Integrated Investment Appraisal of a Steel Manufacturing/Electricity Co-generation Electricity Project

Hazhar Khalid Ali

Submitted to the
Institute of Graduate Studies and Research,
in partial fulfillment of the requirements for the degree of

Master of Science
in
Banking and Finance

Eastern Mediterranean University
June 2016
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Cem Tanova
Acting Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Banking and Finance.

Assoc. Prof. Dr. Nesrin Özataç
Chair, Department of Banking and Finance

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Banking and Finance.

Prof. Dr. Glenn P. Jenkins
Supervisor

Examining Committee

1. Prof. Dr. Glenn P. Jenkins

2. Assoc. Prof. Dr. Bilge Öney

3. Asst. Prof. Dr. Hasan Ulaş Altıok

ABSTRACT

The purpose of this paper is to examine the financial and economic appraisal of a co-generation power plant that utilizes waste heat (flue gas, also known as Corex gas) from a steel-manufacturing factory to generate electricity. It describes how an independent power producer (IPP) generates electricity for supply to industrial consumers and the state electricity board in the state of Karnataka, India. The 260-MW electricity-generating plant is promoted by a local company and its foreign partner on a build-own-operate (BOO) basis, and is financed through a modern project finance arrangement.

A financial model is built based on the FAST modeling standard, and the outcomes of the financial analysis reported. The FAST financial modeling standard is also applied to the economic and stakeholder analysis. The diverse classes of related risk and key risk variables are identified, and risk mitigation measures considered.

Lastly, an economic analysis is conducted, project externalities evaluated, and economic risk factors tested. Conclusions are then presented, based on the outcomes of the completed project analysis.

Keywords: Investment Appraisal, Cogeneration, steel manufacturing, electricity generation, India, project finance, FAST modeling.

ÖZ

Bu çalışmanın amacı çelik üretimi yapılan bir fabrikadaki baca gazı veya bir diğer deyişle Corex gazından faydalanarak, ısı ve elektrik enerjisinin ortak üretiminin yapıldığı güç santralinin finansal ve ekonomik fizibilitesini değerlendirmektir. Bu çalışma bağımsız bir güç üreticisinin nasıl elektrik üretip endüstriyel müşterilerine ve devlet elektrik kurumuna arz ettiğini tanımlar Karnataka, Hindistan devlet. Yerel bir şirket, yabancı bir ortakla modern bir proje finansmanı sözleşmesine dayanarak, 260 MW gücündeki elektrik santralini yap-sahiplen-işlet biçiminde faaliyete geçirecektir.

Finansal analiz FAST modelleme standartlarına göre yapılıp, finansal analizin sonuçları rapor edilmiştir. FAST modelleme standartları ayrıca ekonomik ve paydaş analizleri için de uygulanmıştır. Bunun yanısıra, çeşitli risk kaynakları ve temel risk değişkenleri belirtilip olası riskleri azaltma ölçüleri de not edilmiştir.

Ekonomik analiz yapılmış ve projenin dışsallığı da değerlendirilmiştir. Ekonomik risk faktörleri de ayrıca test edilmiştir. Son olarak tamamlanmış analizin neticesine göre analizin sonuçları belirtilmiştir.

Anahtar Kelimeler: Yatırım Değerlendirmesi, Birleşik Üretim, Çelik Üretimi, Elektrik Üretimi, Hindistan, Proje finansmanı, FAST Modelleme.

DEDICATION

To my dearest Mom and Dad

With love and respect

ACKNOWLEDGMENT

I would like to thank my supervisor Prof. Dr. Glenn Paul Jenkins for his advice and valuable support. I am also grateful to Shahryar Afra and Arif Yurtsev, who provided valuable suggestions and comments during my work.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF EQUATIONS

LIST OF ABBREVIATIONS

ADSCR	Annual Debt Service Coverage Ratio
APLF	Actual Plant Load Factor
BHELRC	Bharat Heavy Electrical Limited–Raytheon Consortium
CBA	Cost-Benefit Analysis
CEA	Central Electricity Authority
CIL	Coal India Limited
CC	Capacity Charge
CSCF	Commodity Specific Conversion Factors
DP	Domestic Partner
ENPV	Economic Net Present Value
ETB	Ethiopian Birr (Currency)
EH	Equity Holders
EOCK	Economic Opportunity Cost of Capital
EOCFX	Economic Opportunity Cost of Foreign Exchange
EC	Energy Charge
ECB	External Commercial Borrowing
EPCC	Engineering, Procurement, and Construction Contract
FEP	Foreign Exchange Premium
FNPV	Financial Net Present Value
FP	Foreign Partner
FSA	Fuel Supply Agreement
IRR	Internal Rate of Return
ICICI	Industrial Credit and Investment Corporation of India
IPP	Independent Power Producer
JTPC	Jindal Tractebel Power Company

JVSL	Jindal Vigayanagar Steel Limited
KEB	Karnataka Electricity Board
LLCR	Loan Life Coverage Ratio
NPLF	Normative Plant Load Factor
NPV	Net Present Value
PLF	Plant Load Factor
PPA	Power Purchased Agreements
USD	United States Dollar
SPV	Special Purpose Vehicle
SEB	State Electricity Board
TPEC	Third-party Exclusive Consumer
WBGSA	Wheeling, Banking and Grid Support Agreement

Chapter 1

INTRODUCTION

1.1 Background

1.1.1 History of India's Power Sector

The primary sources of power in India are coal, followed by gas, hydro-electric and renewable energy (as of March 2009). In 1995/96, for example, India's generating mix comprised 71.1% thermal power, 25.2% hydroelectricity, 2.7% nuclear and 1% non-ordinary sources.

Over the past 60-plus years, the country's power-generating capacity has increased from 1,362MW in late 1947 to around 105,000MW by March 2002 and 147,965MW in March 2009 (Central Electricity Authority, 2007b, 2009), rising further to 210,859MW by end-2012 (CEA, 2007a). Virtually all installed capacity is under the control of State Electricity Boards (SEBs) and public companies, with very little private sector involvement. However, ever-increasing consumer demand has placed exceptional strains on the system, with the public sector struggling to raise the resources required to tackle peak-hour energy shortages. Poor economies of scale further hamper power supplies (Jenkins and Dhakal, 2003).

1.1.2 State of Karnataka

The state of Karnataka lies in southwest India. Originally known as Mysore, the state was formed on 1 November 1956 under the States Reorganization Act, and renamed Karnataka in 1973. The capital and largest city is Bangalore. Karnataka is flanked by

the Arabian Sea and the Laccadive Sea to the west, Goa to the northwest, Maharashtra to the north, Telangana to the northeast, Andhra Pradesh to the east, Tamil Nadu to the southeast, and Kerala to the southwest (Karnataka, 2016).

Figure 1.1: Map of State of Karnataka, India

1.1.3 Electricity Market in India

The Indian power sector faces high peak-hour demand and shortages that reached 12.6 percent of total energy supply in 2001 and 7.5 percent in 2002. Topping peak shortage reached 20.49 percent in 1992 with overall energy deficiencies of 11.7% in 1997 (GOI, 2002a).

Karnataka's associated energy load is around 2.5 times installed capacity, with peak demand of around 33 percent of associated load and around 75 percent of installed capacity (Reddy and Sumithra 1997).

As a result, the weighted average cost of power rose from Rs 2.32 kWh in 2004 to Rs 3.8 kWh in 2012. The pressure on energy prices has been reflected in contracts, with power tariffs rising to Rs 17/kWh on the Indian Energy Exchange Limited in June 2008 and Rs 15/kWh on Power Exchange India Limited in September 2009, remaining unstable since (Shukla and Thampy, 2011).

1.1.4 Reforms of Electricity Sector in India

Since independence, the Government of India (GoI) has been responsible for the development of India's power sector through various public companies, the majority of which are run by the state governments. This structure of provision is unlikely to be able to cope with a continued rapid expansion in demand, especially given the high cost of securing new power-generating capacity.

Efforts to improve the Indian electricity sector began in earnest in 1991, including administrative adjustments aimed at tackling persistent electricity shortages, poor operational execution, and the shaky financial situation of the state electricity board (SEBs).

A key goal of the reforms is to encourage the development of private-sector ventures in the power sector. In 1998, the Central Electricity Regulatory Commission called on the state and central governments to establish Regulatory Commissions responsible for overseeing prices, taxes and subsidies.

The historical evolution of India's power sector can be divided into three periods. The first encompasses the passing of the Electricity Act of 1910 until independence in 1948—a period in which commitments regarding the supply of electricity were drawn up between state governments and licensees. The second stage begins with the

Electricity act of 1948, which defined the administrative structure of the power sector until 1991, defining the single purchaser framework that emerged with the formation of SEBs. Under this framework, private power-generating companies sold output to SEBs. However, the under-pricing of power combined with operational inefficiencies resulted in the disintegration of SEB financial positions, severely undermining their capacity to invest in additional capacity. This lack of investment led to sharp discrepancies in demand and supply, exacerbated by rapid economic growth.

The third stage in the evolution of India's power sector began in 1991, with a focus on boosting power-generating capacity by opening up the market to foreign and domestic private companies, combined with efforts to enhance productivity in the generation and distribution of electricity. This stage entailed six key steps (Jenkins and Dhakal, 2003):

1. Change in previous Acts to allow private firms to produce electricity.
2. Introduce possibility of 100% foreign ownership.
3. Five-year tax holidays.
4. Decreased import charges on power equipment.
5. Guaranteed 16% return for private companies, with a bonus return on equity for every percentage-point above 68.5% plant load factor (PLF).
6. Model for power-purchase agreements (PPAs), including SEB role in production and distribution.

1.1.5 Ownership Structures

In the past, SEBs have restrained electricity production and transmission, assuming a sometimes obstructive role across in power production and transmission through the CEA and executing offices.

Ownership of installed electricity-generating capacity is divided between state governments, central government and private companies, owning 51%, 33% and 16%, respectively (Shukla and Thampy, 2011; see Figure 1.2).

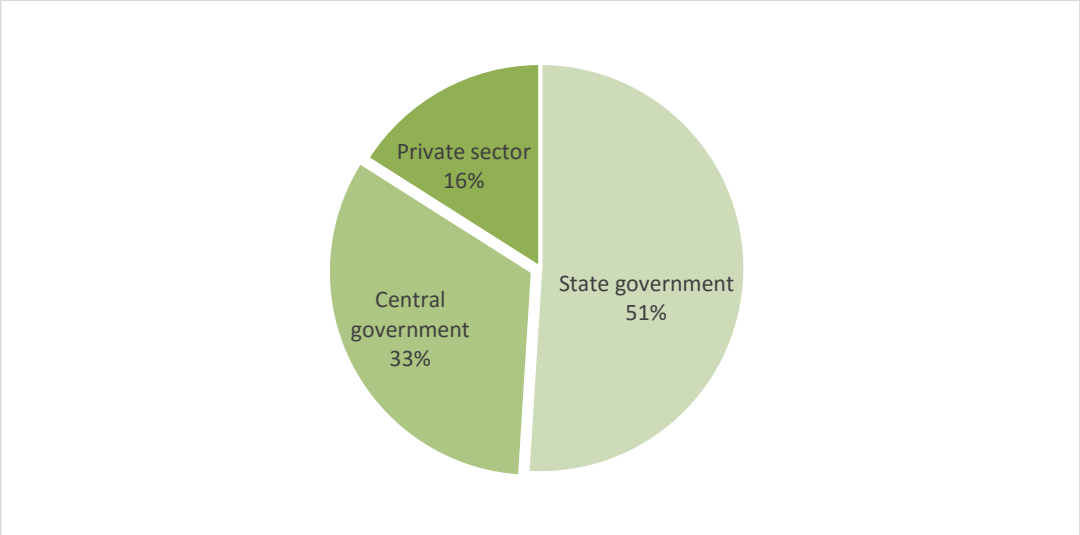


Figure 1.2: Ownership of Electricity-Generating Installed Capacity in India, March 2009 (MW).

1.1.6 India's Energy Sources

India has extremely limited reserves of oil and gas. However, it has the largest reserves of coal on the planet (approximately 12.5% of the global total), and huge stores of lignite. India produces around 345 million tons of coal equivalent (Mtce), importing a further 140 Mtce—around 12% of total global imports of coal. The largest source of India's coal imports is Indonesia, followed by Australia and South Africa, accounting for 21%, 16% and 13% of coal imports, respectively.

The production of coal in India is dominated by the state-owned Coal India Limited (CIL), which accounts for 80% of total national yield. Around 70% of India's annual coal production is used to generate power—a proportion that is set to increase unless

and until nuclear power becomes viable in the country (International Energy Agency, 2015).

Flue gas refers to the gas emitted by a broiler, heater, furnace or steam generator in the process of manufacturing steel, which is channelled through a chimney (flue). The Corex process captures this gas, which would otherwise be wasted, transforming it into Corex gas—a significant source of additional revenue with great environmental benefits (positive natural externalities).

1.2 Aim of the Study

This study examines how an IPP, a devoted customer and a state power board used the contractual process to encourage interest in and delivery of a 260-MW power-generating facility, by a team comprised of a domestic company and its foreign partner. The project is essentially a captive electricity plant for a well-established steel-production factory, using the Corex process to transform flue gas into Corex gas—now the primary fuel in the Indian state of Karnataka.

The study also presents financial returns to investors, economic returns and net gain to projects externalities, before developing and test-case finance strategy for a proposed IPP-backed power-generating project, using a tendering (bidding process).

The financial and economic models used facilitate financial, risk and economic analyses, as well as an assessment of project externalities in order to identify risk variables. The identification of risk variables is critically important, helping to ensure that project contracts appropriately allocate risk so as to best meet investors' expected rate of return, and to facilitate ex-post evaluations of project operations and implementation.

1.3 Project Finance

Project finance generally involves large amounts of capital, assigned in a series of contractual agreements, each applying to a specific element of project implementation and operation. In order for project finance to result in mutual success for all parties, risks must be shared, with each and allocated to the party/ies best able to manage them effectively and efficiently. Project finance may be defined in a number of ways. For example, Jenkins defines it as:

> Financing in which lenders to a project look primarily to the cash flow and assets of that project as the source of payment of their loans (EMU, 2010).

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.

Esty (2004) says:

> 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.

Finnerty (2013) describes project finance 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.

Jenkins (2010) classifies project finance in three categories: full-, non- and limited-recourse financing. Full-recourse refers to financing structures in which lenders will expect debt repayments (interest and principal) to be met by project assets and cash

flow, but also require a creditworthy project sponsor to ensure repayment in the event of force majeure or business disruption. Non-recourse refers to loans covered by project assets and cash flow alone, with no guarantee that interest and principal will be repaid in the event of force majeure or environmental risks. Limited recourse refers to all forms of financing somewhere between non-recourse and full recourse.

Yescombe's description of project finance is the more complete, highlighting the issue of risk-sharing and the diversification of risk, as well as sources of project cash-flow. He also later refers to the special purpose vehicle (SPV)—a means of autonomous project finance (see figure 1.3).

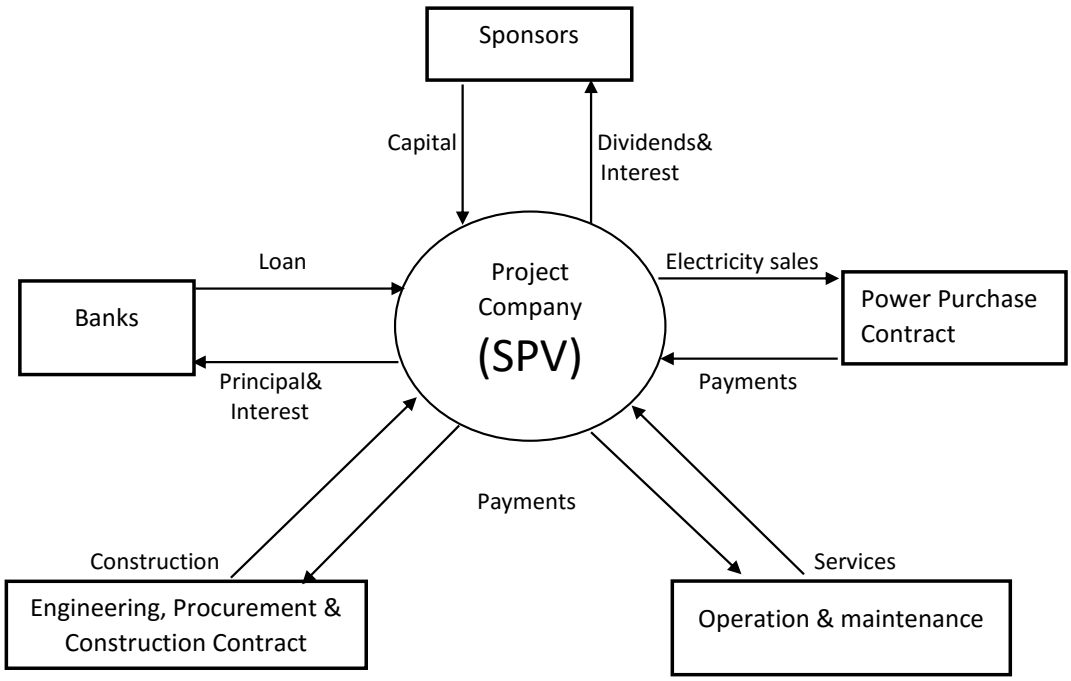


Figure 1.3: Legal Ownership Structures for Project Financing

1.4 Why Project Finance and When?

Beyond securing essential funds, the advantages of project finance are the diversification and allocation of risk, which allows sponsors to back projects that would be too risky to undertake alone. The process of construction and operations are carefully structured through contractual agreements, with the contracting process providing additional scrutiny of investment decisions.

A higher-level effect of project finance is to impose discipline and caution in the use of resources, driving administrators to find the most productive of assets and to release available cash flow, in contrast with a project company division supervisor (Esty, 2004).

Financing procedures are costly and time-consuming, entailing a high degree of unpredictability and complexity. This means the process can require long lead times while not necessarily resulting in lower capital costs, due to high transaction costs and indirect credit support. In short, capital-intensive projects require a large amount of income. As a result, agreements constantly reinforce the need for close supervision of management and operations, to an extent that the corporate finance world would find hard to bear (Comer, 1996; see Figure 1.4 for project finance structure).

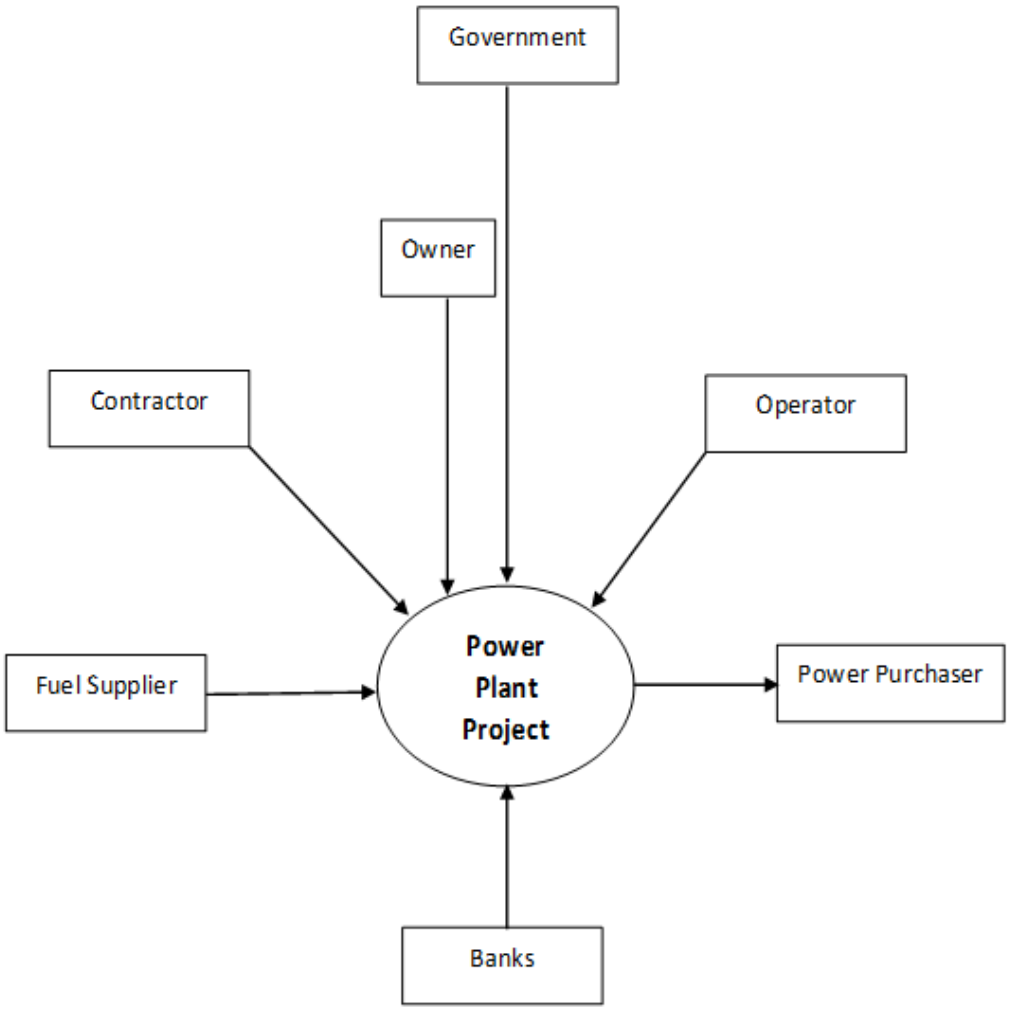


Figure 1.4: Project Finance Structure

Government: Usually an indirect but powerful participant, through the relevant state government, the responsibilities of which may include project endorsement; overseeing sponsoring state organization, operational performance and environmental issues; provision of tax holidays, subsidies and project guarantees; and project regulations or approaches.

Owners and project sponsors: Usually have a stake or equity in a project, supporting the venture alone or as part of a project consortium. Typical sponsors include domestic and/or foreign companies, operators, suppliers of inputs, buyers of outputs and contractors.

Project company: Exists solely to execute a project controlled by project sponsors.

Contractors: Domestic or foreign, responsible for project construction according to technical specifications outlined in contracts.

Operator: Responsible for operation and maintenance of project assets. May be a multinational or a joint-venture vehicle.

Supplier: Provides project inputs—for thermal power plant projects, this includes fuels such as coal, Corex gas and water.

Purchasers: Purchase project output such as electricity. A primary project aim is secure long-term (off-take) contracts with purchasers.

Commercial banks: Source of project financing.

1.5 Risks Related to Project Finance

Project finance involves particular risks, which must be both proportionate to the resources of the project finance consultant, project sponsors and other parties to the financing structure, and allocated to the party best able to manage a given risk effectively. Loan advisers and investors are generally first to highlight the risks inherent to a given project. It is the responsibility of the project adviser's legal counsel to ensure those risks are reduced, shared and allocated to the most appropriate party (see Figure 1.5 for risk priority by type).

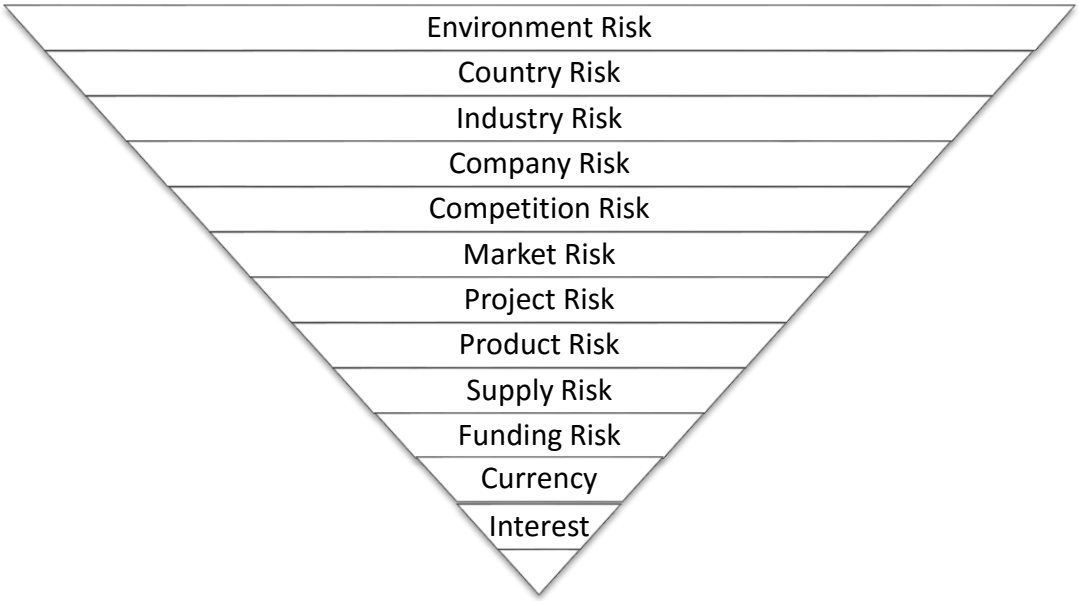


Figure 1.5: Risk Pyramid

1.6 Methodology

Based on Jenkins and Harberger (1997), the cost-benefit analysis (CBA) methodology used here begins with the development of FAST (flexible, appropriate, structured and transparent) standard financial and economic models, creating profit and cash-flow statements that reflect changes in rates of inflation and the real exchange rate.

Individual real and nominal cash flows are then developed from the owner, banker, state-government and national points-of-view, identifying those who gain and those who lose on the basis of financial criteria such as net present value (NPV), annual debt-service coverage ratio (ADSCR), loan-life coverage ratio (LLCR) and internal rate of return (IRR). Sensitivity analysis is then carried out to identify risk variables and their distribution.

1.7 Project Modelling

FAST modelling controls the structure and outline of viable spreadsheets, using a standardized structure and simple, short formulae that can be understood by modellers and non-modellers alike.

FAST modelling is:

1. Flexible—Models are adaptable in the short- and long-run; new data and inputs easily and effectively applied.

2. Appropriate—Models reflect key business assumptions clearly and accurately, without cluttering of uninformative additional elements.

3. Structured—Models are stable, rigorously formatted for secure calculation links, ensuring easy-to-maintain consistency between modellers. Predictable organization of worksheets and equations saves time when building, learning or updating the model.

4. Transparent—Model depends on clear, short easy-to-understand formulae. Financial models are more obviously appropriate where there is clarity over the rationale underlying their structure and format.

1.7.1 Workbook Design

Appropriate modelling begins with the express intention to structure predictable control at the workbook level. Worksheets should therefore be assembled according to the following four classes:

1. Foundation—includes input sheets (constants and series), timing (flags and dates) and calculation of indexation (for financial, economic and risk analyses). These outline key components underpinning the model, and must be designed with great care.

2. Workings—all calculation are fed in with results generated by the model engine.

3. Presentations—Includes financial and economic statements, graphs, essential business inputs and model outputs.

4. Control—includes check sheets (track sheet and delta sheet) and boxes, change tracking, sensitivity control and the set-up for different scenarios.

1.7.2 Model Design

1.7.2.1 Structure of the Worksheet

There are two key rules in the design of a worksheet: each column should have a specific purpose and each purpose a specific column. To that end, columns A-D are for section and sub-section labels, column E is the rule label, column F is the constant, which will usually be inputs but may also be calculations (but numbers are fixed and do not change over time), column G is unit labels (a description of the kind of number represented by each line item), column H is the row total, and columns J onwards are time-base columns (i.e. numbers appearing in those columns refer to a given period; see Table 1.1).

Table 1.1: Model Design and Column Structure

ABCD E	F	G	H	I	J	K	L	M	N	O	P
FSA											
Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7
Construction period				-	1	1	1	1	1	-	-
Operation period				-	-	-	-	-	1	1	1
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7
Fuel price as per FSA (Rs/million kcal)											
Corex gas (premium over the coal price), (sensitivity analysis)	20%	%	-								
Operation period flag	-	flag	16	-	-	-	-	-	1.00	1.00	1.00
Cost at the plant	-	Rs/million kcal	21,840.55	-	-	-	-	-	720.23	777.85	840.08
Monthly Energy delivered (coal)	-	million/kcal	520,961	-	-	-	-	-	16,805	33,610	33,610
Monthly Energy delivered (corex gas)	-	million/kcal	5,340,897	-	-	-	-	-	172,287	344,574	344,574
Monthly Financing cost,coal stock	-	Rs'000000s	384.89	-	-	-	-	-	12.69	13.71	14.80
Monthly Carpet losses,coal stock	-	Rs'000000s	32.76	-	-	-	-	-	1.08	1.17	1.26
Fuel price as per FSA		Rs/million kcal			-	-	-	-	851.48	919.60	993.16
Fuel price as per FSA (Rs/kwh)											
Heat rate for energy charge (coal & corex gas), kilojoules/kwh	10,500	kj/kwh	-								
Number of kcal per kilojoule	0.2388	unit	-								
Million Kcal to Kcal conversion factor	0.000001	factor	-								
Fuel price as per FSA	-	Rs/million kcal	-	-	-	-	-	-	851.48	919.60	993.16
Fuel price as per FSA		Rs/kwh			-	-	-	-	2.13	2.31	2.49

1.7.2.2 Calculation Blocks

Building up models using a calculation block is a key means of ensuring model readability. The following rules govern construction of the calculation block:

1. All calculations are contained in the block
2. One calculation per block
3. Calculation is the last item in the block

For instance, Table 1.1 presents two calculation blocks for fuel-supply agreements.

