Developing a Project Finance Structure and Power Purchase Agreement for an Independent Private Power Plant Project

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ABSTRACT

The aim of this work is to introduce project financing and underlining its importance and application for financing large capital intensive projects, such as infrastructure ones. In order to achieve this purpose, first a brief history of project finance and some distributive statistical findings in different industrial sectors has been presented. Then the financial model of a single cycle power plant being given to an independent power producer is built and its results reported.

In the next step, different categories of associated risk to this private power plant project are being identified, the critical variables captured and the risk simulated. Ultimately, risk mitigation is considered by studying and recommending right type of contracts as far as possible.

Keywords: Project finance, power plant, risk, contract.

ÖZ

Bu çalışmanın amacı proje finansmanı, önemi ve büyük sermayeli projelerin finansmanını tanıtmaktır. Örneğin altyapı projeleri. Bu amaca ulaşmak için ilk olarak proje finansmanının kısa tarihçesi ve farklı endüstriyel sektörlerde bazı dağıtımsal istatistiksel bulgular sunulmuştur. Daha sonra tek çevrim santrali için kurulan finansal model ve sonuçları rapor edilmiştir.

Bir sonraki adımda özel güç santrali projesinin farklı kategorilerde ilişkili riskleri ve riskli değişkenleri tanımlanmış ve risk simule edilmiştir. Sonuç olarak, risk azaltma mümkün olduğunca doğru tipte sözleşmeleri çalışarak ve tavsiye ederek sağlanmıştır.

Anahtar Kelimeler: Proje finansmanı, enerji santrali, risk, sözleşme.

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To My Teachers, Family and Friends

With Love and Respect

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LIST OF ABBREVIATIONS

ADSCR	Annual Debt Service Coverage Ratio
BCR	Benefit Cost Ratio
CFO	Chief Financial Officer
EIA	Environmental Impact Assessment
EPC	Engineering and Procurement Contract
GSA	Gas Supply Agreement
GTA	Gas Transport Agreement
IRR	Internal Rate of Return
JPPL	Jil Power Pun Limited
LLCR	Loan Life Coverage Ratio
LTSA	Long Term Service Agreement
MCF	Thousand Cubic Foot
MFI	Multilateral Financial Institution
MIGA	Multilateral Insurance Guarantee Agency
NPV	Net Present Value
O&M	Operating and Maintenance
PHCP	Power Holding Company of Pina
PPA	Power Purchase Agreement
SCA	Standard Connection Agreement
SPV	Special Purpose Vehicle
UEC	Utility Electric Company

Chapter 1

INTRODUCTION

1.1 Background

Population growth, shortage of funds and resources lead to creation and application of more efficient techniques of allocating funds/resources to public sector capital intensive projects. Based on competition and globalization, privatisation prepares a more suitable context towards this aim which leads to more efficient use of taxpayers' money on public infrastructure capital intensive projects.

According to Finnerty (2007), project finance is not a brand new technique of financing the projects and dates back to late 13^{th} century when the British Monarch negotiated a loan with an Italian Bank to develop the Devon silver mines and was the "rule in commerce" until the 17^{th} century.

Yescombe (2002) states that mainly [the so called developed world's] basic infrastructures' industries such as water, gas, roads, railways, electricity and telephone networks were developed during the late 1700s and 1800s through substantially benefiting private sector funding. However, in the first half of the 20^{th} century governments around the world had emerged as large investment bodies and thus pushed the private sector aside.

However, this incident did not last long, as the current trend of globalization and deregulation of utilities have caused project finance to emerge as yet a smoother way towards financing long-term capital intensive projects.

1.2 Aim of the study

The aim of this study is to introduce and apply modern project finance technique on an electricity generation project to be implemented as an Independent Power Producer (IPP) via a bidding process.

Through this approach, a financial feasibility study and risk analysis based on a financial model of the project is done to distinguish the risky variables of the project so adjustments can be made to the contracts accordingly in order to meet the requirements of a project finance deal and hence make the project attractive to the investors.

1.3 What is Project Finance?

There is no specific agreed upon definition for modern project finance. For instance, Yescombe (2002) defines project finance as:

> ‘’A method of raising long-term debt financing for major projects through ´financial engineering, ´ based on lending against the cash flow generated alone; it depends on a detailed evaluation of a project’s construction, operating and revenue risks, and their allocation between investors, lenders, and other parties through contractual and other arrangements’’(p. 1).

Esty (2004):

> ‘’Project finance, involves the creation of a legally independent project company financed with nonrecourse debt (and equity from one or more sponsor) for the purpose of financing a single purpose, industrial asset’’ (p. 25).

Finnerty (2006):

> ‘’ Project finance maybe defined as the raising of funds on a limited- recourse or nonrecourse basis to finance an economically separable capital investment project in which the providers of the funds look primarily to the cash flow from the project as the source of funds to service their loans and provide the return of and the return on their equity invested in the project’’ (p. 1).

What seems common in all the above given definitions is the concept of nonrecourse nature of debt to be raised for the independent project which actually isolates it from the sponser’s balance sheet and hence reducing/eliminating any hazardous effects of potential project failure to the sponsors. Yescombe’s description seems more comprehensive, for it mentions the source of project cash flows and risk diversification which is namely the contracts involved. However, he has not included the independent nature of the project company in his definition which he mentions later in his book as a ‘’Special Purpose Vehicle’’. In short, the general building blocks of a project finance structure (the SPV of a project) can be depicted as in Figure1.

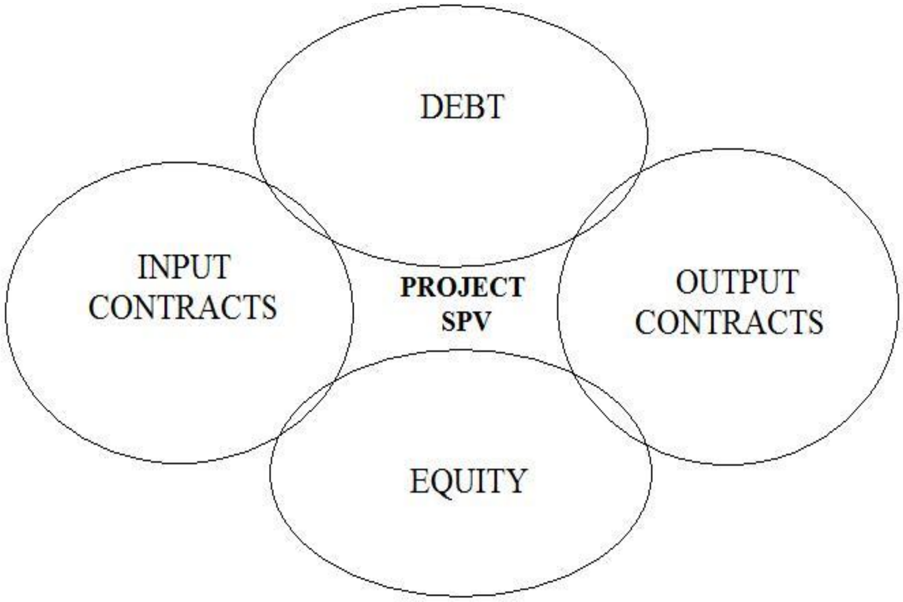


Figure 1: A Holistic View of Project Finance Structure

In Figure1, debt, equity and the input/output contracts blocks, are common for every other project, but the output contracts terminology can vary in different projects. For instance, in road projects, the road is not producing any concrete output to be sold, so output contract term does not make sense, however, there may be tolling stationeries installed which more or less might give an essence of output contracts in entity.

1.4 Why is Project Finance Important?

According to the financial statistics presented in Tables 1.1 and 1.2, a considerable number of projects require huge funding in different sectors every year around the world, to enhance the quality of life and make development happen. In order to ease and catalyze this trend, different key parties to a project, especially the lenders should feel secure in order to get into a deal as they are contributing the most.

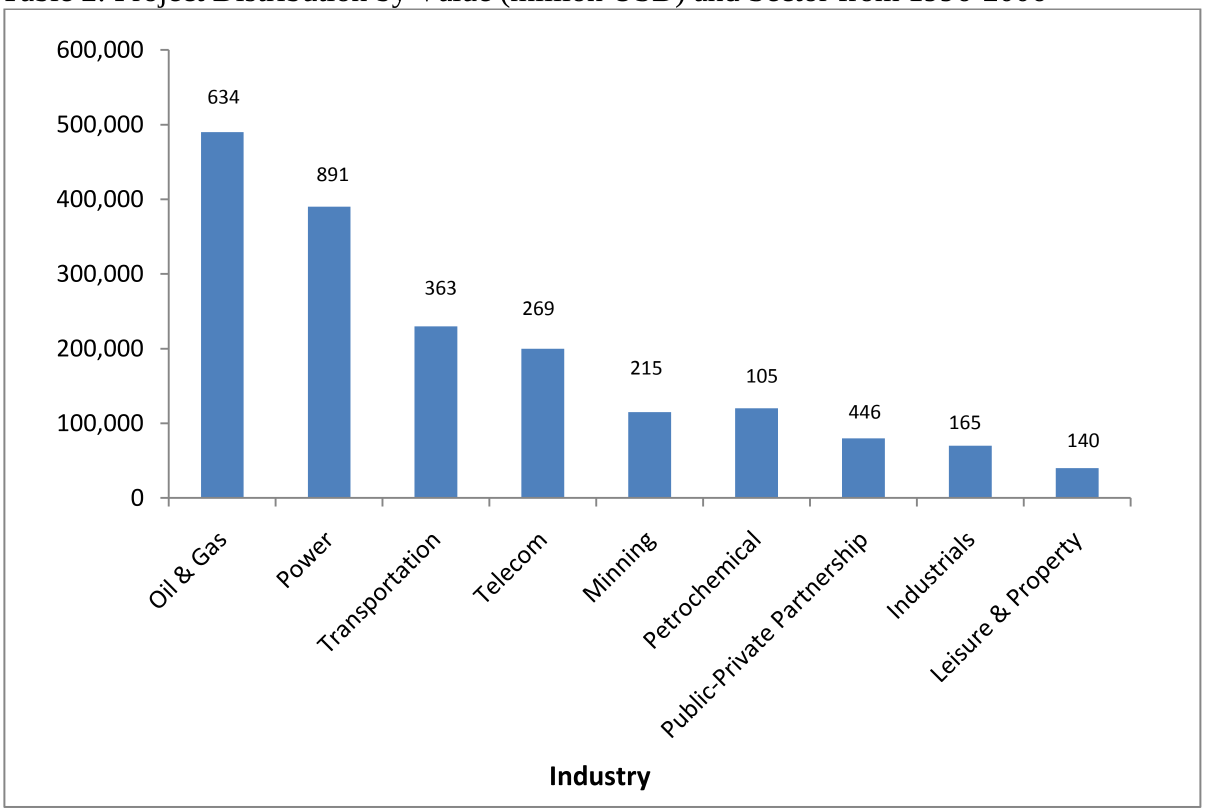
Tables 1.1 and 1.2 represent project distributions according to value and industry sector from 1995 to the first half of 2006.

