (Directions to generating companies): ---** (1) Appropriate Government may specify that a generating company shall, in extraordinary circumstances operate and maintain any generating station in accordance with the directions of that Government.

Explanation. - For the purposes of this section, the expression "extraordinary circumstances" means circumstances arising out of threat to security of the State, public order or a natural calamity or such other circumstances arising in the public interest.

(2) The Appropriate Commission may offset the adverse financial impact of the directions referred to in sub-section (1) on any generating company in such manner as it considers appropriate."

4. Allowing open access on power holidays only
5. Restricting open access for consumers served by common feeders.

### 6.3.4 Findings – impact of Barriers – Loss of competitiveness

Models were made under for Scenarios at different levels of capacity utilisation, when supply of linkage is denied, 50% imported coal and 50% e-auction coal used for generation, is presented below:

***Table 6-10: Impact of Barriers on viability***

| Capacity Utilisation | | 0.00% | 30.00% | 60.00% | 80.00% | 81.41% | 90.00% |
|---|---|---|---|---|---|---|---|
| NPV of Cash Flow in Operating Years | Rs. Crore | (3775.58) | (2974.46) | (1214.20) | (77.78) | 0.00 | 467.49 |
| Project Cost | Rs. Crore | 3850.00 | 3850.00 | 3850.00 | 3850.00 | 3850.00 | 3850.00 |
| Net Profit/ (Loss) | Rs. Crore | (7625.58) | (6824.46) | (5064.20) | (3927.78) | (3850.00) | (3382.51) |

#### *6.3.4.1 Significance of Open Access Charges*

Extending the analysis further to examine the significance of open access charges, results for various levels of reduction in open access charges are presented below, Capacity utilisation is maintained at 60% across the scenarios.

***Table 6-11: Significance of open access charges – Sensitivity Analysis***

| Open access charges reduction by | | 20% | 22% | 30% | 100% |
|---|---|---|---|---|---|
| **NPV of cash earnings** | Rs. Crore | (99.81) | 0.00 | 438.56 | 3495.01 |
| **Project cost** | Rs. Crore | 3850.00 | 3850.00 | 3850.00 | 3850.00 |
| **Net Loss** | Rs. Crore | (3949.81) | (3850.00) | (3411.44) | (354.99) |

Evidently, open access charges present a significant barrier. Even reducing such charges by about 22%, the NPV of net cash earnings will only be nil and not positive.

#### *6.3.4.2 Summarised outcome*

1. High tariff and non-tariff barriers exist and make retail sale non-competitive for IPPs
2. Financial implication of denial of market access is significant – makes projects financially unviable

## 6.4 Viability gaps for IPPs in terms of cost of generation and expected revenue and evaluate options

The same IPP was selected for this purpose of. Relevant information was obtained and Interviews carried out. Financial Models were prepared and subsequently validated by Developer IPP. This IPP has recently been developed by a large Indian power company. The Detailed Project Reports in this context were shared by the officials. Relevant Information was obtained covering:

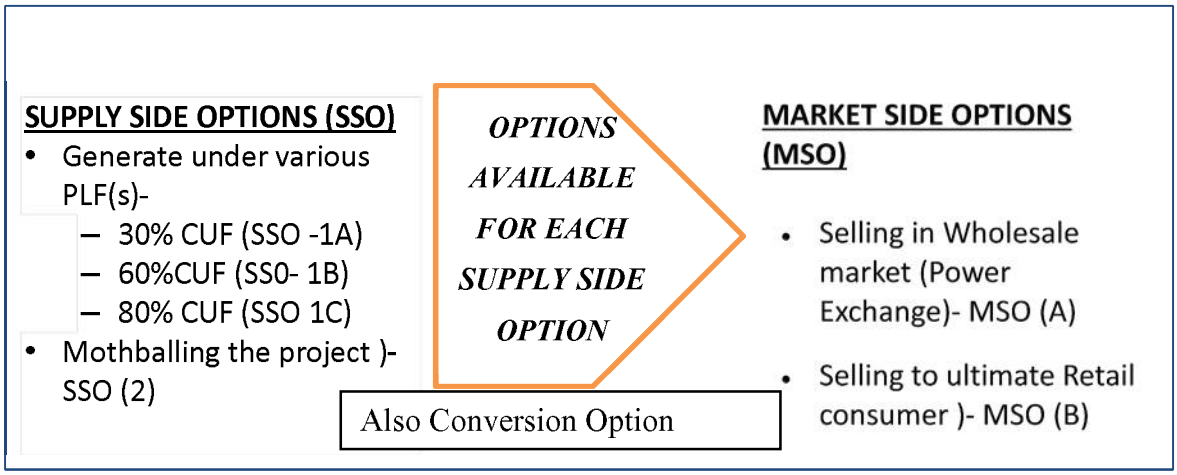
***Table 6-12: Interview Chart VIII: Project Details***

| | |
|---|---|
| Capacity | 2 x 300 MW |
| Location | State of Maharashtra |
| Distance from<br>- Domestic coal source and<br>- Port | <br>670 km<br>750 km |
| Latest project cost | Rs.3479 Cr. |
| Unit size | 300 MW |
| Likely thermal efficiency | 2360 KcAL/kWh |
| Likely secondary oil consumption rate | 1 ML/kWh |
| Auxiliary consumption | 9% |
| Likely Operation & Maintenance expenditure | Rs.22 lac/MW |

Depth Interviews were carried out with Senior officials of the firm who are conversant with investment decisions, technological and business issues. On query, views were expressed on how investment decisions were made in the project – whether such uncertainty was envisaged at the time of decision making.