Other benefits of the calculation block are:

1. All inputs are listed next to the calculation itself
2. Ease-of-navigation using links
3. ‘Smart’ in finding and resolving errors

1.7.3 Multiple Worksheets

Another rule of FAST financial modelling is to set up independent sheets for different calculations, for example, specific sheets for price index, tax, cash-flow statements, risk analysis and so on. This enables the modeller to easily find and address problem issues, as well as making good use of Excel program functions to banner and review chosen zones of given sheets.

1.7.4 Track Sheet and Delta Sheet

The track sheet enables the modeller to track changes in key outputs and the matrix, serving as both a review tool and an analytical tool, used to understand how changes to input assumptions affect output, and to test output when inputs are changed over time.

The delta sheet compares active outputs with stored model output datasets, providing period-by-period comparisons of the project-life financial statement with a snapshot of the financial statement at one point in time.

1.8 Structure

Chapter I provided an overview of the study, followed in Chapter II by a description of the project, project finance, project investment cost and project contractual agreements. Chapters III-V present project financial, risk, management and economic analyses, respectively. Chapter VI presents the main conclusions reached, based on project outcomes.

Chapter 2

THE PROJECT

2.1 Project Description

2.1.1 Jindal Vijayanagar Steel Ltd (JVSL)

The Jindal Group of companies is one of India's largest corporations, with total assets over $4 billion in 2016. The group established Jindal Vigayanagar Steel Ltd (JVSL) in March 1994, and the business was approved in July 1994. A major player in the domestic steel industry, JVSL is the product of Jindal Iron and Steel Co Ltd, the Development Corporation Ltd and Karnataka state industry interests (“Savitri Jindal", 2016).

2.1.2 Tractebel Engineering Company

The foreign partner, Tractebel South Asia, is part of a global organization based in Belgium, which offers international consultancy and engineering services in the power-generation, gas and nuclear industries. Tractebel operates in the United Kingdom, Brazil, Chile, Peru, Uruguay, United States, Canada, Mexico, Turkey, Indonesia, Singapore, Thailand and Australia, as well as South Asia, the Middle East and Africa, with aggregate installed capacity of 115.3 GW in December 2014 ("Tractebel Engineering in a nutshell", 2016).

2.1.3 Project Description (JTPC)

Jindal and Tractebel South Asia established a joint-venture company for a build-own-operate (BOO) power plant, managed and operated by Jindal Group and Tractebel to produce electricity at its Vijayanagar steel manufacturing plant (JVSL),

for consumption at the plant and to third-party exclusive consumers (TPECs). The power plant, about 350 km from Bangalore in the state of Karnataka, has a capacity of 260 MW. Power will be monitored through a producer transformer, for distribution to the steel plant or KEB.

The closest ports—Madras and Mormugao—are linked to the project by railway for the delivery of inputs such as coal (see Figure 2.1). Project management is undertaken by delegates from the Jindal Group and Tractebel South Asia.

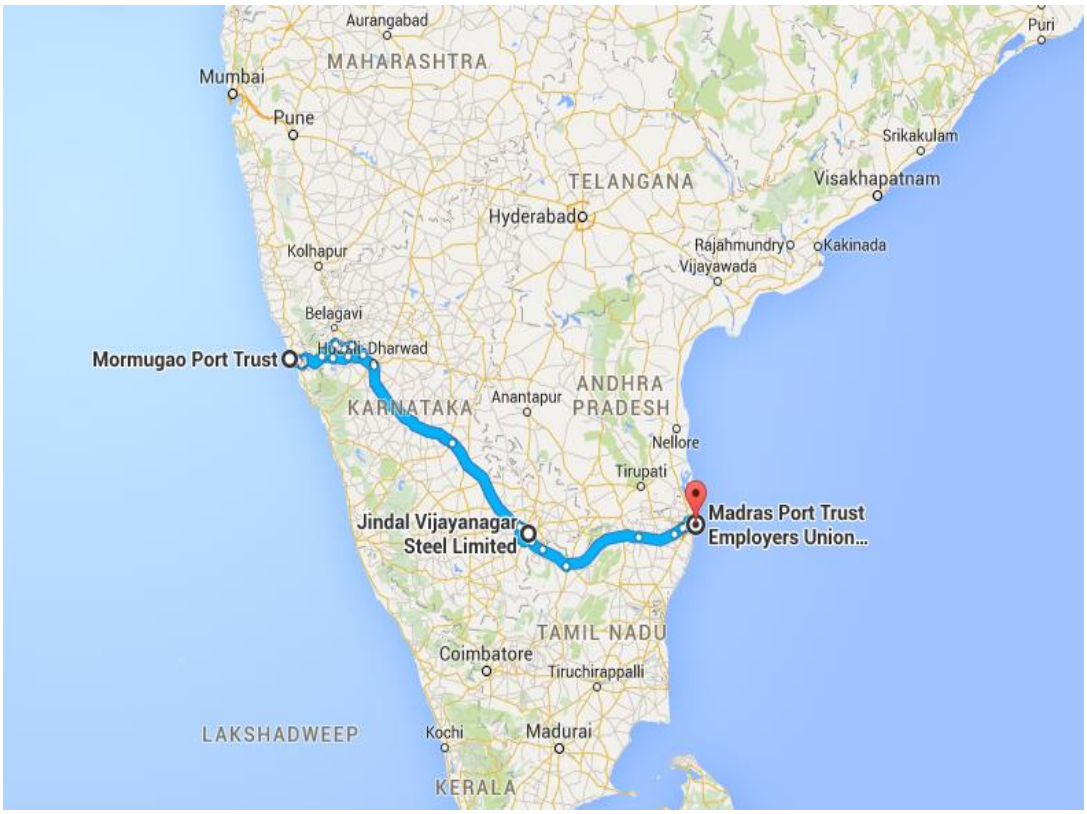


Figure 2.1: JVSL, Madras and Mormugao Port Location

The power plant's main source of power is Corex gas (also referred to here as Corex), generated from fuel gas produced by the steel-making process at Vijayanagar Steel (JVSL). The plant is intended to work one month a year with coal and the remaining 11 months with flue gas, at an actual plant load factor (APLF) of 85%.

Two Corex modules are installed, each of which creates 120,000 Nm3 per hour, with a heat rate 2,330 kcal/kWh and average heat of 1,830 kcal/Nm3. Corex does not require an auxiliary fuel to bolster its burning. However, when coal is used as the essential fuel for start-up and flame stability, auxiliary fuel is required, with average heat of 11,200 kcal/kilolitre, and water at 0.00489 m3/kWh, to produce the required steam. The coal used has an average heat content of 6,000 kcal/kg, with a heat rate 2,500 kcal/kWh.

At 1995 prices, coal inputs are USD 62.96 per MT CIF at Madras. The Corex gas premium is about 20% above average transportation and handling costs of imported coal to the project. Taking into account comparable coal heat content, the auxiliary fuel cost is about Rs 6.53, and about Rs 3/m3 of water (see Table 2.1 for input requirements and prices).

Table 2.1: Input Requirements and Input Prices (Based on First Financial Price Level)

INPUT REQUIREMENT		
Heat content of coal	6,000	kcal/kg
Heat rate of coal	2,500	kcal/kwh
Heat content of corex gas	1,830	kcal/Nm3
Heat rate of corex	2,330	kcal/kwh
Water requirement	0.00489	m3/kwh
Auxiliary fuel consumption	3.5	ml/kwh
Heat content of auxiliary fuel	11,200	kcal/kilolitre
INPUT PRICES (1st year financial price level)		
Coal price	62.96	USD CIF, Madras
Real growth rate in fuel price (sensitivity analysis)	0%	rate
Freight & handling from port to power plant	4%	% of CIF
Corex gas (premium over the coal price), (sensitivity analysis)	20%	%
Water	3	Rs/m3
Auxiliary fuel	6.53	Rs/litre

Table 2.2 indicates that when the project operate at 85% APLF, the JTPC power plant can supply 1,935.96 million kWh of electricity per year. Subtracting its

auxiliary utilization (6.9% of aggregate production), the electricity available is about 1,802.38 million kWh. Most of the power generated is delivered to the steel plant JVSL—estimated at 1,173.84 million kWh of total electricity supply—leaving just 628.54 million kWh of power available for purchase by TPECs. Furthermore, JVSL may in the end retain the entire JTPC output, in line with expected annual increase in steel production.

Table 2.2: Electricity Supply and Consumption

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	9	17	18	19	20	21
Construction period				-	1	-	-	-	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	5	6	7	8	9	17	18	19	20	21
Auxiliary energy consumption														
Auxiliary consumption	6.90%	%of generation	-											
Gross energy generation (Corex +Coal)	-	million kwh	30,007.38	-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	-
Annual auxiliary energy consumption		million kwh	2,070.51		66.79	133.58	133.58	133.58	133.58	133.58	133.58	133.58	133.58	-
Energy available for supply														
Gross energy generation (Corex +Coal)	-	million kwh	30,007.38	-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	-
Annual auxiliary energy consumption	-	million kwh	2,070.51	-	66.79	133.58	133.58	133.58	133.58	133.58	133.58	133.58	133.58	-
Total energy available for supply		million kwh	27,936.87		901.19	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	-
Energy available for TPECs														
Total energy available for supply	-	million kwh	27,936.87	-	901.19	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	1,802.38	-
Annual Energy required by JVSL	-	million kwh	18,781.44	-	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	-
Annual energy available for TPECs		million kwh	9,428.08		-	628.54	628.54	628.54	628.54	628.54	628.54	628.54	628.54	-

There are seven parties with an interest in the financial viability of the project:

1. Equity holders: contributed around 30% of aggregate capital.

2. Bankers: contributed around 70% of aggregate capital and credits. Parties focus on project financial viability, to establish whether debt service requirements can be met by operations.

3. JVSL: signed up and involved with the FSA and PPA of the JTPC project. Likely to want to understand reserve funds anticipated in connection with option power sources.

4. KEB: provides wheeling, banking and grid support agreement (WBGSA). Likely to want to know how may gain financially from the project.

5. Jindal Group: domestic equity holder with biggest share in JTPC project, as well as owning JVSL steel plant.

6. Tractebel: foreign partner and equity holder. Does not have option to exchange project advantages. JVSL is committed customer and provider of essential fuel; foreign partner must guarantee that procurements with fixed price segments constitute real partition of tariffs in the PPA, subsequently ensuring predetermined rate of return to domestic and foreign partners. Tractebel therefore needs to understand the rate of return independently.

7. JVSL and JTPC combined: as the domestic partner, JVSL likely to be more concerned about overall financial benefits of the project than JTPC.

2.2 Project Finance and Equity

The financing of the project derived from domestic borrowing, foreign borrowing, equity participation and supplier credits. As Table 2.3 demonstrates, the Jindal equity contribution and Tractebel equity contribution totals about Rs 1,800 million, with aggregate equity participation of Rs 3,600 million. There are three sources of borrowing: Industrial Credit and Investment Corporation of India (ICICI), providing Rs 4770 million; and foreign lenders U.S. Exim Bank and external commercial borrowing (ECB), providing USD 75.1 million and USD 27.1 million, respectively.

Table 2.3: Investment Disbursement Plan (Rs, USD. Million Based on First Financial Price Level)

Financial year ending			1	2	3	4	5	6
	Unit	Total						
Domestic loan (ICICI)	Rs'000000s	4,770			1,900	2,280	590	
US Exim Bank	USD'000000s	75.1			30	36	9.1	
External commercial borrowing (ECB)	USD'000000s	27.1			10.9	12.9	3.4	
Jindal's equity contribution	Rs'000000s	1,800	900	900				
Tractbel's equity contribution	Rs'000000s	1,800	900	900				

Rupee term loan. The Industrial Credit and Investment Corporation of India (ICICI) provides a credit of Rs 4,770 million at a 17.6% nominal rate of return. The loan begins in the third financial year, with the annual total received estimated to be Rs 2,216.16 million at the end of third financial year, Rs 2,872.14 million at the end of fourth financial year and Rs 802.69 million at end of fifth financial year. The credit is reimbursed in 36 quarterly equivalent portions, starting in the sixth financial period. Given domestic inflation of 8%, the real rate of return is expected to be 8.91%, including the 3% premium charged by the Industrial Credit and Investment Corporation of India over its development rate (see Table 2.4 for Rupee term loan for ICICI).

Table 2.4: Loan Repayment Schedule for ICICI (Rs, Million)

	Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
	Financial year ending				-	3	4	5	6	7	8	9	10	11	12	13	14	15
	Construction period				-	1	1	1	-	-	-	-	-	-	-	-	-	-
	Operation period				-	-	-	1	1	1	1	1	1	1	1	1	1	1
	Model column counter	Constant	Unit	Total	-	3	4	5	6	7	8	9	10	11	12	13	14	15
LOAN REPAYMENT SCHEDULE																		
Domestic loan (ICICI) (Nominal, million Rs)																		
	Domestic loan (ICICI) received end of the year (Million Rs)																	
	Domestic Price Index	-	index	-	-	1.17	1.26	1.36	1.47	1.59	1.71	1.85	2.00	2.16	2.33	2.52	2.72	2.94
	Domestic loan (ICICI)	-	Rs'000000s	4,770	-	1,900.00	2,280.00	590.00	-	-	-	-	-	-	-	-	-	-
	Loan received period flag	-	flag	3	-	1.0	1.0	1.0	-	-	-	-	-	-	-	-	-	-
	Loan received end of the year (ICICI)		Rs'000000s	5,890.99		2,216.16	2,872.14	802.69	-	-	-	-	-	-	-	-	-	-
	Domestic loan repayment period flag	-	flag	9	-	-	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
	SENIOR DEBT BALANCE																	
	Senior debt balance BEG		Rs'000000s			-	2,216.16	5,478.85	7,247.07	6,861.16	6,407.25	5,873.35	5,245.36	4,506.70	3,637.86	2,615.92	1,413.88	(0.00)
plus	Interest accrued during the year	-	Rs'000000s	-	-	-	390.55	965.53	1,277.14	1,209.13	1,129.14	1,035.05	924.38	794.21	641.09	461.00	249.16	(0.00)
Less	Annual repayment installment	-	Rs'000000s	-	-	-	-	-	1,663.04	1,663.04	1,663.04	1,663.04	1,663.04	1,663.04	1,663.04	1,663.04	1,663.04	-
	a-interest (Domestic loan (ICICI))		Rs'000000s			-	-	-	1,277.14	1,209.13	1,129.14	1,035.05	924.38	794.21	641.09	461.00	249.16	-
	b-Principal repayment (ICICI)		Rs'000000s			-	-	-	385.90	453.91	533.90	627.99	738.66	868.83	1,021.95	1,202.04	1,413.88	-
Plus	Loan received end of the year (ICICI)	-	Rs'000000s	5,890.99	-	2,216.16	2,872.14	802.69	-	-	-	-	-	-	-	-	-	-
	Senior debt balance		Rs'000000s			2,216.16	5,478.85	7,247.07	6,861.16	6,407.25	5,873.35	5,245.36	4,506.70	3,637.86	2,615.92	1,413.88	(0.00)	(0.00)

Foreign lender Exim Bank provides USD 75.1 million. The loan starts in the third financial year, the price of credit distributions the payment are USD 30 million in the third financial year, USD 36 million in the fourth financial year and USD 9.1 million in the fifth financial year, at an estimated nominal rate of 7.22%. Taking account of the US inflation rate of 3%, gives a real loan rate of 4.1%, including commissions

and insurance. The advance is reimbursed in 20 half-yearly equivalent portions, starting in the eighth financial year (see Table 2.5 for dollar term loan for U.S Exim bank).

Table 2.5: Loan Repayment Schedule for U.S Exim Bank (USD, Million)

	Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
	Financial year ending				-	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Construction period				-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Operation period				-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Model column counter	Constant	Unit	Total	-	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
US Exim Bank Loan (Nominal, million USD)																					
	US Exim bank loan received end of the year (Million USD)																				
	US Inflation Index	-	index	-	-	1.07	1.11	1.15	1.19	1.23	1.27	1.32	1.36	1.41	1.46	1.51	1.56	1.62	1.68	1.73	1.79
	US Exim Bank	-	USD'000000s	75.10	-	30.00	36.00	9.10	-	-	-	-	-	-	-	-	-	-	-	-	-
	Loan received period flag	-	flag	3	-	1.0	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	Loan received end of the year (US Eximbank)		USD'000000s	82.49		32.14	39.91	10.44	-	-	-	-	-	-	-	-	-	-	-	-	-
	US Exim bank loan repayment period flag	-	flag	10	-	-	-	-	-	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
	SENIOR DEBT BALANCE																				
	Senior debt balance BEG		USD'000000s			-	32.14	74.54	90.75	97.78	105.35	97.99	90.06	81.51	72.31	62.39	51.70	40.18	27.77	14.40	(0.00)
Plus	Interest accrued during the year	-	USD'000000s	-	-	-	2.49	5.77	7.03	7.57	8.16	7.59	6.97	6.31	5.60	4.83	4.00	3.11	2.15	1.12	(0.00)
Less	Annual repayment installment	-	USD'000000s	-	-	-	-	-	-	-	15.52	15.52	15.52	15.52	15.52	15.52	15.52	15.52	15.52	15.52	-
	a-interest (US Exim bank)		USD'000000s			-	-	-	-	-	8.16	7.59	6.97	6.31	5.60	4.83	4.00	3.11	2.15	1.12	-
	b-principal repayment (US Exim bank)		USD'000000s			-	-	-	-	-	7.36	7.93	8.55	9.21	9.92	10.69	11.52	12.41	13.37	14.40	-
Plus	Loan received end of the year (US Eximbank)	-	USD'000000s	82.49	-	32.14	39.91	10.44	-	-	-	-	-	-	-	-	-	-	-	-	-
	Senior debt balance					32.14	74.54	90.75	97.78	105.35	97.99	90.06	81.51	72.31	62.39	51.70	40.18	27.77	14.40	(0.00)	(0.00)

Foreign lender ECB provides finance of USD 27.1 million. Based on the first financial year price level and change in the LIBOR rate, withdrawals are USD 10.86 million in the third financial year, USD 12.86 million in the fourth financial year and USD 3.43 million in the fifth financial year, based on a nominal interest rate of 8%. Taking account of the US inflation rate of 3% gives a real loan rate of 4.83%, including commissions and insurance. The ECB premium is 1.5% over the 1.6% LIBOR rate, and ensured commission. The loan is reimbursed in six semi-annual equivalent portions, starting in the ninth financial year (see Table 2.6 for external commercial borrowing loan schedule).

Table 2.6: Loan Repayment Schedule for External Commercial Borrowing (ECB), (USD, Million)

						31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
	Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
	Financial year ending				-	3	4	5	6	7	8	9	10	11	12
	Construction period				-	1	1	1	-	-	-	-	-	-	-
	Operation period				-	-	-	1	1	1	1	1	1	1	1
	Model column counter	Constant	Unit	Total	-	3	4	5	6	7	8	9	10	11	12
External commercial borrowing (ECB)(Nominal, million USD)															
	External commercial borrowing (ECB)received end of the year (Million USD)														
	US Inflation Index	-	index	-	-	1.07	1.11	1.15	1.19	1.23	1.27	1.32	1.36	1.41	1.46
	[External commercial borrowing (ECB)]	-	USD'000000s	27.14	-	10.86	12.86	3.43	-	-	-	-	-	-	-
	Loan received period flag	-	flag	3	-	1.0	1.0	1.0	-	-	-	-	-	-	-
	Loan received end of the year (ECB)		USD'000000s	29.82		11.63	14.25	3.93	-	-	-	-	-	-	-
	External commercial borrowing (ECB) repayment period fla	-	flag	3	-	-	-	-	-	-	-	1.00	1.00	1.00	-
	SENIOR DEBT BALANCE														
	Senior debt balance BEG		USD'000000s			-	11.63	26.87	33.09	35.90	38.96	42.27	29.31	15.25	(0.00)
Plus	Interest accrued during the year	-	USD'000000s	-	-	-	0.99	2.28	2.81	3.05	3.31	3.59	2.49	1.30	(0.00)
Less	Annual repayment installment	-	USD'000000s	-	-	-	-	-	-	-	-	16.55	16.55	16.55	-
	a-interest (ECB)		USD'000000s			-	-	-	-	-	-	3.59	2.49	1.30	-
	b-principal repayment (ECB)		USD'000000s			-	-	-	-	-	-	12.96	14.06	15.25	-
Plus	Loan received end of the year (ECB)	-	USD'000000s	29.82	-	11.63	14.25	3.93	-	-	-	-	-	-	-
	Senior debt balance BEG		USD'000000s			11.63	26.87	33.09	35.90	38.96	42.27	29.31	15.25	(0.00)	(0.00)

Equity contributions from Jindal and Tractebel amount to Rs 900 million each in the first and second financial years.

2.3 Project Investment Cost

The total project investment cost based on the first financial year price level is Rs 11,948.30 million, comprising USD 119.5 million and Rs 7,764 million. Tables 2.7 and 2.8 demonstrate primary costs, which are land, pre-operating cost of Rs 14 million and Rs 2,264.5 million, respectively, the EPC contract estimated at Rs 9,070 million, margin for working capital of Rs 184.8 million, and total miscellaneous fixed assets of about Rs 415 million. Consumptions incorporate import obligations, taxes, royalties, work taxes and personal income taxes, according to state laws.

Table 2.7: Investment Cost Schedule (Rs. Million Based on First Financial Year Price Level)

					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Model period ending										
Financial year ending				-	1	2	3	4	5	6
Construction period				-	1	1	1	1	1	-
Operation period				-	-	-	-	-	1	1
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6
Total investment cost (Real, million Rs)										
Total Preliminary and Pre-operative Expenses	-	Rs'000000s	2,264.5	-	1,329	935.5	-	-	-	-
Total land cost	-	Rs'000000s	14	-	14	-	-	-	-	-
Total Engineering, Procurement & Construction Contract	-	Rs'000000s	9,070	-	422	799.5	3,250	3,614.5	984	-
Total Miscellaneous Fixed Assets	-	Rs'000000s	415	-	35	65	80	190	45	-
Total Margin Money for Working Capital	-	Rs'000000s	184.8	-	-	-	-	184.8	-	-
Total investment cost (Real, million Rs)		Rs'000000s	11,948.30		1,800	1,800	3,330	3,989.30	1,029	-

Table 2.8: Investment Cost Schedule by Detail (Rs. Million Based on First Financial Year Price Level)

					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Model period ending										
Financial year ending				-	1	2	3	4	5	6
Construction period				-	1	1	1	1	1	-
Operation period				-	-	-	-	-	1	1
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6
Preliminary and Pre-operative Expenses										
Salaries & Wages	-	Rs'000000s	160	-	100	60	-	-	-	-
Travel	-	Rs'000000s	14	-	9	5	-	-	-	-
Technical Consultation Fee	-	Rs'000000s	112.5	-	100	12.5	-	-	-	-
Legal Fees	-	Rs'000000s	49	-	40	9	-	-	-	-
Financial Advisory Fees	-	Rs'000000s	98	-	80	18	-	-	-	-
Financing Fees	-	Rs'000000s	1,831	-	1,000	831	-	-	-	-
Total Preliminary and Pre-operative Expenses		Rs'000000s	2,264.50		1,329	935.5	-	-	-	-
Land										
Cost of land	-	Rs'000000s	14.0	-	14.0	-	-	-	-	-
Total land cost		Rs'000000s	14		14.0	-	-	-	-	-
Engineering, Procurement & Construction Contract										
Plant (material)	-	Rs'000000s	804	-	100	300	404	-	-	-
Plant (labor)	-	Rs'000000s	910	-	150	300	300	150	10	-
Machinery & Equipment	-	Rs'000000s	6,446.00	-	-	-	2,346	3,314.5	785.5	-
Technical Consultation Fee	-	Rs'000000s	910	-	172	199.5	200	150	188.5	-
Total Engineering, Procurement & Construction Contract		Rs'000000s	9,070		422	799.5	3,250	3,614.5	984	-
Miscellaneous Fixed Assets										
Housing	-	Rs'000000s	30	-	30	-	-	-	-	-
Substation	-	Rs'000000s	250	-	-	50	50	150	-	-
Ash Pond	-	Rs'000000s	130	-	-	15	30	40	45	-
Office & Support Equipment	-	Rs'000000s	5	-	5	-	-	-	-	-
Total Miscellaneous Fixed Assets		Rs'000000s	415		35	65	80	190	45	-
Margin Money for Working Capital										
Inventory of coal	-	Rs'000000s	109.9	-	-	-	-	109.9	-	-
Cash	-	Rs'000000s	74.9	-	-	-	-	74.9	-	-
Total Margin Money for Working Capital		Rs'000000s	184.8		-	-	-	184.8	-	-

2.4 Project Contractual Arrangement

Briefly, the power plant JTPC is an independent generator of electricity, which sells about 70% of power produced to JVSL and the rest to KEB for use by TPECs. As agreed under fuel-supply agreements (FSAs), JVSL has to provide sufficient fuel (coal and Corex gas), as well as to buy electricity from the project at the price specified in the power purchase agreement (PPA). Power surplus to the steel plant's needs is delivered to a specified outside purchaser, TPEC. KEB provides grid support facilities under the wheeling, banking and grid support agreement (WBGSA). Tractebal South Asia provides transmission and distribution, but ownership transfers to KEB on completion of the project.

2.4.1 Fuel Supply Agreement

JVSL agrees to provide the required coal and Corex gas. Typically, coal is imported, as mentioned in Chapter one. The Rs fuel value (FV) per million kcal is defined by:

$$\text{Fuel Value (FV)} = \frac{[\,L * \{Q + E * (1 + P)\} + S + L]}{(Q + E)}$$

Equation 2.1: Fuel Value

Where:

L, represents cost of million kcal of coal landed.

Q, represents quantity of coal energy delivered per month per million kcal.

E, represents quantity of Corex energy delivered per year per million kcal.

P, represents premium of coal price over Corex gas price.

S, represents stocking charge per month, million Rs.

L, represents losses due to misappropriation of coal stock, million Rs.

Table 2.9 shows the fuel requirement as indicated by the FSA. JTPC ensures delivery of 960 million Nm3 per year as base Corex, with minimum heat content of 1,600 kcal per Nm3 and maximum heat of 1,900 kcal per Nm3. Stock of coal to be maintained by JVSL is estimated to be 200,000 MT, with minimum permitted head content of 5,000 kcal per kilogram and maximum permitted heat of 7,000 kcal per kg. Stock is satisfactory at 100% capacity, sufficient to cover three months, and stocking charge incorporates the financing expense of the stock.

Table 2.9: Fuel Supply Requirements

FUEL SUPPLY AGREEMENT (FSA)		
Minimum off-take of corex gas per year	960	million Nm3
Stock of coal to be maintained by JVSL	200,000	MT
Minimum permitted heat content of corex gas	1,600	kcal/Nm3
Maximum permitted heat content of corex gas	1,900	kcal/Nm3
Minimum permitted heat content of coal	5,000	kcal/kg
Maximum permitted heat content of coal	7,000	kcal/kg
Coal stocking charge, financing cost of coal stock	17.62%	%
Corex supply by the steel plant	11	month
Carpet losses	1.5%	% of stok.v
Maximum dust content	5	mg/Nm3 of cx.g

2.4.2 Power Purchase Agreement

The electricity tariffs per kWh derive from capacity charge (CC) and energy charge (EC), which is affirmed by the PPA. EC is essentially determined by the cost of fuels, including auxiliary fuel, which is provided by the JTPC. EC is calculated according to the following formula:

$$\text{Energy Charge (EC)} = \frac{\text{FV} * \text{HRS}}{(1 - \text{AC})}$$

Equation 2.2: Energy Charge

Where:

FV represents fuel value.

HRS represents heat requirement.

AC represents auxiliary fuel consumption.