Table 1: Project Distribution by Value from 1996-2006

Project Value (million USD)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
< 100	32	36	49	59	115	40	70	111	165	141	61
100-250	47	55	65	59	96	36	33	56	91	86	43
250-500	35	39	49	68	71	38	34	35	56	63	19
500-1000	20	39	33	31	39	29	21	30	42	30	13
>1000	21	35	30	41	36	27	12	25	24	28	21
Total	155	204	226	258	357	170	170	257	378	348	157
% of Projects ≥ 100	**79%**	**82%**	**78%**	**77%**	**68%**	**76%**	**59%**	**57%**	**56%**	**59%**	**61%**

[a] Until the first half of 2006
(adapted from Finnerty, 2007, p.33)

Table 2: Project Distribution by Value (million USD) and Sector from 1996-2006



[a] Until the first half of 2006
(adapted from Finnerty, 2007, p.33)

According to Table 1.1, about 68% of projects on average being done every year are worth 100 million dollars or more. Table 1.2 shows the distribution of projects across different sectors from 1996 to 2006, which the power sector projects are the largest in frequency but oil and gas in investment value.

Project finance is emerging due to some of its aspects and characteristics, which brings it into picture and makes it worthwhile to be applied by the investors seeking to invest in capital intensive projects. Such characteristics are namely as separate incorporation, contractual risk sharing, high leverage characteristic, higher managerial discipline in cash flow spending, etc. which play an important role in distinguishing project finance technique for financing finite life capital intensive projects compared to other methods. Project finance high leverage composition results in higher return on equity.

Table 3 : Benefits of Higher Debt on Equity Return

	Lower Debt	**Higher Debt**
Project Cost	100	100
Debt	40	80
Equity	60	20
Project Earnings	20	20
Interest on Debt	7%	9%
Payable Interest	2.8	7.2
Profit	17.2	12.8
Equity Return	**29%**	**64%**

(adapted from Yescombe, 2002, p.14)

According to Table 1.3 we can see that project finance with high leverage characteristic overcomes the problem of equity return on infrastructure capital intensive projects, which requires sufficient high return in order to absorb equity investments.

Another aspect of higher leverage in project finance context would be its disciplinary consequences on managerial discretion in utilizing the stream of cash flow, which leads project managers to more efficient allocation of funds and less waste of free cash flow compared to a corporate division manager (Esty 2004, 217).

A further interesting aspect of project finance technique, is its separate incorporated treatment of a project, i.e. segregating it from the firm's other activities and thus inducing more confidence in managers to go after positive NPV but riskier projects, which they had been reluctant to undertake, fearing to affect the main firm's financial status adversely in case of failure (Esty 2004, 220).

To sum it up, project finance is a technique which leads to accomplish financing of a project at a minimum liability for its debt and equity holders. , however, it has its own complications as well. For instance, higher transaction costs than comparable conventional financings for it is structured around a set of contracts that will require due diligence by all parties wishing to get involved.

Chapter 2

PROJECT DESCRIPTION AND METHODOLOGY

2.1 Project Rationale

Unreliable supply of power from the state-owned Power Holding Company of the Country of Pina has highlighted the need for building new power capacities (due to commercial reasons imaginary names for the project, area and the country are being used). A 140 MW single cycle power plant (Jil) is to be built in Pun; an area of growing industrial and commercial activities in country of Pina, which is in serious need of efficient and reliable power supply to meet its flourishing demand.

The rationale behind the Jil project is to provide reliable and efficient electric power to industrial clusters in the region. This has been necessitated by the unreliable supply of power from the state-owned Power Holding Company of Pina. (PHCP). As a result most industrial concerns commit significant resources towards the private generation of electricity. This has implications on the operating cost profile of these companies and in addition also affects the pricing of their products and services. The project as conceived is designed to offer industrial clusters in Pun, a cheaper and more reliable source of electricity, which would have a positive effect on their pricing and operating cost profile.

A survey of the companies indicate that the larger companies produce their own kWh power at about 20 US cents/kWh, while the smaller companies produce at about 25 US cents/kWh or more.

Each company would necessarily maintain power production staff to deal with the logistics of hauling diesel fuel to the plant and providing space within the facility for power production. Most of the companies use PHCP's power as backup to their own power generation. Hence the Jil project is designed to meet the needs of these industrial concerns in Pun.

2.2 Project Description

Jil Power Pun Limited (JPPL) is the project Special Purpose Vehicle (SPV) established to generate and distribute electric power to UEC (Utility Electric Company) and industrial clusters in Pun. The project is to be given to an Independent Power Producer (IPP) via a bidding solicitation process.

In order to achieve this purpose, the company proposes to construct a power plant with 140 MW capacity in Pun, South of Pina. JPPL also proposes to construct an extensive new network at 33 kV and 11kV to supply its industrial customers. The network will extend to over 60 kilometres. The construction phase is expected to extend no longer than one year.

Given the proximity of the plant to a Petroleum Development Corporation which is a gas gathering facility, the power plant would run on natural gas. The JPPL power plant will comprise 3 open cycle gas turbines running primarily on natural gas. To ensure reliability, the unit sizes will be such that the plant will be able to meet its guaranteed capacity with the loss of one unit. In the event of generation deficits due to gas outages, the plant through the 33KV substations with grid connections would be able to in feed electricity to its customer from the national grid.

Based on the results of the market study, about 60% of the power generated will be sold to industrial customers while the balance of 40% will be sold to the Utility Electric Company (UEC) for onward sale to commercial and residential customers. UEC is another SPV which will be set up by JPPL, specifically to distribute power to residential and commercial customers. The sale of power will be governed by a Power Purchase Agreement (PPA) which is indexed to inflation. Four JPPL constructed distribution substations and three PHCP leased distribution substations each rated 33/11 KV and 2 X 15 MVA with dual 33KV in feeds shall provide the 11 KV sources. Commercial and residential customers, however, shall be connected and metered after transformation of the 11 KV sources to 415V. Deduction of the total 11 KV industrial loads from the total energy delivered to the injection substations shall provide the value of energy which UEC shall pay for under the terms of the PPA. It is incumbent on UEC to adopt appropriate measures to bill and collect revenues from the residential and commercial customers in order to pay JPPL and have a reasonable balance to fund its operations. The residential and commercial customers will each sign a Standard Connection Agreement (SCA) with UEC, and this agreement will guide the business relations between both parties.

2.3 Methodology Approached

Any Government investment should be in the public interest, therefore, in order to increase the probability of approving good projects and reduce the risk of accepting bad projects, both public and the private sector need to perform comprehensive cost-benefit evaluation and analysis of such capital intensive projects.

According to Jenkins et al. (2010), a comprehensive cost-benefit feasibility analysis entails financial, economic, risk and stakeholder analysis in order to learn about different aspects of the project before entering any kind of bidding process. However the private sector might be more interested in the financial and its relevant risk analysis. In this particular case study, the economic and stakeholder analyses have not been covered, which keeps the room open for further analysis in this regard.

Adopted from Jenkins et al. (2010), the cost-benefit analysis approach being employed is based on generating a financial model of the project which entails developing income and different cash flow statements that interprets nominal values into real values considering any changes in the inflation and the growth of the real prices. At the second step both nominal and real cash flow statements from different points of view namely as the total investment (Banker's) and the equity (owner's) point of view entailing costs and benefits are being developed in order to come up with some distinguished indicators and criterions such as Net Present Value (NPV), Internal Rate of Return (IRR), Annual Debt Service Coverage Ratio (ADSCR) and LLCR (Loan Life Coverage Ratio).

Next step would be distinguishing the risky variables by performing sensitivity analysis on the input variables and observing their effects on the outputs which then leads us to capturing the ones resulting in significant fluctuations of the outputs, to be announced as risky variables. Ultimately, the last step would be capturing and monitoring the uncertainty associated to these variables as far as possible by developing or finding relevant probability distributions for each and running the Monte Carlo risk simulation via Crystal Ball [TM] software.

Chapter 3

FINANCIAL ANALYSIS

3.1 Objectives of the Financial Analysis

Different parties are involved in each project and thus different points of views in every aspect of a project need to be considered incorporating the associated costs and benefits of each in order to commence a project with open eyes.

The objective of the financial analysis is to learn about the financial capabilities of the project from different points of view which brings into picture many factors relating to various scenarios and evaluate whether the project is financially viable. For it matters the policy making process when trade-offs are to be done between the financial and economic concerns.

3.2 Different Points of Views

At the very first step, every other project whether public or private needs to be analyzed on its financial merits, especially before any kind of external financing in order to learn about the project's self capabilities to cover its operating and investment costs relying on its own forecasted benefits. This point of view is known as the Banker's (total investment) perspective, for the banker requires making sure about the soundness of the project on its own merits before giving any loans to it. He considers the investment costs to be composed of both potential debt and equity proportions, and thus the annual net cash flow to be the amount available to both the equity holders and the creditors.

Another point of view is the owner's (equity) point of view, which assumes capital outlays to be only consisted of equity funds. However, it is very similar to the Banker's point of view in terms of components but more comprehensive, i.e. it takes into account the loan payments and repayments as well, for the owner intends to learn whether he would be better off by investing in this project after having received and paid whatever obliged on his behalf due to the project, compared to alternative investment options elsewhere in the market. There also exists government budget perspective which should be done by the governments to ensure that adequate resources within the relevant departments involved in the project exist for further allocation in this regard.

In this case study the Banker's and the Owner's are the different perspectives being considered in developing the different cash flow statements.

3.3 Developing Cash Flow Statements

In this power generation case (JPPL), the project duration is set to be sixteen years, i.e. one year of construction and fifteen years of operation. Starting with year zero, the inputs, outputs and deliverables that form the principle flows are projected over sixteen years, having accounted for the inflation in the nominal prices. The JPPL main output is the power generated and delivered to the customers which is a source of cash inflow plus other factors such as the liquidation values, but the inputs are the items causing cash outflows such as land, fuel, machinery.