Based on inputs received from these officials, Financial models were prepared at various Capacity Utilisation Factors (Plant Load Factor - PLF) to arrive at cost of generation under various Supply Side Options.

***Figure 6-2: Supply side & Market side Options***




Similarly, the Market Side Options were identified – Selling in wholesale market (Power Exchange) and to ultimate Retail Consumer. Likely price in the wholesale market (Power Exchanges) were also assessed[48]. Sensitivity/ Scenario Analyses were carried out with options as under:

a) Mothballing the project
b) Full scale generation
c) Generate under lower PLF(s)

Further, an analysis was carried out to a certain the level of wholesale market (Power Exchange) price which allows the project to attain Break-even. Similarly, the Market Side options, i.e. selling to Ultimate retail consumer (to High Voltage consumers) was modelled corresponding to Supply Side Options with sensitivity analysis of barriers.

[48] These are primarily Day-ahead Market meaning bids on Sell/Buy are placed for the next calendar day.

### 6.4.1 Market Side Option A - Selling at the Power Exchange (MSO A)

#### *6.4.1.1 Assumptions*

Other Values as agreed for the exercise are as under:

***Table 6-13: Critical Assumptions***

| *Item* | ***Figure of assumption*** | ***Source of data*** |
|---|---|---|
| **Coal usage** | • At the time of project conception: entirely domestic linkage coal used for generation.<br>• Present: 50% E-auction coal and 50% imported coal used for generation. | Assumption made as per ground situation and basis of DPR preparation in the project conception phase |
| **Coal price** | • At the time of project conception: Domestic linkage coal price has been assumed same as envisaged during project conception stage.<br>• Present: Coal price for e-auction and imported (Indonesian) coal price trend has been considered. | Developer and coal companies |
| **Norms for fixed costs** | • O&M cost assumed as per CERC Tariff Regulations.<br>• Norms for working capital and interest on working capital is considered as per CERC Tariff Regulations.<br>• Depreciation of fixed assets has been considered as per CERC Tariff Regulations. | CERC Tariff Regulations |
| **Rate of interest** | • Rate of interest on long term loan capital has been considered @ 12.50%.<br>• Rate of interest on working capital loan has been assumed same as that of long term loan. | Developer and Lenders |
| **No. of days of operations** | • Twenty five days of downtime has been considered in a year.<br>• Otherwise, the plant is considered to be available for generation for the entire year.<br>• A year has been assumed to be consisted of 365 days. | Assessment |
| **Scenario build up** | Four different scenarios of capacity utilisation have been assumed:<br>• 30% PLF;<br>• 60% PLF; | Assessment |

| *Item* | ***Figure of assumption*** | ***Source of data*** |
|---|---|---|
| | • 80% PLF; and<br>• Project mothballed. | |
| **Other assumptions** | Under the scenario of project mothballed condition, following assumptions are made:<br>• O&M cost is 50% of normal.<br>• Spares requirement has been assumed to be one-fourth of normal operating conditions. | Developer and Industry Practice |
| **Efficiency condition at low loads** | No deterioration of efficiency/ heat rate has been considered for low load operations. | Assumption |

#### *6.4.1.2 GAP ANALYSIS : OUTCOME UNDER VARIOUS SCENARIOS*

***Table 6-14: Scenario 1: 30% Capacity Utilisation [Plant Load Factor (PLF)]***

| | | **At the time of project conceptualisation** | **Current scenario** |
|---|---|---|---|
| Capacity Utilisation | % | 30% | 30% |
| Total Ex-Bus Generation | MU | 1434.89 | 1434.89 |
| Total Fixed Cost | Rs. Crore | 670.14 | 685.14 |
| Total Variable Cost | Rs. Crore | 141.63 | 359.12 |
| Total Cost | Rs. Crore | 811.78 | 1044.27 |
| Fixed Cost per unit | Rs./ kWh | 4.67 | 4.77 |
| Variable Cost per unit | Rs./ kWh | 0.99 | 2.50 |
| **Total Cost per unit** | Rs./ kWh | **5.66** | **7.27** |
| **Market determined price** | Rs./ kWh | **7.49** | **2.60** |
| **Profit/ (Loss) per unit** | Rs./ kWh | | **(4.67)** |
| **Total Profit/ (Loss)** | Rs. Crore | | **(670.09)** |

- Deterioration in efficiency/ heat rate due to low load operation has not been factored in.

***Table 6-15: Scenario 2: 60% Capacity Utilisation [Plant Load Factor (PLF)]***

| | | **At the time of project conceptualisation** | **Current scenario** |
|---|---|---|---|
| Capacity Utilisation | *%* | 60% | 60% |
| Total Ex-Bus Generation | *MU* | 2869.78 | 2869.78 |
| Total Fixed Cost | *Rs. Crore* | 674.66 | 696.60 |
| Total Variable Cost | *Rs. Crore* | 283.27 | 718.25 |
| Total Cost | *Rs. Crore* | 957.93 | 1414.85 |
| Fixed Cost per unit | *Rs./ kWh* | 2.35 | 2.43 |
| Variable Cost per unit | *Rs./ kWh* | 0.99 | 2.50 |
| **Total Cost per unit** | *Rs./ kWh* | **3.34** | **4.93** |
| **Market determined price** | *Rs./ kWh* | **7.49** | **2.60** |
| **Profit/ (Loss) per unit** | *Rs./ kWh* | | **(2.33)** |
| **Total Profit/ (Loss)** | *Rs. Crore* | | **(668.66)** |

- Deterioration in efficiency/ heat rate due to low load operation has not been factored in.