The CC is a fixed cost applied for each of kWh consumption—in particular, interest on loan, economic depreciation, operation and maintenance expenses, income tax paid, return on equity and expenses incurred in the production of more power. As Table 2.10 shows, the PPA determines a 16.96% ensured nominal rate for the US dollar equity holder. Annual provision for operation and maintenance is 2.5% of project cost, adjusted for domestic inflation. The agreement stipulates that when the power plant exceeds a plant load factor (PLF) of 68.5% there will be a bonus for each percentage point gain. First, fixed expenses for each of the expense segments at plant load factor of 68.5% need to be accepted. Second, dividing the discounted sum total of fixed costs by discounted energy sales over the life of the project yields the base fixed cost for each unit of electricity (we have used a discount rate of 10.5% and incentive of 0.7 when the plant operates above 68.5% PLF).

Table 2.10: Power Purchase Agreement

POWER PURCHASE AGREEMENT (PPA)		
Heat rate for energy charge (coal & corex gas), kilojoules/kwh	10,500	kj/kwh
Heat rate for energy charge (coal & corex gas) during stabilization	10,900	kj/kwh
Plan load factor(NPLF) at break-even price=fixed cost(sensitivity analysis)	68.50%	%
Plant load factor (PLF) during the stabilization period	51.4%	%
Incentive for each % point of PLF greater than 68.5%(sensitivity analysis)	0.7	unit of %PLF
Guaranteed return on equity (in dollars)	13%	real
Guaranteed return on equity (in dollars)	16.96%	nominal
Number of kcal per kilojoule	0.2388	unit

The capacity charge is determined by the relationship per kWh/Rs:

$$\text{Capacity Charge (CC)} = \text{Fixed cost} * \{1 + 0.7 * (\text{actual plan load factor} - 68.50\%) * \%\ \text{rate of return}$$

Equation 2.3: Capacity Charge when Plant Operate above 68.5% PLF

If the plant operates below a PLF of 68.5%, the CC paid to JTPC is lower than the return on equity:

$$\text{Capacity Charge (CC)} = \text{Fixed cost} * \{1 - \%\ \text{rate of return}\ )$$

Equation 2.4: Capacity Charge When Plant Operates below 68.5% PLF

2.4.3 Wheeling, Banking and Grid Support Agreement

The Wheeling, Banking and Grid Support Agreement (WBGSA) allows the sale of surplus power to third-party exclusive consumers at any price, through the KEB transmission and distribution system. However, KEB does not allow the spot sale of power to state TEPCs. An agreement requires JTPC to sell electricity to TEPCs according to its ability to receive a dependable amount of power. To make up for supplies not received during shortages, KEB demands a month-to-month banking fee equivalent to 1% of the most extreme measure of a reasonable electricity deposit with KEB—about 50 million kWh. Electricity equalization is processed as follows:

$$\text{Closing} = \text{Opening} + \text{electricity deposit} - \text{electricity drawdown} - 0.5\text{MU}$$

Opening balance will be zero if the closing balance is zero or less than zero. The opening balance would be 50 million kWh if the closing balance exceeds 50 million kWh for the following month, in a relationship continued over successive months. A penalty payment is charged if the closing balance is below negative 5 million kWh—a penalty that is 1.5 times greater than the relevant tariff. This penalty option requires

JTPC to evaluate the PLF properly. JTPC is required to enter sales agreements with TPECs, or face penalty charges for excess withdrawals of electricity. Burden breaking-point on electricity deposits is likewise expected to help avoid punitive penalties on JTPC instalments, by keeping power with the KEB when there are ample electricity providers.

As shown in Table 2.11, the wheeling charge accounts for about 10% of total electricity purchased by TPEC and banking fees are 1% of maximum electricity deposits. The grid support charge of Rs 14.6 million per annum should be paid to KEB by JTPC. A further expense is caused by the fluctuating burden because of power demand from hot-strip factories.

Table 2.11: Wheeling, Banking, and Grid Support Agreement (WBGSA)

Model period ending		
Financial year ending		
Construction period		
Operation period		
Model column counter	**Constant**	
WHEELING, BANKING AND GRID SUPPORT AGREEMENT (WBGSA)		
Wheeling charges	10%	%of TPEC.e.pur
Banking fee	1%	%of max.dep
Maximum permissible deposit	50	million kwh
Excess withdrawal without penalty	5	million kwh
Penalty payment over the applicable price	50%	%
Grid support payment	14.6	Rs'000000s p.a

2.4.4 Turnkey Engineering, Procurement and Construction Contract

Project works are carried out under the terms of a fixed-cost EPC contract with the Bharat Heavy Electrical Ltd-Raytheon Consortium (BHELRC). The agreement specified that the first and second 130-MW project units would be commissioned by May and November of the fifth financial year (1998), respectively. The agreement calls for a Rs 1.73 million penalty per kcal increment in heat rate, as well as a Rs 100

million penalty for each MW shortfall in electricity. The agreement likewise indicates time overrun guarantees for the first month of USD 75,000 per day and of USD 150,000 per day for the second month. The aggregate penalties are nonetheless counted at 15%.

Table 2.12: Turnkey Engineering, Procurement and Construction Contract

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6
Construction period				-	1	1	1	1	1	-
Operation period				-	-	-	-	-	1	1
Model column counter	**Constant**	**Unit**	**Total**	-	1	2	3	4	5	6
Engineering, Procurement & Construction Contract										
Plant (material)	-	Rs'000000s	804	-	100	300	404	-	-	-
Plant (labor)	-	Rs'000000s	910	-	150	300	300	150	10	-
Machinery & Equipment	-	Rs'000000s	6,446.00	-	-	-	2,346	3,314.5	785.5	-
Technical Consultation Fee	-	Rs'000000s	910	-	172	199.5	200	150	188.5	-
Total Engineering, Procurement & Construction Contract		Rs'000000s	9,070		422	799.5	3,250	3,614.5	984	-

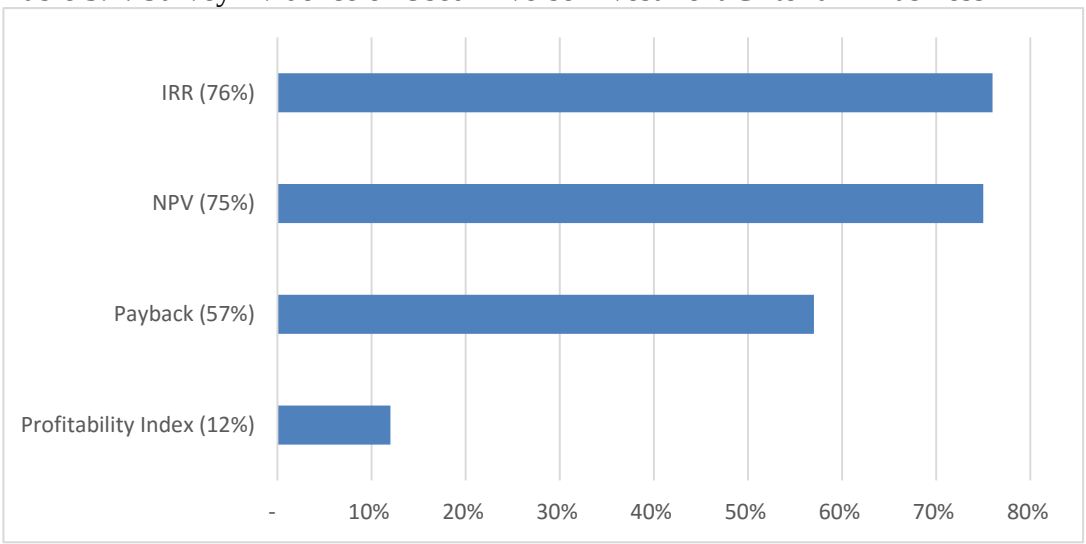
Chapter 3

FINANCIAL ANALYSIS

3.1 Evaluation Criteria of Financial Analysis

Project viability may be assessed in different ways, including net present value (NPV), internal rate of return (IRR), debt service reserve account, which includes annual debt coverage ratio (ADSCR) and loan-life coverage ratio (LLCR), payout-payback period and profitability ratio. However, with the exception of NPV—a generally accepted basis for analysis—many of these criteria are unreliable, with particular weaknesses in specific situations.

Table 3.1: Survey Evidence of Used Diverse Investment Criteria in Business



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

$$NPV^0 = \sum_{t=0}^{n} \frac{(B_t - G_t)}{(1+r)^t}$$

Equation 3.1: Net Present Value

NPV is measured as the algebraic summation of the PV of cash flow for every year, discounted by the social discount rate (or required rate of return), and can differ across periods measured to assess changes in wealth created by a project.

An NPV of zero indicates no change in wealth, meaning a project can generate the discount rate on capital, which is equal to the private cost of funding. If NPV is more than zero, there will be a gain in wealth created by the project, meaning the project can generate a discount rate above the basic cost of funds. But if NPV is less than zero, the project cannot generate the required rate of return and is therefore not attractive.

The Internal Rate of Return (IRR), widely used by investors to appraise project returns, is the discount rate at which NPV is equivalent to zero (see equation 3.1). Although widely used (still more than NPV), this criterion is problematic in cases where decision-makers must choose between projects whose NPV and IRR produces different conclusions regarding project viability (Jenkins et al., 2010). Such projects include those with multiple rates of return, as well as those that are:

1. Mutually exclusive and of different sizes.
2. Mutually exclusive with different lengths of life.
3. Started up differently, and provide different IRRs.

The pay-out or payback period is another criterion by which to measure how long a projects will take to cover its original investment cost, where the preference is obviously for a shorter repayment period. This index may be useful when a project is subject to a high level of political risk (Allen, Myers and Brealey, 2010).

The ADSCR and LLCR are other criteria to evaluate project financial viability—i.e. whether a project will be able to meet debt service requirements and generate a positive rate of return for equity holders. This criterion is used by bankers.

$$\text{ADSCR}_i = \frac{\text{Annual Net Cash Flow}_i}{\text{Annual Debt Repayment}_i}$$

Equation 3.2: Annual Debt Service Coverage Ratio

$$\text{LLCR}_i = \frac{\text{PV(Net cash flow}_i : \text{Net Cash flow}_t)}{\text{PV(Debt Repayment}_i : \text{Debt Repayment}_t)}$$

Equation 3.3: Loan Life Coverage Ratio

Where: annual debt repayment includes principal and interest paid on loan in basic year i. The last year of debt repayment is denoted as t.

Bank annual debt service coverage ratios vary according to the risk-averseness of a given institution, but are usually in the range of 1.5 to 1.7. Financial institutions first examine project ADSCR. If the ADSCR is equal to or more than 1.5 for each year of the project, project cash flow is deemed sufficient to serve the debt obligation. If the ADSCR for a particular year is less than 1, project cash flow is considered, using the loan life coverage ratio (LLCR) to establish whether bridge-financing is worth undertaking, and to establish the resilience of project cash flows over the life of the

project, notwithstanding individual years is which this is insufficient to meet debt requirements (see Table 3.27).

3.2 Financial Analysis of JTPC

The following section outlines the general assumptions and financial inputs on which the financial model is based, presenting output figures for reasonable JTPC project operations. The financial analysis is evaluated using a range of investment criteria. The financial life of the project covers a five-year construction period and 16 years of operation, generating a reasonable scenario for investment appraisal by potential suppliers of capital (e.g. private-sector financial specialists and institutional investors). The financial assessments are presented in Rupee-denominated terms, given that a critical project expense is Rupee-denominated and that the majority of finance will be met by Rupee-denominated instruments. Likewise, customer tariffs and duties will also be in Rupees.

The financial analysis provides results from the points of view of equity holders, banks, JVS, KEB, the domestic equity holder, Tractebel South Asia, JTPC and JVSL Combined.

3.2.1 Parameters and Assumptions

Table 3.2 details the parameters and main assumptions regarding the financial analysis.

Table 3.2: Timing Assumptions and Non-changeable Technical Inputs

INPUT CONSTANT		
TIMING ASSUMPTIONS		
First modelling column financial year number	1	year
Last modeling column financial year number	21	year
First date time ruler	1-Apr	date
Month per model period (Full year)	12	month
First year of construction (Financial year)	1	year
Last year of construction (Financial year)	5	year
First year of operation (Financial year)	5	year
Last year of operation (Financial year)	20	year
Total operations year	16	year
First year of Preliminary and Pre-operative Expenses (Financial year)	1	year
Last year of Preliminary and Pre-operative Expenses (Financial year)	2	year
NON CHANGEABLE MODEL TECHNICAL INPUTS		
Total number of hours per month	730	hour
Number of monthes per year	12	month
Number of operating hours in a year	8,760	hour
Number of days per year	365	day
$ to $000s conversion factor	0.0010	factor
MW to KWH convertion factor	0.0010	factor
Kg to gram conversion factor	1,000	factor
Kcal to million Kcal conversion factor	1,000,000	factor
Million Kcal to Kcal conversion factor	0.000001	factor

Table 3.3: Taxes, Duties and Royalties

TAXES, DUTIES AND ROYALTIES		
Import duty on Equipmwnt & machinery	24%	% of CIF
Import duty on coal	22%	% of CIF
Import duty on furnace oil	30%	% of CIF
Import duty on steel	85%	% of CIF
Import duty on cement	10%	% of CIF
Exercie duty	10%	% of m.v
Counter vailing duty (CVD)	10%	% of m.v
Sales tax, (inclusive of excise duty) ts	4%	%
Royalty on sand/gravel/stone R	15	Rs/p.m.ton
Personal income tax	20%	%
Stamp duty	7.5%	%
Construction tax (works tax)	4%	%
Corporate income tax (1-5 years) Scenario 1	0%	%
Corporate income tax (6-10 years) Scenario 2	30%	%
Corporate income tax (beyond 10 years) Scenario 3	43%	%

3.2.2 Macroeconomic Indicators

Using Jenkins and Harberger's (1997) methodology and based on 1995 prices, India's inflation rate has varied from 4-18%, giving an annualized average of 8%. For the US dollar (the project foreign currency), US inflation rates based on 1995 prices have ranged from 206%, giving an annualized average of 3.5%. The expected

exchange rate for the first financial year of the project is 35 Rs/USD, while the Indian social discount rate and foreign exchange premium is equal to 5.59% and 10.74%, respectively.

Table 3.4: Macroeconomic Indicators

MACRO-ECONOMICS INDICATORS		
Inflation rate, India (sensitivity analysis)	8.00%	rate
Inflation rate, USA (sensitivity analysis)	3.50%	rate
Real Exchange rate, Rs/US $ (1st year financial price level)	35	r. Rs/USD
Percentage change in real exchange rate (sensitivity analysis)	0%	%
Economic opportunity cost of capital	10.74%	%
Opportunity cost of foreign exchange	24%	%

3.2.3 Price Index and Exchange Rate

The compound factor under the annualized inflation rate is used to calculate the rate of inflation, which is registered for 21 financial years, after which the relative price index is calculated by dividing the Rs price index by the US dollar. The exchange rate is calculated by multiplying the relative price index by the expected exchange rate of 35 Rs/USD, for each year of project life. The relative index captures the relative movement of prices in individual countries, which affects the movement of the nominal rate against the real currency, reflecting changes in macroeconomic parameters.

Table 3.5: Price Index and Exchange Rate

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	19	20	21
Construction period				-	1	1	1	1	-	-	-
Operation period				-	-	-	-	-	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	19	20	21
PRICE INDEX AND EXCHANGE RATES											
Inflation rate, India (sensitivity analysis)	8.00%	rate	-								
First model column flag (Forcast Flag)	-	flag	1.0	-	1.0	-	-	-	-	-	-
Domestic Price Index		index			1.000	1.080	1.166	1.260	3.996	4.316	4.661
Inflation rate, USA (sensitivity analysis)	3.50%	rate	-								
First model column flag (Forcast Flag)	-	flag	1.0	-	1.0	-	-	-	-	-	-
US Inflation Index		index			1.0000	1.0350	1.0712	1.1087	1.8575	1.9225	1.9898
Domestic Price Index	-	index	-	-	1.000	1.080	1.166	1.260	3.996	4.316	4.661
US Inflation Index	-	index	-	-	1.000	1.035	1.071	1.109	1.857	1.923	1.990
Relative Price Index		index			1.000	1.043	1.089	1.136	2.151	2.245	2.342
Real Exchange rate, Rs/US $ (1st year financial price level)	35	r. Rs/USD	-								
Percentage change in real exchange rate (sensitivity analysis)	0%	%	-								
Relative Price Index	-	index	-	-	1.0	1.0	1.1	1.1	2.2	2.2	2.3
Expected nominal exchange rate		n. Rs/USD			35.0000	36.5217	38.1096	39.7666	75.2956	78.5693	81.9853

3.2.4 Tax Depreciation and Economic Depreciation

Tax deterioration is a devaluation that can be recorded as a cost on tax returns for a given reporting period, reducing the amount of taxable income. Deterioration is the steady charging against the cost of a fixed asset over its useful life.

The best method to calculate depreciation under generally accepted accounting principles (GAAP) is the straight-line strategy—a technique that is easiest to calculate, results in fewer mistakes, continues predictably, and transfers well from the firm-prepared statement for tax purpose.

We expect the project operation period to be 15 years. In the Indian economic context, the life of plant (building and civil work) is 20 years, operating life 15 years, and the life of miscellaneous fixed assets and machinery 10 and 20 years, respectively. The agreed annual tax depreciation rate is 7.5% for plant (building and

civil work), 10% for miscellaneous fixed assets and 25% for machinery, with a 10-year amortizing period for development expenditures.

Table 3.6: Economic Life and Depreciation Rate

ECONOMIC LIFE		
Plant (building & civil work)	20	year
Machinery & equipment	20	year
Miscellaneous fixed assets	10	year
Operating life of the project life	15	year
DEPRECIATION RATE FOR TAX PURPOSE		
Plant (building & civil work)	7.5%	% p.a
Machinery & equipment	25%	% p.a
Miscellaneous fixed assets	10%	% p.a
Amortization period of development expenditure	10	year

Table 3.7: Tax Depreciation and Economic Depreciation (Nominal, Million Rs)

Model period ending				31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending			-	5	6	7	17	18	19	20	21
Construction period			-	1	-	-	-	-	-	-	-
Operation period			-	1	1	1	1	1	1	1	-
Model column counter	Unit	Total	-	5	6	7	17	18	19	20	21
TAX DEPRECIATION (Nominal, Million Rs)											
Depreciation value of Plant (Buildings and Civil Works)	Rs'000000s	1,873.66	-	144.13	144.13	144.13	144.13	-	-	-	-
Depreciation value of Machinary & Equipment	Rs'000000s	7,980.35	-	1,995.09	1,995.09	1,995.09	-	-	-	-	-
Depreciation value of Miscellaneous Fixed Assets	Rs000000s	499.08	-	49.91	49.91	49.91	-	-	-	-	-
Depreciation value of Amortization of non-asset capital expenditure	Rs'000000s	3,405.49	-	340.55	340.55	340.55	-	-	-	-	-
Total Depreciation for Tax Purposes	Rs'000000s	13,758.59		2,529.67	2,529.67	2,529.67	144.13	-	-	-	-
DEPRECIATION FOR ECONOMIC VALUE (Nominal,Million Rs)											
Depreciation value of Plant (Buildings and Civil Works)	Rs'000000s	1,537.37	-	96.09	96.09	96.09	96.09	96.09	96.09	96.09	-
Depreciation value of Machinary & Equipment	Rs'000000s	6,384.28	-	399.02	399.02	399.02	399.02	399.02	399.02	399.02	-
Depreciation value of Miscellaneous Fixed Assets	Rs000000s	499.08	-	49.91	49.91	49.91	-	-	-	-	-
Depreciation value of Reinvestment in Miscellaneous Fixed Assets	Rs000000s	646.48	-	-	-	-	107.75	107.75	107.75	107.75	-
Total Depreciation for Economic Value	Rs000000s	9,067.21		545.01	545.01	545.01	602.85	602.85	602.85	602.85	-

3.2.5 Liquidation Value

Liquidation value is the aggregate worth of a firm's physical resources (assets) when it ceases business. Liquidation value is dictated by assets including land, building and civil work, machinery and equipment owned by the firm. Towards the end of the

operation period, the vast majority of such assets will have residual value, with the exception of land (the residual value of which is equal to its book value, unless the project operation resulted in an improvement or deterioration in value).

Table 3.8: Liquidation Value (Nominal, Million Rs)

Model period ending				31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending			-	1	2	3	4	19	20	21
Construction period			-	1	1	1	1	-	-	-
Operation period			-	-	-	-	-	1	1	-
Model column counter	Unit	Total	-	1	2	3	4	19	20	21
LIQUIDATION VALUE (Nominal, Million Rs)										
Last model period flag	flag	1.00	-	-	-	-	-	-	-	1.00
Total Nominal Initail value of Plant (Buildings and Civil Works)	Rs'000000s	-	-	250.00	648.00	821.15	188.96	-	-	-
Depreciation value of Plant (Buildings and Civil Works)	Rs'000000s	1,537.37	-	-	-	-	-	96.09	96.09	-
Liquidation value of Plant (Buildings and Civil Works)	Rs'000000s			-	-	-	-	-	-	384.34
Total Nominal Initial value of Machinary & Equipment	Rs'000000s	-	-	-	-	2,736.37	4,175.32	-	-	-
Depreciation value of Machinary & Equipment	Rs'000000s	6,384.28	-	-	-	-	-	399.02	399.02	-
Liquidation value of Machinary & Equipment	Rs'000000s			-	-	-	-	-	-	1,596.07
Total Nominal intial value of Reinvestment in Miscellaneous Fixed Assets	Rs000000s	1,077.47	-	-	-	-	-	-	-	-
Depreciation value of Reinvestment in Miscellaneous Fixed Assets	Rs000000s	646.48	-	-	-	-	-	107.75	107.75	-
Liquidation vallue of Miscellaneous Fixed Assets	Rs000000s			-	-	-	-	-	-	430.99
Total Nominal Initial value of land	Rs'000000s	14.00	-	14.00	-	-	-	-	-	-
Liquidation vallue of land	Rs'000000s			-	-	-	-	-	-	14.00

3.2.6 Input Requirement

A summary of input requirements is presented in the tables that follow.

Table 3.9: Input Requirement and Prices (First Financial Year Price Level)

INPUT REQUIREMENT		
Heat content of coal	6,000	kcal/kg
Heat rate of coal	2,500	kcal/kwh
Heat content of corex gas	1,830	kcal/Nm3
Heat rate of corex	2,330	kcal/kwh
Water requirement	0.00489	m3/kwh
Auxiliary fuel consumption	3.5	ml/kwh
Heat content of auxiliary fuel	11,200	kcal/kilolitre
INPUT PRICES (1st year financial price level)		
Coal price	62.96	USD CIF, Madras
Real growth rate in fuel price (sensitivity analysis)	0%	rate
Freight & handling from port to power plant	4%	% of CIF
Corex gas (premium over the coal price), (sensitivity analysis)	20%	%
Water	3	Rs/m3
Auxiliary fuel	6.53	Rs/litre

Table 3.10: Corex Gas and Coal Requirement

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	19	20	21
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	-
Model column counter	Constar	Unit	Total	-	5	6	7	8	19	20	21
COREX REQUIREMENT											
Heat content of corex gas	1,830	kcal/Nm3	-								
Heat rate of corex	2,330	kcal/kwh	-								
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	-
Requirement of corex gas		Mm3/kwh			1.27	1.27	1.27	1.27	1.27	1.27	-
Total energy generation with corex gas	-	million kwh	27,506.77	-	887.32	1,774.63	1,774.63	1,774.63	1,774.63	1,774.63	-
Annual requirement of corex gas		million Nm3	35,022.27		1,129.75	2,259.50	2,259.50	2,259.50	2,259.50	2,259.50	-
COAL REQUIREMENT (Million, Kg)											
Heat content of coal	6,000	kcal/kg	-								
Heat rate of coal	2,500	kcal/kwh	-								
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	-
Requirement of coal		kg/kwh			0.42	0.42	0.42	0.42	0.42	0.42	-
Total energy generation with coal	-	million kwh	2,500.62	-	80.67	161.33	161.33	161.33	161.33	161.33	-
Annual requirement of coal		million kg	1,041.92		33.61	67.22	67.22	67.22	67.22	67.22	-

Table 3.11: Auxiliary Fuel and Water Requirement

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	19	20	21
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	-
Model column counter	Constar	Unit	Total	-	5	6	7	8	19	20	21
AUXILIARY FUEL REQUIREMENT											
Auxiliary fuel consumption	3.50	ml/kwh	-								
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	-
Requirement of furnace oil		ml/kwh			3.50	3.50	3.50	3.50	3.50	3.50	-
MW to KWH convertion factor	0.0010	factor	-								
Number of monthes per year	12	month	-								
Gross energy generation (Corex +Coal)	-	million kwh	30,007.38	-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	-
Annual requirement of furnace oil		million litre	8.75		0.28	0.56	0.56	0.56	0.56	0.56	-
WATER REQUIREMENT											
Water requirement	0.0049	m3/kwh	-								
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	-
Requirement of water		m3/kwh			0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	-
Gross energy generation (Corex +Coal)	-	million kwh	30,007.38	-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	1,935.96	-
Annual requirement of water		million m3	146.74		4.73	9.47	9.47	9.47	9.47	9.47	-

3.2.7 Electricity Generation and Supply

The base-case investigation assumes that the plant operates at an average of 85% actual plant load factor from the second period of operations until project-end, producing an annual total of 1,935.96 million kWh, minus auxiliary-fuel

consumption equivalent to 6.9% of that total to give a final annual total of 1,802.38 million kWh of power.

Around 70% of annual output—1,173.84 million kWh—is provided to JVSL, with the remaining 628.54 million kWh sold to third-party exclusive consumers, TPEC, in the state of Karnataka. The amount available to TPEC does not account for transmission failures, although these are regular occurrences. However, the wheeling, banking and grid support agreement (WBGSA) makes no reference to such incidents, and we do not take account of any adjustments required in the event of such failures.

Under the terms of agreement with KEB, JTPC cannot engage in the spot-sale of power to TPEC, due to KEB regulations regarding electricity deposits and withdrawals to protect against power shortages.

Table 3.12 presents power plant electricity generation and supply position at an actual plant load factor (APLF) of 85%, a figure known as PAF.

Table 3.12: Electricity Generation and Supply (Millions of kWh)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	4	5	6	7	19	20	21
Construction period				-	1	1	-	-	-	-	-
Operation period				-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	4	5	6	7	19	20	21
Gross energy generation (Corex +Coal)											
Total energy generation with corex gas	-	million kwh	27,506.77	-	-	887.32	1,774.63	1,774.63	1,774.63	1,774.63	-
Total energy generation with coal	-	million kwh	2,500.62	-	-	80.67	161.33	161.33	161.33	161.33	-
Gross energy generation (Corex +Coal)		million kwh	30,007.38		-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	-
Auxiliary energy consumption											
Auxiliary consumption	6.90%	%of generation	-								
Gross energy generation (Corex +Coal)	-	million kwh	30,007.38	-	-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	-
Annual auxiliary energy consumption		million kwh	2,070.51		-	66.79	133.58	133.58	133.58	133.58	-
Energy available for supply											
Gross energy generation (Corex +Coal)	-	million kwh	30,007.38	-	-	967.98	1,935.96	1,935.96	1,935.96	1,935.96	-
Annual auxiliary energy consumption	-	million kwh	2,070.51	-	-	66.79	133.58	133.58	133.58	133.58	-
Total energy available for supply		million kwh	27,936.87		-	901.19	1,802.38	1,802.38	1,802.38	1,802.38	-
Energy sold to JVSL											
Total energy available for supply	-	million kwh	27,936.87	-	-	901.19	1,802.38	1,802.38	1,802.38	1,802.38	-
Annual energy available for TPECs	-	million kwh	9,428.08	-	-	-	628.54	628.54	628.54	628.54	-
Annual energy sold to JVSL		million kwh	18,508.79		-	901.19	1,173.84	1,173.84	1,173.84	1,173.84	-
Energy available for TPECs											
Total energy available for supply	-	million kwh	27,936.87	-	-	901.19	1,802.38	1,802.38	1,802.38	1,802.38	-
Annual Energy required by JVSL	-	million kwh	18,781.44	-	-	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	-
Annual energy available for TPECs		million kwh	9,428.08		-	-	628.54	628.54	628.54	628.54	-
Opening balance ("OB")		million kwh			-	-	-	50.00	50.00	50.00	-
[Commitment to TPECs, (drawdawn)]	-	million kwh	-	-	-	-	565.00	565.00	565.00	565.00	-
Energy supplied through JVSL	-	million kwh	9,428.08	-	-	-	628.54	628.54	628.54	628.54	-
Annual banking fee	-	million kwh	90.00	-	-	-	6.00	6.00	6.00	6.00	-
Excess (drawdawn) from KEB	-	million kwh	-	-	-	-	0	0	0	0	-
Closing balance ("CB")		million kwh			-	-	57.54	107.54	107.54	107.54	-

3.2.8 Fuel Prices

JTPC is committed to the provision of Corex gas volumes totalling 960 million m3 per annum, while JVSL provides coal stock of 200,000 MT per annum. The required Corex gas heat content is between 1,600 kcal/Nm3 and 1,900 kcal/Nm3, while the required coal heat content is between 5,000 kcal/kg and 7,000 kcal/kg. The coal stock cost is assessed by ICICI, with annual cost of coal stock transportation including carpet-loss (misfortune included) is expected to be 1.5% of total stock value annually. Corex gas dust must be below 5 mg per Nm3, and the plant should operate for 11 months of the year with Corex gas and one month with coal. Under the

fuel-supply agreement, auxiliary fuel is excluded as an expense (see Tables 3.13 and 3.14).