Table 4: JPPL Outputs / Cash Inflow Items

OUTPUTS / CASH INFLOW ITEMS
Total Energy sales Revenue (VAT inclusive)
Change in Accounts Receivable
Liquidation Values
Land
Plant, Machinery & Spare Parts
Vehicles, Crane & Workshop
Building, Furniture & Equipment

Table 5: JPPL Inputs / Cash Outflow Items

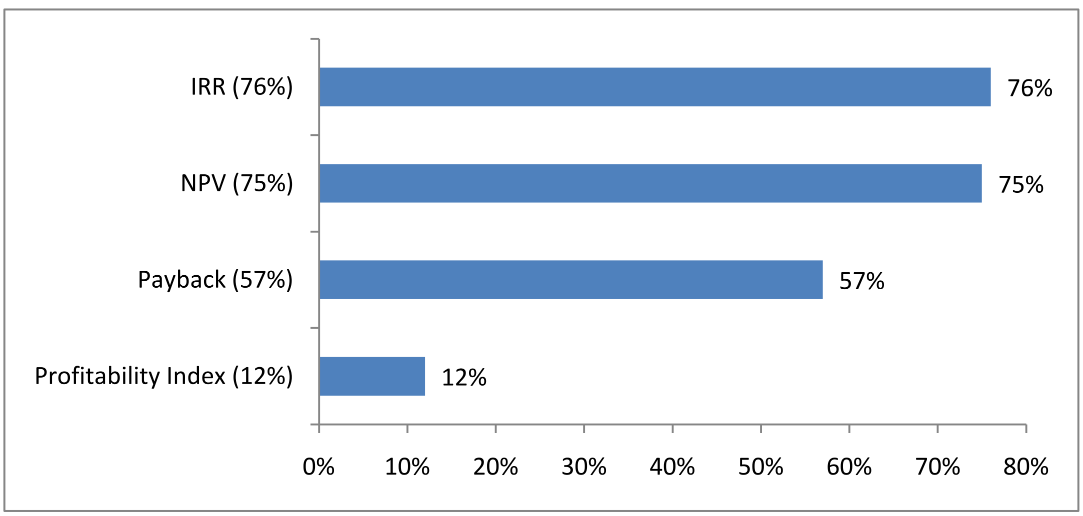
INPUTS/ CASH OUTFLOW ITEMS
INVESTMENT COSTS
Land
Investment in UEC
Total EPC & Spare Parts
Vehicles, Crane & Workshop
Building, Furniture & Equipment
Insurance Costs
Construction Management Fees
Contingencies
OPERATING & MAINTENANCE COSTS
Fuel Cost
Statutory fees & permits
O & M (VAT inclusive)
Insurance premium
Rents
Employee salaries
Adminstrative costs (VAT inclusive)
Change in Accounts Payable
Change in Cash Balance
Net VAT Liability
Corporate Income Tax

The above items are all included both in the total investment (banker's) cash flow statement and the equity (owner's) point of view cash but before financing.

3.4 Financial Evaluation Criteria

Various criterions do exist and are being applied to evaluate projects financially. These criterions are namely as Net Present Value (NPV), Internal Rate of Return (IRR), payback period, benefit-cost ratio and the debt service ratios, i.e. Annual Debt Service Ratio (ADSCR) and Loan Life Coverage Ratio (LLCR). However, not all of them are reliable, for each has certain shortcomings in different scenarios except for the NPV which is a widely accepted criterion by the economists and financial analysts.

Table 6: Survey Evidence on CFOs using different investment criterions



(adopted from: Principles of Corporate Finance, 9th edition, Allen, Brealey and Myers)

According to the above survey on the Percentage of CFOs Who Always, or Almost Always, Use a Particular technique for evaluating investment projects, presented in table 6, the most widely used criterions are the IRR and NPV used by 76% and 75% of the firms respectively; however, IRR is not reliable due to shortcomings which will be mentioned as following.

Net present value (NPV) is the summation of the present value of the net cash flow (B_i - C_i) of each year discounted by the required rate of return (r_i) which can be different for different periods.

$$NPV = \sum_{i=0}^{n} \frac{(B_i - C_i)}{\prod_{j=0}^{i} (1 + r_i)^j} \qquad (1)$$

If NPV equals zero then has it means that the benefits generated by the project are leveling the costs, being discounted by the require rate of return, hence the rate of return earned on this project is equal to the required rate of return on this project and other investment alternatives available elsewhere in the market, i.e. the investors are neither better off nor worse off by investing in this project compared to other alternatives.

If NPV is greater than zero then it reveals that the benefits of the project are exceeding its costs, hence the rate of return obtained due to the project is higher than the discount rate used to discount the net cash flows, so the investors are better off by investing in the project compared to similar risk alternative opportunities elsewhere in the capital market. Ultimately, negative NPV means that the costs of the project are exceeding the benefits generated, so the rate of return obtained on the project would be lower than the required rate of return by the investors, which means that the investors are worse off by investing in this project compared to alternative investment opportunities elsewhere in the capital market.

Another criterion is the Internal Rate of Return (IRR), which is the rate of return (r_i) that makes the NPV formula (i.e. equation1) equal to zero referring to the scenario that the investors would be indifferent between investing in the specific project or other alternatives with similar risk magnitude. This criteria although being still widely used and even slightly more than NPV (Allen, Brealey and Myers, 2008, p.130) but has severe shortcomings which makes it unreliable for decision making. For instance, in case of having more than one negative net cash flow during the life time of the project which is totally common to occur then IRR will generate multiple results for it is actually the root of a mathematical equation which is the time profile of the incremental cash flows of the project it also does not consider different scale, different timing and different length of life of the project (Jenkins et al., 2010).

Payback period or pay-out ratio is the other index which according to the presented survey in Table 6 is being applied by 57% of the firms. This index measures the number of years which takes for the benefits of the project to cover its investment costs, which the shorter would be the better. The problem with this index is the scope of cash flows which it takes into account. This translates into usually a benchmark set for each project to cover its cost, thus any further cash flows beyond that level are not seen, and i.e. it is not considering the time value of money which then makes the index to be unrealistic and unreliable.

The other criterion is the benefit-cost ratio also referred to as profitability index which according to Table 6 is used by 12% of the firms. This index is consisted of present value of cash inflows over the present value of the cash outflows.

$$BCR = \frac{PV(Benefits)}{PV(Costs)}$$

The shortcoming with the BCR is the way we define costs, for instance the case of recurrent cost, which the ranking of the projects change depending on how you treat the cost item, i.e. either netting them out from the cash inflows or adding them the outflows.

The debt service coverage ratios known as Annual Debt Service Capacity Ratio (ADSCR) and Loan Life Coverage Ratio (LLCR) are the ones mostly used by the bankers. In order to learn about the project's capabilities to cover its annual debt obligations the bankers look at the ADSCR, which is the result of the net cash flow of the project before financing for each year over the debt obligations of that year.

$$ADSCR_t = \frac{ANCF_t}{DebtObligations_t}$$

The intended ADSCR for each Bank or financial institution varies according to their risk averseness, but usually is a figure ranging from 1.5 to 1.7. If the ADSCR is 1.5 then it means that the project's benefits or annual net cash flows are exceeding its benefits by 50%. If the ADSCR is not sufficient for a specific year then the banker may look at the project's ability to cover its debt from that specific year onward, which translates to Loan Life Coverage Ratio (LLCR). Loan Life Coverage ratio is the present value of the net cash flows from a specific year till the end of the loan life of the project over the present value of the debt obligation for the same period, which both should be discounted using the real interest being paid on the loan financing. There is no specific limit for the LLCR but usually the bankers require a figure above 1.7 based on their risk averseness. The LLCR tells the banker if the project is expected to be capable of producing enough cash from a specific year till the end of the loan life of the project which helps him to decide on making bridge-financing for those years which the project has low ADSCRs, i.e. it is not capable of meeting its annual debt obligations.

3.5 Financial Analysis of JPPL

In this section the inputs and general assumptions that form the basis of the financial modeling and reasonable future operating results for the Jil Independent Power Project are presented. The results of the financial modeling and analysis are obtained in terms of different investment criterions. The financial projections cover a 15-year explicit forecast period, to provide sufficient basis for investment appraisal by potential providers of capital (private sector investors, institutional investors, etc). The financial estimates have been prepared in US Dollars, given that a significant percentage of project cost is US Dollar-denominated hence; the development will be financed largely by US Dollar-denominated instruments. Also, the payment of customer tariffs would be indexed against the US Dollar at the point of payment.

3.5.1 Basic Assumptions and Parameters

A summary of the macro-economic assumptions in the financial model is presented in the table below:

Table 7: Macroeconomic assumptions

US Average Annual Inflation Rate	2.40%
Pina Average Annual Inflation Rate	9.35%
Real Exchange	D127.8 : 1 US$
Value Added Tax (VAT)	5%
Corporate Income tax	30%

3.5.2 Investment Costs

The financial forecasts assume an estimated total project investment cost of 250 million USD, which for Vehicle, crane & workshop it will occur in years zero, four, eight and twelve. It is envisaged that the construction of the JPPL power plant would be completed in a year. The following table provides a detailed breakdown of project costs in real terms, i.e. year zero prices.

Table 8: JPPL investment costs

Land	204.68
Investment in UEC	1,661.40
Plant, Machinery & Spare Parts (Total EPC)	27,523.75
Vehicles, Crane & Workshop	648.33
Building, Furniture & Equipment	234.90
Insurance Costs	191.70
Construction Management Fees	319.50
Contingencies	1,246.52
Total (Real, Million US$)	**250.63**

3.5.3 Capital Structure

The capital structure would be 40% equity and 60% debt. The debt is to be provided from different sources both domestic and international. The international creditors are the multilateral financial institutions (MFIs) Table 9 presents the capital structure in detail.

Table 9: JPPL Capital Structure

Equity & quasi-equity		US$ million	% of Capital
	Equity	50	20%
	Preferred shares	50	20%
	Sub-total	**100**	**40%**
Debt			
	Foreign debt	100	40%
	Local debt	50	20%
	Sub-total	**150**	**60%**
Total		**250**	**100%**

According to the above table, like every other capital intensive project, the share of debt is more in order to raise the equity return for absorbing equity investors.

3.5.4 Financing Instruments

The financial projections assume that the project would be able to secure US Dollar denominated debt. For the purpose of the forecasts, we have assumed the same costs of capital for foreign and local debt. The terms of the various financial instruments are presented below:

Table 10: Financing Instruments

Instrument	Terms of Instrument	Cost of Capital
Equity	Redeemable	16.59%
Quasi-equity	Redeemable	15%
Foreign debt	Two-year moratorium on principle repayment, 8-year tenor	10-year LIBOR plus 400 basis points estimated at 9%
Local Debt	Two-year moratorium on principle repayment, 8-year tenor	10-year LIBOR plus 400 basis points estimated at 9%

The foreign loan proportion is 70% of the total debt and the domestic one is the remaining. In loan issues the interesting point in this case is that the local banks are lending in USD, in order to hedge their profits against high fluctuations in the domestic inflation and thus enjoy a more stable business. Since according to the below formula the spread between the nominal interest rate (i) and the inflation (gp^e) determines the real rate of return.

$$r = \frac{(i - gp^e)}{(1 + gp^e)}$$

3.5.5 Revenues

JPPL will generate revenue streams from the sale of power to industrial customers and UEC through Power Purchase Agreements (PPAs). In addition, the company will earn income from the emission commission.

3.5.6 Energy available for sale

The volume of energy available for sale is determined by making certain adjustments to the total power generated from JPPL's power plant. These adjustments reflect the capacity degradation factor, technical and non-technical losses which are incurred during the course of delivering power to industrial customers and UEC.