***Table 6-16: Scenario 3: 80% Capacity Utilisation [Plant Load Factor (PLF)]***

| | | At the time of project conceptualisation | Current scenario |
|---|---|---|---|
| Capacity Utilisation | *%* | 80% | 80% |
| Total Ex-Bus Generation | *MU* | 3826.37 | 3826.37 |
| Total Fixed Cost | *Rs. Crore* | 677.68 | 704.24 |
| Total Variable Cost | *Rs. Crore* | 377.69 | 957.67 |
| Total Cost | *Rs. Crore* | 1055.37 | 1661.91 |
| Fixed Cost per unit | *Rs./ kWh* | 1.77 | 1.84 |
| Variable Cost per unit | *Rs./ kWh* | 0.99 | 2.50 |
| **Total Cost per unit** | *Rs./ kWh* | **2.76** | **4.34** |
| **Market determined price** | *Rs./ kWh* | **7.49** | **2.60** |
| **Profit/ (Loss) per unit** | *Rs./ kWh* | | **(1.74)** |
| **Total Profit/ (Loss)** | *Rs. Crore* | | **(665.79)** |

***Table 6-17: Scenario 4: Mothballing of Plant (No Generation)***

| | | **At the time of project conceptualisation** | **Current scenario** |
|---|---|---|---|
| Capacity Utilisation | *%* | 0% | 0% |
| Total Ex-Bus Generation | *MU* | 0.00 | 0.00 |
| Total Fixed Cost | *Rs. Crore* | 584.68 | 584.68 |
| Total Variable Cost | *Rs. Crore* | 0.00 | 0.00 |
| Total Cost | *Rs. Crore* | 584.68 | 584.68 |
| Fixed Cost per unit | *Rs./ kWh* | | |
| Variable Cost per unit | *Rs./ kWh* | | |
| **Total Cost per unit** | *Rs./ kWh* | | |
| **Market determined price** | *Rs./ kWh* | **7.49** | **2.60** |
| **Profit/ (Loss) per unit** | *Rs./ kWh* | | |
| **Total Profit/ (Loss)** | | **(584.68)** | **(584.68)** |

- Fixed cost is significantly lower as O&M cost is significantly lower in this scenario. Also, requirement of working capital is also significantly lower in this scenario, requiring less outgo towards interest on working capital.

### *6.4.1.3 Illustrative Model - Tariff at 60% CUF (Plant Load Factor)*

***Table 6-18: Input***

| **Input sheet for Cost Computation** | | **Original Scenario** | **Current Scenario** |
|---|---|---|---|
| | | **(At the time of Project Conceptualisation)** | **(Based on current market conditions)** |
| | | | |
| **Installed capacity input** | | | |
| Capacity of plant | *MW* | 600 | 600 |
| | | | |
| **Capital cost related inputs** | | | |
| **Original Asset** | | | |
| Land and Site development | *Rs. Crore* | 65.00 | |
| BTG supply | *Rs. Crore* | 1157.86 | |
| Balance of Plant including civil work and erection (including BTG erection) | *Rs. Crore* | 936.60 | |
| Railway siding | *Rs. Crore* | 52.00 | |
| Transmission line | *Rs. Crore* | 94.00 | |
| Reservoir | *Rs. Crore* | 35.00 | |
| Taxes and duties | *Rs. Crore* | 380.00 | |
| Sundry infrastructure works & overheads | *Rs. Crore* | 116.50 | |
| Consultancy charges & overheads | *Rs. Crore* | 104.75 | |
| Finance costs | *Rs. Crore* | 433.69 | |
| Margin Money for Working Capital | *Rs. Crore* | 91.60 | |
| Contingencies | *Rs. Crore* | 12.00 | |
| **Total capital cost (for 2 X 300 MW)** | *Rs. Crore* | **3479.00** | |
| **Pro-rated capital cost for offered installed capacity** | *Rs. Crore* | **3479.00** | |
| | | | |
| **Additional Capitalisation during the year** | *Rs. Crore* | 0.00 | 0.00 |
| | | | |
| **Debt and Equity** | | | |
| Debt | | 75% | 75% |