Table 3.13: Coal Price at the Plant (Nominal, Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	18	19	20
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	5	6	7	8	18	19	20
Coal price (Nominal, Rs CIF, Madras)											
Coal price	-	USD CIF, Madras	-	-	72.25	74.78	77.39	80.10	112.99	116.95	121.04
Expected nominal exchange rate	-	n. Rs/USD	-	-	41.50	43.30	45.18	47.15	72.16	75.30	78.57
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Coal price		Rs CIF,Madras			2,997.97	3,237.81	3,496.84	3,776.58	8,153.36	8,805.63	9,510.08
Tariff (Nominal, Rs)											
Import duty on coal	22%	% of CIF	-								
Tariff		% of CIF			659.55	712.32	769.30	830.85	1,793.74	1,937.24	2,092.22
Freight & handling (Nominal, Rs)											
Freight & handling from port to power plant	4%	% of CIF	-								
Freight & handling		% of CIF			119.92	129.51	139.87	151.06	326.13	352.23	380.40
Countervaling duty (Nominal, Rs)											
Counter vailing duty (CVD)	10%	% of m.v	-								
Countervaling duty		Rs			377.74	407.96	440.60	475.85	1,027.32	1,109.51	1,198.27
Sales tax (Nominal, Rs)											
Sales tax, (inclusive of excise duty) ts	4%	%	-								
Sales tax		Rs			166.21	179.50	193.86	209.37	452.02	488.18	527.24
Cost at the plant (Nominal, Rs)											
Cost at the plant		Rs	131,043.32		4,321.40	4,667.11	5,040.48	5,443.72	11,752.58	12,692.79	13,708.21
Heat content of coal	6,000	kcal/kg	-								
Calorific value of coal		kcal/kg			6,000	6,000	6,000	6,000	6,000	6,000	6,000
Kg to gram conversion factor	1,000	factor	-								
Kcal to million Kcal conversion factor	1,000,000	factor	-								
Cost at the plant		Rs/million kcal	21,840.55		720.23	777.85	840.08	907.29	1,958.76	2,115.46	2,284.70
Coal delivered											
Annual requirement of coal	-	million kg	1,041.92	-	33.61	67.22	67.22	67.22	67.22	67.22	67.22
Annual Energy delivered (coal)		million/kcal	6,251,537.5		201,662.5	403,325.0	403,325.0	403,325.0	403,325.0	403,325.0	403,325.0
Monthly Energy delivered (coal)		million/kcal	520,961.46		16,805.21	33,610.42	33,610.42	33,610.42	33,610.42	33,610.42	33,610.42

Table 3.14: Corex Delivered, Financial Cost of Coal Stock, Fuel Price (Rs per kWh)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	18	19	20
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	5	6	7	8	18	19	20
Corex gas delivered											
Heat content of corex gas	1,830	kcal/Nm3	-								
Calorific value of corex gas		kcal/Nm3			1,830.00	1,830.00	1,830.00	1,830.00	1,830.00	1,830.00	1,830.00
Annual requirement of corex gas	-	million Nm3	35,022.27	-	1,129.75	2,259.50	2,259.50	2,259.50	2,259.50	2,259.50	2,259.50
Annual Energy delivered (corex gas)		million/kcal	64,090,762.5		2,067,443.95	4,134,887.90	4,134,887.90	4,134,887.90	4,134,887.90	4,134,887.90	4,134,887.90
Monthly Energy delivered (corex gas)		million/kcal	5,340,896.87		172,287.00	344,573.99	344,573.99	344,573.99	344,573.99	344,573.99	344,573.99
Financing cost,coal stock (Nominal, million Rs)											
Stock of coal to be maintained by JVSL	200,000	MT	-								
Coal stocking charge, financing cost of coal stock	17.62%	%	-								
Million Kcal to Kcal conversion factor	0.000001	factor	-								
Cost at the plant	-	Rs	131,043.32	-	4,321.40	4,667.11	5,040.48	5,443.72	11,752.58	12,692.79	13,708.21
Annual Financing cost,coal stock		Rs'000000s	4,618.70		152.31	164.50	177.65	191.87	414.23	447.36	483.15
Monthly Financing cost,coal stock		Rs'000000s	384.89		12.69	13.71	14.80	15.99	34.52	37.28	40.26
Carpet losses,coal stock (Nominal, million Rs)											
Carpet losses	1.50%	% of stok.v	-								
Annual Carpet losses,coal stock		Rs'000000s	393.13		12.96	14.00	15.12	16.33	35.26	38.08	41.12
Monthly Carpet losses,coal stock		Rs'000000s	32.76		1.08	1.17	1.26	1.36	2.94	3.17	3.43
Fuel price as per FSA (Rs/million kcal)											
Corex gas (premium over the coal price), (sensitivity analysis)	20%	%	-								
Fuel price as per FSA		Rs/million kcal			851.48	919.60	993.16	1,072.62	2,315.70	2,500.96	2,701.03
Fuel price as per FSA (Rs/kwh)											
Heat rate for energy charge (coal & corex gas), kilojoules/kwh	10,500	kj/kwh	-								
Number of kcal per kilojoule	0.2388	unit	-								
Fuel price as per FSA	-	Rs/million kcal	-	-	851.48	919.60	993.16	1,072.62	2,315.70	2,500.96	2,701.03
Fuel price as per FSA		Rs/kwh			2.13	2.31	2.49	2.69	5.81	6.27	6.77
Fuel price, FSA (1st year Financial price level)											
Domestic Price Index	-	index	-	-	1.36	1.47	1.59	1.71	3.70	4.00	4.32
Fuel prices		Rs/kwh			1.57	1.57	1.57	1.57	1.57	1.57	1.57

3.2.9 Tariff

The power tariff is calculated according to the power purchase agreement (PPA), on the basis of the capacity charge (CC) and energy charge (EC). As agreed in the PPA, EC is fixed at Rs 1.69 per kWh, and also capacity charge (CC) of Rs 1.88 kWh in the fifth financial year, Rs 1.45 kWh in the sixth financial year, Rs 1.38 kWh in seventh financial year and Rs 1.22 in the last year of operations. Such variability in the CC reflects changes in interest payments, corporate tax payable and inflation. However, such steep fluctuations would unsettle buyers, especially those for whom power is a significant input (see table 3.15).

Table 3.15: Energy Charge and Capacity Charge per PPA

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	2	3	4	5	6	7	19	20
Construction period				-	1	1	1	1	-	-	-	-
Operation period				-	-	-	-	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	2	3	4	5	6	7	19	20
ENERGY CHARGE												
Auxiliary consumption	6.90%	%of generation	-									
Fuel price as per FSA	-	Rs/million kcal	-	-	-	-	-	851.48	919.60	993.16	2,500.96	2,701.03
Energy charge, PPA		Rs/million kcal			-	-	-	914.58	987.75	1,066.77	2,686.31	2,901.22
Heat rate for energy charge (coal & corex gas), kilojoules/kwh	10,500	kj/kwh	-									
Number of kcal per kilojoule	0.2388	unit	-									
Million Kcal to Kcal conversion factor	0.000001	factor	-									
Energy charge as per PPA (Nominal)		Rs/kwh			-	-	-	2.29	2.48	2.67	6.74	7.27
Energy charge as per PPA (Real)		r.Rs/kwh			-	-	-	1.69	1.69	1.69	1.69	1.69
CAPACITY CHARGE												
Total Interest expenses on loan	-	Rs'000000s	-	-	-	-	-	-	1,277.14	1,209.13	-	-
Depreciation expenses		Rs000000s			-	-	-	741.48	800.80	864.86	2,409.00	2,601.72
Operation & maintenance costs	2.50%	%	-									
Total investment cost (Real, million Rs)	-	Rs'000000s	11,948.30	-	1,800.00	3,330.00	3,989.30	1,029.00	-	-	-	-
Operation & maintenance expenses		Rs'000000s			-	-	-	406.39	438.90	474.01	1,193.64	1,289.13
Real Exchange rate, Rs/US $ (1st year financial price level)	35.00	r. Rs/USD	-									
Guaranteed return on equity (in dollars)	17%	nominal	-									
[Jindal's equity contribution]	-	Rs'000000s	1,800.00	-	900.00	-	-	-	-	-	-	-
[Tractbel's equity contribution]	-	Rs'000000s	1,800.00	-	900.00	-	-	-	-	-	-	-
Expected nominal exchange rate	-	n. Rs/USD	-	-	36.52	38.11	39.77	41.50	43.30	45.18	75.30	78.57
Return on equity		Rs'000000s			-	-	-	723.66	755.12	787.95	1,313.11	1,370.20
Income Tax	-	Rs'000000s	23,881.22	-	-	-	-	-	-	-	3,699.59	3,995.56
Total energy available for supply	-	million kwh	27,936.87	-	-	-	-	901.19	1,802.38	1,802.38	1,802.38	1,802.38
Capacity charge		Rs/kwh			-	-	-	2.08	1.82	1.85	4.78	5.14
Capacity charge (Real)		Rs/kwh			-	-	-	1.53	1.24	1.17	1.20	1.19
Capacity charge at 68.5%PLF		Rs/kwh			-	-	-	1.88	1.45	1.38	1.19	1.22

The levelized capacity charge (CC) is calculated by separating the PV of capacity expenses from the PV of aggregate electricity produced at a plant load factor of 68.5%, using the discount rate of 10.5%, which is almost same with as the Indian economic cost of capital and rate of return to the domestic equity holders.

The levelized CC at the first financial price level is Rs 1.35 per kWh. The adjusted levelized CC when power-plant operations exceed 68.5% APLF is Rs 1.38 per kWh, providing a 70% annual return on equity at 85% APLF (see table 3.16).

Table 3.16: Levelized Capacity Charge and Adjustment Capacity Charge

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	18	19	20
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	5	6	7	8	18	19	20
Capacity charge at 68.5%PLF		Rs/kwh			1.88	1.45	1.38	1.45	1.18	1.19	1.22
Unit energy		kwh			1.00	1.00	1.00	1.00	1.00	1.00	1.00
PV of tariff at 68.5% PLF											
Discount rate at 68.5% PLF	10.50%	factor	-								
PV of tariff @68.5% PLF	10.26	Rs/kwh									
PV of unit kwh at 68.5% PLF											
PV of unit kwh @68.5% PLF	7.60	Rs/kwh									
Levelized capacity charge (Real)											
Total operations year	16	year	-								
Levelized capacity charge (Real)	1.35	Rs/kwh									
Levelized capacity charge (Real) (sensitivity analysis)	1.35	Rs/kwh	-								
Adjustments capacity charge (Real,Rs)											
Plan load factor(NPLF) at break-even price=fixed cost(sensitivity analysis)	68.50%	%	-								
Incentive for each % point of PLF greater than 68.5%(sensitivity analysis)	0.70	unit of %PLF	-								
Guaranteed return on equity (in dollars)	16.96%	nominal	-								
Expected, PLF	-	% /kwh	-	-	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Operation period flag	-	flag	16.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. capacity charge (Real)		r.Rs/kwh			1.38	1.38	1.38	1.38	1.38	1.38	1.38
Tariff,JVSL, (Real,Rs ,1st year financial price level)											
Energy charge as per PPA (Real)	-	r.Rs/kwh	-	-	1.69	1.69	1.69	1.69	1.69	1.69	1.69
Adj. capacity charge (Real)	-	r.Rs/kwh	-	-	1.38	1.38	1.38	1.38	1.38	1.38	1.38
Tariff, JTCL (Real)		r.Rs/kwh			3.06	3.06	3.06	3.06	3.06	3.06	3.06

The long-term (minor) expense of providing power to industrial users in Karnataka is evaluated at Rs 2.73kWh based on the first financial price level (ICICI, 1995b). According to analysis of the base case, the price of electricity supplied to third-party exclusive consumers (TPECs) in the state of Karnataka is almost equal to the price of electricity provided by the Karnataka Electricity Board (KEB). The average tariff is Rs 2.10 per kWh for industrial users based on the first financial price level, which is less than the market price (see table 3.17).

Table 3.17: Adjustment Tariff for JTPC and Industrial Users (Real, Rs per kWh)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	18	19	20
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	5	6	7	8	18	19	20
Adjustment tariff for (TPEC and Industrial users), (Real ,Rs/kwh)											
Adj. tariff for TPEC (Real)		r.Rs/kwh			2.10	2.10	2.10	2.10	2.10	2.10	2.10
Unadj. tariff for TPEC (Real)		r.Rs/kwh			2.10	2.10	2.10	2.10	2.10	2.10	2.10
Adj. tariff, industrial users (Real)		r.Rs/kwh			2.10	2.10	2.10	2.10	2.10	2.10	2.10
Regulated electricity price to select industrial users	2.10	r.Rs/kwh	-								
Structural adjustment growth rate in electricity price (sensitivity analysis)	0.00%	%	-								
Operation period flag	-	flag	16.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Unadj. tariff, industrial users, (Real)		r.Rs/kwh			2.10	2.10	2.10	2.10	2.10	2.10	2.10
Marginal cost for the industrial users (1st year price)	2.73	r.Rs/kwh	-								
Operation period flag	-	flag	16.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Marginal cost for the industrial users (1st year price)		r.Rs/kwh			2.73	2.73	2.73	2.73	2.73	2.73	2.73

3.2.10 Operation Costs

3.2.10.1 Operation and Maintenance Costs

Based on the first financial year price level, we expected an investment cost of 2.5%, for spare parts and repair materials (85%) and labour (15%) (see Table 3.18).

Table 3.18: Operation and Maintenance Costs (Nominal, Million Rs)

Cost of fuel (coal + corex) to JTPC											
Cost of coal as fuel	-	Rs'000000s	10,272.64	-	172.22	371.99	401.75	433.89	936.74	1,011.68	1,092.62
Cost of corex gas as fuel	-	Rs'000000s	112,999.07	-	1,894.41	4,091.93	4,419.29	4,772.83	10,304.19	11,128.52	12,018.80
Cost of fuel (coal + corex) to JTPC		Rs'000000s	123,271.71		2,066.63	4,463.93	4,821.04	5,206.73	11,240.93	12,140.20	13,111.42
Cost of auxiliary fuel											
Price of furnace oil	-	Rs/litre	-	-	4.76	5.14	5.55	6.00	12.95	13.99	15.10
Annual requirement of furnace oil	-	million litre	8.75	-	0.28	0.56	0.56	0.56	0.56	0.56	0.56
Cost of auxiliary fuel		Rs'000000s	80.19		1.34	2.90	3.14	3.39	7.31	7.90	8.53
Cost of cooling water											
Water price	-	Rs/m3	-	-	4.08	4.41	4.76	5.14	11.10	11.99	12.95
Annual requirement of water	-	million m3	146.74	-	4.73	9.47	9.47	9.47	9.47	9.47	9.47
Cost of cooling water		Rs'000000s	1,152.37		19.32	41.73	45.07	48.67	105.08	113.49	122.57
Cost of O &M (labor, spare parts, overhead..)											
share of labor											
Operation & maintenance costs	2.5%	%	-								
a-Share of labor	15%	%	-								
Total investment cost (Real, million Rs)	-	Rs'000000s	11,948.30	-	1,029.00	-	-	-	-	-	-
Domestic Price Index	-	index	-	-	1.36	1.47	1.59	1.71	3.70	4.00	4.32
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
share of labor		Rs'000000s	1,848.51		60.96	65.83	71.10	76.79	165.78	179.05	193.37
share of material											
Operation & maintenance costs	2.5%	%	-								
b-Share of material	85%	%	-								
Total investment cost (Real, million Rs)	-	Rs'000000s	11,948.30	-	1,029.00	-	-	-	-	-	-
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Share of material		Rs'000000s	10,474.92		345.43	373.06	402.91	435.14	939.44	1,014.59	1,095.76
Cost of O &M (labor, spare parts, overhead..)		Rs'000000s	12,323.43		406.39	438.90	474.01	511.93	1,105.22	1,193.64	1,289.13

3.2.10.2 Wheeling, Banking and Grid Support Fees

The project pays wheeling expenses at a rate of 10% of the total estimated power consumed by final-connection TPECs. The wheeling, banking and grid support agreement (WBGSA) does not account for transmission and distribution losses. However, a penalty charge of 50% of relevant power tariffs is levied if KEB is required to make up for deficiencies in delivery duties to final connections. JVSL discounts the wheeling expense to the project but does not pay any penalty.

Under WBGSA licenses, the power plant must store at least 50 million kWh of power each month with KEB. The banking charge is equivalent to 1% of the 50 million kWh. A statement regarding energy stores, withdrawals and deposits is produced for monthly closing and opening balances.

JTPC pays Rs 14.60 million per year to KEB in grid support charges, the cost of which is refunded to JTPC by JVSL and balanced each year to account for domestic inflation (see table 3.19).

Table 3.19: Wheeling, Banking and Grid Support Fees (Nominal, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	5	6	7	8	18	19	20
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	5	6	7	8	18	19	20
Penalty payment											
Penalty payment over the applicable price	50%	%	-								
Excess (drawdawn) from KEB	-	million kwh	-	-	-	0	0	0	0	0	0
Electricity price for TPEC	-	Rs/kwh	-	-	2.86	3.09	3.33	3.60	7.77	8.39	9.06
Penalty payment		Rs'000000s	-		0	0	0	0	0	0	0
Banking & grid support fee											
Grid support payment	14.60	Rs'000000s	-								
Annual banking fee	-	million kwh	90.00	-	0	6.00	6.00	6.00	6.00	6.00	6.00
Adj. tariff for TPEC (Real)	-	r.Rs/kwh	-	-	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Domestic Price Index	-	index	-	-	1.36	1.47	1.59	1.71	3.70	4.00	4.32
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Banking & grid support fee		Rs'000000s	1,105.02		19.86	39.97	43.16	46.62	100.64	108.69	117.39
Cost of coal to JVSL											
Carpet losses	1.50%	% of stok.v	-								
Annual requirement of coal	-	million kg	1,041.92	-	33.61	67.22	67.22	67.22	67.22	67.22	67.22
Cost at the plant	-	Rs	131,043.32	-	4,321.40	4,667.11	5,040.48	5,443.72	11,752.58	12,692.79	13,708.21
Kg to gram conversion factor	1,000	factor	-								
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost of coal to JVSL		Rs'000000s	8,795.53		147.46	318.50	343.99	371.50	802.05	866.21	935.51
Avoided Cash Outflow to JVSL											
Electricity price for TPEC	-	Rs/kwh	-	-	2.86	3.09	3.33	3.60	7.77	8.39	9.06
Annual energy sold to JVSL	-	million kwh	18,508.79	-	901.19	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84	1,173.84
Avoided Cash Outflow to JVSL		Rs'000000s	100,919.35		2,574.72	3,621.99	3,911.75	4,224.69	9,120.78	9,850.44	10,638.48

3.2.11 Working Capital

Electricity customers in India are billed at intervals of between one and six months. Accounts receivable is expected to be 12% of sales revenue, equivalent to a 45-day delay in instalments. The cash balance and accounts payable is estimated to be 8.33% of recurring costs, comparable to a one-month delay in instalments—figures used to build income models from the perspectives of JTPC, JVSL and KEB (see Tables 3.20, 3.21, 3.22, 3.23).

Table 3.20: Working Capital

WORKING CAPITAL		
Accounts receivable (sensitivity analysis)	12%	% of sale rev
Accounts payable (sensitivity analysis)	8.33%	% of recu cost
Cash balance	8.33%	% of recu cost

Table 3.21: Change in Working Capital for JTPC (Nominal, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	4	5	6	7	19	20	21
Construction period				-	1	1	-	-	-	-	-
Operation period				-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	4	5	6	7	19	20	21
Working capital for JTPC											
ACCOUNTS RECEIVABLE											
Accounts receivable (sensitivity analysis)	12%	% of sale rev	-								
Total Cash Inflows for JTPC	-	Rs'000000s	283,369.90	-	-	3,774.97	10,282.49	11,121.76	28,006.47	30,246.99	-
Accounts Receivables		Rs'000000s			-	453.00	1,233.90	1,334.61	3,360.78	3,629.64	-
ACCOUNTS PAYABLE											
Accounts payable (sensitivity analysis)	8.33%	% of recu cost	-								
[Total Cash Outflows for JTPC]	-	Rs'000000s	185,938.34	-	-	2,341.33	6,746.93	7,303.35	18,391.08	19,862.37	-
Accounts Payable		Rs'000000s			-	195.03	562.02	608.37	1,531.98	1,654.54	-
CASH BALANCE											
Cash balance	8.33%	% of recu cost	-								
[Total Cash Outflows for JTPC]	-	Rs'000000s	185,938.34	-	-	2,341.33	6,746.93	7,303.35	18,391.08	19,862.37	-
Total Margin Money for Working Capital(nominal price)	-	Rs000000s	232.79	-	232.79	-	-	-	-	-	-
Cash Balance		Rs'000000s			232.79	195.03	562.02	608.37	1,531.98	1,654.54	-
MOVEMENT IN WORKING CAPITAL											
Accounts Receivables	-	Rs'000000s	-	-	-	453.00	1,233.90	1,334.61	3,360.78	3,629.64	-
Changes in Accounts Receivables A/R JTPC		Rs'000000s			-	(453.00)	(780.90)	(100.71)	(248.95)	(268.86)	3,629.64
Accounts Payable	-	Rs'000000s	-	-	-	195.03	562.02	608.37	1,531.98	1,654.54	-
Changes in Accounts Payable A/P JTPC		Rs'000000s			-	(195.03)	(366.99)	(46.35)	(113.48)	(122.56)	1,654.54
Cash Balance	-	Rs'000000s	-	-	232.79	195.03	562.02	608.37	1,531.98	1,654.54	-
Margin Money for Working Capital period flag	-	flag	1	-	1.0	-	-	-	-	-	-
Changes in Cash Balance C/B JTPC		Rs'000000s			-	(37.76)	366.99	46.35	113.48	122.56	(1,654.54)

Table 3.22: Change in Working Capital for JVSL (Nominal, Million Rs)

					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Model period ending											
Financial year ending				-	5	6	7	8	19	20	21
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	5	6	7	8	19	20	21
Working capital for JVSL											
ACCOUNTS RECEIVABLE											
Total Revunue from (Coal + Corex)	-	Rs'000000s	123,271.71	-	2,066.63	4,463.93	4,821.04	5,206.73	12,140.20	13,111.42	-
[Total Cash Outflows for JTPC]	-	Rs'000000s	185,938.34	-	2,341.33	6,746.93	7,303.35	7,887.62	18,391.08	19,862.37	-
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	-
Accounts Receivables		Rs'000000s			0.88	0.66	0.66	0.66	0.66	0.66	-
ACCOUNTS PAYABLE											
Accounts payable (sensitivity analysis)	8.33%	% of recu cost	-								
Cost of coal to JVSL	-	Rs'000000s	8,795.53	-	147.46	318.50	343.99	371.50	866.21	935.51	-
Accounts payable (due to coal)		Rs'000000s			12.28	26.53	28.65	30.95	72.16	77.93	-
MOVEMENT IN WORKING CAPITAL											
Accounts Receivables	-	Rs'000000s	-	-	0.88	0.66	0.66	0.66	0.66	0.66	-
Changes in Accounts Payable A/P JTPC	-	Rs'000000s	-	-	(195.03)	(366.99)	(46.35)	(48.67)	(113.48)	(122.56)	1,654.54
Last model period flag	-	flag	1.00	-	-	-	-	-	-	-	1.00
Changes in Accounts Receivables A/R of JVSL due to JTPC		Rs'000000s			(172.15)	(242.81)	(30.60)	(32.13)	(74.91)	(80.90)	1,092.18
Accounts payable (due to coal)	-	Rs'000000s	-	-	12.28	26.53	28.65	30.95	72.16	77.93	-
Changes in Accounts Payable A/P (Due to coal)		Rs'000000s			(12.28)	(14.25)	(2.12)	(2.29)	(5.34)	(5.77)	77.93
Changes in Accounts Receivables A/R JTPC	-	Rs'000000s	-	-	(453.00)	(780.90)	(100.71)	(106.77)	(248.95)	(268.86)	3,629.64
Changes in Accounts Payable A/P (Due to coal)	-	Rs'000000s	-	-	(12.28)	(14.25)	(2.12)	(2.29)	(5.34)	(5.77)	77.93
Changes in Accounts Payable A/P of JVSL due to JTPC		Rs'000000s			(465.28)	(795.15)	(102.83)	(109.06)	(254.29)	(274.63)	3,707.57

Table 3.23: Change in Working Capital for KEB (Nominal, Million Rs)

					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Model period ending											
Financial year ending				-	5	6	7	8	19	20	21
Construction period				-	1	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	5	6	7	8	19	20	21
Working capital for KEB											
ACCOUNTS RECEIVABLE											
Accounts receivable (sensitivity analysis)	12%	% of sale rev	-								
Total Cash Inflows for KEB	-	Rs'000000s	6,724.14	-	19.86	232.06	267.28	288.66	673.06	726.91	-
Accounts Receivables (due to JTPC)		Rs'000000s			2.38	27.85	32.07	34.64	80.77	87.23	-
MOVEMENT IN WORKING CAPITAL											
Accounts Receivables (due to JTPC)	-	Rs'000000s	-	-	2.38	27.85	32.07	34.64	80.77	87.23	-
Changes in Accounts Receivables A/R of KEB (due to JTPC)		Rs'000000s			(2.38)	(25.46)	(4.23)	(2.57)	(5.98)	(6.46)	87.23

3.2.12 Unit Costs and Prices

A summary of unit costs and prices is presented in Table 3.24.

Table 3.24: Unit Costs and Prices (Nominal, Rs)

					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Model period ending					5	6	7	8	18	19	20
Financial year ending				-	1	-	-	-	-	-	-
Construction period				-	1	1	1	1	1	1	1
Operation period				-	1	2	3	4	18	19	20
Model column counter	Constant	Unit	Total	-							
Price of electricity for JVSL											
Tariff, JTCL (Real)	-	r.Rs/kwh	-	-	3.06	3.06	3.06	3.06	3.06	3.06	3.06
Electricity price for JVSL		Rs/kwh			4.17	4.50	4.86	5.25	11.33	12.24	13.22
Price of electricity for TPEC											
Adj. tariff for TPEC (Real)	-	r.Rs/kwh	-	-	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Electricity price for TPEC		Rs/kwh			2.86	3.09	3.33	3.60	7.77	8.39	9.06
Price of electricity for KEB											
Adj. tariff, industrial users (Real)	-	r.Rs/kwh	-	-	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Electricity price for KEB		Rs/kwh			2.86	3.09	3.33	3.60	7.77	8.39	9.06
Price of water											
Water	3	Rs/m3	-								
Operation period flag	-	flag	16	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Water price		Rs/m3			4.08	4.41	4.76	5.14	11.10	11.99	12.95
Price of furnace oil											
Auxiliary fuel consumption	3.50	ml/kwh	-								
Price of furnace oil		Rs/litre			4.76	5.14	5.55	6.00	12.95	13.99	15.10
Wheeling charge to KEB											
Wheeling charges	10%	%of TPEC.e.pur	-								
Electricity price for TPEC	-	Rs/kwh	-	-	2.86	3.09	3.33	3.60	7.77	8.39	9.06
Full capacity energy generation period flag	-	flag	15	-	-	1.00	1.00	1.00	1.00	1.00	1.00
Wheeling charges to KEB		Rs/kwh			-	0.31	0.33	0.36	0.78	0.84	0.91

3.2.13 Financial Indicators

Using data for operational and maintenance costs, investment costs and assumptions for working capital, we can build cash-flow statements from each stakeholder's point of view, taking account of liquidation values, debt requirement (interest and principal) and tax payable. The liquidation of capital is calculated by deducting total deterioration from underlying book values. Debt requirements are assessed in terms of PMT capacity, while corporate tax payments include the effects of a fall in the value of the rupee as per standard reimbursements of foreign equity. Each perspective takes account of synopsis insights, such as NPV, IRR, ADSCR and LLCR.