Table 11: Energy Generation and available for sale

Year	**1**	**2**	**3**	**4**	**5**
Maximum Available Capacity, Technically (MW)	140	137	134	132	129
Capacity Degradation Factor (annual detorioration)		-2%	-2%	-2%	-2%
Available Capacity after Degradation (MW)	**140**	**137**	**134**	**132**	**129**
Generation availability factor	92%	92%	92%	92%	92%
Gross Capacity available (MW)	**129**	**126**	**124**	**121**	**119**
Plant Load Factor	84%	84%	84%	84%	84%
Total Energy Generation (MW)	**108**	**106**	**104**	**102**	**100**
Gas Outages (% of Net energy generated)	0.82%	0.82%	0.82%	0.82%	0.82%
Energy Lost, due to Gas Outages (MW)	1.06	1.04	1.01	0.99	0.97
Net Energy Generated (MW)	**107.1**	**105**	**102.9**	**100.8**	**98.8**
% of Transmission Losses of Industrial Customers	5.00%	5.00%	5.00%	5.00%	5.00%
Energy Sales to Industrial Customers (MW)	**61**	**60**	**59**	**57**	**56**
% of Transmission Losses of Residential/Commercial Customers	7.00%	7.00%	7.00%	7.00%	7.00%
Energy Sales to Residential and Commercial Customers (MW)	**40**	**39**	**38**	**38**	**37**
Gross Energy Sales (MW)	**101**	**99**	**97**	**95**	**93**
Gross Energy Sales (MWh)	884,076	866,395	849,067	832,086	815,444

3.5.7 Tariff

Power sales will be at a standard tariff of 13 cents (US$0.13) per kilowatt hour for industrial customers while the charge to UEC (for Commercial and Residential customers) will be 4 cents (US$0.04). The following table highlights the revenue projections from industrial customers and the UEC. The tariff rates are projected in line with inflation, i.e. they are indexed to price index and grow by inflation in nominal terms.

Table 12: Electricity Tariff and Energy sales projections

Year	**1**	**2**	**3**	**4**	**5**
Industrial Customers					
Tariff ($/KWh)	**0.133**	**0.136**	**0.14**	**0.143**	**0.146**
Energy sales to Industrial Customers (KWh)	561,698,210	550,464,246	539,454,961	528,665,862	518,092,545
Income, VAT inclusive (Nominal, Million US$)	75	75	75	76	76
Utility Electric Company **(Residential & Commercial Customers)**					
Tariff ($/KWh)	**0.041**	**0.042**	**0.043**	**0.044**	**0.045**
Energy Sales to Res. & Comm. Customers (KWh)	366,581,990	359,250,350	352,065,343	345,024,036	338,123,555
Income, VAT inclusive (Nominal, Million US$)	15	15.1	15.1	15.2	15.2
Cost of ER per metric tonne ($)	8.4	8.6	8.8	9	9.2
Carbon Dioxide Reduction Commission (Nominal, Million US$)	1.39	1.42	1.45	1.49	1.52
Total Energy Sales Revenue (Nominal, Million US$), VAT inclusive	**91**	**92**	**92**	**92**	**93**

3.5.8 Fuel and Operating costs

The costs include the gas price, which is indexed to inflation, and the operating costs which consist primarily of operations and maintenance costs, insurance and management fees, general consulting fees and statutory fees and permits.

Table 13: Fuel Requirements, Fuel Costs (Nominal, Million US$)

Year	1	2	3	4	5
Total Energy Generation (MWh)	947,762	928,807	910,231	892,026	874,185
Total Energy Generation (KWh)	947,761,920	928,806,682	910,230,548	892,025,937	874,185,418
Scf/Kwh @ 38.8% efficiency	8.62	8.62	8.62	8.62	8.62
Gas Consumption (Mcf)	8,103,782	7,941,706	7,782,872	7,627,215	7,474,671
Gas Price (US$/Mcf)	1.33	1.36	1.40	1.43	1.46
Total Fuel Cost (Nominal, Million US$), VAT inclusive	11.33	11.37	11.41	11.45	11.49

Table 14: Operating and Maintenance Costs (Nominal, Million US$)

Year	**1**	**2**	**3**	**4**	**5**
Fuel Cost (domestic currency)	1,546	1,657	1,775	1,902	2,039
Statutory fees & permits (domestic currency)	419	458	501	548	599
O & M (VAT inclusive)	**587**	**642**	**702**	**767**	**839**
Insurance					
All-perils, Liability and machinery breakdown (0.6% Total project costs)	207	226	247	270	296
Total debt service per annum	1,725	1,842	4,845	4,911	4,964
Business Interruption (1.2% Debt Service in each month)	2	2	5	5	5
Insurance Premium	**208**	**228**	**252**	**275**	**301**
Rents	**58**	**18**	**20**	**22**	**25**
Employee salaries	**316**	**346**	**378**	**413**	**452**
Administrative costs (VAT inclusive)	**148**	**162**	**177**	**194**	**212**
Total Operating & Maintenance Costs (Nominal, Million US$)	**24**	**24**	**24**	**25**	**25**

3.5.9 Financial Indicators

The investment appraisal for JPPL was conducted by using free cash flows generated by the project and different indicators for different points of view are generated.

3.5.9.1 Banker's Point of view (Total Investment)

Having developed the financial model of this project by incorporating the input data from table of parameters with other basic assumptions, different cash flow statements from two different points of view of the banker and the owner is obtained. The difference between the banker and the owner is the loan payment and repayment which is seen in the owner and indicated in the banker as before and after financing in order to generate the relevant financial indicators.

Table 15: Cash Flow Statement from Banker's point of view

Year	**Net Cash Flow Before Financing (Real, Million US$)**	**Total Annual Loan Repayment (Real, Million US$)**	**Annual Debt Service Coverage Ratio (ADSCR)**	**Loan Life Coverage Ratio (LLCR)**
0	-247.45	0.00	0.0	0.0
1	**44.40**	**12.34**	**3.6**	**2.2**
2	**48.18**	**12.05**	**4.0**	**2.1**
3	**48.20**	**28.99**	**1.7**	**1.9**
4	**45.69**	**26.88**	**1.7**	**2.0**
5	**45.39**	**24.84**	**1.8**	**2.0**
6	**44.02**	**22.89**	**1.9**	**2.1**
7	**42.66**	**21.02**	**2.0**	**2.2**
8	**40.03**	**19.22**	**2.1**	**2.3**
9	**40.07**	**17.49**	**2.3**	**2.4**
10	**38.79**	**15.83**	**2.4**	**2.4**
11	35.04	0.00	0.0	0.0
12	32.57	0.00	0.0	0.0
13	33.18	0.00	0.0	0.0
14	32.22	0.00	0.0	0.0
15	31.25	0.00	0.0	0.0
16	101.82	0.00	0.0	0.0

According to Annual Debt Service Coverage Ratio (ADSCR) in table 15, JPPL is capable to cover its annual debt obligations from its yearly projected net cash flow. The ADSCR in years one and two are extremely high which is due to the absence of principle payments in these years.

Years three and four are the ones having the lowest ADSCRs which are not actually falling behind the common bottom line measure accepted by most banks (i.e. 1.5 which is the usually the lowest required by most banks). So, basically the JPPL is strong enough in terms of generating cash to feed its operating costs and the debt obligations, hence is needless of any bridge financing or escrow funds. As a result there is no need to look at the LLCRs as since, they are high enough. Thus from the banker's point of view this is a good project and worth giving it the loan.

3.5.9.2 Owners' point of view (Equity holder)

In order to assess the project from the owners' point of view, a more comprehensive cash flow statement compared to the bankers' is being developed, containing the loan payment and repayment, too. For JPPL equity holders the following indicators have been generated which the Net Present Value is the most reliable one for making investment decisions upon. The following table shows five year net cash flow projection from the owners' point of view.

Table 16: Owners' point of view net cash flow (Real, Million US$)

Year	**Net Cash Flow Before Financing (Million US$)**	Loan Disbursement (Real, Million US$)	Total Annual Loan Repayment (Real, Million US$)	**Net Cash Flow After Financing (Million US$)**
0	**-247.45**	148	0	**-99.52**
1	**44.40**	0	12	**32.05**
2	**48.18**	0	12	**36.13**
3	**48.20**	0	29	**19.20**
4	**45.69**	0	27	**18.82**
5	**45.39**	0	25	**20.55**
6	**44.02**	0	23	**21.13**
7	**42.66**	0	21	**21.65**
8	**40.03**	0	19	**20.81**
9	**40.07**	0	17	**22.58**
10	**38.79**	0	16	**22.95**
11	**35.04**	0	0	**35.04**
12	**32.57**	0	0	**32.57**
13	**33.18**	0	0	**33.18**
14	**32.22**	0	0	**32.22**
15	**31.25**	0	0	**31.25**
16	**101.82**	0	0	**101.82**

According to the above net cash flows and discount them at 16.59% required rate of return on equity, which declares the return on alternative investment opportunities with similar level of risk the Net Present Value (NPV) on JPPL project is expected to be 50.68 Million US$. This result for our NPV reveals that by investing in this project the equity holders will recover their capital and still will be better off by 50.68 Million US$ compared to other investment opportunities with the same level of risk and hence makes the project commercially viable.

Although IRR is not a reliable criterion but in order to meet the demand of those 76% of the CFOs (refer to Table 6) , who might be searching for it, this item is obtained as

25.6%, which is higher than the equity required rate of return, i.e. 16.59% and emphasizes on the soundness of the project in financial terms.

As a result, JPPL is an attractive investment opportunity, given that the cash flows generated are sufficient to recoup the initial investment at the rate of return required by investors. In addition, the forecasts indicate that JPPL will be financially stable.

Chapter 4

RISK ANALYSIS AND MANAGEMENT

4.1 Risk Analysis

Every other project is associated with risk. Riskiness arises from uncertainty created by further forecasting the values through time.

Each project is consisted of different input variables such as inflation rate, exchange rate, interest rate, input material prices and quantities, etc. where each is subject to uncertainty and risk as we try to further project its value through time. Therefore the project's output or indicator results and overall its success gets prone to risk and uncertainty.

In order to distinguish and mitigate this uncertainty at every stage of our analysis, first we should develop a base case for our analysis. A base case is a deterministic case which uses fixed numbers for inputs and leads us to fixed answer results in project indicators, such as what we developed in chapter three for the financial part of our analysis. The next step would be to capture the risky variables. Risky variables are those which small deviation in them from the base case causes great change in project outcome results. An approach to recognize them is to run sensitivity or scenario analysis on different variables in order to observe their movements due to small changes in their initial values. The next step would be to assign probability distributions to each risky variable (Jenkins et al. 2010).