| Input sheet for Cost Computation | | Original Scenario | Current Scenario |
|---|---|---|---|
| | | (At the time of Project Conceptualisation) | (Based on current market conditions) |
| Equity | | 25% | 25% |
| Debt | *Rs. Crore* | 2609.25 | 0.00 |
| Equity | *Rs. Crore* | 869.75 | 0.00 |
| Rate of interest on loan capital | | 12.50% | 12.50% |
| | | | |
| **Availability related inputs** | | | |
| Planned outage in a year | *days* | 20 | 20 |
| Unplanned outage in a year | *days* | 5 | 5 |
| | | | |
| **Capacity utilisation** | | | |
| Capacity utilisation factor for the plant | *%* | 60.00% | 60.00% |
| | | | |
| **Performance parameters related inputs** | | | |
| Are the boiler feed pumps electrically driven | | Yes | |
| Design unit heat rate of the units | *kCal/ kWh* | 2220.00 | |
| Maximum design heat rate permissible as per Regulation | *kCal/ kWh* | 2300.00 | |
| Applicable heat rate for computation of tariff | *kCal/ kWh* | 2300.00 | 2300.00 |
| Expected actual heat rate | *kCal/ kWh* | 2360.00 | 2360.00 |
| | | | |
| Normative secondary specific oil consumption | *ml/ kWh* | 0.50 | 0.50 |
| Expected actual secondary specific fuel oil consumption | *ml/ kWh* | 1.00 | 1.00 |
| | | | |
| GCV of secondary fuel oil | *kCal/ litre* | 9500 | 9500 |
| | | | |
| GCV of linkage coal | *kCal/ kg* | 4050 | 4050 |
| GCV of E-auction coal | *kCal/ kg* | 3300 | 3300 |
| GCV of imported coal | *kCal/ kg* | 4800 | 5050 |
| | | | |
| Blending proportion of linkage coal | *ratio by weight* | 100% | 0% |
| Blending proportion of E-auction coal | *ratio by weight* | 0% | 50% |
| Blending proportion of imported coal | *ratio by weight* | 0% | 50% |

| Input sheet for Cost Computation | | Original Scenario | Current Scenario |
|---|---|---|---|
| | | (At the time of Project Conceptualisation) | (Based on current market conditions) |
| | | | |
| Heat contribution of linkage coal in combustion | % | 100.00% | 0.00% |
| Heat contribution of E-auction coal in combustion | % | 0.00% | 39.52% |
| Heat contribution of imported coal in combustion | % | 0.00% | 60.48% |
| | | | |
| **Fuel price input** | | | |
| Price of secondary fuel oil | *Rs./ kl* | 62500 | 45000 |
| Price of linkage coal | *Rs./ Tonne* | 1440 | |
| Price of E-auction coal | *Rs./ Tonne* | | 2876 |
| Price of imported coal | *Rs./ Tonne* | | 5055 |
| | | | |
| **Norm for O&M cost** | | | |
| As per CERC Regulation | *Rs. Lakh/ MW* | 21.21 | 22.48 |
| | | | |
| **Norm for working capital computation** | | | |
| Fuel cost (coal+sec oil) | *Months* | 2.00 | 2.00 |
| Month O&M cost | *Months* | 1.00 | 1.00 |
| Maintenance spares | *% O&M cost* | 20.00% | 20.00% |
| Receivables | *Months* | 2.00 | 2.00 |
| | | | |
| **Asset stacking for computation of depreciation** | | | |
| Opening GFA | | | |
| Leasehold land | *Rs. Crore* | 65.00 | 65.00 |
| Plant and machinery | *Rs. Crore* | 3414.00 | 3414.00 |
| Total | *Rs. Crore* | 3479.00 | 3479.00 |
| Additional capitalisation during the year | | | |
| Leasehold land | *Rs. Crore* | 0.00 | 0.00 |
| Plant and machinery | *Rs. Crore* | 0.00 | 0.00 |
| Total | *Rs. Crore* | 0.00 | 0.00 |
| Retirement of asset | | | |
| Leasehold land | *Rs. Crore* | 0.00 | 0.00 |
| Plant and machinery | *Rs. Crore* | 0.00 | 0.00 |
| Total | *Rs. Crore* | 0.00 | 0.00 |
| Closing GFA | | | |

| Input sheet for Cost Computation | | Original Scenario | Current Scenario |
|---|---|---|---|
| | | (At the time of Project Conceptualisation) | (Based on current market conditions) |
| Leasehold land | *Rs. Crore* | 65.00 | 65.00 |
| Plant and machinery | *Rs. Crore* | 3414.00 | 3414.00 |
| Total | *Rs. Crore* | 3479.00 | 3479.00 |
| Rate of depreciation | | | |
| Leasehold land | | 3.34% | 3.34% |
| Plant and machinery | | 5.28% | 5.28% |
| | | | |
| **Rate for income tax computation** | | | |
| MAT rate | | 20.0075% | 20.0075% |
| | | | |
| **Rate of interest for working capital** | | | |
| Rate of interest considered same as in long term loan | | 12.50% | 12.50% |