The evaluation of net present value (NPV) depends on the rate of return applicable to each perspective. The real rate of return for the foreign partner is about 12%

(reducing the 16% nominal rate of return for foreign investors in India's electricity sector by 3.5% to take account of US inflation). However, the real rate of return to domestic partners JVSL and KEB is lower than the 10.5% foreign real rate of return, which is almost equivalent to India's economic opportunity cost of capital. The rate of return for foreign and domestic partners is estimated at 11.3%.

3.2.13.1 Cash Flow Statement from Bank's Perspective (Total Investment)

Tables 3.25 and 3.26 present the cash-flow statement from the bank's point of view (total investment) in nominal and real term. In addition to standard inflows and outflows of cash presented in a non-specific cash-flow statement, we investigate the wheeling fee, banking fee and grid support fee as inflows and outflows, on the grounds that JVSL discounts these project inputs based on WBGSA. Subsequent cash-flow statements to be presented from each perspective (JVSL, JTPC and KEB) will be established by including or excluding lines from the bank's cash-flow statement.

Table 3.25: Cash Flow Statement from Bank's Point of View (Total Investment) (Nominal, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	8	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	8	20	21
RECEIPTS														
Electricity sale to JVSL	-	Rs'000000s	147,185.87	-	-	-	-	-	3,755.10	5,282.49	5,705.09	6,161.50	15,515.69	-
Electricity sales through JVSL to TPECs	-	Rs'000000s	76,800.75	-	-	-	-	-	-	2,828.54	3,054.82	3,299.21	8,307.96	-
Sales revenue to JVSL from TPECs	-	Rs'000000s	52,659.14	-	-	-	-	-	-	1,939.41	2,094.57	2,262.13	5,696.43	-
Banking & grid support fee	-	Rs'000000s	1,105.02	-	-	-	-	-	19.86	39.97	43.16	46.62	117.39	-
Wheeling charge to KEB	-	Rs'000000s	5,619.12	-	-	-	-	-	-	192.09	224.12	242.05	609.52	-
Changes in Accounts Receivables A/R JTPC	-	Rs'000000s	-	-	-	-	-	-	(453.00)	(780.90)	(100.71)	(106.77)	(268.86)	3,629.64
Liquidation Value														
Liquidation vallue of land include inflation		Rs'000000s	65.25		-	-	-	-	-	-	-	-	-	65.25
Liquidation value of Plant (Buildings &Civil Works)		Rs'000000s	1,791.40		-	-	-	-	-	-	-	-	-	1,791.40
Liquidation value of Machinary & Equipment		Rs'000000s	7,439.22		-	-	-	-	-	-	-	-	-	7,439.22
Date of Depreciate miscellaneous fixed asset			2.72		-	-	-	-	-	-	-	-	-	-
Liquidation vallue of Miscellaneous Fixed Assets		Rs'000000s	738.64		-	-	-	-	-	-	-	-	-	738.64
Total Cash Inflows (nominal)		**Rs'000000s**	**293,404.41**		-	-	-	-	**3,321.97**	**9,501.59**	**11,021.0**	**11,904.7**	**29,978.13**	**13,664.15**
EXPENDITURES														
Investment Cost														
Total Preliminary and Pre-operative Expenses	-	Rs'000000s	2,339.34	-	1,329.00	1,010.34	-	-	-	-	-	-	-	-
Total Cost of land	-	Rs'000000s	14.00	-	14.00	-	-	-	-	-	-	-	-	-
Total Engineering, Procurement & Construction Contract	-	Rs'000000s	10,968.21	-	422.00	863.46	3,790.80	4,553.23	1,338.72	-	-	-	-	-
Total Miscellaneous Fixed Assets	-	Rs000000s	499.08	-	35.00	70.20	93.31	239.35	61.22	-	-	-	-	-
Total value of Reinvestment in Miscellaneous Fixed asset	-	Rs000000s	1,077.47	-	-	-	-	-	-	-	-	-	-	-
Total Margin Money for Working Capital	-	Rs000000s	232.79	-	-	-	-	232.79	-	-	-	-	-	-
Operating Costs														
Cost of coal as fuel	-	Rs'000000s	10,272.64	-	-	-	-	-	172.22	371.99	401.75	433.89	1,092.62	-
Cost of corex gas as fuel	-	Rs'000000s	112,999.07	-	-	-	-	-	1,894.41	4,091.93	4,419.29	4,772.83	12,018.80	-
Cost of auxiliary fuel	-	Rs'000000s	80.19	-	-	-	-	-	1.34	2.90	3.14	3.39	8.53	-
Cost of cooling water	-	Rs'000000s	1,152.37	-	-	-	-	-	19.32	41.73	45.07	48.67	122.57	-
Cost of O &M (labor, spare parts, overhead..)	-	Rs'000000s	12,323.43	-	-	-	-	-	406.39	438.90	474.01	511.93	1,289.13	-
Wheeling charge to KEB	-	Rs'000000s	5,619.12	-	-	-	-	-	-	192.09	224.12	242.05	609.52	-
Banking & grid support fee	-	Rs'000000s	1,105.02	-	-	-	-	-	19.86	39.97	43.16	46.62	117.39	-
Penalty payment	-	Rs'000000s	-	-	-	-	-	-	0	0	0	0	0	-
Sales revenue to JVSL from TPECs	-	Rs'000000s	52,659.14	-	-	-	-	-	-	1,939.41	2,094.57	2,262.13	5,696.43	-
Changes in Accounts Payable A/P JTPC	-	Rs'000000s	-	-	-	-	-	-	(195.03)	(366.99)	(46.35)	(48.67)	(122.56)	1,654.54
Changes in Cash Balance C/B JTPC	-	Rs'000000s	-	-	-	-	-	-	(37.76)	366.99	46.35	48.67	122.56	(1,654.54)
Income Tax	-	Rs'000000s	23,881.22	-	-	-	-	-	-	-	-	-	3,995.56	-
Total Cash Outflows (nominal)		**Rs'000000s**	**234,990.30**		**1,800.00**	**1,944.00**	**3,884.11**	**5,025.37**	**3,680.70**	**7,118.93**	**7,705.10**	**8,321.51**	**24,950.55**	-
Net cash flows after tax Without financing (nominal)		Rs'000000s	58,414.11		(1,800.00)	(1,944.00)	(3,884.11)	(5,025.37)	(358.72)	2,382.66	3,315.94	3,583.21	5,027.58	13,664.15

Table 3.26: Cash Flow Statement from Bank's Point of View (Total Investment) (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	8	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	8	20	21
RECEIPTS														
Electricity sale to JVSL		Rs'000000s	56,687.72		-	-	-	-	2,760.11	3,595.17	3,595.17	3,595.17	3,595.17	-
Electricity sales through JVSL to TPECs		Rs'000000s	28,875.82		-	-	-	-	-	1,925.05	1,925.05	1,925.05	1,925.05	-
Sales revenue to JVSL from TPECs		Rs'000000s	19,798.97		-	-	-	-	-	1,319.93	1,319.93	1,319.93	1,319.93	-
Banking & grid support fee		Rs'000000s	422.60		-	-	-	-	14.60	27.20	27.20	27.20	27.20	-
Wheeling charge to KEB		Rs'000000s	2,108.00		-	-	-	-	-	130.73	141.23	141.23	141.23	-
Changes in Accounts Receivables A/R JTPC		Rs'000000s			-	-	-	-	(332.97)	(531.47)	(63.47)	(62.30)	(62.30)	778.73
Liquidation Value														
Liquidation vallue of land		Rs'000000s	14.00		-	-	-	-	-	-	-	-	-	14.00
Liquidation value of Plant (Buildings and Civil Works)		Rs'000000s	384.34		-	-	-	-	-	-	-	-	-	384.34
Liquidation value of Machinary & Equipment		Rs'000000s	1,596.07		-	-	-	-	-	-	-	-	-	1,596.07
Liquidation vallue of Miscellaneous Fixed Assets		Rs'000000s	158.47		-	-	-	-	-	-	-	-	-	158.47
Total Cash Inflows (Real)		**Rs'000000s**	**109,086.94**		**-**	**-**	**-**	**-**	**2,441.75**	**6,466.62**	**6,945.13**	**6,946.29**	**6,946.29**	**2,931.62**
EXPENDITURES														
Investment Cost														
Total Preliminary and Pre-operative Expenses		Rs'000000s	2,264.50		1,329.00	935.50	-	-	-	-	-	-	-	-
Total Cost of land		Rs'000000s	14.00		14.00	-	-	-	-	-	-	-	-	-
Total Engineering, Procurement & Construction Contract		Rs'000000s	9,070.00		422.00	799.50	3,250.00	3,614.50	984.00	-	-	-	-	-
Total Miscellaneous Fixed Assets		Rs'000000s	415.00		35.00	65.00	80.00	190.00	45.00	-	-	-	-	-
Total value of Reinvestment in Miscellaneous Fixed Assets		Rs'000000s	366.84		-	-	-	-	-	-	-	-	-	-
Total Margin Money for Working Capital		Rs'000000s	184.80		-	-	-	184.80	-	-	-	-	-	-
Operating Costs														
Cost of coal as fuel		Rs'000000s	3,924.18		-	-	-	-	126.59	253.17	253.17	253.17	253.17	-
Cost of corex gas as fuel		Rs'000000s	43,165.97		-	-	-	-	1,392.45	2,784.90	2,784.90	2,784.90	2,784.90	-
Cost of auxiliary fuel		Rs'000000s	30.63		-	-	-	-	0.99	1.98	1.98	1.98	1.98	-
Cost of cooling water		Rs'000000s	440.21		-	-	-	-	14.20	28.40	28.40	28.40	28.40	-
Cost of O &M (labor, spare parts, overhead..)		Rs'000000s	4,779.32		-	-	-	-	298.71	298.71	298.71	298.71	298.71	-
Wheeling charge to KEB		Rs'000000s	2,108.00		-	-	-	-	-	130.73	141.23	141.23	141.23	-
Banking & grid support fee		Rs'000000s	422.60		-	-	-	-	14.60	27.20	27.20	27.20	27.20	-
Penalty payment		Rs'000000s	-		-	-	-	-	0	0	0	0	0	-
Sales revenue to JVSL from TPECs		Rs'000000s	19,798.97		-	-	-	-	-	1,319.93	1,319.93	1,319.93	1,319.93	-
Changes in Accounts Payable A/P JTPC		Rs'000000s			-	-	-	-	(143.35)	(249.77)	(29.21)	(28.40)	(28.40)	354.98
Changes in Cash Balance C/B JTPC		Rs'000000s			-	-	-	-	(27.76)	249.77	29.21	28.40	28.40	(354.98)
Income Tax		Rs'000000s	7,312.79		-	-	-	-	-	-	-	-	925.82	-
Total Cash Outflows (Real)		**Rs'000000s**	**94,126.70**		**1,800.00**	**1,800.00**	**3,330.00**	**3,989.30**	**2,705.42**	**4,845.02**	**4,855.52**	**4,855.52**	**5,781.34**	**-**
Net cash flows after tax without financing(Real)		Rs'000000s	14,960.25		(1,800.00)	(1,800.00)	(3,330.00)	(3,989.30)	(263.67)	1,621.60	2,089.60	2,090.77	1,164.95	2,931.62

Project evaluation from a banker's perspective requires an understanding of the contractual agreements that will determine whether a project will be able to meet its loan requirements. This can be established by calculating the annual debt service coverage ratio (ADSCR)—that is, annual net cash flow divided by annual debt repayment. As shown in Table 3.27, ADSCRs indicate that the project would not

meet its debt-service requirements because of a cash shortfall in the tenth financial year of Rs 1.07 million.

Table 3.27: ADSCR and LLCR Analysis (Nominal, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	6	7	8	9	10	11	16	17	18
Construction period				-	-	-	-	-	-	-	-	-	-
Operation period				-	1	1	1	1	1	1	1	1	1
Model column counter	Constant	Unit	Total	-	6	7	8	9	10	11	16	17	18
ADSCR Analysis (Nominal, million Rs)													
ADSCR													
Dividend Payment													
Dividend Payment		Rs'000000s			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash Available for Debt Servicing													
Loan period flag	-	flag	12.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
Cash available for debt servicing		Rs'000000s			2,382.66	3,315.94	3,583.21	3,869.87	3,544.06	3,733.65	3,959.96	4,254.98	-
Debt Repayment													
Debt Repayment		Rs'000000s			1,663.04	1,663.04	2,394.73	3,240.70	3,309.30	3,380.87	1,028.48	1,073.20	-
Annual Debt Service Coverage Ratio ADSCR		**Rs'000000s**			**1.43**	**1.99**	**1.50**	**1.19**	**1.07**	**1.10**	**3.85**	**3.96**	-
LLCR													
Weighted average cost of capital	15.45%	nominal.per.a	-										
Time-line	20	line	-	-	5.00	6.00	7.00	8.00	9.00	10.00	15.00	16.00	17.00
Discounting factors @ WACL		factor			0.49	0.42	0.37	0.32	0.27	0.24	0.12	0.10	0.09
Loan period flag	-	flag	12.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
Discounting factors @ WACL for loan period		factor			0.49	0.42	0.37	0.32	0.27	0.24	0.12	0.10	-
PV of available cash													
Cash available for debt servicing	-	Rs'000000s	-	-	2,382.66	3,315.94	3,583.21	3,869.87	3,544.06	3,733.65	3,959.96	4,254.98	-
Discounting factors @ WACL for loan period	-	factor	-	-	0.49	0.42	0.37	0.32	0.27	0.24	0.12	0.10	-
PV of available cash		Rs'000000s			1,161.60	1,400.23	1,310.58	1,225.98	972.50	887.40	458.85	427.05	-
Present value of debt													
Debt Repayment	-	Rs'000000s	-	-	1,663.04	1,663.04	2,394.73	3,240.70	3,309.30	3,380.87	1,028.48	1,073.20	-
Discounting factors @ WACL for loan period	-	factor	-	-	0.49	0.42	0.37	0.32	0.27	0.24	0.12	0.10	-
Present value of debt		Rs'000000s			810.77	702.25	875.88	1,026.66	908.08	803.55	119.17	107.71	-
Annualized LLCR Annalysis		**Rs'000000s**			**1.51**	**1.52**	**1.46**	**1.46**	**1.53**	**1.70**	**3.90**	**3.96**	-

To establish whether the project generates sufficient cash overall to justify bridge-financing requires a test of project net cash flow using the loan life coverage ratio (LLCR)—that is, the present value of all cash flow divided by present value of all debt repayment from the specific year until the end of the loan period (see equation 3.3). LLCR indicates sufficient project cash flow to serve debt despite individual years in which cash flow is not sufficient to meet debt requirements. The discount rate of 6.9% is derived from real and nominal weighted average cost of the obligation; base LLCR is 1.46 for the ninth financial year; and the greatest LLCR is 3.96, for the last year of the loan repayment.

3.2.13.2 Cash-Flow Statement from Equity Holders' Perspective

Table 3.28 presents the cash-flow statement from the perspective of equity holders JTPC (foreign and domestic partners), on the basis of debt minus loan repayment (interest and principal) in pertinent years for cash inflow and outflow (from Table 3.25). Using an expected rate of return to equity holders of 11.25%, we established a net present value (NPV) of Rs 352.57 million and an internal rate of return (IRR) of 12.33%. We then separated net cash flows to calculate NPV and IRR for each partner separately. For the domestic partner (JTPC) NPV at the point discount rate of 10.5% would be Rs 314.85 million with an IRR of 12.33%. For the foreign partner NPV at the point discount rate of 12% would be USD 1.46 million.

Table 3.28: Cash-flow Statement from Equity Holders Point of View (Real, Million Rs, USD)

						31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
	Model period ending													
	Financial year ending				-	1	2	3	4	5	6	19	20	21
	Construction period				-	1	1	1	1	1	-	-	-	-
	Operation period				-	-	-	-	-	1	1	1	1	-
	Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	19	20	21
Equity Holders (1st year financial price level Rs)														
	Net cash flows after tax without financing(Real)	-	Rs'000000s	14,960.25	-	(1,800.00)	(1,800.00)	(3,330.00)	(3,989.30)	(263.67)	1,621.60	1,164.95	1,164.95	2,931.62
	Loan received end of the year (ICICI)	-	Rs'000000s	5,890.99	-	-	-	2,216.16	2,872.14	802.69	-	-	-	-
	Loan received end of the year (US Eximbank)	-	USD'000000s	82.49	-	-	-	32.14	39.91	10.44	-	-	-	-
	Loan received end of the year (ECB)	-	USD'000000s	29.82	-	-	-	11.63	14.25	3.93	-	-	-	-
	Domestic Price Index	-	index	-	-	1.00	1.08	1.17	1.26	1.36	1.47	4.00	4.32	4.66
	Expected nominal exchange rate	-	n. Rs/USD	-	-	35.00	36.52	38.11	39.77	41.50	43.30	75.30	78.57	81.99
Plus	Loan inflow		Rs'000000s			-	-	3,330.00	3,990.00	1,028.50	-	-	-	-
Less	Repayments (principle + interest) (Real)	-	Rs'000000s	12,586.50	-	-	-	-	-	-	1,131.84	-	-	-
	After tax net cash flow with financing(1st year financial price level)		**Rs'000000s**	**10,722.25**		**(1,800.00)**	**(1,800.00)**	**0.00**	**0.70**	**764.83**	**489.76**	**1,164.95**	**1,164.95**	**2,931.62**
	Expected rate of return on equity holders (domestic + foreign)	11.25%	real.per.a	-										
	NPV equity holders (Real)	**352.57**	**Rs'000000s**											
	NPV bankers (Real)	**(1,051.46)**	**Rs'000000s**											
	NPV loan inflow (Real)	**6,259.40**	**Rs'000000s**											
	NPV repayments(principal+interest)(Real)	**7,438.19**	**Rs'000000s**											
	IRR equity holders(real)	**12.33%**	**rate**											
Domestic Partner JTPC, (1st year financial price level Rs)														
	Domestic partner	50%	%	-										
	After tax net cash flow with financing(1st year financial price level)	-	Rs'000000s	10,722.25	-	(1,800.00)	(1,800.00)	0.00	0.70	764.83	489.76	1,164.95	1,164.95	2,931.62
	Domestic partner net cash flow with financing		Rs'000000s	5,361.12		(900.00)	(900.00)	0.00	0.35	382.41	244.88	582.48	582.48	1,465.81
	Expected rate of return on equity, domestic partner	10.5%	real.per.a	-										
	NPV Domestic partner (Real)	**314.85**	**Rs'000000s**											
	IRR domistic partner (Real)	**12.33%**	**rate**											
Foreign Partner (1st year financial price level USD)														
	Foreign partner	50%	%	-										
	After tax net cash flow with financing (Nominal)	-	Rs'000000s	42,278.37	-	(1,800.00)	(1,944.00)	0.00	0.88	1,040.54	719.62	4,655.17	5,027.58	13,664.15
	Expected nominal exchange rate	-	n. Rs/USD	-	-	35.00	36.52	38.11	39.77	41.50	43.30	75.30	78.57	81.99
	Foreign partner After tax net cash flow with financing (Nominal)		USD'000000s	286.23		(25.71)	(26.61)	0.00	0.01	12.54	8.31	30.91	31.99	83.33
	US Inflation Index	-	index	-	-	1.00	1.04	1.07	1.11	1.15	1.19	1.86	1.92	1.99
	Foreign partner After tax net cash flow with financing (Real)		USD'000000s	153.17		(25.71)	(25.71)	0.00	0.01	10.93	7.00	16.64	16.64	41.88
	Expected rate of return on equity, foreign partner	12.0%	real.per.a	-										
	NPV Foreign partnner (Real)	**1.46**	**USD'000000s**											

3.2.13.3 Cash-flow Statement from JVSL Perspective

Table 3.29 presents the JVSL-perspective cash-flow statement. Cash inflows are derived from the provision of fuel to the project and the sale of electricity to the third party exclusive consumer (TPEC). Cash outflows incorporated/avoided are justified because JVSL was producing 1.25 million tons of steel per year, when JVSL had purchased power from KEB. The cash out flows are instalments JVSL paid for power purchased from JTPC, at a price specified in the PPA. A major cost to JVSL is the import of 200,000MT of coal, as well as the payment of JTPC wheeling charge,

banking and grid support charges. At a return on domestic partner equity of 10.51%, NPV is Rs 5,401.31 million.

Table 3.29: Cash Flow Statement from JVSL Point of View (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	4	5	6	7	8	19	20	21
Construction period				-	1	1	-	-	-	-	-	-
Operation period				-	-	1	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	4	5	6	7	8	19	20	21
Receipts												
Avoided Cash Outflow to JVSL		Rs'000000s	38,868.46		-	1,892.50	2,465.06	2,465.06	2,465.06	2,465.06	2,465.06	-
Sales revenue to JVSL from TPECs		Rs'000000s	19,798.97		-	-	1,319.93	1,319.93	1,319.93	1,319.93	1,319.93	-
Cost of coal as fuel		Rs'000000s	3,924.18		-	126.59	253.17	253.17	253.17	253.17	253.17	-
Cost of corex gas as fuel		Rs'000000s	43,165.97		-	1,392.45	2,784.90	2,784.90	2,784.90	2,784.90	2,784.90	-
Changes in Accounts Receivables A/R of JVSL due to JTPC		Rs'000000s			-	(126.54)	(165.25)	(19.28)	(18.75)	(18.75)	(18.75)	234.33
Total Cash inflows (Real)		Rs'000000s	105,437.14		-	3,285.00	6,657.82	6,803.79	6,804.32	6,804.32	6,804.32	234.33
Cash outflows												
Domestic Price Index	-	index	-	-	1.26	1.36	1.47	1.59	1.71	4.00	4.32	4.66
Expenditures												
Total sales revenue to JTPC		Rs'000000s	85,563.54		-	2,760.11	5,520.23	5,520.23	5,520.23	5,520.23	5,520.23	-
Cost of coal to JVSL		Rs'000000s	3,359.92		-	108.38	216.77	216.77	216.77	216.77	216.77	-
Banking & grid support fee		Rs'000000s	422.60		-	14.60	27.20	27.20	27.20	27.20	27.20	-
Wheeling charge to KEB		Rs'000000s	2,108.00		-	-	130.73	141.23	141.23	141.23	141.23	-
Changes in Accounts Payable A/P of JVSL due to JTPC		Rs'000000s	(979.78)		-	(341.99)	(541.17)	(64.80)	(63.64)	(63.64)	(63.64)	795.45
Total Cash Outflows (Real)		Rs'000000s	90,474.27		-	2,541.10	5,353.76	5,840.63	5,841.79	5,841.79	5,841.79	795.45
Net cash flows to JVSL (Real)		**Rs'000000s**	**14,962.87**		**-**	**743.89**	**1,304.06**	**963.16**	**962.53**	**962.53**	**962.53**	**(561.13)**
Expected rate of return on equity, domestic partner	10.51%	real per a	-									
NPV Domestic partner JVSL (Real)	**5,401.31**	**Rs'000000s**										

3.2.13.4 Cash Flow Statement from KEB Perspective

Table 3.30 presents the cash-flow statement from the KEB point of view. There are no expenses or cash outflows, while cash inflows are derived from wheeling expense (10% of total estimated wheeled power) and banking, grid and support charges of 1%, at the maximum permitted level of power stored with KEB. As indicated in the wheeling, banking and grid support agreement (WBGSA), penalty charges apply when the month-on-month closing balance of power stored with KEB falls below 5 million kWh. At a real discount rate of 10.51%, project NPV from the KEB perspective is Rs 821.98 million, meaning the project would be attractive to the electricity board.

Table 3.30: Cash-flow Statement from KEB Point of View (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	4	5	6	7	8	19	20	21
Construction period				-	1	1	-	-	-	-	-	-
Operation period				-	-	1	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	4	5	6	7	8	19	20	21
Cash inflows												
Domestic Price Index	-	index	-	-	1.26	1.36	1.47	1.59	1.71	4.00	4.32	4.66
RECEIPTS												
Wheeling charge to KEB		Rs'000000s	2,108.00		-	-	130.73	141.23	141.23	141.23	141.23	-
Banking & grid support fee		Rs'000000s	422.60		-	14.60	27.20	27.20	27.20	27.20	27.20	-
Penalty payment		Rs'000000s	-		-	-	-	-	-	-	-	-
Changes in Accounts Receivables A/R of KEB (due to JTPC)		Rs'000000s			-	(1.75)	(17.33)	(2.66)	(1.50)	(1.50)	(1.50)	18.71
Total cash inflows KEB (Real)		Rs'000000s	2,508.10		-	12.85	140.60	165.77	166.94	166.94	166.94	18.71
NPV												
Expected rate of return on equity, domestic partner	10.51%	real.per.a	-									
NPV of KEB (Real)	**821.98**	**Rs'000000s**										

3.2.14 Financial Analysis Results

JVSL is owned by Jindal Group, promoter and domestic investors JTPC, and Jindal groups. As a rule, domestic investors would be expected to be more interested in the project's overall (financial and economical) net gain to Jindal but not JTPC. With an NPV of 5,716.16 million for JTPC and JVSL combined (Jindal Group), as measured at first financial year price levels (real term) the project represents significant financial gain.

Based on project financial cash-flow statements from the perspective of JTPC, total investment (banks), JVSL, TPEC and KEB, the project is profitable and therefore attractive. From the total-investment point-of-view, the project is of interest because project cash flow can serve debt requirements. Foreign partner Tractebel gain, with project NPV of USD 1.46 million and real IRR of 12.33%. Jindal groups, as domestic investor JTPC, stands to gain Rs 314.85 million with a real IRR of 12.33%, while JVSL gains Rs 5,401.31 million—a combined net gain for JTPC and JVSL of Rs 5,716.16 million. KDB benefits to the sum of Rs 821.98 million.

Table 3.31: Financial Analysis Results (Real, Nominal Millions of USD and Rs)

NPV equity holders (Domestic + Foreign),(nominal)	352.57	Rs'000000s
IRR (Nominal)	21.32%	rate
NPV Foreign partnner (Real)	1.46	USD'000000s
IRR foreign partner (Real)	12.33%	rate
NPV Domestic partner JTPC (Real)	314.85	Rs'000000s
IRR domistic partner JTPC (Real)	12.33%	rate
NPV Domestic partner JVSL (Real)	5,401.31	Rs'000000s
NPV (JTPC +JVSL) combined (Real)	5,716.16	Rs'000000s
NPV of KEB (Real)	821.98	Rs'000000s

Chapter 4

RISK ANALYSIS AND RISK MANAGEMENT

4.1 Risk Analysis

Risk is a measure of possible deviation from an anticipated result, and is associated with every project. Risk emerges from instability, the extent of which varies over and must be determined for a project-relevant period of time. The information, data and input variables likely to affect a given project generally include rates of interest, inflation and exchange, as well as input requirements and prices and technical support, each of which is liable to risk over the course of project life.

In order to identify and mitigate sources of risk likely to apply at each phase of examination, a base or deterministic case is constructed on the basis of several inputs (see discussion of financial analysis in chapter three). The goal is to capture key risk variables—those which, when adjusted a small amount from the base-case scenario, result in significant changes in project outputs. Sensitivity analysis assesses the sensitivity of variables to changes in base-case values and how these movements affect outputs (Jenkins, 2010).

4.2 Risk Analysis for JTPC

Rising electricity demand in India highlights the need for more investment in power projects. Nonetheless, investment to acquire equity in a power project entails a high degree of uncertainty, and risks need to be carefully considered. Key financial risks

and their ramifications are outlined in Table 4.1. However, the effect of several risk variables are impossible to quantify (see table 4.1 for risk factors).

Table 4.1: Risk Factors of JTPC Project

	Period		Completion	
Types of Risks	Construction	Operation	Pre	Post
Construction (Design defects)	X		X	
Process failure	X		X	
Completion risk	X		X	
cost over run	X	. X	X	X
project not completed	X		X	
Inputs requirnment (Raw material)	X	X	X	X
Operating risks		X		X
Market risks		X		X
Political or legal risks on tariff	X	X	X	X
Interest rate risk	X	X	X	X
Sales and fuel supply agreements FSA		X		X
Environmental risk	X	X	X	X
Availability of connection to grid		X		X
Technical risk	X	X	X	X
Exchange rate risk	X	X	X	X
Project finance	X	X	X	X
Currency risk	X	X	X	X

4.3 Key Risk Variables

The deterministic assessment of financial net present value (FNPV) depends on parameters that are subject to change over the life of the project. Sensitivity analysis is therefore conducted on key risk variables, in order to determine their effects on project NPV from the point of view of JTPC, JVSL, TPEC and KEB.