Probability distributions are obtained through statistical studying of the past trends of data for the variable or experts recommendations regarding it. Then by assigning and integrating the risky variables probability distributions into our model via applying a Monte Carlo risk simulation (which is widely accepted since 1940) through Crystal Ball™ software that a probability distribution will be generated for our indicator results, which captures and envisages the risk and level of deviation in our project indicator results due to fluctuation of our inputs (Jenkins et al. 2010).

4.2 Analyzing JPPL Project Risk

Growing demand in energy highlights the need for more power projects to be done in the future, the past data (refer to table2) shows that power projects have been ranked as the second largest in frequency in a ten years duration. Power projects are no exception from being risky as they are the second largest capital intensive projects after gas and oil projects (refer to table2) with many inputs into them.

4.2.1 JPPL Risk Factors

The different project risks associated to Jil Power Pun Limited, Independent Power Producer are listed below. These risks can be classified in different categories according to their time of occurrence in the project cycle. The different classifications can be pre-completion vs. post completion or construction phase vs. operation phase.

Table 17: JPPL project risks

	completion		implementation	
Type of Risks	**pre-**	**post-**	**construction**	**operation**
Construction risks	x		x	
Operating risks		x		x
Market (off-take) risks		x		x
Supply risks		x		x
Environmental risks	x	x	x	x
Political/legal risks	x	x	x	x
Project and financing structure risks	x	x	x	x
Planning and approval risks	x			
Exchange rate risks		x		x

4.2.2 Risky Variables

Having performed sensitivity analysis on the inputs of our project and studied their effects on its financial indicators risky variables are determined. The risky variables are the ones that small change in them causes high variance from the base in the indicators. The detailed results from our sensitivity analysis are presented below:

Table 18: JPPL Financial Sensitivity Results to Investment Cost Overrun Factor

Investment Cost Overrun Factor	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
-5%	33	1.6	1.6	1.7	1.8	1.8	1.9
0%	24	1.5	1.5	1.6	1.7	1.7	1.8
5%	15	1.4	1.5	1.6	1.6	1.6	1.7
10%	7	1.4	1.4	1.5	1.5	1.6	1.6
20%	-10	1.3	1.3	1.4	1.4	1.4	1.5
30%	-28	1.2	1.2	1.3	1.3	1.3	1.4
35%	-36	1.1	1.1	1.2	1.3	1.3	1.3

Investment Cost overruns are inevitable and do happen in many projects. Many projects are delayed which means cost overruns. In some cases this variable jeopardizes the success of the project by reducing its performance. This variable according to the above results is risky since 10% change in it, reduces the NPV by 17 million US$ from the base case of 51 million US$ presented in with black ribbon. It also affects the ADSCRs and LLCRs. At 35% our project would not be interesting commercially. Thus, our project is sensitive to cost overruns and its probability distribution should be considered so its risk can be simulated.

Table 19: JPPL Financial Sensitivity Results to US inflation

US Inflation	**NPV (Million US$)**	**ADSCR3**	**ADSCR4**	**ADSCR5**	**LLCR3**	**LLCR4**	**LLCR5**
1.50%	22.9	1.5	1.5	1.6	1.6	1.7	1.7
1.70%	23.1	1.5	1.5	1.6	1.6	1.7	1.7
2.00%	23.5	1.5	1.5	1.6	1.7	1.7	1.7
2.40%	24.1	1.5	1.5	1.6	1.7	1.7	1.8
2.80%	24.6	1.5	1.5	1.6	1.7	1.7	1.8
3.50%	25.4	1.5	1.5	1.7	1.7	1.8	1.9

Table 20: JPPL Financial Sensitivity Results to Pina inflation

Pina Inflation	**NPV (Million US$)**	**ADSCR3**	**ADSCR4**	**ADSCR5**	**LLCR3**	**LLCR4**	**LLCR5**
7%	29.9	1.5	1.5	1.6	1.7	1.8	1.8
9.35%	24.1	1.5	1.5	1.6	1.7	1.7	1.8
13%	9.0	1.5	1.5	1.6	1.6	1.6	1.7
15%	-7.1	1.5	1.5	1.6	1.6	1.6	1.6
17%	-34.6	1.5	1.5	1.5	1.5	1.5	1.5
20%	-123.4	1.5	1.4	1.5	1.4	1.4	1.4
22%	-249.9	1.5	1.4	1.5	1.3	1.3	1.2
25%	-684.3	1.4	1.4	1.4	1.1	1.1	1.0

Table 21: JPPL Financial Sensitivity Results to Real Exchange Rate

Real Exchange Rate	**NPV (Million US$)**	**ADSCR3**	**ADSCR4**	**ADSCR5**	**LLCR3**	**LLCR4**	**LLCR5**
122	24.06	1.5	1.5	1.6	1.7	1.7	1.8
125	24.06	1.5	1.5	1.6	1.7	1.7	1.8
127.8	24.07	1.5	1.5	1.6	1.7	1.7	1.8
130	24.07	1.5	1.5	1.6	1.7	1.7	1.8
132	24.07	1.5	1.5	1.6	1.7	1.7	1.8
135	24.07	1.5	1.5	1.6	1.7	1.7	1.8

Table 22: JPPL Financial Sensitivity to Real Interest rate of loans

Real Interest Rate on the Loan	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
4%	32	1.65	1.65	1.75	1.80	1.83	1.87
5%	28	1.58	1.59	1.69	1.74	1.77	1.82
6%	24	1.51	1.52	1.63	1.68	1.72	1.77
7%	20	1.45	1.47	1.57	1.62	1.67	1.73
8%	16	1.39	1.41	1.52	1.57	1.62	1.68
9%	12	1.34	1.37	1.47	1.53	1.58	1.64

According to the above tables the foreign and domestic inflations are not risky variables for the projects financial indicators do not vary significantly from the obtained deterministic case due to their fluctuations. JPPL is not sensitive to real exchange at all since none of the results change from the base by its variance.

Higher real interest on loan decreases project's profitability by lowering the NPV and less bankable by reducing the debt service capacity ratios and vice versa, but these effects are not significant, so this variable cannot be considered as risky, too.

Table 23: JPPL Financial Sensitivity to Plant Load Factor

Plant Load Factor	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
90%	41	1.6	1.6	1.8	1.8	1.9	1.9
84%	24	1.5	1.5	1.6	1.7	1.7	1.8
80%	13	1.4	1.4	1.5	1.6	1.6	1.7
75%	-1	1.3	1.3	1.4	1.5	1.5	1.5
70%	-15	1.2	1.2	1.3	1.4	1.4	1.4
60%	-44	1.1	1.0	1.1	1.1	1.1	1.2

According to table 21. plant load factor is a risky variable. As the plant load factor decreases by only 4% from 84%, the NPV decreases significantly from 51 million dollars to 39 million dollars. The project's capability to service its debt obligations also decrease and deteriorate its bankability. The breakeven load factor is 67% at which the NPV reaches to zero and the debt service ratios are affected adversely.

Table 24: JPPL Financial Sensitivity to Gas Price

Gas Price	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
0.7	41	1.62	1.64	1.75	1.81	1.86	1.92
0.9	35	1.59	1.60	1.71	1.77	1.81	1.87
1.1	30	1.55	1.56	1.67	1.72	1.77	1.82
1.3	24	1.51	1.52	1.63	1.68	1.72	1.77
1.5	19	1.47	1.48	1.59	1.63	1.67	1.72
1.7	13	1.44	1.44	1.54	1.59	1.63	1.68
1.8	10	1.42	1.42	1.52	1.57	1.60	1.65
2.5	-9	1.29	1.29	1.38	1.41	1.44	1.48
3.0	-23	1.19	1.19	1.27	1.30	1.32	1.36

According to the base case the gas price is determined to be 1.3 $/Mcf but if it increases by only 20 cents then the NPV decreases significantly so does the ADSCR of year3. Gas price can rise till 3.14 $/Mcf, which would be the breakeven price. But the project bankability has ruined and it definitely needs external sources of equity financing such as sunk funds or escrow fund in order to get capable to be performed.

Table 25: JPPL Financial Sensitivity to Industrial Electricity tariff

Industrial Electricity Tariff	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
0.09	-45	1.0	1.0	1.1	1.1	1.1	1.2
0.11	-11	1.3	1.3	1.4	1.4	1.43	1.47
0.13	24	1.5	1.5	1.6	1.7	1.7	1.8
0.15	59	1.7	1.8	1.9	2.0	2.0	2.1
0.17	93	2.0	2.0	2.2	2.2	2.30	2.38

Table 26: JPPL Financial Sensitivity to commercial and residential Electricity tariff

Commercial & Residential Electricity Tariff	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
0.02	1	1.4	1.4	1.5	1.5	1.5	1.6
0.03	13	1.4	1.4	1.5	1.6	1.6	1.7
0.04	24	1.5	1.5	1.6	1.7	1.7	1.8
0.05	35	1.6	1.6	1.7	1.8	1.8	1.9
0.06	47	1.7	1.7	1.8	1.9	1.9	2.0

According to the electricity tariffs, JPPL is financially more sensitive to industrial tariff than the commercial one. Since only 4 cents of decline in industrial rates the project slips to negative NPV and below minimum acceptable rates for the debt service ratios. Hence both are considered as risky variables.

Table 27: JPPL risky variables

Risky Variables
Investment cost overrun
Plant load factor
Gas Price
Industrial Electricity tariff
Commercial and residential Electricity tariff
Pina Inflation

In the financial sensitivity analysis we also modelled the JPPL project's sensitivity to share of debt which indirectly enlightens a characteristic of project financing as well.

Table 28: JPPL sensitivity to share of debt

Share of Debt	**NPV (Million US$)**	**ADSCR3**	**ADSCR4**	**ADSCR5**	**LLCR3**	**LLCR4**	**LLCR5**
	24.07	1.51	1.52	1.63	1.68	1.72	1.77
35%	-2	2.5	2.6	2.7	2.8	2.9	3.0
40%	3	2.2	2.3	2.4	2.5	2.5	2.6
45%	8	2.0	2.0	2.1	2.2	2.3	2.3
50%	13	1.8	1.8	1.9	2.0	2.0	2.1
55%	19	1.6	1.7	1.8	1.8	1.9	1.9
60%	24	1.5	1.5	1.6	1.7	1.7	1.8
65%	29	1.4	1.4	1.5	1.6	1.6	1.6
70%	35	1.3	1.3	1.4	1.4	1.5	1.5
75%	40	1.2	1.2	1.3	1.4	1.4	1.4
80%	45	1.2	1.2	1.2	1.3	1.3	1.3

As it is observed in the above table, as share of debt increases the NPV raises but at the same time the project's capability to observe its debt obligations decreases, which is an important subject to be considered carefully.