***Table 6-19: Computation***

| | | Original Scenario | Current Scenario |
|---|---|---|---|
| **Plant capacity** | ***MW*** | **600** | **600** |
| No. of days in the year | *days* | 365 | 365 |
| **Computation of plant availability** | | | |
| No. of available hours in the year | *Hours* | 8760 | 8760 |
| Capacity utilisation factor | *%* | 60% | 60% |
| Average hours for actual generation | *Hours* | 5256 | 5256 |
| **Computation of PLF and generation** | | | |
| Expected actual auxiliary energy consumption | *%* | 9.00% | 9.00% |
| Gross generation in the year | *MU* | 3153.60 | 3153.60 |
| Total annual generation at bus-bar | *MU* | 2869.78 | 2869.78 |
| **Computation of fuel consumption** | | | |
| Secondary fuel oil consumption | *litres* | 3153600 | 3153600 |
| Total heat input from secondary oil | *Mn kCal* | 29959 | 29959 |
| Total heat input required for generation | *Mn kCal* | 7442496 | 7442496 |
| Total heat input required from coal | *Mn kCal* | 7412537 | 7412537 |
| Heat input from linkage coal | *Mn kCal* | 7412537 | 0 |
| Heat input from E-auction coal | *Mn kCal* | 0 | 2929506 |
| Heat input from imported coal | *Mn kCal* | 0 | 4483031 |
| **Consumption of linkage coal** | ***kg*** | **1830256000** | **0** |
| **Consumption of E-auction coal** | ***kg*** | **0** | **887728958** |
| **Consumption of imported coal** | ***kg*** | **0** | **887728958** |
| **Computation of fuel cost** | | | |
| Total cost of secondary oil | *Rs. Crore* | 19.710 | 14.191 |
| Total cost of linkage coal | *Rs. Crore* | 263.557 | 0.000 |
| Total cost of E-auction coal | *Rs. Crore* | 0.000 | 255.311 |

| | | Original Scenario | Current Scenario |
|---|---|---|---|
| Total cost of imported coal | *Rs. Crore* | 0.000 | 448.747 |
| **Total fuel cost** | ***Rs. Crore*** | **283.267** | **718.249** |
| | | | |
| **Computation of Variable Cost** | | | |
| Total fuel cost | *Rs. Crore* | 283.267 | 718.249 |
| Total ex-bus generation | *MU* | 2869.78 | 2869.78 |
| Variable Cost per unit | *Rs./ kWh* | 0.987 | 2.503 |
| | | | |
| **Computation of depreciation** | | | |
| Leasehold land | *Rs. Crore* | 2.17 | 2.17 |
| Plant and machinery | *Rs. Crore* | 180.26 | 180.26 |
| Total depreciation for the year | *Rs. Crore* | 182.43 | 182.43 |
| | | | |
| **Computation of interest on loan capital** | | | |
| Opening balance of loan | *Rs. Crore* | 2609.25 | 2609.25 |
| Addition of loan during the year | *Rs. Crore* | 0.00 | 0.00 |
| Repayment of loan | *Rs. Crore* | 182.43 | 182.43 |
| Reduction in loan due to retired/ replaced assets | *Rs. Crore* | 0.00 | 0.00 |
| Closing balance of loan | *Rs. Crore* | 2791.68 | 2791.68 |
| Average loan during the year | *Rs. Crore* | 2700.47 | 2700.47 |
| Rate of interest | | 12.50% | 12.50% |
| Interest for the year | *Rs. Crore* | 337.56 | 337.56 |
| | | | |
| **Computation of O&M cost** | | | |
| O&M cost for the year | *Rs. Crore* | 127.26 | 134.88 |
| | | | |
| **Computation of working capital** | | | |
| Cost of fuel | *Rs. Crore* | 23.61 | 59.85 |
| O&M cost | *Rs. Crore* | 10.61 | 11.24 |
| Maintenance spares | *Rs. Crore* | 25.45 | 26.98 |
| Receivables | *Rs. Crore* | 159.65 | 235.81 |
| Total working capital | *Rs. Crore* | 219.32 | 333.88 |
| | | | |
| **Computation of interest on working capital** | | | |
| Rate of interest (SBAR on date of application) | | 12.50% | 12.50% |

| | | Original Scenario | Current Scenario |
|---|---|---|---|
| Interest on working capital | *Rs. Crore* | 27.41 | 41.73 |
| **Computation of Fixed Cost** | | | |
| Interest on loan capital | *Rs. Crore* | 337.56 | 337.56 |
| Depreciation | *Rs. Crore* | 182.43 | 182.43 |
| Operation and Maintenance expenses | *Rs. Crore* | 127.26 | 134.88 |
| Interest on working capital | *Rs. Crore* | 27.41 | 41.73 |
| Total Fixed Cost | *Rs. Crore* | 674.66 | 696.60 |
| Ex-bus generation | *MU* | 2869.78 | 2869.78 |
| Fixed Cost per unit | *Rs./ kWh* | 2.351 | 2.427 |
| **Total Cost computation** | | | |
| Total Fixed Cost | *Rs. Crore* | 674.66 | 696.60 |
| Total Variable Cost | *Rs. Crore* | 283.27 | 718.25 |
| Total Cost computation | *Rs. Crore* | 957.93 | 1414.85 |
| **Cost per unit** | ***Rs./ kWh*** | **3.338** | **4.930** |

***Table 6-20: Output***

| | | At the time of project conceptualisation | Current scenario |
|---|---|---|---|
| Capacity Utilisation | *%* | 60% | 60% |
| Total Ex-Bus Generation | *MU* | 2869.78 | 2869.78 |
| Total Fixed Cost | *Rs. Crore* | 674.66 | 696.60 |
| Total Variable Cost | *Rs. Crore* | 283.27 | 718.25 |
| Total Cost | *Rs. Crore* | 957.93 | 1414.85 |
| Fixed Cost per unit | *Rs./ kWh* | 2.35 | 2.43 |
| Variable Cost per unit | *Rs./ kWh* | 0.99 | 2.50 |
| **Total Cost per unit** | *Rs./ kWh* | **3.34** | **4.93** |
| **Market determined price** | *Rs./ kWh* | **7.49** | **2.60** |
| **Profit/ (Loss) per unit** | *Rs./ kWh* | | **(2.33)** |
| **Total Profit/ (Loss)** | *Rs. Crore* | **1190.96** | **(668.66)** |

#### *6.4.1.4 Summary of Findings*

As can be seen from the above computation, loss is minimum in Mothballing option (0% CUF) and maximum under 30% CUF. Huge loss looks to be a fait accompli under all the conditions.