Sensitivity analysis is applied on the inputs of project risk variables, to establish their impact on financial outputs. Risk variables are selected on the grounds that small adjustments to their values under the base case results in a significant impact on financial results.

The following section presents the results of sensitivity analysis on key risk variables.

Investment Cost Overrun: NPV turns negative from the equity holder and foreign partner perspectives when the cost of capital is equal to 5%, and at 10% from the domestic partner perspective (see Table 4.2).

Table 4.2: Financial Sensitivity Results to Investment Cost Overrun (First Year Financial Price Level)

	% Change	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)	PV (JVSL)	PV (JTPC+JVSL)
	Capital Cost	Rs'000000s	USD'000000S	%	%	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5	6	7
		352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
1	-5%	816.11	8.02	13.96%	13.96%	548.71	5,401.31	5,950.02
2	-3%	630.69	5.40	13.28%	13.28%	455.17	5,401.31	5,856.48
3	0%	352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
4	5%	(110.96)	(5.10)	10.94%	10.94%	80.99	5,401.31	5,482.29
5	10%	(574.50)	(11.66)	9.74%	9.74%	(152.88)	5,401.31	5,248.43
6	12%	(641.86)	(12.70)	9.62%	9.62%	(183.71)	5,401.31	5,217.60
7	14%	(827.89)	(15.33)	9.20%	9.20%	(277.58)	5,401.31	5,123.73
8	15%	(920.91)	(16.64)	9.00%	9.00%	(324.51)	5,401.31	5,076.79

Table 4.2 indicates that project NPV from the equity holder and foreign and domestic partner perspectives decreases where real expenses overrun by more than 5% of total expected costs. Variability in capital cost does not affect NPV from the JVSL perspective.

Primary Fuel Prices: a rise in the cost of imported coal has a negative effect on NPV from all perspectives (equity holders, JVSL, foreign and domestic partners), and vice versa. The effect of variation in fuel costs is countervailed by increments in the power purchase agreement (PPA—see Table 4.3).

Table 4.3: Financial Sensitivity Results of Effect of Changes in Real Price of Fuel (First Year Financial Price Level)

	% Change	NPV(EH)	NPV(FP)	NPV(DP)	PV of JVSL	PV (JTPC+JVSL)
	Fuel Price	Rs'000000s	USD'000000S	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5
		352.57	1.46	314.85	5,401.31	5,716.16
1	-9%	379.84	1.84	328.92	5,495.23	5,824.15
2	-6%	370.75	1.71	324.23	5,463.91	5,788.14
3	-3%	361.66	1.59	319.54	5,432.61	5,752.15
4	0%	352.57	1.46	314.85	5,401.31	5,716.16
5	3%	343.48	1.34	310.16	5,370.02	5,680.18
6	6%	334.39	1.21	305.47	5,338.74	5,644.20
7	9%	325.30	1.09	300.78	5,307.46	5,608.24

In Table 4.3, a fuel cost increment does not enhance project NPV for JVSL, as it is countervailed by comparable increments in required power instalments.

Premium on Corex gas supply: over cost of imported coal is 20%, as provided by the PPA, and project NPV from the foreign and domestic partner and the equity-holder perspective declines with any increase in the Corex premium (see Table 4.4). Conversely, a fall in the premium has a positive effect on project NPV for foreign and domestic partners, equity holders, as well as JVSL and JTPC combined.

Table 4.4: Financial Sensitivity Results of Change in Premium on Corex Supply (First Year Financial Price Level)

	% Change	NPV(EH)	NPV(FP)	NPV(DP)	PV of JVSL	PV (JTPC+JVSL)
	Premium	Rs'000000s	USD'000000S	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5
		352.57	1.46	314.85	5,401.31	5,716.16
1	-100%	632.82	5.34	459.46	5,327.85	5,787.32
2	-75%	574.43	4.53	429.34	5,340.66	5,770.00
3	-54%	525.39	3.85	404.03	5,352.97	5,757.00
4	-25%	457.66	2.92	369.08	5,371.27	5,740.35
5	-5%	410.96	2.27	344.98	5,384.43	5,729.41
6	0%	399.28	2.11	338.95	5,387.78	5,726.73
7	10%	375.93	1.79	326.90	5,394.51	5,721.41
8	20%	352.57	1.46	314.85	5,401.31	5,716.16

Inflation (gpe): a rise in India's rate of inflation, from 6% to 18%, results in a fall in project NPV from the domestic and foreign partner and the equity-holder perspective (see Table 4.5), but a rise for that of JVSL. However, the net impact on JVSL and JTPC combined is positive, because of changes in working capital.

Sharp fluctuations in the rate of inflation are the norm in India, recently ranging from 6-18% within a given year. This factor alone may not impact project NPV from the domestic-partner perspective but may have a negative impact on the foreign partner, depending on the interplay of/with other variable factors.

Table 4.5: Financial Sensitivity Results of Change Domestic and Foreign Inflation Rates (First Year Financial Price Level)

		Inflation	NPV(EH)	NPV(FP)	NPV(DP)	PV of JVSL	PV (JTPC+JVSL)
		Rate	Rs'000000s	USD'000000S	Rs'000000s	Rs'000000s	Rs'000000s
			1	2	3	4	5
Domestic			352.57	1.46	314.85	5,401.31	5,716.16
	1	6%	395.47	2.08	336.01	5,351.21	5,687.22
	2	8%	352.57	1.46	314.85	5,401.31	5,716.16
	3	10%	309.08	0.84	293.30	5,449.59	5,742.89
	4	12%	265.46	0.21	271.61	5,496.15	5,767.76
	5	14%	222.05	(0.41)	249.99	5,541.07	5,791.05
	6	16%	179.18	(1.02)	228.59	5,584.44	5,813.03
	7	18%	137.06	(1.62)	207.56	5,626.35	5,833.90

		Inflation	NPV(EH)	NPV(FP)	NPV(DP)	PV of JVSL	PV (JTPC+JVSL)
		Rate	Rs'000000s	USD'000000S	Rs'000000s	Rs'000000s	Rs'000000s
Foreign			1	2	3	4	5
			352.57	1.46	314.85	5,401.31	5,716.16
	1	1.0%	370.72	1.71	324.35	5,442.53	5,766.88
	2	1.5%	366.91	1.66	322.35	5,434.28	5,756.64
	3	2.0%	363.20	1.61	320.41	5,426.04	5,746.45
	4	2.5%	359.57	1.56	318.51	5,417.80	5,736.30
	5	3.0%	356.03	1.51	316.66	5,409.55	5,726.21
	6	3.5%	352.57	1.46	314.85	5,401.31	5,716.16
	7	4.0%	349.19	1.42	313.08	5,393.07	5,706.15
	8	4.5%	345.89	1.37	311.36	5,384.82	5,696.18
	9	5.0%	342.66	1.33	309.67	5,376.58	5,686.25

Table 4.5 indicates that an increase in domestic inflation from 6% to 18% results in decreased NPV for foreign and domestic partners and equity holders, but an increase in NPV for JVSL. A rise in US inflation from 1% to 5% results in reduced NPV for all parties.

Exchange Rate (Rs/USD): Table 4.6 indicates the effect of a real increase or decrease in the value of the rupee against the dollar. Around 30% of project finance and equity are dollar denominated. Any increase in the US dollar would therefore reduce the investment cost, enhancing banks' NPV. The pricing of primary fuels is also based on the US dollar, and the price of fuel is built into the sales price of electricity.

Table 4.6: Financial Sensitivity of Effect of % Changes in Real Exchange Rate, Rs/USD (First Year Financial Price Level)

	% Change	NPV(EH)	NPV(FP)	NPV(DP)	PV of JVSL	PV (JTPC+JVSL)	NPV bankers	NPV loan	NPV repayments	NPV of diffrence
	Forex rate	Rs'000000s	USD'000000S	Rs'000000s	Rs'000000s	Rs'000000s	Rs'000000s	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5	6	7	8	9
		352.57	1.46	314.85	5,401.31	5,716.16	(1,051.46)	6,259.40	7,438.19	1,178.79
1	-10%	261.93	0.10	272.57	5,505.67	5,778.24	(1,039.22)	5,991.06	7,184.71	1,193.65
2	-8%	280.06	0.40	281.03	5,484.79	5,765.82	(1,041.67)	6,044.73	7,235.40	1,190.67
3	-5%	307.25	0.82	293.71	5,453.48	5,747.19	(1,045.34)	6,125.23	7,311.45	1,186.22
4	-3%	325.38	1.08	302.17	5,432.61	5,734.77	(1,047.79)	6,178.90	7,362.15	1,183.24
5	0%	352.57	1.46	314.85	5,401.31	5,716.16	(1,051.46)	6,259.40	7,438.19	1,178.79
6	5%	397.89	2.05	335.99	5,349.16	5,685.15	(1,057.58)	6,393.58	7,564.93	1,171.36
7	10%	443.21	2.58	357.13	5,297.04	5,654.16	(1,063.70)	6,527.75	7,691.67	1,163.93
8	15%	488.53	3.06	378.26	5,244.93	5,623.19	(1,069.82)	6,661.92	7,818.41	1,156.50
9	20%	533.85	3.51	399.40	5,192.84	5,592.24	(1,075.94)	6,796.09	7,945.15	1,149.07

As indicated in Table 4.6, NPV moves in line with income and fuel price. A lower fuel price enhances the NPV of JVSL. By contrast, devaluation enhances domestic partner NPV, since payments are in rupees—an advantage obviously lost to the foreign partner.

Accounts Receivable (A/R): an expansion in project receivables from 5% to 40% has a negative effect on project NPV for each party, when annual accounts receivable surpass 15% (foreign partner), 20% (equity holders) and 25% (domestic partner). Increasing accounts receivable increases project NPV for JVSL, because JVSL is the main purchaser of power from JTPC (see table 4.7).

Table 4.7: Financial Sensitivity of Effect Changes in Accounts Receivable, as % of Annual Sales (First Year Financial Price Level)

	% Change	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)	PV (JVSL)	PV (JTPC+JVSL)
	Anuual sale	Rs'000000s	USD'000000S	%	%	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5	6	7
		352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
1	5%	754.69	7.02	13.62%	13.62%	522.47	4,986.08	5,508.54
2	10%	467.46	3.05	12.69%	12.69%	374.17	5,282.67	5,656.84
3	15%	180.24	(0.92)	11.80%	11.80%	225.87	5,579.27	5,805.14
4	20%	(106.99)	(4.89)	10.94%	10.94%	77.57	5,875.86	5,953.43
5	25%	(394.21)	(8.87)	10.12%	10.12%	(70.72)	6,172.45	6,101.73
6	30%	(681.44)	(12.84)	9.35%	9.35%	(219.02)	6,469.05	6,250.03
7	35%	(968.66)	(16.81)	8.61%	8.61%	(367.32)	6,765.64	6,398.33
8	40%	(1,255.89)	(20.78)	7.92%	7.92%	(515.61)	7,062.24	6,546.62

An increase in accounts receivable results in a decrease in project NPV and IRR from the equity-holder and foreign and domestic partner viewpoints, while NPV for JVSL increases because it is a major consumer of electricity.

Accounts Payable (A/P): an increase in project accounts payable from 5% to 40% has the opposite effect, resulting in a positive change in project NPV for equity holders and foreign and domestic partners, and a negative impact on NPV for JVSL because JVSL is a major purchaser of electricity from JTPC (see table 4.8).

Table 4.8: Financial Sensitivity of Changes in Accounts Payable, as % of Annual Recurring Expenditure (First Year Financial Price Level)

	% Change	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)	PV (JVSL)	PV (JTPC+JVSL)
	Recurring cost	Rs'000000s	USD'000000S	%	%	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5	6	7
		352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
1	5%	227.34	(0.27)	11.94%	11.94%	250.18	5,489.14	5,739.32
2	10%	415.38	2.33	12.53%	12.53%	347.28	5,357.26	5,704.54
3	15%	603.42	4.93	13.13%	13.13%	444.38	5,225.39	5,669.77
4	20%	791.46	7.53	13.75%	13.75%	541.48	5,093.51	5,634.99
5	25%	979.50	10.13	14.38%	14.38%	638.58	4,961.64	5,600.22
6	30%	1,167.54	12.73	15.02%	15.02%	735.68	4,829.76	5,565.44
7	35%	1,355.58	15.33	15.68%	15.68%	832.78	4,697.89	5,530.66
8	40%	1,543.63	17.93	16.34%	16.34%	929.87	4,566.01	5,495.89

An increase in accounts payable from 5% to 40% results in improved NPV and IRR for equity holders, foreign and domestic partners and JVSL.

Actual Plant Load Factor (APLF): Table 4.9 provides data on the production and dissemination of power between TPECs and JVSL, in terms of variations in APLF with associated capacity charge (CC)—change that is the result of the regulation of tariffs under power purchase agreements (PPAs). Benefits to the power plant are greatest when operation above the brake point of 68.5%, with JTPC's CC adjusted from 1.12 to 1.38, and additional KEB bonuses for each unit produced above 68.5%.

Table 4.9: Financial Sensitivity of Changes in Actual Plant Load Factor (APLF) (First Year Financial Price Level)

		Energy avilable	JVSL	TPEC	Adj. C.C
	% of APLF	million kwh	million kwh	million kwh	r.Rs/kwh
		1	2	3	4
		1,802.38	1,173.84	628.54	1.38
1	50.0%	1,060.22	1,060.22	0	1.12
2	53.0%	1,123.84	1,123.84	0	1.12
3	56.0%	1,187.45	1,173.84	13.61	1.12
4	59.0%	1,251.06	1,173.84	77.22	1.12
5	68.5%	1,452.51	1,173.84	278.67	1.35
6	71.5%	1,516.12	1,173.84	342.28	1.36
7	74.5%	1,579.73	1,173.84	405.89	1.36
8	77.5%	1,643.35	1,173.84	469.51	1.37
9	79.0%	1,675.15	1,173.84	501.31	1.37
10	81.0%	1,717.56	1,173.84	543.72	1.37
11	83.0%	1,759.97	1,173.84	586.13	1.37
12	85.0%	1,802.38	1,173.84	628.54	1.38

Adjustment Rate: KEB charges TPECs Rs 2.10 per kWh in the first financial year, while the electricity price was Rs 2.73 per kWh for long-term industrial users. This means there is a probability that electricity prices will range from Rs 2.10 for TPEC to 2.73 for industrial users per kWh in the first financial price level, making the structural adjustment rate every year at a settled rate of the current tariffs. Table 4.10 demonstrates that an increase in the adjustment rate will decrease NPV from the perspective of equity holders and foreign and domestic investors, however an increase in the adjustment rate has a positive impact on project NPV for JVSL.

Table 4.10: Financial Sensitivity of Changes in Annual Rate of Tariff Adjustment to TPECs (First Year Financial Price Level)

	Adjustment rate	NPV(EH) Rs'000000s	NPV(FP) USD'000000S	PV (DP) Rs'000000	PV (JVSL) Rs'000000s	PV (JTPC+JVSL) Rs'000000s	PV (KEB) Rs'000000s
		1	2	3	4	5	6
		352.57	1.46	314.85	5,401.31	5,716.16	821.98
1	3.0%	328.54	1.14	302.23	8,616.66	8,918.89	954.64
2	5.0%	322.16	1.05	298.96	9,449.28	9,748.25	988.87
3	10.0%	316.28	0.96	295.99	10,210.08	10,506.07	1,019.90
4	15.0%	314.01	0.93	294.85	10,503.20	10,798.05	1,031.62
5	20.0%	313.14	0.92	294.42	10,615.67	10,910.09	1,035.88
6	25.0%	312.28	0.91	293.99	10,728.15	11,022.14	1,040.14
7	30.0%	311.41	0.89	293.55	10,840.66	11,134.22	1,044.41
8	35.0%	311.41	0.89	293.55	10,840.66	11,134.22	1,044.41

Capacity Charge (CC): the levelized capacity charge has been evaluated in terms of cost segments determined in the PPA. As demonstrated in Table 4.11, an increase in CC will increase project NPV for suppliers of electricity, which are equity holders, foreign partners and domestic partners, but reduce NPV from the perspective of JVSL, as well as JVSL and JTPC combined.

Table 4.11: Financial Sensitivity of Changes in Capacity Charge (Rs/kWh, First Year Financial Price Level)

	Capacity	NPV(EH)	NPV(FP)	IRR(FP)	IRR (DP)	NPV(DP)	PV (JVSL)	PV (JTPC+JVSL)
	Rs/kwh	Rs'000000s	USD'000000S	%	%	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5	6	7
		352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
1	1.30	(14.06)	(3.47)	11.21%	11.21%	120.08	5,884.81	6,004.89
2	1.32	130.56	(1.53)	11.65%	11.65%	196.91	5,694.09	5,891.00
3	1.34	275.17	0.42	12.09%	12.09%	273.73	5,503.38	5,777.11
4	1.36	419.79	2.37	12.53%	12.53%	350.56	5,312.66	5,663.22
5	1.38	564.41	4.31	12.96%	12.96%	427.38	5,121.95	5,549.33
6	1.40	709.03	6.26	13.39%	13.39%	504.21	4,931.23	5,435.44
7	1.50	1,432.12	15.99	15.46%	15.46%	888.34	3,977.65	4,865.99

A rise in the CC from Rs 1.30 to Rs 1.50 per kWh would improve the internal rate of return (IRR) for both domestic and foreign partners of 15.46%, and diminish JVSL's advantage by around 33%. This clearly enhances the ADSCR, as the rise in CC increases net cash flow.

Normative Plant Load Factor (NPLF): the regulating or breakeven plant load factor ensures electricity supply to customers in specific areas. According to the power purchase agreement (PPA) and base case, the standardizing plant load factor is 68.5% (see table 4.12).

Table 4.12: Financial Sensitivity of Changes in Normative Plant Load Factor (First Year Financial Price Level)

	NPLF	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)	PV (JVSL)	PV (JTPC+JVSL)
	Annual	Rs'000000s	USD'000000S	%	%	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3	4	5	6	7
		352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
1	60.5%	443.52	2.69	12.60%	12.60%	363.17	5,281.36	5,644.53
2	62.5%	420.79	2.38	12.53%	12.53%	351.09	5,311.35	5,662.44
3	64.5%	398.05	2.07	12.47%	12.47%	339.01	5,341.34	5,680.34
4	66.5%	375.31	1.77	12.40%	12.40%	326.93	5,371.32	5,698.25
5	68.5%	352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
6	70.5%	329.83	1.16	12.26%	12.26%	302.77	5,431.29	5,734.07
7	72.5%	307.10	0.85	12.19%	12.19%	290.69	5,461.28	5,751.97
8	74.5%	284.36	0.54	12.12%	12.12%	278.61	5,491.27	5,769.88
9	76.5%	261.62	0.24	12.05%	12.05%	266.53	5,521.25	5,787.79

When the plant operates at 66.5% PLF—i.e. 2% below breakpoint—project NPV from the equity-holder, foreign and domestic investor perspectives increases to Rs 375.31 million, USD 1.77 million and Rs 326.93 million, respectively, while NPV from JVSL's point of view decreases to Rs 5,371.32 million.

Incentive Point: the NPV of equity holders as well as foreign and domestic partners will increase with a 0.1% positive change in incentive point, yet decrease for NPV of JVSL and JVSL+ JTPC. The motivator point in the PPA could therefore be adjusted (see Table 4.13).

Table 4.13: Financial Sensitivity of Changes in Incentive Point (First Year Financial Price Level)

	Incentive Point	NPV(EH) Rs'000000s	NPV(FP) USD'000000S	IRR(EH) %	IRR (FP) %	NPV(DP) Rs'000000s	PV (JVSL) Rs'000000s	PV (JTPC+JVSL) Rs'000000s
		1	2	3	4	5	6	7
		352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
1	0.50	298.97	0.74	12.17%	12.17%	286.38	5,471.99	5,758.37
2	0.60	325.77	1.10	12.25%	12.25%	300.61	5,436.65	5,737.26
3	0.70	352.57	1.46	12.33%	12.33%	314.85	5,401.31	5,716.16
4	0.80	379.37	1.82	12.41%	12.41%	329.09	5,365.97	5,695.05
5	0.90	406.17	2.18	12.49%	12.49%	343.32	5,330.63	5,673.95
6	1.00	432.97	2.55	12.57%	12.57%	357.56	5,295.29	5,652.84

Interest rate: project loans are affected by changes to a number of interest rates (LIBOR, domestic and foreign), which in turn affect project NPV. According to sensitivity analysis, NPV for equity holders, domestic and foreign partners diminishes with a rise in the interest rate in real terms (see table 4.14). Foreign-partner NPV is negative if the interest rate for supplier's credit surpasses 4.5% and if the domestic rate surpasses 8%.

Table 4.14: Financial Sensitivity of Changes in Real Interest Rate (First Year Financial Price Level)

		% Change	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)
		Interest rate	Rs'000000s	USD'000000S	%	%	Rs'000000s
			1	2	3	4	5
Domestic Borrowing Rate			352.57	1.46	12.33%	12.33%	314.85
	1	4.00%	617.18	5.06	13.14%	13.14%	454.14
	2	5.91%	352.57	1.46	12.33%	12.33%	314.85
	3	6.00%	339.74	1.29	12.29%	12.29%	308.09
	4	7.00%	194.94	(0.68)	11.85%	11.85%	231.87
	5	8.00%	46.05	(2.70)	11.39%	11.39%	153.50
		% Change	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)
		Interest rate	Rs'000000s	USD'000000S	%	%	Rs'000000s
Suppliers's Credit Rate			1	2	3	4	5
			352.57	1.46	12.33%	12.33%	314.85
	1	2.0%	389.59	1.96	12.44%	12.44%	334.66
	2	2.5%	352.57	1.46	12.33%	12.33%	314.85
	3	3.0%	314.47	0.95	12.22%	12.22%	294.46
	4	3.5%	275.27	0.43	12.10%	12.10%	273.48
	5	4.0%	234.93	(0.11)	11.98%	11.98%	251.89
	6	4.5%	193.45	(0.66)	11.85%	11.85%	229.69
		% Change	NPV(EH)	NPV(FP)	IRR(EH)	IRR (FP)	NPV(DP)
		Interest rate	Rs'000000s	USD'000000S	%	%	Rs'000000s
			1	2	3	4	5
LIBOR Rate			352.57	1.46	12.33%	12.33%	314.85
	1	1.5%	358.59	1.54	12.35%	12.35%	318.05
	2	2.0%	345.42	1.37	12.31%	12.31%	311.05
	3	2.5%	331.91	1.18	12.27%	12.27%	303.89
	4	3.0%	318.08	1.00	12.22%	12.22%	296.55
	5	3.5%	303.92	0.81	12.18%	12.18%	289.03
	6	4.0%	289.41	0.61	12.14%	12.14%	281.33
	7	4.5%	274.55	0.41	12.09%	12.09%	273.45

4.4 Project Finance Risks and Project Risk Mitigation

A principle trademark of project finance is non-recourse or limited recourse lending (see chapter one). This drives potential investors and lenders to conduct due diligence on contracts with, for example, input suppliers, off-take contractors and administrators, as well as for project operation and maintenance. This process alleviates a degree of risk and uncertainty, identifying and reallocating risk to parties best able to bear and manage them efficiently. The following is a synopsis of some anticipated risk elements and mitigating actions regarding the JTPC power plant.

4.4.1 Project Risk

Project risk is for the most part concerned with establishing the viability of a project and the reputation of those involved in its implementation. The main tool for mitigating risk in this context is via the choice of contractual agreements governing build, design and operation, and the selection of project managers with a demonstrated record of success. Independent advisory designers can assume a part in assessing project feasibility, highlighting specific areas of uncertainty for project lenders.

4.4.2 Market Risk

Market risk refers to uncertainty regarding project output and demand. The major means of mitigating against this sort of uncertainty is the long-term off-take contract, committing signatories to the production and the purchase of project outputs. Cost per unit of production can be fixed, or it can vary according to factors such as inflation and interest rates.

4.4.3 Country Risk

Country risk refers to political risk, including the introduction of a non-convertible currency or the banning of currency transfers, national economic risk and political instability.

4.4.4 Political Risk

Political risk refers to the risk of political upheaval, policy change and changes to legal, tax and administrative frameworks.

4.4.5 Industry Risk

Project sponsors must examine the business environment and uncertainties confronting commercial enterprises in their proposed area of operation. Production

costs and the price of substitute items and inputs are basic issues of interest. Project lenders may also be concerned by:

1. The impact of other existing or forthcoming projects.
2. Transportation and other charges affecting end clients.
3. Substitute goods and services.
4. Alternative potential customers.
5. Present and forthcoming goods and services; cost and supply issues.
6. Potential for supply interruptions and value variances.

4.4.6 Supplier

The main focus is on guaranteeing project supplies, such as fuel, power, water, technical support and so on, through long-term contracts. There are three basic measures of secure supply: quality, quantity and accessibility. Can suppliers meet quality standards? Can suppliers provide sufficient quantities of input? Is supply dependable or are interruptions likely?

4.4.7 Contractor

Important issues in relation to project development and construction are delays and cost-overruns. Here, contractual arrangements should focus on specifying tasks and standards, and the reputation, competence and financial stability of contract partners.

4.4.8 Operation

Project operators are responsible for the operation and maintenance of project assets, which will generate cash flow and profit. Project sponsors and financiers must obviously ensure that the project can generate sufficient cash flow to service debts, as well as secure positive return to equity holders through the life of the project. In the case of power project, risk is related to maintaining productive, non-stop project

operations. Motivating contractual arrangements are one means of designating and reallocating risk to the parties best able to bear a particular risk.

4.4.9 Product Risk

This risk may include project production and design defects. The basic uncertainty here is unnamed risks created by project outputs, such as environmental damage or the negative health impacts of electro-magnetic radiation on nearby populations. Utilizing tried and tested approaches to these issues can significantly reduce such risks and any associated liabilities.

4.4.10 Funding Risk

This risk is important when, for instance, an equity holders fail to pay the agreed amount. Financiers may not have the ability to raise equivalent funds from the business sector, and securing alternative project finance may prove difficult. Financing risk can also refer to the need to separately assess local and foreign currency-exchange risks. The advice of an experienced financial consultant can be critical in this regard.

4.4.11 Currency Risk

There are two uncertainties regarding currency risk: the exchange rate and currency controls, which can be hedged via a currency swap.

4.4.12 Interest Rate

Interest rate risk is significant to project finance involving foreign borrowing and lending, and when funds are sourced from capital markets. Such risk can be managed through hedging tools such as the interest rate cap—a form of derivative where payment is made when the interest rate is above a certain point, a mix of fixed and floating rates, or an interest rate swap.

4.4.13 Environmental

An in-depth environmental study should be undertaken, to minimise the risk of pollution and identify the source of any likely dangerous materials.

Chapter 5

ECONOMIC ANALYSIS

5.1 Introduction

The financial and risk analyses conducted thus far considered the perspective of each partner. This section evaluates the project's impact on the national economy.

India is subject to constant power shortages. In such circumstances, there will be considerable differences in the amounts consumers are willing to pay for a unit of electricity.

The co-generation project examined here entails a number of economic advantages. Efficiency is improved with the use of Corex gas—the main source of energy, which is formed by converting flue gas, normally discharged as waste. This reduces the need for imported coal as well as reducing CO2 emissions.

At the same time, however, the distorting effects of tariffs, taxes and subsidies result in differences between economic values and prices, requiring conformity in cost streams to accurately quantify economic net present value (ENPV). We therefore undertake cost-benefit analysis to properly ascertain the project's true economic impact.

5.2 Methodology

Economic net cash flows are established through incorporated economic and financial analysis (Jenkins and Harberger, 1996). The first step is to separate tradable

and non-tradable goods and services. Second, the economic price of individual tradable commodities is established, by subtracting distortions and adjusting for FEP. Third, we alter financial estimates of non-tradable commodities to determine their demand price and supply price. We then calculate economic prices using the following formula:

$$P^e = W^s * P^s + W^d * P^d$$

Equation 5.1: Economic value

Where P^e is economic value

W^s and W^d are the weight of supply and of demand, respectively

P^s and P^d are the price of supply and of demand, respectively .

The final step is to calculate conversion factors for each tradable and non-tradable good and service (item) in the cash-flow statement, which in our model derives from the bank's (total investment) perspective. Assessing the economic value of power and Corex gas requires particular techniques.

5.3 Economic Opportunity Cost of Foreign Exchange

The economic opportunity cost of foreign exchange is a means of quantifying distortions (export tax, tariffs and subsidy) when cash is sourced from capital markets and used to buy tradable or non-tradable goods and services. Where a given factor or source of funds are effected in local currency, but foreign currency impacts on the movement of demand and supply for tradable and non-tradable commodities, that movement must take place in the domestic currency. For instance, according to the FSA, JVSL should provide sufficient primary fuel (Corex gas and coal) to JTPC, at a price tied to the normal transportation cost of high-calorie coal, an amounting to

some 140 Mtce. JTPC is financed through foreign borrowing, foreign equity holders, supplier credits, etc. (see table 5.1).