4.3 Risk Simulation

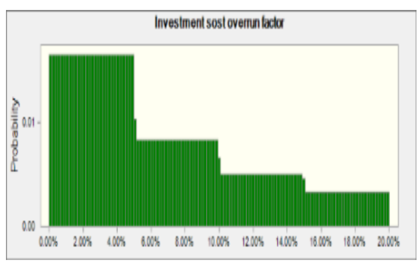
Having distinguished the risky variables, we now should assign probability distribution to each variable in order to depict and simulate their effects on project indicators. The simulation process is being done by running the Crystal Ball Monte Carlo risk simulation software which is widely used and accepted in today's applications.

4.3.1 Risky Variables Probability distributions

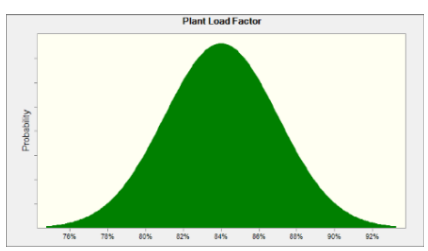
The probability distributions for risky variables are either obtained from experts, institutions, etc. or derived by running regression and doing parameterization on historic data.

Table 29: Probability distributions for risky variables

<table>
<tr><th>Risky Variable</th><th>Probability Distribution Schematic</th></tr>
<tr><td>Investment Cost Overrun

(Custom Distribution)</td><td>

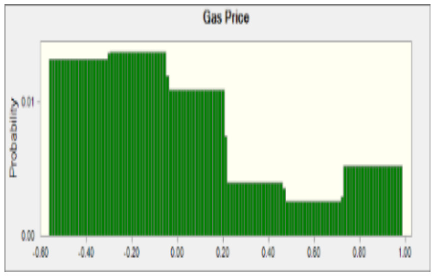
<table>
<tr><th>Min</th><th>Max</th><th>Probability</th></tr>
<tr><td>0%</td><td>5%</td><td>50%</td></tr>
<tr><td>5%</td><td>10%</td><td>25%</td></tr>
<tr><td>10%</td><td>15%</td><td>15%</td></tr>
<tr><td>15%</td><td>20%</td><td>10%</td></tr>
</table></td></tr>
<tr><td>Plant Load Factor

(Normal Distribution)</td><td>

<table>
<tr><td>Mean</td><td>84%</td></tr>
<tr><td>Standard Deviation</td><td>4%</td></tr>
</table></td></tr>
</table>

Gas Price

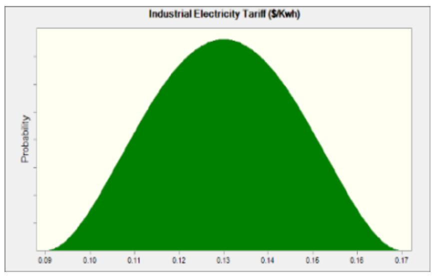
(Custom Distribution)



Min	Max	Probability
-56.50%	-30.60%	26.70%
-30.60%	-4.80%	27.70%
-4.80%	21.00%	22.00%
21.00%	46.90%	8.00%
46.90%	72.70%	5.10%
72.70%	98.50%	10.50%

Industrial Electricity Tariff

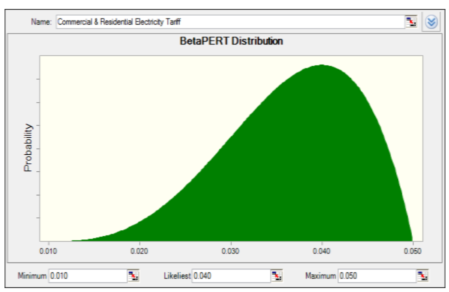
(BetaPERT)



Minimum	9 ¢
Likeliest	13¢
Maximum	19¢

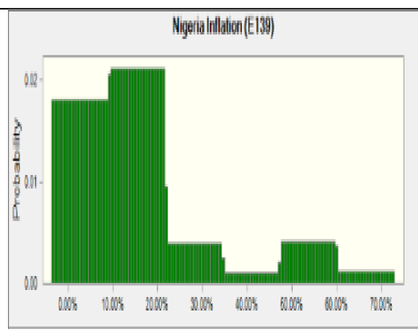
Commercial & Residential Electricity Tariff

(BetaPERT)



Minimum	1 ¢
Likeliest	4¢
Maximum	5¢

Pina Inflation



min	max	probability
-3.7%	9.0%	36%
9.0%	21.8%	43%
21.8%	34.6%	8%
34.6%	47.3%	2%
47.3%	60.1%	8%
60.1%	72.8%	2%

4.3.2 Simulated Forecast Variables

The JPPL indicators being selected to get their probability distribution simulated as forecast variables are net present value (NPV) for the owners plus annual debt service coverage ratios (ADSCRs) and loan life coverage ratios (LLCRs) for years three, four and five.

4.3.2.1 Net Present Value Simulated Forecast

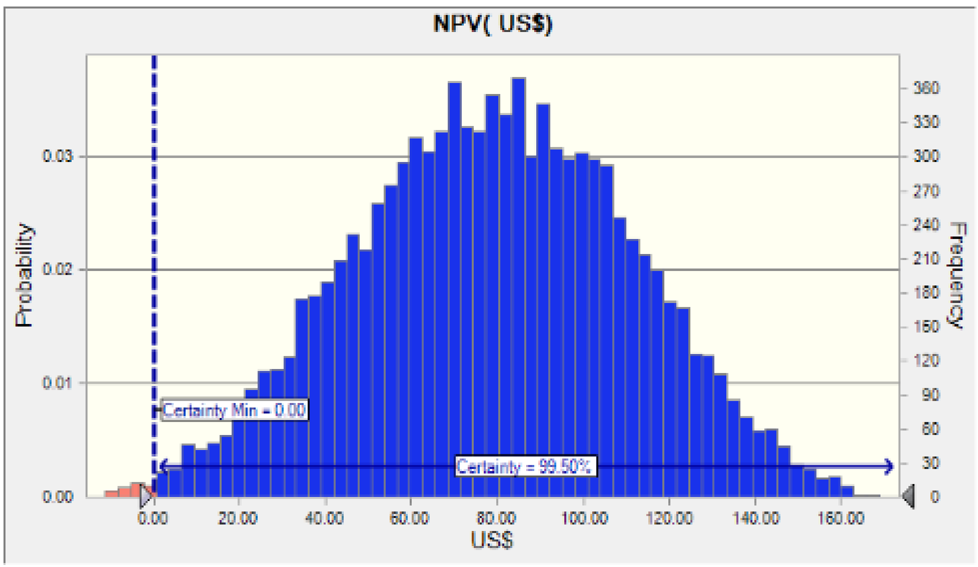


Figure 2: Net Present Value Simulated Forecast

Figure 2 shows the probability distribution of Net Present Value obtained for our project due to variability of the risky variables based on their probability distribution and 10000 run of Monte Carlo simulation through Crystal Ball^{TM} software.

The certainty associated to having a positive NPV for JPPL is 99.5% which shows the high degree of certainty obtaining minimum level of financial soundness of the project.

Table 30: Statistic results of NPV simulation (US$)

Statistics of NPV (Million US$)					
Trials	10000		Skewness	-0.0521
Base Case	**50.68**		Kurtosis	2.64
Mean	**78.85**		Coeff. of Variability	0.4075
Median	79.31		**Minimum**	**-30.41**
Mode	---		**Maximum**	**176.45**
Standard Deviation	**32.13**		Range Width	206.86
Variance	1,032.34		Mean Std. Error	0.32

As claimed by the net present value statistics table, the NPV falls in a range of minimum to maximum of -30.41 to 176.45, with a mean or expected value of 78.85, having a standard deviation of 32.13 which is high being half of the mean. Thus high riskiness is being observed which is mainly due to the gas prices movements if follow the oil pattern of fluctuation.