*Table 6-21: Summary of Findings*

| | Option – MSO-A | Annual Profit /(Loss) |
|---|---|---|
| **MSO-A:SSO-1A** | 30% Capacity Utilisation | Rs.( 670.09 Cr.) |
| **MSO-A:SSO-1B** | 60% Capacity Utilisation | Rs.( 668.66 Cr.) |
| **MSO-A:SSO-1C** | 80% Capacity Utilisation | Rs.( 665.79 Cr.) |
| **MSO-A:SSO-2** | Mothballing the plant | Rs.(584.68 Cr.) |

#### *6.4.1.5 Break Even price of sale*

The model was run to find out the realization revenue per unit which can allow the IPP to recover all its cost (No loss No gain) to attain Break even.

The following table summarises the position.

*Table 6-22: Break Even price*

| CUF | Ex-bus price (Rs./ kWh) |
|---|---|
| 30% | 7.27 |
| 60% | 4.93 |
| 80% | 4.34 |

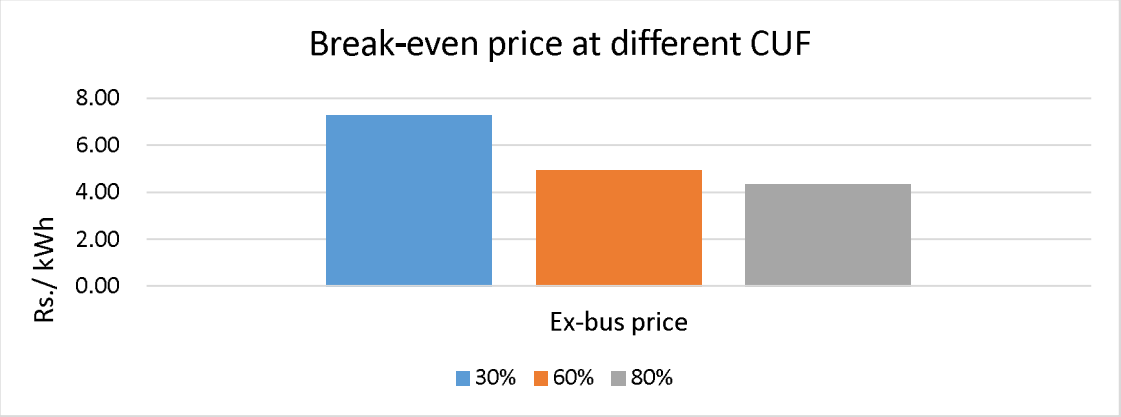



*Figure 6-3: Break even price at different CUF*

#### *6.4.1.6 Significance of linkage coal*

At 60% level of capacity utilisation, the model is run with varying use of linkage and e-auction coal. Scenario 3 envisages "what-if" linkage coal is supplied.

***Table 6-23: Linkage coal significance***

| | |
|---|---|
| **Scenario 1** | 100% linkage coal |
| **Scenario 2** | 75% linkage coal and 25% e-auction coal |
| **Scenario 3** | 50% linkage coal, 25% e-auction coal and 25% imported coal |
| **Scenario 4** | No linkage coal, 50% e-auction coal and 50% imported coal |

***Table 6-24: Outcome – Linkage coal significance***

| **Coal source:** | | **Scenario 1** | **Scenario 2** | **Scenario 3** | **Scenario 4** |
|---|---|---|---|---|---|
| Linkage | ratio by weight | 100% | 75% | 50% | 0% |
| E-auction | ratio by weight | 0% | 25% | 25% | 50% |
| Imported | ratio by weight | 0% | 0% | 25% | 50% |
| Profit/ (Loss) per unit | | (1.79) | (1.86) | (2.07) | (2.33) |
| Total Profit/ (Loss) | | (513.69) | (533.78) | (594.04) | (668.66) |

It is clearly demonstrated that with increasing use of linkage coal the Net Earning improves, but even with 100% linkage coal, the costs are not recouped. Breaking even will require about 179 P/U higher realization from the wholesale market.