Table 5.1: Inputs for Foreign Exchange Premium (2012, Prices)

	Constant	Unit
Total exports	225,502.00	USD'000000s
Total imports	323,435.00	USD'000000s
Import tariffs	1,517.00	Rs'Billion
Export subsidies	-	Rs'Billion
Export tax	-	Rs'Billion
Billion to million conversion factor	1,000.00	factor
Exchange rate, Rs/US $ (2012 prices)	49.46	Rs/USD

Using the EOCFX technique, the Indian foreign exchange premium (FEP) based on 2012 inputs and prices is estimated at 5.59% (Jenkins and Harberger, 1996—see Table 5.2).

Foreign Exchange Premium (FEP)

$$= \frac{\text{tariff revenues} + \text{export subsidies} - \text{export tax}}{\text{value of import} + \text{value of export}}$$

Equation 5.2: Foreign Exchange Premium

Table 5.2: Foreign Exchange Premium (2012, Prices)

	Constant	Unit	Total	-	
Total exports	225,502.00	USD'000000s	-		
Total imports	323,435.00	USD'000000s	-		
Exchange rate, Rs/US $ (2012 prices)	49.46	Rs/USD	-		
First financial year flag	-	flag	1.00	-	1.00
Total exports(TE)		Rs'000000s			11,152,201.41
Total imports(TI)		Rs'000000s			15,995,477.93
Import tariffs	1,517.00	Rs'Billion	-		
Export subsidies	0	Rs'Billion	-		
Export tax	0	Rs'Billion	-		
Billion to million conversion factor	1,000	factor	-		
First financial year flag	-	flag	1.00	-	1.00
Import tariffs (IT)		Rs'000000s			1,517,000.00
Export subsidies(ES)		Rs'000000s			0
Export tax(ET)		Rs'000000s			0
formula= IT+ES-ET/TI+TE					
Foreign exchane premium		rate			5.59%

5.4 Economic Opportunity Cost of Capital

EOCK is defined as the lowest rate at which: equity holders receive a return on capital; all project expenses and debt requirements are met; and the project contributes to economic growth.

In the economic analysis, we discounted economic cash inflows, outflows and economic externalities by EOCK over the life of the project. If ENPV is equal to or more than zero, the project is deemed to have a positive effect on the economy and the project is attractive from the economic perspective. If NPV is below zero, the project may have a negative effect on the economy and is therefore not attractive from the economic perspective (see table 5.3).

Table 5.3: EOCK Inputs and Forecast of Investors and Savers Group

Forecast			-	Forecast	Forecast	Forecast
Model column counter	Constant	Unit	-	1	2	3
Corporate tax rate	43%	tax rate				
Equilibrium nominal interest rate in domestic capital market	15.61%	nominal rate				
Average minimum prime lending real rate(Forecast and actual)	5.10%	real rate				
Average nominal cost of foreign borrowing	6.69%	nominal rate				
Average real interest on new foreign debt, all creditors (Forecast)	4.60%	real rate				
Percentage stock of debt borrowed on the basis of variable interest rate	13.12%	nominal rate				
Suppliers of capital (savers) (Forecast)		Type of tax		Marginal	Elasticity	Amount
Income groups				tax rate	of supply	Rs'000000s
Corporation		Corporate		43%	1.14	142,200.00
Public enterprise		Corporate		43%	0.65	10,400.00
High low income group		Income		0%	0.15	120,290.30
High medium income group		Income		20%	0.30	233,504.70
High income group		Income		30%	0.60	353,795.00
Foreign		Withholding		20%	1.14	278,000.00
Total		**Rs'000000s**				**1,138,190.00**
Expected rate of domestic inflation (gpe)	10%	rate				
Expected rate of foreign inflation (gpef)	2%	rate				
Total debt	3,117,920	Rs'000000s				
Borrowing with variable interest rate	409,150	Rs'000000s				
Demanders of capital (investors) (Forecast)		type of tax or		Marginal	Elasticity	Amount
Investor groups		subsidy		tax rate	of demand	Rs'000000s
Government		Cor. tax		0%	0	315,000
Public		Cor. tax		43%	(0.79)	345,000
Corporate		Cor. tax		43%	(1.57)	565,000
Other		Cor. tax		43%	(0.79)	419,000
Total		**Rs'000000s**				**1,644,000.00**

We used Jenkins and Harberger's (1996) methodology to evaluate EOCK (see Table 5.4).

$$EOCK = f1 * p + f2 * r + f3 * mc$$

Equation 5.3: Economic Opportunity Cost of Capital

Where f1, f2 and f3 are the weighted averages of postponed investment, domestic savers and foreign capital inflow, respectively, and p, r and mc represent the rate of postponed investment, domestic savers and foreign capital inflow, respectively.

$$EOCK = \frac{\varepsilon^{s}_{d}\left(\frac{S_d}{S_t}\right) * r + \varepsilon^{s}_{f}\left(\frac{S_f}{S_t}\right) * mc - \pi\left(\frac{I_t}{S_t}\right) * p}{\varepsilon^{s}_{d}\left(\frac{S_d}{S_t}\right) + \varepsilon^{s}_{f}\left(\frac{S_f}{S_t}\right) - \pi\left(\frac{I_t}{S_t}\right)}$$

Equation 5.4: Economic Opportunity Cost of Capital in term of Elasticity of Demand and Supply

Where $\left(\frac{S_d}{S_t}\right)$ represents the share of domestic savings in total savings, $\left(\frac{S_f}{S_t}\right)$ represents the share of foreign savings in total savings and $\left(\frac{I_t}{S_t}\right)$ represents the share of total investment in total savings.

Table 5.4: Economic Opportunity Cost of Capital

Forecast			-	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Model column counter	Constant	Unit	-	1	2	3	4	5	6
Income groups				Marginal tax rate (tp)	Nominal return (r)	Real return (r')	Share in Total,W	Elasticity of supply, E	Elasticity x Share
Corporation				43%	0.09	(0.01)	0.12	1.14	0.14
Public enterprise				43%	0.09	(0.01)	0.01	0.65	0.01
High low income group				0%	0.16	0.05	0.11	0.15	0.02
High medium income group				20%	0.12	0.02	0.21	0.30	0.06
High income group				30%	0.11	0.01	0.31	0.60	0.19
Foreign				20%	0.1205	0.01862	0.24	1.14	0.28
nominal cost of foreign borrowing	0.15	nominal							
Marginal coast of Foregin	0.02	nominal							
Investor groups				Marginal subsidy/tax	Nominal return (&)	Real return (&')	Share in Total,Z	Elasticity of demand, N	Elasticity x Share
Government				0%	0.1561	0.0510	0.1916	0	0
Public enterprise				43%	0.2739	0.1581	0.2099	(0.79)	(0.16)
Corporation				43%	0.2739	0.1581	0.3437	(1.57)	(0.54)
Others				43%	0.2739	0.1581	0.2549	(0.79)	(0.20)
SUM(Ei * r'i * Wi)				0.008					
SUM(Nj * &'j * Zj) * It/St				(0.21)					
SUM(Ei * Wi)				0.69					
SUM(Nj * Zj) * It/St]				(1.31)					
Economic Opportunity Cost of Capital (EOCK)				10.74%					

5.5 Commodity Specific Conversion Factors

The following section presents the methodology used to establish commodity specific conversion factors (CSCF—Jenkins and Harberger, 1996).

$$\text{CSCF} = \frac{\text{Economic value}}{\text{Financial value}}$$

Equation 5.5: Commodity Specific Conversion Factors

Economic price differs from financial price, in that financial price is the market value, include different distortions such as taxes, tariffs and subsidies. We apply CSCF to financial cash inflows and cash outflows to establish relevant economic terms.

The result using the conversion factor indicates whether the project contributes to or impedes economic growth. If the conversion factor results in a figure larger than zero, economic value is greater than financial price, and the project is wealth-generating from the economic point of view. Conversely, if the conversion factor results in a figure less than zero, the economic value is less than the financial price and the project cannot benefit the economy (see Table 5.5 for examples of conversion factors for cooling water and land, and Table 5.6 for all conversion factors).

Table 5.5: Conversion Factor for Cooling Water and Land (First Year Financial Price Level)

COOLING WATER						
	Elasticity of demand, Nd	(1.00)	unit	-		
	Elasticity of supply, Es	1.00	unit	-		
	Pump-head price, Ps, rupee per cubic meter	3.00	Rs/m3	-		
	Sales tax, ts, % of pump-head price	0	%	-		
	First financial year flag	-	flag	1.00	-	1.00
	Demand price, Pd = Ps + ts*Ps		Pd			3.00
	Weight on supply side, Ws = Es/(Es-Nd*Qd/Qs)		Ws			0.50
	Weight on demand side, Wd = -(Nd*Qd/Qs)/(Es-Nd*Qd/Qs)		Wd			0.50
	Economic price, Pe = Pd * Wd + Ps * Ws		Pe			3.00
	Specific conversion factor (SCF) for cooling water		**factor**			**1.00**
LAND						
	Cost of land	-	Rs'000000s	14.00	-	14.00
	Stamp duty	7.50%	%	-		
	Land registration	0.40%	%of sale.pr	-		
	Demand Elasticity, Nd	(2.50)	unit	-		
	Supply Elasticity, Es	0.90	unit	-		
	First financial year flag	-	flag	1.00	-	1.00
	Supply price of land, Ps		Ps			12.97
	Supply weight, Ws		Ws			0.26
	Demand weight, Wd		Wd			0.74
	Economic value of land		Pe			12.89
	Specific conversion factor (SCF) (Land)		**factor**			**0.92**

Table 5.6: List of Commodity Specific Conversion Factors (First Year Financial Price Level)

Specific conversion factor (SCF) (Skilled labor)	**factor**	**0.98**
Specific conversion factor (SCF) (Unskilled labor)	**factor**	**1.00**
Specific conversion factor (SCF) (Sand, Gravel&Stone)	**factor**	**0.96**
Specific conversion factor (SCF) for cooling water	**factor**	**1.00**
Specific conversion factor (SCF) (Land)	**factor**	**0.92**
Specific conversion factor (SCF) for coal stocking	**factor**	**1.00**
Weighted conversion factor (Margin money for working capital)	**factor**	**0.86**
Specific conversion factor (SCF) (Steel)	**factor**	**0.51**
Specific conversion factor (SCF) (Cement)	**factor**	**0.84**
Specific conversion factor (SCF) (Equipment and machinery)	**factor**	**0.75**
Specific conversion factor (SCF) Coal	**factor**	**0.76**
Specific conversion factor (SCF) for auxiliary fuel	**factor**	**0.72**
Conversion factor for the sale of electricity to JVSL	**factor**	**1.08**
Conversion factor of non-base load TPEC	**factor**	**1.43**
Conversion factor for corex gas	**factor**	**0.00**
Weighted conversion factor (changes in accounts receivable)	**factor**	**1.20**
Weighted conversion factor (Changes accounts payable)	**factor**	**0.98**
Specific conversion factor (SCF) (Other material)	**factor**	**1.00**
Weighted conversion factor (Housing)	**factor**	**0.81**
Weighted conversion factor (substation)	**factor**	**0.81**
Specific conversion factor (SCF) (Equipment and machinery)	**factor**	**0.75**
Weighted conversion factor (Ash pond)	**factor**	**0.92**
Composite weighted conversion factor (miscellaneous fixed assets)	**factor**	**0.85**
Adjusted conversion factor (miscellaneous fixed assets)	**factor**	**0.81**
Weighted conversion factor (Plant ,material and labor)	**factor**	**0.82**
Specific conversion factor (SCF) (Technical consultation fee)	**factor**	**1.06**
Weighted Conversion factor (Machinery&Equipment and techinical fee)	**factor**	**0.79**
Adjusted conversion factor (EPC)	**factor**	**0.76**
Weighted conversion factor (operation &maintenance)	**factor**	**0.95**
Weighted conversion factor (Preliminary&pre-operation expenses)	**factor**	**1.02**
Specific conversion factor (SCF) (Refund of banking & grid support fee)	factor	0.00
Specific conversion factor (SCF) (Refund of wheeling fee)	factor	0.00
Specific conversion factor (SCF) (Changes in cash balance)	factor	1.00
Specific conversion factor (SCF) (Income tax)	factor	0.00

5.6 Economic Value of Electricity

JVSL operates on a 24-basis, powering the steel, pelletization and oxygen plant, as well as providing sufficient fuel to the power plant. Demand for JVSL output at peak hours is estimated to be 212 MW, with off-peak hour demand of 132 MW. JTPC thus meets JVSL annual demand of 1,173.84 million kWh. Actual plan load factor at 85% will produce 1,935.96 million kWh, at which rate more than 628.54 million kWh is transferred to Karnataka TPECs, minus wheeling, transfer and delivery losses of 10.11%.

As shown in Figure 5.1, the project can deliver TPECs a net amount of 565 million kWh at a price of Rs 2.10 per kWh. JVSL therefore faces an additional cost of Rs 3.48 per kWh, calculated by measuring the amounts provided to each consumer with their respective marginal costs to reflect the original estimate of Rs 2.73/kWh. JVSL exhibits maximum willingness-to-pay for base-load supply.

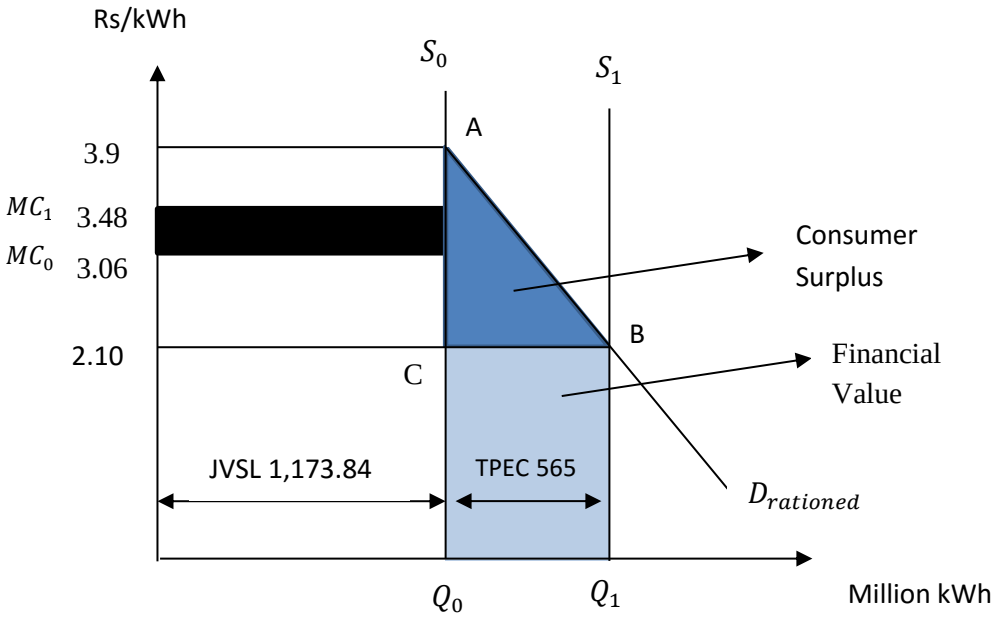


Figure 5.1: Demand for Electricity

The above figure indicates:

Economic value Q_0ABQ_1 = Financial value Q_0CBQ_1 + Consumer surplus ABC

= (Q_0C *CB) + ½*(CA*CB)

= (2.1*565) + ½*(3.9-2.10)*565

= 1186.5 + 508.5

Economic value Q_0ABQ_1 = Rs 1,695 million kWh

Conversion factor = Economic value Q_0ABQ_1 / Financial value Q_0CBQ_1 =1.428.

5.7 Environmental Concerns

The power plant is intended to work eleven months of the year with Corex gas and one month with imported coal. The use of Corex gas results in avoided costs of foreign exchange needed to pay for imported coal, as well as avoided CO2 emissions resulting from the burning of coal. In the event that Corex gas were not utilized, the amount of coal needed would rise from 0.068 to 0.810 million Mtc annually.

The precise economic and environmental advantages of not burning coal are calculated according to Jorgenson's methodology (1998). Each kWh of electricity requires 0.42 kg of coal. Coal transportation comprises 53% of altered carbon, of which about 90% is converted into greenhouse gases, with a carbon discharge of 0.21 kg each kWh generated, or 0.77 per kg of CO2. The use of Corex thus saves 0.37 MT of CO2 emissions every year—an important factor to include in analysis.

5.8 Statement of Economic Benefits and Costs from Indian Perspective

Economic cash flow is derived from the financial cash flow from the total investment perspective, by multiplying each item by its CSCF. We have estimated the CSCF for Corex gas, wheeling, banking and grid support, and penalty payments to be zero. A

CSCF of zero for wheeling, banking and grid support reflects the negligible additional expense to KEB of wheeling power (see Appendix for detailed economic costs and benefits; see Table 5.7 for economic net resource flow and NPV from the India perspective).

Table 5.7: Statement of Economic Benefit and Cost from India Perspective (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	19	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	19	20	21
Economic Cost		Rs'000000s	46,453.73		1,714.20	1,611.76	2,531.76	3,056.49	1,123.90	2,594.94	2,415.66	2,415.00	2,415.00	(288.55)
Economic Benefit	-	Rs'000000s	121,134.34	-	-	-	-	-	2,578.91	7,204.94	7,767.04	7,768.44	7,768.44	2,593.76
NET RESOURCE OUT FLOW (Economic Benefit/Cost)		Rs000000s	74,680.62		(1,714.20)	(1,611.76)	(2,531.76)	(3,056.49)	1,455.01	4,610.00	5,351.38	5,353.44	5,353.44	2,882.31
Economic Opportunity Cost of Capital (EOCK)	-	-	-	-	10.74%	-	-	-	-	-	-	-	-	-
NPV for India at economic discount rate (Real)	19,300.56	Rs'000000s												
Internal Rate of Return (IRR)for India	32.02%	rate												
Potential Tax Revenue Losses														
Annual loss in potential tax revenue	-	Rs'000000s	-	-	563.06	-	-	-	-	-	-	-	-	-
First year of operation flag	-	flag	1.00	-	-	-	-	-	1.00	-	-	-	-	-
Full capacity energy generation period flag	-	flag	15.0	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-
Annual Potential Tax Revenue Losses		Rs'000000s			-	-	-	-	281.53	563.06	563.06	563.06	563.06	-
Avoided cost of CO2 generation														
Annual avoided cost of carbon emission	-	Rs'000000s	-	-	444.41	-	-	-	-	-	-	-	-	-
Annual Avoided cost of CO2 generation		Rs'000000s			-	-	-	-	222.21	444.41	444.41	444.41	444.41	-
Economic Opportunity Cost of Capital (EOCK)	-	-	-	-	10.74%	-	-	-	-	-	-	-	-	-
PV of Potential Tax Revenue Loss	3,962.81	Rs'000000s												
PV of avoided cost of CO2 generation	3,127.78	Rs'000000s												
NPV for India, with adjustment for tax loss	15,337.75	Rs'000000s												
NPV for World at economic discount rate (Real)	18,465.53	Rs'000000s												

The table above shows discounted economic net benefit and cost at an economic opportunity cost of capital of 10.74%. From the India perspective, ENPV is Rs 19,300.56 million with an IRR of 32.02%. (These estimates do not include the value of avoided CO2 emissions and the potential tax revenue loss on avoided coal imports.) The PV of the avoided cost of CO2 generation is Rs 3,127.78 million, with positive environmental externalities. The PV of potential tax revenue loss is Rs

3,962.81 million. NPV for India adjusted for tax revenue loss is Rs 15,337.75 million, with aggregate social advantage from the worldwide economy perspective totalling Rs 18,465.53 million.

5.9 Economic Key Risk Variables

India ENPV cannot realistically be converted to a negative term, in spite of the fact that it is likely to be sensitive to changes n some of the key variables examined in the models. Key risk variables particular to contracts are excluded from the sensitivity test, therefore exchanges would not influence the economy.

5.9.1 Economic Sensitivity Analysis

Investment cost overrun: the economy picks up if real capital cost prerequisites are not exactly the assessed expense of building the plant. Table 5.8 presents adjustments to NPV from the economic perspective.

Table 5.8: Economic Sensitivity of Changes in Capital Investment Cost (First Year Financial Price Level)

	% change Capital Cost	NPV econ Rs'000000s	EIRR %
		1	2
		19,300.56	32.02%
1	(0.05)	19,687.95	33.16%
2	(0.03)	19,532.99	32.69%
3	0	19,300.56	32.02%
4	0.20	17,751.03	28.18%
5	0.40	16,201.49	25.15%
6	0.80	13,102.41	20.61%
7	1.00	11,552.88	18.85%
8	1.10	10,778.11	18.06%

ENPV will not turn negative even if the investment cost is increased by 100%, while economic IRR will remain above the economic discount rate of 10.74%.

Actual plan load factors (APLF): if the plant operates under 30% APLF, there is a negative effect on ENPV. Table 5.9 illustrates the effect of an increase in APLF from 30% to 85%, with ENPV rising from Rs 5,010.21 million to Rs 19,300.56 million.

Table 5.9: Economic Sensitivity of Changes in Actual Plant Load Factor (APLF)
(First Year Financial Price Level)

		NPV econ	EIRR
	% of APLF	Rs'000000s	%
		1	2
		19,300.56	32.02%
1	30.0%	5,010.21	17.83%
2	40.5%	8,580.89	21.98%
3	50.0%	11,811.50	25.32%
4	60.0%	14,492.91	27.86%
5	70.0%	16,240.32	29.43%
6	80.0%	18,000.30	30.95%
7	85.0%	19,300.56	32.02%

The above table indicates that APLF has a positive relationship with ENPV and EIRR, which is a highest at an APLF of 85%.

Adjustment Rate: an increase in adjustment rate will decrease the ENPV and EIRR, based on the fact that JVSL's most extreme ability to pay for power diminishes with an increase in the KEB's price of electricity. This finding depends on our assessment that the additional expense of supplying power from imported coal to work at an APLF of 85% utilizing 6.9% auxiliary fuels results in an electricity price of Rs 2.73 per kWh (see table 5.10).

Table 5.10: Economic Sensitivity of Structural Adjustment Growth Rate of the KEB Tariff (First Year Financial Price Level)

	Adjustment rate	NPV econ Rs'000000s	EIRR %
		1	2
		19,300.56	32.02%
1	5.0%	18,774.32	31.58%
2	10.0%	18,292.19	31.17%
3	15.0%	17,815.62	30.76%
4	20.0%	17,340.71	30.36%
5	25.0%	16,865.15	29.95%
6	30.0%	16,389.01	29.53%
7	35.0%	16,389.01	29.53%

As indicated in Table 5.10, an increase in the adjustment rate from 5% to 35% results in a decrease in ENPV and IRR to 17,117.29 and 29.67%, respectively.

Inflation: the India economic NPV declines by Rs 527.67 million when the domestic inflation rate rises from 6% to 18%—due principally to the real change of working capital. The US inflation rate does not effect ENPV or EIRR (see Table 5.11).

Table 5.11: Economic Sensitivity of Changes in Annual Inflation Rates (First Year Financial Price Level)

		inflation rate	NPV econ Rs'000000s	EIRR %
			1	2
Domestic			19,300.56	32.02%
	1	6%	19,398.26	32.10%
	2	8%	19,300.56	32.02%
	3	10%	19,207.01	31.95%
	4	12%	19,117.42	31.88%
	5	14%	19,031.59	31.81%
	6	16%	18,949.37	31.74%
	7	18%	18,870.59	31.68%
		inflation rate	NPV econ Rs'000000s	EIRR %
Foreign			1	2
			19,300.56	32.02%
	1	1.0%	19,300.82	32.02%
	2	1.5%	19,300.77	32.02%
	3	2.0%	19,300.72	32.02%
	4	2.5%	19,300.67	32.02%
	5	3.0%	19,300.62	32.02%
	6	3.5%	19,300.56	32.02%
	7	4.0%	19,300.51	32.02%

Real Exchange Rate: Table 5.12 demonstrates an inverse relationship between the exchange rate and ENPV. An increase in the exchange rate results in a decrease in ENPV and vice versa. This is principally due to fact that an appreciation of the rupee reduces the cost of imports—i.e. coal.

Table 5.12: Economic Sensitivity of % Change in Real Exchange Rate, Rs/USD (First Year Financial Price Level)

	% Change	NPV econ
	Forex rate	Rs'000000s
		1
		19,300.56
1	-10%	19,426.06
2	-8%	19,401.01
3	-5%	19,363.39
4	-3%	19,338.28
5	0%	19,300.56
6	5%	19,237.58
7	10%	19,174.46
8	15%	19,111.22
9	20%	19,047.85

Cost of CO2 Emissions: Table 5.13 demonstrates the PV of the avoided cost of CO2 emissions, rising from Rs 3,127.78 million to 5,994.91 million, with the cost of CO2 per metric ton increment rising from USD 36 to USD 69.

Table 5.13: Economic Sensitivity of Changes in Carbon Emission Cost (First Year Financial Price Level)

	USD/MT	NPV econ	PV AC of CO2	NPV world
	Co2 emission	Rs'000000s	Rs'000000s	Rs'000000s
		1	2	3
		19,300.56	3,127.78	18,465.53
1	36.00	19,300.56	3,127.78	18,465.53
2	42.00	19,300.56	3,649.07	18,986.82
3	46.00	19,300.56	3,996.60	19,334.35
4	50.00	19,300.56	4,344.13	19,681.88
5	55.00	19,300.56	4,778.55	20,116.30
6	60.00	19,300.56	5,212.96	20,550.71
7	64.00	19,300.56	5,560.49	20,898.24
8	69.00	19,300.56	5,994.91	21,332.66

5.10 Economic Analysis Results

Based on the economic investigation and analysis from the India perspective, the project can transfer income to the economy, with ENPV of Rs 19,300.56 million and an IRR of 32.02%, at an EOCK of 10.74%. As established by sensitivity analysis, ENPV does not turn negative even in the unlikely event that actual plant load factor falls below 30%—a rate so low as to represent near-constant breakdowns.

Economic gains under the project are due to two major factors: rising demand for electricity and the utilization of Corex gas as a primary source of fuel.

Our assessment begins by identifying and allocating economic gains to relevant parties, followed by an examination of economic externalities. Economic PV is calculated on the basis of discounted EOCK of 10.74%. The PV of the avoided cost of CO2 generation is calculated at Rs 3,127.78 million—a huge benefit in terms of environmental externalities. The PV of potential tax revenue loss is Rs 3,962.81 million, while ENPV for India with adjustment for tax losses is equal to Rs 15,337.75 million, equivalent to a gain to the economy and PV worldwide of Rs 18,465.53 million.

5.11 Stakeholder Analysis

The differences between financial and economic values and their cash flows creates project externalities. These differences emerge because of distortions in financial statements. Likewise, the economic value of foreign currency is often higher than the official exchange rate. This may result in understating the value of benefits if the project sells tradable outputs and/or understating costs if the project uses tradable

inputs. There are also differences in terms of what consumers are willing to pay for output, especially in the context of power deficits.

Once it is established who utilizes yields and contributes inputs (see Table 5.14), externalities can be assigned to stakeholders including KEB, electricity consumers (TPECs and JVSL), producers (JTPC), government and JTPC project stakeholders.

The project creates NPV for externalities of Rs 20,048.66 million—to the benefit of KEB (Rs 678.62 million), JVSL (Rs 16,064.72 million), the government (Rs 1,644.95 million) and TPECs (Rs 2,743.36 million—see Appendix for stakeholder resource inflows and outflows).