4.3.2.2. Annual Debt Service Coverage Ratios Simulated Forecasts

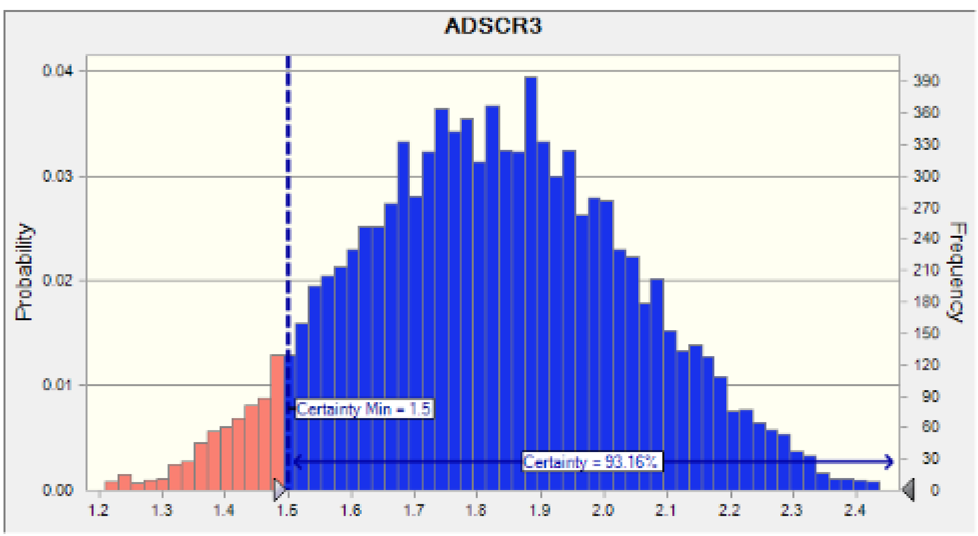


Figure 3: Annual debt service coverage ratios of year three simulated forecasts

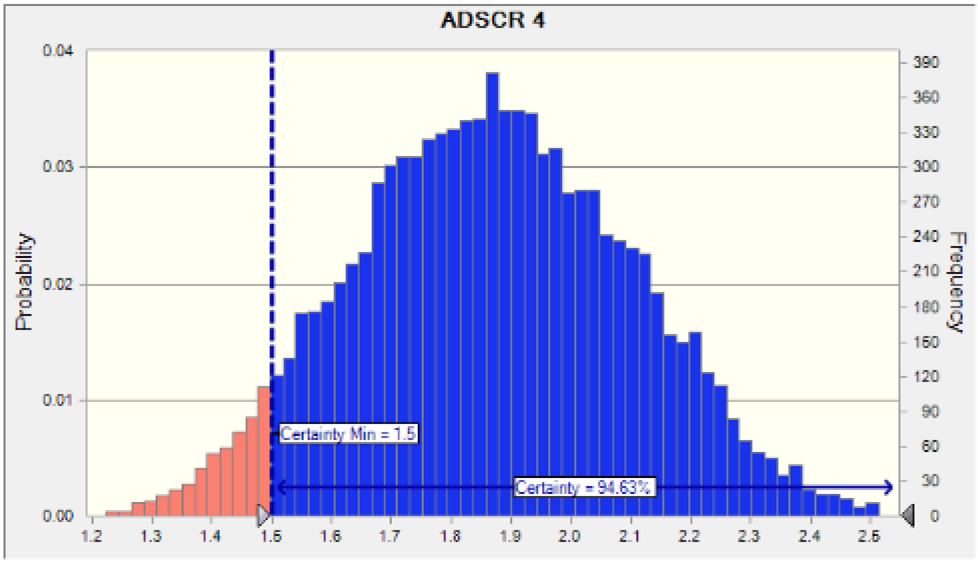


Figure 4: Annual debt service coverage ratios of year four simulated forecasts

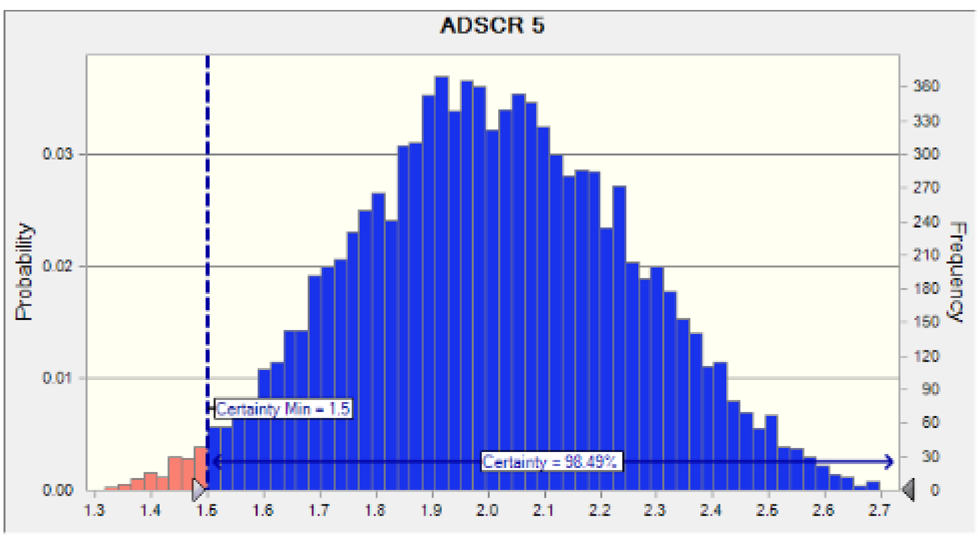


Figure 5: Annual debt service coverage ratios of year five simulated forecasts

The simulated forecast results for annual debt service coverage ratios presented in figures3, 4 and 5 show that the certainty to get above 1.5 benchmark is more than 90%

for all of them or less than 10% probability of needing to look for extra sources of financing such as bridge financing.

Table 31: Statistic results of ADSCR3 simulation

Statistics ADSCR3				
Trials	10000		Skewness	0.0592
Base Case	**1.7**		Kurtosis	2.68
Mean	**1.8**		Coeff. of Variability	0.1199
Median	1.8		**Minimum**	**1.2**
Mode	---		**Maximum**	**2.5**
Standard Deviation	**0.2**		Range Width	1.3
Variance	0		Mean Std. Error	0

Table 32: Statistic results of ADSCR4 simulation

Statistics of ADSCR4				
Trials	10000		Skewness	0.049
Base Case	**1.7**		Kurtosis	2.69
Mean	**1.9**		Coeff. of Variability	0.1233
Median	1.9		**Minimum**	**1.2**
Mode	---		**Maximum**	**2.7**
Standard Deviation	**0.2**		Range Width	1.5
Variance	0.1		Mean Std. Error	0

Table 33: Statistic results of ADSCR5 simulation

Statistics of ADSCR5				
Trials	10000		Skewness	0.0661
Base Case	**1.8**		Kurtosis	2.71
Mean	**2**		Coeff. of Variability	0.1225
Median	2		**Minimum**	**1.2**
Mode	---		**Maximum**	**2.8**
Standard Deviation	**0.2**		Range Width	1.6
Variance	0.1		Mean Std. Error	0

Based on the statistics for the annual debt service coverage ratios of years three, four and five, they are falling in a range of 1.2 to 2.5, 2.7 and 2.8, respectively. The standard deviation is 0.2 for all three years with the means of 1.8, 1.9 and 2 respectively, which shows a moderate level of risk for each year.

4.3.2.3 Loan Life Coverage Ratios Simulated Forecasts

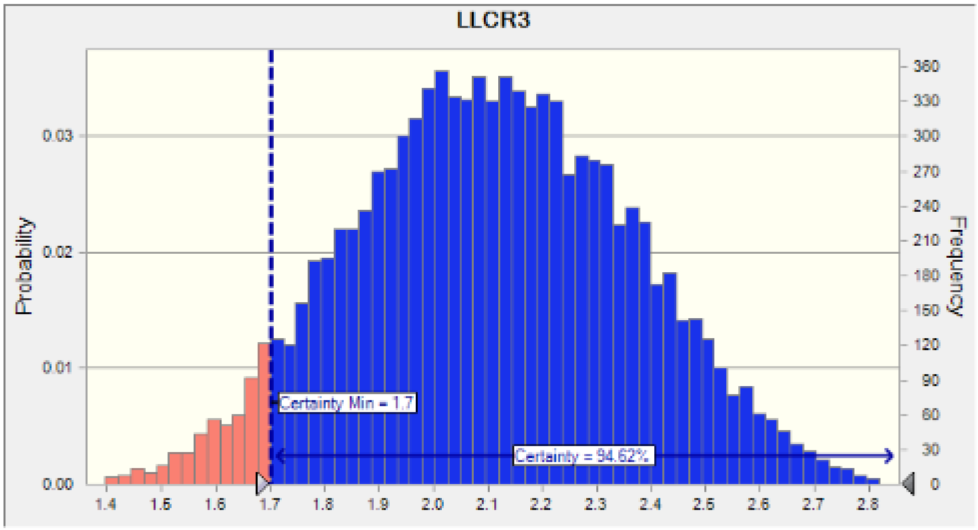


Figure 6: Loan life coverage ratios of year three simulated forecasts

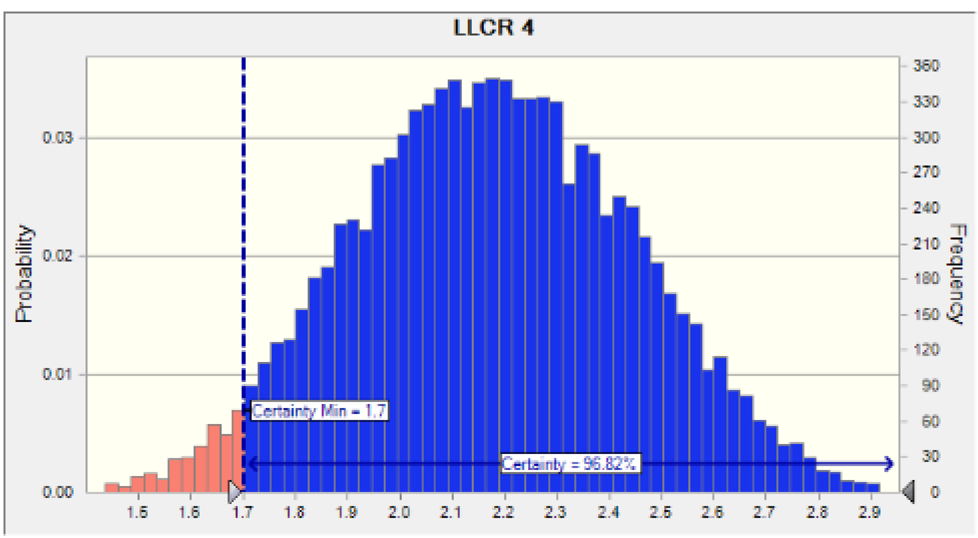


Figure 7: Loan life coverage ratios of year four simulated forecasts

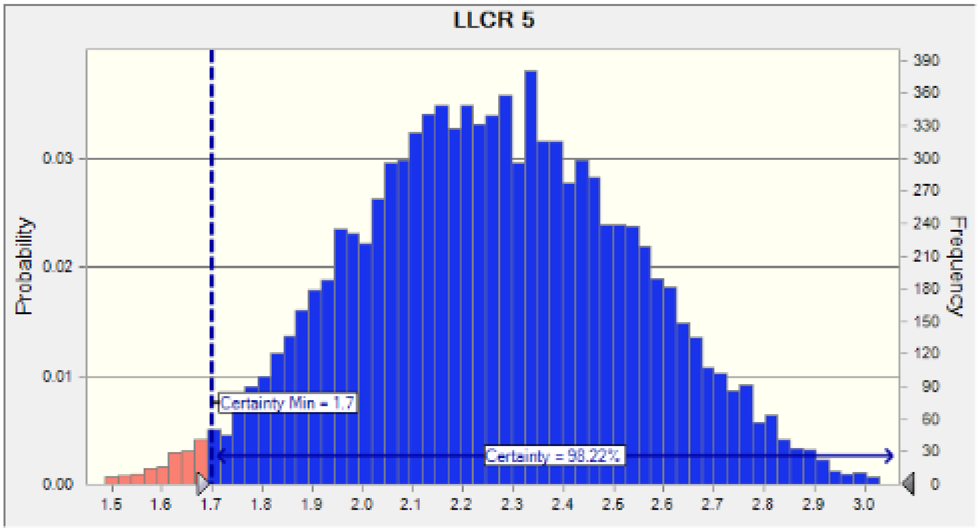


Figure 8: Loan life coverage ratios of year five simulated forecasts

Depicted in figures 5, 6 and 7, is the loan life coverage ratio probability distribution of years three, four and five. Loan life coverage ratio is the capability of project to cover its debt obligations from a specific year till the end of the loan life of the project, i.e. it takes an aggregate level of the project net cash flows into account. This ratio is referred to whenever the banker sees weak annual ability of the project net cash flows in covering its debt obligations, i.e. unconvincing ADSCRs, so he needs to plan a strategy to deal with this issue. If LLCR for a specific year is convincing then a strategy can be applying for bridge financing, for the project future cash flows are large enough to cover that year's deficit by granting it an extra loan. If LLCRs are weak then the banker might propose provisions by setting special funds such as sinking funds.

The above results show that there is more than 90% probability to get LLCRs above the minimum benchmark (depends by the creditors risk averseness), which is not bad. But in order to get a better view we should refer to the statistics of the above simulations for further analysis.