### 6.4.2 Market Side Option B - Selling to ultimate Retail Consumers (MSO B)

*Table 6-25: Assumptions*

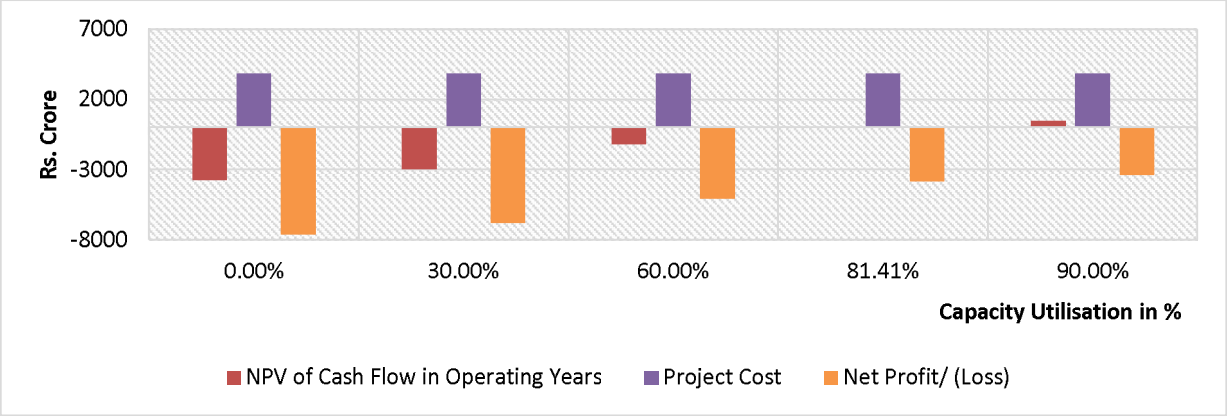
| | | |
|---|---|---|
| No. of year | | 1 |
| Year start date | | 01/04/2015 |
| Year end date | | 3/31/2016 |
| **Performance parameters** | | |
| Expected actual heat rate | kCal/ kWh | 2360 |
| Expected actual secondary specific fuel oil consumption | ml/ kWh | 1.00 |
| Expected actual auxiliary energy consumption | % | 9.00% |
| **Fuel parameters** | | |
| GCV of secondary fuel oil | kCal/ litre | 9500 |
| GCV of E-auction coal | kCal/ kg | 3300 |
| GCV of imported coal | kCal/ kg | 5050 |
| Blending proportion of E-auction coal | ratio by weight | 50% |
| Blending proportion of imported coal | ratio by weight | 50% |
| **Fuel price input** | | |
| Price of secondary fuel oil | Rs./ kl | 45000 |
| Price of E-auction coal | Rs./ Tonne | 2876 |
| Price of imported coal | Rs./ Tonne | 5055 |
| **Norm for O&M cost** | | |
| As per CERC Regulation (for first year) | Rs. Lakh/ MW | 21.21 |
| **Norm for working capital** | | |
| Fuel cost (coal+sec oil) | Months | 2.00 |
| Month O&M cost | Months | 1.00 |
| Maintenance spares | % O&M cost | 20% |
| Receivables | Months | 2.00 |
| Rate of interest | % p.a. | 12.50% |
| **Transmission charge** | | |
| Contracted capacity on Maharashtra state transmission network | MW | 550 |
| STU transmission charge | Rs./ kW/ month | 194.79 |
| Monthly transmission charge payable | Rs. Crore | 10.71 |
| Total transmission charges for the year | Rs. Crore | 128.56 |
| **Other open access charges** | | |
| Wheeling charges on MSEDCL network @ 22 kV network | Rs./ kWh | 0.83 |

| | | |
|---|---|---|
| No. of year | | 1 |
| Year start date | | 01/04/2015 |
| Year end date | | 3/31/2016 |
| Cross subsidy surcharge payable by HT Industrial consumer | Rs./ kWh | 1.49 |
| **Tariff of industrial consumer** | | |
| MSEDCL HT Industrial Tariff (express feeder) | Rs./ kWh | 8.02 |
| Realisable price from open access sale | Rs./ kWh | 6.82 |

Scenarios at different levels of capacity utilisation, when supply of linkage is denied, 50% imported coal and 50% e-auction coal used for generation, is presented below:

***Table 6-26 Net Cash Flow at various Capacity Utilisation***

| **Capacity Utilisation** | | **0.00%** | **30.00%** | **60.00%** | **80.00%** | **81.41% *** | **90.00%** |
|---|---|---|---|---|---|---|---|
| NPV of Cash Flow in Operating Years | Rs. Crore | (3775.58) | (2974.46) | (1214.20) | (77.78) | 0.00 | 467.49 |
| Project Cost | Rs. Crore | 3850.00 | 3850.00 | 3850.00 | 3850.00 | 3850.00 | 3850.00 |
| Net Profit/ (Loss) | Rs. Crore | (7625.58) | (6824.46) | (5064.20) | (3927.78) | (3850.00) | (3382.51) |




* A lifecycle worksheet covering economics of 25 years of operations leading to NPV computation is placed as Appendix – 1.

### 6.4.3 Scenario analysis – coal mix

At 60% level of capacity utilisation, the model is run with varying use of linkage and e-auction coal. Scenario 3 envisages "what-if" linkage coal is supplied.

***Table 6-27: Scenario Analysis***

| | |
|---|---|
| **Scenario 1** | No linkage coal, 50% e-auction coal and 50% imported coal, and gradual CSS reduction by 5% each year till CS reaches the level of 20% (Applicable tariff reaches 120% of average cost of supply) |
| **Scenario 2** | 75% linkage coal and 25% e-auction coal, and gradual CSS reduction by 5% each year till CS reaches the level of 20% (Applicable tariff reaches 120% of average cost of supply) |
| **Scenario 3** | 100% linkage coal, and gradual CSS reduction by 5% each year till CS reaches the level of 20% (Applicable tariff reaches 120% of average cost of supply) |

The results are presented below:

***Table 6-28 : Net Cash Flow at various cost mix***

| | | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|---|
| **NPV** | Rs. Crore | (1214.20) | 59.78 | 483.30 |
| **Project Cost** | Rs. Crore | 3850.00 | 3850.00 | 3850.00 |
| **Net (Loss)** | Rs. Crore | (5064.20) | (3790.22) | (3366.70) |

It is clearly demonstrated that with increasing use of linkage coal the Net Earning improves.