Referring to the analysis presented in Table 5.14, financial NPV is negative Rs 748.09 million at an economic discount rate of 10.74%, despite the fact that FNPV to project equity holders at a rate of 11.25% is Rs 352.57 million. Project externalities are calculated by EOCK, with the negative NPV balanced by aggregate externalities, which ought to be equivalent to ENPV.

$$\text{ENPV} = \text{FNPV} + \text{PV of externalities at EOCK } 10.74\%$$

19,300.56= -748.09 + 20,048.66

Table 5.14: Statement of Externalities (First Financial Year Price Level)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	19	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	19	20	21
TOTAL RESOURCE OUTFLOW		Rs'000000s	(47,672.97)		(85.80)	(188.24)	(798.24)	(932.81)	(1,581.52)	(2,250.08)	(2,439.87)	(3,366.34)	(3,366.34)	(288.55)
NPV for total resource outflow at economic discount rate (Real)	(16,064.72)	Rs'000000s												
TOTAL RESOURCE INFLOW	-	Rs'000000s	12,047.40	-	-	-	-	-	137.16	738.31	821.91	822.14	822.14	(337.86)
NPV for total resource inflow at economic discount rate (Real)	3,983.94	Rs'000000s	-	-	-	-	-	-	-	-	-	-	-	-
NET RESOURCE FLOW		Rs'000000s	59,720.37		85.80	188.24	798.24	932.81	1,718.68	2,988.40	3,261.78	4,188.49	4,188.49	(49.31)
NPV for Externalities at economic discount rate (Real)	20,048.66	Rs'000000s												
Reconciliation between Economic, Financial and Distributive Analysis														
Financial NPV at economic discount rate (Real)	(748.09)	Rs'000000s	-	-	-	-	-	-	-	-	-	-	-	-
NPV for India at economic discount rate (Real)	19,300.56	Rs'000000s	-	-	-	-	-	-	-	-	-	-	-	-
NPV for Externalities at economic discount rate (Real)	20,048.66	Rs'000000s	-	-	-	-	-	-	-	-	-	-	-	-
NPV for India at economic discount rate (Real)														
Financial NPV at economic discount rate (Real)	(748.09)	Rs'000000s	-	-	-	-	-	-	-	-	-	-	-	-
Plus NPV for Externalities at economic discount rate (Real)	20,048.66	Rs'000000s	-	-	-	-	-	-	-	-	-	-	-	-
NPV for India at economic discount rate (Real)	19,300.56	Rs'000000s												

Chapter 6

CONCLUSION

This is a complex project involving many stakeholders, engaged through a range of agreements, such as PPA, FSA, WBGSA and EPC contracts. The base-case financial analysis indicates that both Jindal Group and Tractebel South Asia benefit from the project, with NPV of Rs 352.57 million and IRR of 12.33% at a discount rate of 11.25%. NPV from the foreign partner perspective is USD 1.46 million with IRR of 12.33%, at a discount rate of 12%, while for the domestic partner NPV is Rs 314.85 million with IRR of 12.33% at a discount rate of 10.51%. NPV to JVSL is estimated at Rs 5,401.31 million, and Rs 821.98 million for KEB, both discounted at 10.51%. The additional profit to JVSL comes from supply of fuels (Corex gas and imported coal) and the purchase of electricity from JTPC, while KEB profit derives from full use of its transmission and distribution infrastructure.

The utilization of Corex gas results in significant profit in terms of environmental externalities, totalling Rs 3,127.78 million. ENPV and EIRR from the India perspective are Rs 20,144.53 million and 32.17%, respectively. Other NPV externalities accrue to JVSL (Rs 15,695.55 million), TPEC (Rs 2,743.36 million), KEB (Rs 678.62 million) and the government (Rs 20,144.53 million). Steel manufacturer JVSL benefits most, accounting for some 74% of aggregate economic profit.

Risk analysis indicates that equity holders are faced with different exogenous risks, for example, foreign and/or domestic inflation rates, exchange rate, cost of imported inputs and loan rates, especially on foreign debt. As the loss in returns to the domestic partner is compensated by gains made by JVSL (a business venture of the O.P. Jindal Industries Group), the foreign partner alone is subject to the risk of variability in these base-case parameters.

A key finding of this assessment is that the fuel supply agreement (FSA) proviso regarding energy charge (EC) should be revised. Under the current agreement, any discount for the use of Corex gas is automatically applied to the price of imported coal. This is deceptive in terms of the sensitivity test, as a reduction in the premium on Corex gas increases net profits for every partner. The associated risk to foreign partner Tractebel South Asia may be decreased by transferring some of JVSL's economic gains from increases in the capacity charge (CC). This can be achieved by lowering the normative PLF, increasing the incentive point or increasing the guaranteed rate of return. An increase in each of the three parameters is attractive, in light of the fact that foreign partner (Tractebel) total share in the project is just 15% of aggregate capital investment..

REFERENCES

Amulya, K. N. Reddy., & Gladys, D. Sumithra. (1997). Karnataka's power sector: some revelations. *Economic and Political Weekly*, *32*(12), 585–600. Retrieved from http://www.jstor.org/stable/4405198

Central Electricity Authority (CEA), 2007a. *National electricity plan*, CBIP, New Delhi.

Central Electricity Authority (CEA), 2007b. *Growth of electricity sector in India from 1947–2007*, CBIP, New Delhi.

Central electricity authority. (2009). Power scenario at glance, April. http:// www.cea.gov.inS.

Comer, B. (1996). Project finance teaching note. *The Wharton School*.

Esty, B. C. (2004). Why study large projects? An introduction to research on project finance. *European Financial Management*, *10*(2), 213-224.

Finnerty, J. D. (2013). *Project financing: asset-based financial engineering*. John Wiley & Sons.

Franklin Allen, Stewart C., & Myers, Richard A. Brealey. (2010). Why net present value leads to better investment decisions than other criteria. *Principles of corporate finance.*

GOI. 2002a. Annual report on the working of state electricity boards & electricity departments (2001–02). *Planning commission (Power & Energy Division), government of India*, New Delhi.

Jenkins, G., Kuo, C. Y., & Harberger, A. C. (2010). Discounting and alternative investment criteria. *Cost-Benefit Analysis for Investment Decisions*, Queen‟s University, Canada.

ICICI (Industrial Credit and Investment Corporation of India). (1995b). Appraisal report of jindal vijayanagar steel limited. Bombay, India.

ICICI (Industrial Credit and Investment Corporation of India). (1995a). Appraisal report of jindal tractebel power company limited. Bombay, India.

International energy agency. (2015). *India Energy Outlook* (p.31).

Jenkins, G., Kuo, C. Y., & Harberger, A. C. (2011). *Cost-Benefit Analysis for Investment Decisions: Forward, Table of Contents, Preface and Chapter 1 (The Integrated Analysis of Investment Projects)* (No. 2011-01). JDI executive programs.

Jenkins, G., & Dhakal, D. N. S. (2003). *Integrated Investment Appraisal of a Cogeneration Electricity Project Agreement with Global Environment Externalities* (No. 2003-01). JDI executive programs.

Jenkins, G. P., & Harberger, A. C. (1997). *Cost-Benefit Analysis of Investment Decisions*. Boston, MA: Harvard Institute for International Development.

Jenkins, G. P., & Harberger, A. C. (1996). *Cost-Benefit Analysis for Investment Decisions.* Cambridge, Massachusetts: Harvard Institute for International Development.

Jorgenson, Dale W. (1998). *Energy, the environment, and economic growth*. The MIT Press, Cambridge, MA, USA, vol 2.

Karnataka. (2016). wikipedia. Retrieved 10 April 2016, from https://en.wikipedia.org/wiki/Karnataka

Project finance emu. (2010). Slideshare.net. Retrieved 7 April 2016, from http://www.slideshare.net/bejoylinp/project-finance-emu

Savitri jindal. (2016). wikipedia. Retrieved 18 April 2016, from https://en.wikipedia.org/wiki/Savitri_Jindal

Shukla, U. K., & Thampy, A. (2011). Analysis of competition and market power in the wholesale electricity market in India. *Energy Policy*, *39*(5), 2699-2710.

Tractebel engineering in a nutshell. (2016). Tractebel-engie.com. Retrieved 18 April 2016, from http://www.tractebel-engie.com/about-us/tractebel-engineering-in-a-nutshell/

T101e FAST financial modelling (online). (2016). Book.f1f9.com. Retrieved 7 April 2016, from http://book.f1f9.com/collections/courses/products/t101e-fast-financial-modelling

Yescombe, E. R. (2002). *Principles of Project Finance* (p. 1). London: Yescombe Consulting Ltd.

APPENDIX

Appendix A: Statement of Economic Benefits and Externalities from Indian Point of View

Statement of Economic Benefits from Indian Economic Point of View (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	19	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	19	20	21
Economic Opportunity Cost of Capital (EOCK)	-	-	-	-	10.74%	-	-	-	-	-	-	-	-	-
Net cash flows after tax without financing(Real)	-	Rs'000000s	14,960.25	-	(1,800.00)	(1,800.00)	(3,330.00)	(3,989.30)	(263.67)	1,621.60	2,089.60	1,164.95	1,164.95	2,931.62
Financial NPV at economic discount rate (Real)	(748.09)	Rs'000000s												
Financial Internal Rate of Return (IRR)	9.62%	rate												
BENEFIT INFLOWS														
RECEIPTS														
Conversion factor for the sale of electricity to JVSL	-	factor	-	-	1.08	-	-	-	-	-	-	-	-	-
Electricity sale to JVSL	-	Rs'000000s	56,687.72	-	-	-	-	-	2,760.11	3,595.17	3,595.17	3,595.17	3,595.17	-
Economic value of Electricity sale to JVSL		Rs'000000s	61,179.61		-	-	-	-	2,978.82	3,880.05	3,880.05	3,880.05	3,880.05	-
Conversion factor for the sale of electricity to JVSL	-	factor	-	-	1.08	-	-	-	-	-	-	-	-	-
Electricity sales through JVSL to TPECs	-	Rs'000000s	28,875.82	-	-	-	-	-	-	1,925.05	1,925.05	1,925.05	1,925.05	-
Economic value of Electricity sales through JVSL to TPECs		Rs'000000s	31,163.91		-	-	-	-	-	2,077.59	2,077.59	2,077.59	2,077.59	-
Conversion factor of non-base load TPEC	-	factor	-	-	1.43	-	-	-	-	-	-	-	-	-
Sales revenue to JVSL from TPECs	-	Rs'000000s	19,798.97	-	-	-	-	-	-	1,319.93	1,319.93	1,319.93	1,319.93	-
Economic value of Sales revenue to JVSL from TPECs		Rs'000000s	28,284.24		-	-	-	-	-	1,885.62	1,885.62	1,885.62	1,885.62	-
Specific conversion factor (SCF) (Refund of banking & grid support fee)	-	factor	-	-	0.00	-	-	-	-	-	-	-	-	-
Banking & grid support fee	-	Rs'000000s	422.60	-	-	-	-	-	14.60	27.20	27.20	27.20	27.20	-
Economic value of Banking & grid support fee		Rs'000000s	-		-	-	-	-	0	0	0	0	0	-
Specific conversion factor (SCF) (Refund of wheeling fee)	-	factor	-	-	0.00	-	-	-	-	-	-	-	-	-
Wheeling charge to KEB	-	Rs'000000s	2,108.00	-	-	-	-	-	-	130.73	141.23	141.23	141.23	-
Economic value of Wheeling charge to KEB		Rs'000000s	-		-	-	-	-	-	0	0	0	0	-
Weighted conversion factor (changes in accounts receivable)	-	factor	-	-	1.20	-	-	-	-	-	-	-	-	-
Changes in Accounts Receivables A/R JTPC	-	Rs'000000s	-	-	-	-	-	-	(332.97)	(531.47)	(63.47)	(62.30)	(62.30)	778.73
Economic value of Changes in Accounts Receivables A/R JTPC		Rs'000000s			-	-	-	-	(399.91)	(638.33)	(76.23)	(74.82)	(74.82)	935.31
Liquidation Value														
Specific conversion factor (SCF) (Land)	-	factor	-	-	0.92	-	-	-	-	-	-	-	-	-
Liquidation vallue of land	-	Rs'000000s	14.00	-	-	-	-	-	-	-	-	-	-	14.00
Economic value of Liquidation vallue of land		Rs'000000s	12.89		-	-	-	-	-	-	-	-	-	12.89
Weighted conversion factor (Plant ,material and labor)	-	factor	-	-	0.82	-	-	-	-	-	-	-	-	-
Liquidation value of Plant (Buildings and Civil Works)	-	Rs'000000s	384.34	-	-	-	-	-	-	-	-	-	-	384.34
Economic value of Liquidation value of Plant (Buildings and Civil Works)		Rs'000000s	315.48		-	-	-	-	-	-	-	-	-	315.48
Specific conversion factor (SCF) (Equipment and machinery)	-	factor	-	-	0.75	-	-	-	-	-	-	-	-	-
Liquidation value of Machinary & Equipment	-	Rs'000000s	1,596.07	-	-	-	-	-	-	-	-	-	-	1,596.07
Economic value of Liquidation value of Machinary & Equipment		Rs'000000s	1,195.94		-	-	-	-	-	-	-	-	-	1,195.94
Composite weighted conversion factor (miscellaneous fixed assets)	-	factor	-	-	0.85	-	-	-	-	-	-	-	-	-
Liquidation vallue of Miscellaneous Fixed Assets	-	Rs'000000s	158.47	-	-	-	-	-	-	-	-	-	-	158.47
Economic value of Liquidation vallue of Miscellaneous Fixed Assets		Rs'000000s	134.14		-	-	-	-	-	-	-	-	-	134.14
Economic Benefit		Rs'000000s	121,134.34		-	-	-	-	2,578.91	7,204.94	7,767.04	7,768.44	7,768.44	2,593.76

Statement of Economic Cost from Indian Economic Point of View (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	19	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	19	20	21
Investment Cost														
Weighted conversion factor (Preliminary&pre-operation expenses)	-	factor	-	-	1.02	-	-	-	-	-	-	-	-	-
Total Preliminary and Pre-operative Expenses	-	Rs'000000s	2,264.50	-	1,329.00	935.50	-	-	-	-	-	-	-	-
Economic value of Total Preliminary and Pre-operative Expenses		Rs'000000s	2,304.59		1,352.53	952.06	-	-	-	-	-	-	-	-
Specific conversion factor (SCF) (Land)	-	factor	-	-	0.92	-	-	-	-	-	-	-	-	-
Total Cost of land	-	Rs'000000s	14.00	-	14.00	-	-	-	-	-	-	-	-	-
Economic value of Total Cost of land		Rs'000000s	12.89		12.89	-	-	-	-	-	-	-	-	-
Adjusted conversion factor (EPC)	-	factor	-	-	0.76	-	-	-	-	-	-	-	-	-
Total Engineering, Procurement & Construction Contract	-	Rs'000000s	9,070.00	-	422.00	799.50	3,250.00	3,614.50	984.00	-	-	-	-	-
Economic value of Total Engineering, Procurement & Construction Contract		Rs'000000s	6,883.85		320.29	606.80	2,466.65	2,743.30	746.83	-	-	-	-	-
Adjusted conversion factor (miscellaneous fixed assets)	-	factor	-	-	0.81	-	-	-	-	-	-	-	-	-
Total Miscellaneous Fixed Assets	-	Rs'000000s	415.00	-	35.00	65.00	80.00	190.00	45.00	-	-	-	-	-
Economic value of Total Miscellaneous Fixed Assets		Rs'000000s	337.77		28.49	52.90	65.11	154.64	36.63	-	-	-	-	-
Adjusted conversion factor (miscellaneous fixed assets)	-	factor	-	-	0.81	-	-	-	-	-	-	-	-	-
Total value of Reinvestment in Miscellaneous Fixed Assets	-	Rs'000000s	366.84	-	-	-	-	-	-	-	-	-	-	-
Economic value of Total value of Reinvestment in Miscellaneous Fixed Assets		Rs'000000s	298.57		-	-	-	-	-	-	-	-	-	-
Weighted conversion factor (Margin money for working capital)	-	factor	-	-	0.86	-	-	-	-	-	-	-	-	-
Total Margin Money for Working Capital	-	Rs'000000s	184.80	-	-	-	-	184.80	-	-	-	-	-	-
Economic value of Total Margin Money for Working Capital		Rs'000000s	158.56		-	-	-	158.56	-	-	-	-	-	-
Total Investment cost		**Rs'000000s**	**9,996.24**		**1,714.20**	**1,611.76**	**2,531.76**	**3,056.49**	**783.45**	-	-	-	-	-
Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	19	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	19	20	21
Operating Costs														
Specific conversion factor (SCF) Coal	-	factor	-	-	0.76	-	-	-	-	-	-	-	-	-
Cost of coal as fuel	-	Rs'000000s	3,924.18	-	-	-	-	-	126.59	253.17	253.17	253.17	253.17	-
Economic value of Cost of coal as fuel		Rs'000000s	2,987.08		-	-	-	-	96.36	192.71	192.71	192.71	192.71	-
Conversion factor for corex gas	-	factor	-	-	0.00	-	-	-	-	-	-	-	-	-
Cost of corex gas as fuel	-	Rs'000000s	43,165.97	-	-	-	-	-	1,392.45	2,784.90	2,784.90	2,784.90	2,784.90	-
Economic value of Cost of corex gas as fuel		Rs'000000s	-		-	-	-	-	0	0	0	0	0	-
Specific conversion factor (SCF) for auxiliary fuel	-	factor	-	-	0.72	-	-	-	-	-	-	-	-	-
Cost of auxiliary fuel	-	Rs'000000s	30.63	-	-	-	-	-	0.99	1.98	1.98	1.98	1.98	-
Economic value of Cost of auxiliary fuel		Rs'000000s	21.93		-	-	-	-	0.71	1.41	1.41	1.41	1.41	-
Specific conversion factor (SCF) for cooling water	-	factor	-	-	1.00	-	-	-	-	-	-	-	-	-
Cost of cooling water	-	Rs'000000s	440.21	-	-	-	-	-	14.20	28.40	28.40	28.40	28.40	-
Economic value of Cost of cooling water		Rs'000000s	440.21		-	-	-	-	14.20	28.40	28.40	28.40	28.40	-
Weighted conversion factor (operation &maintenance)	-	factor	-	-	0.95	-	-	-	-	-	-	-	-	-
Cost of O &M (labor, spare parts, overhead..)	-	Rs'000000s	4,779.32	-	-	-	-	-	298.71	298.71	298.71	298.71	298.71	-
Economic value of Cost of O &M (labor, spare parts, overhead..)		Rs'000000s	4,540.31		-	-	-	-	283.77	283.77	283.77	283.77	283.77	-
Specific conversion factor (SCF) (Refund of wheeling fee)	-	factor	-	-	0.00	-	-	-	-	-	-	-	-	-
Wheeling charge to KEB	-	Rs'000000s	2,108.00	-	-	-	-	-	-	130.73	141.23	141.23	141.23	-
Economic value of Wheeling charge to KEB		Rs'000000s	-		-	-	-	-	-	0	0	0	0	-
Specific conversion factor (SCF) (Refund of banking & grid support fee)	-	factor	-	-	0.00	-	-	-	-	-	-	-	-	-
Banking & grid support fee	-	Rs'000000s	422.60	-	-	-	-	-	14.60	27.20	27.20	27.20	27.20	-
Economic value of Banking & grid support fee		Rs'000000s	-		-	-	-	-	0	0	0	0	0	-
Conversion factor of non-base load TPEC	-	factor	-	-	1.43	-	-	-	-	-	-	-	-	-
Penalty payment	-	Rs'000000s	-	-	-	-	-	-	0	0	0	0	0	-
Economic value of Penalty payment		Rs'000000s	-		-	-	-	-	0	0	0	0	0	-
Conversion factor of non-base load TPEC	-	factor	-	-	1.43	-	-	-	-	-	-	-	-	-
Sales revenue to JVSL from TPECs	-	Rs'000000s	19,798.97	-	-	-	-	-	-	1,319.93	1,319.93	1,319.93	1,319.93	-
Economic value of Sales revenue to JVSL from TPECs		Rs'000000s	28,284.24		-	-	-	-	-	1,885.62	1,885.62	1,885.62	1,885.62	-
Weighted conversion factor (Changes accounts payable)	-	factor	-	-	0.19	-	-	-	-	-	-	-	-	-
Changes in Accounts Payable A/P JTPC	-	Rs'000000s	-	-	-	-	-	-	(143.35)	(249.77)	(29.21)	(28.40)	(28.40)	354.98
Economic value of Changes in Accounts Payable A/P JTPC		Rs'000000s			-	-	-	-	(26.83)	(46.74)	(5.47)	(5.31)	(5.31)	66.43
Specific conversion factor (SCF) (Changes in cash balance)	-	factor	-	-	1.00	-	-	-	-	-	-	-	-	-
Changes in Cash Balance C/B JTPC	-	Rs'000000s	-	-	-	-	-	-	(27.76)	249.77	29.21	28.40	28.40	(354.98)
Economic value of Changes in Cash Balance C/B JTPC		Rs'000000s			-	-	-	-	(27.76)	249.77	29.21	28.40	28.40	(354.98)
Specific conversion factor (SCF) (Income tax)	-	factor	-	-	0.00	-	-	-	-	-	-	-	-	-
Income Tax	-	Rs'000000s	7,312.79	-	-	-	-	-	-	-	-	925.82	925.82	-
Economic value of Income Tax		Rs'000000s	-		-	-	-	-	-	-	-	0	0	-
Total Operating Costs		Rs'000000s	36,457.49		-	-	-	-	340.45	2,594.94	2,415.66	2,415.00	2,415.00	(288.55)
Economic Cost (Total investment cost + Total operating cost)		**Rs'000000s**	**46,453.73**		**1,714.20**	**1,611.76**	**2,531.76**	**3,056.49**	**1,123.90**	**2,594.94**	**2,415.66**	**2,415.00**	**2,415.00**	**(288.55)**

Statement of Externalities Resource Inflow (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending	.			-	4	5	6	7	8	9	19	20	21
Construction period				-	1	1	-	-	-	-	-	-	-
Operation period				-	-	1	1	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	4	5	6	7	8	9	19	20	21
RESOURCE INFLOW													
Sales to JVSL		Rs'000000s	4,491.89		-	218.71	284.88	284.88	284.88	284.88	284.88	284.88	-
NPV for Sales to JVSL at economic discount rate (Real)	1,526.97	Rs'000000s											
Sales through JVSL		Rs'000000s	2,288.09		-	-	152.54	152.54	152.54	152.54	152.54	152.54	-
NPV for Sales through JVSL at economic discount rate (Real)	739.76	Rs'000000s											
Collection from TPECs		Rs'000000s	8,485.27		-	-	565.68	565.68	565.68	565.68	565.68	565.68	-
NPV for Collection from TPECs at economic discount rate (Real)	2,743.36	Rs'000000s											
Refund of banking & grid support fee		Rs'000000s	(422.60)		-	(14.60)	(27.20)	(27.20)	(27.20)	(27.20)	(27.20)	(27.20)	-
NPV for Refund of banking & grid support fee at economic discount rate (Real)	(141.62)	Rs'000000s											
Refund of wheeling fee		Rs'000000s	(2,108.00)		-	-	(130.73)	(141.23)	(141.23)	(141.23)	(141.23)	(141.23)	-
NPV for at Refund of wheeling fee economic discount rate (Real)	(678.62)												
Change in accounts receivable		Rs'000000s	(192.83)		-	(66.95)	(106.86)	(12.76)	(12.53)	(12.53)	(12.53)	(12.53)	156.57
NPV for Change in accounts receivable at economic discount rate (Real)	(141.68)												
Liquidation Value													
Land		Rs'000000s	(1.11)		-	-	-	-	-	-	-	-	(1.11)
Plant (buildings & civil works)		Rs'000000s	(68.86)		-	-	-	-	-	-	-	-	(68.86)
NPV for Plant (buildings & civil works) at economic discount rate (Real)	(8.95)	Rs'000000s											
Machinery & equipment		Rs'000000s	(400.13)		-	-	-	-	-	-	-	-	(400.13)
NPV for Machinery & equipment at economic discount rate (Real)	(51.99)	Rs'000000s											
Miscellaneous fixed assets		Rs'000000s	(24.33)		-	-	-	-	-	-	-	-	(24.33)
NPV for Miscellaneous fixed assets at economic discount rate (Real)	(3.16)	Rs'000000s											
TOTAL RESOURCE INFLOW		**Rs'000000s**	**12,047.40**		**-**	**137.16**	**738.31**	**821.91**	**822.14**	**822.14**	**822.14**	**822.14**	**(337.86)**

Statement of Externalities Resource Outflow (Real, Million Rs)

Model period ending					31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Financial year ending				-	1	2	3	4	5	6	7	19	20	21
Construction period				-	1	1	1	1	1	-	-	-	-	-
Operation period				-	-	-	-	-	1	1	1	1	1	-
Model column counter	Constant	Unit	Total	-	1	2	3	4	5	6	7	19	20	21
RESOURCE OUTFLOW														
Economic Opportunity Cost of Capital (EOCK)	10.74%	-	-	-	-	-	-	-	-	-	-	-	-	-
Preliminary & pre-operative expenses		Rs'000000s	40.09		23.53	16.56	-	-	-	-	-	-	-	-
NPV for Preliminary & pre-operative expenses at economic discount rate (Real)	38.49	Rs'000000s												
cost of land		Rs'000000s	(1.11)		(1.11)	-	-	-	-	-	-	-	-	-
NPV for cost of land at economic discount rate (Real)	(1.11)	Rs'000000s												
Engineering, Procurement & Construction Contract		Rs'000000s	(2,186.15)		(101.71)	(192.70)	(783.35)	(871.20)	(237.17)	-	-	-	-	-
NPV for Engineering, Procurement & Construction Contract at EOCK rate	(1,713.62)	Rs'000000s												
Miscellaneous fixed assets		Rs'000000s	(77.23)		(6.51)	(12.10)	(14.89)	(35.36)	(8.37)	-	-	-	-	-
NPV for Miscellaneous fixed assets at economic discount rate (Real)	(61.18)	Rs'000000s												
value of Reinvestment in Miscellaneous Fixed Assets		Rs'000000s	(68.27)		-	-	-	-	-	-	-	-	-	-
NPV for value of Reinvestment at economic discount rate (Real)	(16.36)	Rs'000000s												
Margin money for working capital		Rs'000000s	(26.24)		-	-	-	(26.24)	-	-	-	-	-	-
NPV for Margin money for working capital at economic discount rate (Real)	(19.32)	Rs'000000s												
Operating Costs														
Cost of coal		Rs'000000s	(937.10)		-	-	-	-	(30.23)	(60.46)	(60.46)	(60.46)	(60.46)	-
NPV for Cost of coal at economic discount rate (Real)	(313.30)	Rs'000000s												
Cost of corex gas		Rs'000000s	(43,165.97)		-	-	-	-	(1,392.45)	(2,784.90)	(2,784.90)	(2,784.90)	(2,784.90)	-
NPV for Cost of corex gas at economic discount rate (Real)	(14,431.53)	Rs'000000s												
Cost of auxiliary fuel		Rs'000000s	(8.71)		-	-	-	-	(0.28)	(0.56)	(0.56)	(0.56)	(0.56)	-
NPV for Cost of auxiliary fuel at economic discount rate (Real)	(2.91)	Rs'000000s												
Cost of O &M (labor, spare parts, overhead..)		Rs'000000s	(239.01)		-	-	-	-	(14.94)	(14.94)	(14.94)	(14.94)	(14.94)	-
NPV for Cost of O &M (labor, spare parts, overhead..) at EOCK rate (Real)	(82.38)	Rs'000000s												
Cost of wheeling fee		Rs'000000s	(2,108.00)		-	-	-	-	-	(130.73)	(141.23)	(141.23)	(141.23)	-
NPV for Cost of wheeling fee at economic discount rate (Real)	(678.62)	Rs'000000s												
Banking and grid support fee		Rs'000000s	(422.60)		-	-	-	-	(14.60)	(27.20)	(27.20)	(27.20)	(27.20)	-
NPV for Banking and grid support fee at economic discount rate (Real)	(141.62)	Rs'000000s												
Penalty payment		Rs'000000s	-		-	-	-	-	0	0	0	0	0	-
NPV for Penalty payment at economic discount rate (Real)	0.00	Rs'000000s												
Refund of TPECs Revenue to JVSL		Rs'000000s	8,485.27		-	-	-	-	-	565.68	565.68	565.68	565.68	-
NPV for Refund of TPECs Revenue to JVSL at economic discount rate (Real)	2,743.36	Rs'000000s												
Change in accounts payable		Rs'000000s			-	-	-	-	116.53	203.02	23.74	23.08	23.08	(288.55)
NPV for Change in accounts payable at economic discount rate (Real)	260.32	Rs'000000s												
Change in cash balance		Rs'000000s			-	-	-	-	-	-	-	-	-	-
NPV for Change in cash balance at economic discount rate (Real)	0.00	Rs'000000s												
Income Tax		Rs'000000s	(7,312.79)		-	-	-	-	-	-	-	(925.82)	(925.82)	-
NPV for Income Tax at economic discount rate (Real)	(1,644.95)	Rs'000000s												
TOTAL RESOURCE OUTFLOW		**Rs'000000s**	**(47,672.97)**		**(85.80)**	**(188.24)**	**(798.24)**	**(932.81)**	**(1,581.52)**	**(2,250.08)**	**(2,439.87)**	**(3,366.34)**	**(3,366.34)**	**(288.55)**
NPV for total resource outflow at economic discount rate (Real)	**(16,064.72)**	**Rs'000000s**												