Table 34: Statistic results of ADSCR3 simulation

Statistics LLCR3				
Trials	10000		Skewness	0.0246
Base Case	**1.9**		Kurtosis	2.64
Mean	**2.1**		Coeff. of Variability	0.1203
Median	2.1		**Minimum**	**1.3**
Mode	---		**Maximum**	**2.9**
Standard Deviation	**0.3**		Range Width	1.6
Variance	0.1		Mean Std. Error	0

Table 35: Statistic results of ADSCR3 simulation

Statistics of LLCR 4				
Trials	10000		Skewness	0.027
Base Case	**2**		Kurtosis	2.64
Mean	**2.2**		Coeff. of Variability	0.1213
Median	2.2		**Minimum**	**1.3**
Mode	---		**Maximum**	**3**
Standard Deviation	**0.3**		Range Width	1.7
Variance	0.1		Mean Std. Error	0

Table 36: Statistic results of ADSCR3 simulation

Statistics of LLCR 5				
Trials	10000		Skewness	0.0329
Base Case	**2**		Kurtosis	2.65
Mean	**2.3**		Coeff. of Variability	0.1218
Median	2.3		**Minimum**	**1.4**
Mode	---		**Maximum**	**3.1**
Standard Deviation	**0.3**		Range Width	1.8
Variance	0.1		Mean Std. Error	0

According to the above statistics, the loan life coverage ratios for all three years are more or less falling in the same range with identical standard deviation for all of them, which shows similar moderate riskiness for all the years of three, four and five.

4.4 Risk Management

A main project finance characteristic is being none or limited recourse liability. This property of project finance leads the potential investors and creditors to the project to do due diligence on different contractual arrangements and agreements set in place with different parties involved within the project such as suppliers, off takers, operators etc. which is an approach that leads to risk mitigation and some sort of risk management being unique to project finance deals. This approach actually transfers different risks to different parties who can best manage it and thus let lenders to take on remainder risks.

Below is a summary of some project risk factors mitigations set in place to reduce the riskiness of the Jil Power Pun Limited Project.

4.4.1 Construction Risk Mitigation

The construction risk can be mitigated by hiring a competent and experienced EPC contractor following an open tendering process. Also the contract can be placed on a fixed price and provisions be made for contingencies to prevent cost overruns.

4.4.2 Operating Risks Mitigation

To guard against unsatisfactory plant performance, the O&M contractor, who has extensive experience in the maintenance of similar plants, will work to ensure completeness and technical soundness. The EPC Contractor would also give guarantees on the performance and content. Periodic overhauls will be carried out to prevent the breakdown of plants and equipment. Management of the plant will be contracted to competent companies who will provide guarantees of performance.

4.4.3 Market/ Output Risks Mitigation

Market risk can be mitigated by careful demand studying and also signing appropriate take-or-pay contracts with the UEC and industrial customers together with placing suitable bank guarantees for fulfilling any contingencies by off-takers such as delays, etc. Industrial customers need to be selected so that fluctuations in their demand do not create risks of loan default in project.

4.4.4 Supply Risks Mitigation

Supply risks can be reduced by signing supply or pay contracts with the suppliers. For instance in this case the gas price can either be fixed or indexed to inflation upon a mutual agreement with the supplier; however, fixing the gas price is very far from mind for it moves with world prices and it is less likely to occur. But indexing is more rational which requires the price to be partly indexed to PPA.

4.4.5 Environmental Risks Mitigation

An environmental impact assessment (EIA) study establishing a wide-ranging and comprehensive baseline of the current environment is being conducted on the project. This will mitigate against the risk of contamination or discovery of hazardous materials, amongst others.

4.4.6 Political / Legal Risks

Political risks such as confiscation, expropriation and nationalization will be mitigated by Multilateral Insurance Guarantee Agency (MIGA) Insurance. Legal risk is mitigated by the appointment of competent and highly reputed local and international legal firms.

4.4.7 Project Financing structure Risks

There is significant indicative interest from investors on the project to suggest that funding risk will be minimal. Also the proposed financing structure will mitigate the funding risks. Shareholders agreements and loan agreements will mitigate any ambiguity in the rights and responsibilities of each part.

4.4.8 Exchange Rate Risk

The Project's exchange rate risk is mitigated by the tariff structure which is denominated in US Dollars, or the domestic equivalent at the rate prevailing on the date of payment. This ensures minimal foreign exchange risk and guarantees payment of foreign currency denominated debt service obligations. But if there are sudden fluctuations in the exchange rate it may be difficult to pass the additional costs to final consumers in a sudden manner and there may be a need of phasing in a take-or-pay context. It means that the IPP gives them the power and asks them for the minimum amount of payment through the PPA for the moment in order to get able to pay its debt and getting the rest in a phasing manner.

4.5. Contractual Structure

The following section provides a description of the contracts set in order to manage and mitigate the risks.

4.5.1 Gas Supply Agreement (GSA) and Gas Transport Agreement (GTA)

In order to facilitate the delivery of natural gas to the power plant, JPPL plans to enter a two different contracts of gas supply agreement (GSA) and gas transport agreement (GTA) with the suppliers.

4.5.2 Power Purchase Agreements (PPA)

JPPL would enter into Power Purchase Agreements with industrial off-takers and UEC. UEC is another SPV which will be set up by JPPL, specifically to distribute power to residential and commercial customers. Binding letters of intent will be signed with the industry off-takers, while JPPL and UEC will sign a PPA through which 40% of power generated would be sold to UEC for onward sale to residential and commercial consumers. This agreement would include terms such as purchase price of power per kilowatt hour, guaranteed sales volume etc.

4.5.3 Standard Connection Agreements

Commercial and residential customers will sign a Standard Connection Agreement with the UEC, in order to be supplied with electricity.

4.5.4 Loan Agreement

The loan agreement will set forth the rights and obligations of the borrower (JPPL), and the lenders.

4.5.5 Engineering & Procurement Contract (EPC)

The EPC sets obligations of the contractor to JPPL and the Owner's Engineer with regards to the design and installation of the power plant on a turnkey basis.

4.5.6 Operations & Maintenance Agreement (O&M)

This agreement will cover the operations and management of the entire power plant. A plant operator will be appointed following an open tendering process.

4.5.7 Long Term Service Agreement

The selected EPC contractor will have the responsibility of arranging a Long Term Service Agreement (LSTA) to cover gas turbine maintenance with a reputable turbine service company.

Chapter 5

CONCLUSION

5.1 Project Financing Structure

An integrated feasibility study of a single cycle power plant in the industrial cluster of Pun in country of Pina[2] has been performed to learn about the financial and risk prospects of such a necessary project. In order to promote privatization and enhance efficiency of both the service and usage of taxpayers' money the project is to be rendered via a tendering process to an Independent Power Producer.

In order to achieve such an aim at a low cost the proposed financing strategy is to apply project financing. Project financing makes the project more interesting from owners' point of view by limiting or eliminating the recourse profile on liabilities and giving more weight to debt which increases the return on equity.

Table 37: Share of Debt sensitivity

Share of Debt	NPV (Million US$)	ADSCR3	ADSCR4	ADSCR5	LLCR3	LLCR4	LLCR5
35%	20	2.7	2.8	3.0	3.2	3.3	3.4
40%	26	2.4	2.5	2.7	2.8	2.9	3.0
45%	32	2.2	2.2	2.4	2.5	2.6	2.7
50%	39	2.0	2.0	2.2	2.3	2.3	2.4
55%	45	1.8	1.8	2.0	2.1	2.1	2.2
60%	51	1.7	1.7	1.8	1.9	2.0	2.0
65%	57	1.5	1.6	1.7	1.8	1.8	1.9
70%	63	1.4	1.5	1.6	1.7	1.7	1.8
75%	69	1.4	1.4	1.5	1.6	1.6	1.7
80%	75	1.3	1.3	1.4	1.5	1.5	1.6

On the other hand, project financing technique requires further disclosure of project affairs to potential creditors since higher share of debt makes the project more risky to default (i.e. lower debt service indicators in the table above) from bankers' point of view. Thus, they require careful due diligence on every subject impacting the project such as different contractual arrangement with different parties involved in the project to reduce their risk as much as possible by transferring them to parties capable of managing them best.

5.2 Project Financial and Risk Analysis

The financial analysis results declare that the there is 99.5% certainty to get zero or positive net present value. The deterministic result of NPV from our base case is 50.68 Million dollars with 80% certainty to acquire the value.

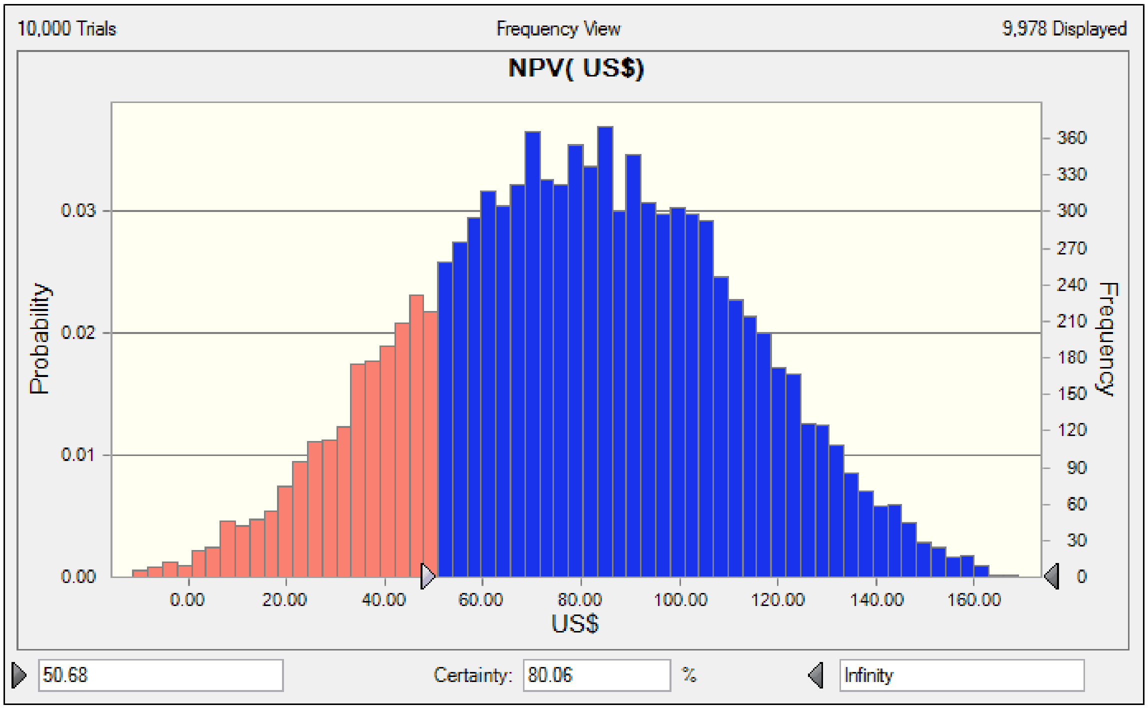


Figure 9: Deterministic NPV probability distribution

The debt service indicators are also high with certainties above 90% for achieving the minimum acceptable benchmark by different creditors. To sum it up, the project is commercially acceptable.

5.3 Policy recommendations

The industrial cluster is pushing for further generation in Pun and hours of black outs during the peak and off-peak hours leaves no doubt about the economic benefits of this project existing to the people in that region. But measuring alternative costs of technology together with their associated economic benefits could help the public sector to go after the higher cost-effective alternative, which may not be necessarily the single cycle power plant.

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