### 6.4.4 Significance of Open Access Charges – Gap Analysis

Extending the analysis further to examine the significance of open access charges, results for various levels of reduction in open access charges are presented below, Capacity utilisation is maintained at 60% across the scenarios.

***Table 6-29: Sensitivity of Open Access charges***

| Open access charges reduction by | | 20% | 22% | 30% | 100% |
|---|---|---|---|---|---|
| **NPV of cash earnings** | Rs. Crore | (99.81) | 0.00 | 438.56 | 3495.01 |
| **Project cost** | Rs. Crore | 3850.00 | 3850.00 | 3850.00 | 3850.00 |
| **Net Loss** | Rs. Crore | (3949.81) | (3850.00) | (3411.44) | (354.99) |

Evidently, open access charges present a significant barrier. Even reducing such charges by about 22%, the NPV of net cash earnings will only be nil and not positive.

## 6.5 Cost of Flexibility and Effect thereof – Assessing "Conversion Option" Efficacy

***Table 6-30: Interview Chart IX - Flexibility***

| Queries | Responses |
|---|---|
| Could there be any flexibility built in to deal with uncertainty of fuel | Perhaps Yes |
| If so, what could have been thought of | Multi-fuel firing in Boiler |
| Cost impact thereof | About Rs.30 Cr. per 300 MW Boiler |

In interviews with senior officials of the IPP, questions were raised as to the options now at hand of the developer. Real option theory was discussed to find out applicability of such theory in decision making at this stage, if any. It was a clear reply from the officials that such uncertainty was not considered during taking the investment decision. Such policy reversal was unprecedented in independent India. Any meaningful application of Real Option theory at this stage is ruled out because there is very little that can be addressed through investment in physical/ human assets now. On query, the IPP categorically informed also that even on hindsight, applicability of real option theory at the time of taking investment decision would not have served any useful purpose to circumvent future problems of such supervening nature. Further, any large capex based flexibility introduced in design of the power plant would have rendered the

project even more uncompetitive today. Therefore, the possibility of any "conversion"49 do not seem to exist today. Given this policy scenario, divestment is still a theoretical possibility. The officials were not hopeful about their sunk costs being recovered through divestment.

In this regard, information was obtained from the IPP as to the nature of capital expenditure that would have been additionally required to build in flexibility relating to fuel for this project – if the Boiler was multi-fuel and capable of burning coal, oil and gas, the additional expenditure is about Rs.30 Cr. per 300 MW Boiler on a delivered to site basis. This input was simulated in the financial model and the results are summarized below for 60% capacity utilisation factor.

***Table 6-31: Capex – Tariff Linkage - At 60% CUF***

| | Addl. Capex | Per Unit Addl. Fixed Cost for 1st yr of operation | Per Unit Addl. Variable Cost |
|---|---|---|---|
| Impact of flexibility at 60% CUF | Rs.60 Cr. | 4 P/U | 500 P/U |

***Table 6-32: Comparative Heat Value of Fuels –***

| Type of Coal | Delivered Cost of Heat Value |
|---|---|
| | Rs./GCal |
| Linkage Coal | 755 |
| E-auction | |
| Imported Coal | |
| Oil | |
| Gas | 3200 |

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Additional variable cost for implementing the flexibility will not be less than about Rs.5 per kWh, considering Delivered differential cost of Heat which is the cheapest in coal (Table above).

This clearly shows that such flexibility would not have been helpful today:

(a) Because it would have required much higher Break-even tariff from the market. As it is, the project is bleeding.

(b) The other fuel options being costlier than imported coal, use of such other fuel would have resulted in a drain in variable cost also, thus making the gap even more yawning..

Developers' contention that application of ROT would not have been helpful today to circumvent present uncertainties encountered stands validated.

## 6.6 **Finding - overall**

Interviews and financial analyses examine the barriers in Indian Retail Power market and their implications on viability of Indian IPPs. The analyses go on to further examine the ROT options that are currently available to these IPPs concerning both production/ supply and market sides. The outcomes are:

1. All Flexible Production Options and Mothballing Option are financially unviable in prevailing situation
2. All Market Selection Options are financially unviable in prevailing situation
3. Premium for Conversion Option would have been infructuous - prevailing situation would not allow exercising this option

## 6.7 **Conclusion**

While examining project viability of IPPs under current scenario from the point of view of fuel policy and power market, this section studies background and implication of change in coal policy, identifies barriers in retail power market together with their impact and also quantifies overall viability gap for the IPPs under various options available to them. It establishes that impact of fuel policy change is significant. Also, existing tariff and non-tariff barriers in the retail market lead to denial of market access for IPPs and make their investments financially unviable under all flexible production options and moth balling options. Premium in the form of higher capex for conversion options if built in the original plant design would not have helped today because prevailing situation does not allow exercising these options. Overall the Section establishes that the investments made by IPPs are in deep distress calling for immediate initiatives to be taken by stakeholders involved in order to main-stream them, which is dealt with in the next Section.