Comprehensive Financial Model For Oil and Gas Field Projects In Qatar

Thesis submitted in accordance with the requirements of the University of Leeds for the Degree of Doctor of Philosophy

By

FAISAL F.J. AL-THANI

B.Sc (Petroleum Engineering, University of Tulsa, Oklahoma, USA)
M.Sc (Project Management, University of Bath, UK)
MBA (Strategic Information System, Heroit Watt University, UK)

**University of Leeds, School of Civil Engineering,
Construction Management Research Group,**

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Abstract

Project finance is essentially the raising of finance for a new project, secured against future revenues rather than an existing corporate balance sheet or other existing assets. The completion of the project, its successful and profitable operations, is therefore the key concern for all lenders and investors. This means that all the elements influencing the costs, revenues and returns from the project are of interest when determining the finance structure. Existing financial models were not designed to cover all these essential aspects. Analysis of the projected cash flows for the deal is therefore essential, from financial close to the end of the concession or plant life, under a range of assumptions.

A case study is developed using Qatar's North Field, RasGas (Ras Laffan Liquefied Gas Company) data for this purpose. This is a multi-billion dollar company set up to develop the Gas Extracting and Utilisation Project in Qatar. The projects cannot be financed from the present country revenue, and therefore, external project financing is required. Decisions have to be made regarding the amount to be raised, acceptable securities, criteria for a Target Capital Structure for all new Gas/Oil Extraction/Utilisation Projects and other related decisions.

The thesis verifies and validates a unique, innovative, specific, accurate and cost saving Comprehensive Financial Model for the oil and gas industry in Qatar, to facilitate the evaluation of new projects in the future.

About the Author

Currently in the capacity of Assistant to the General Manager, BP (after merging with Atlantic Richfield Company, Arco) Qatar, Faisal Fahad J. Al-Thani is a graduate (B.Sc) Petroleum Engineer from the University of Tulsa, Oklahoma, USA. Further, he also has to his credit an M.Sc in Project Management from the University of Bath, and an MBA in Strategic Information System from Heroit Watt University, United Kingdom.

Responsibilities include overall management of BP business operations in Qatar covering all technical, commercial, financial and administrative aspects. Major advantages of being in this position are being able to participate in BP (being a global player in the field of oil and gas) international management programmes.

On completion of his education, Faisal joined Qatar General Petroleum Corporation (*now Qatar Petroleum, QP*), Petroleum Engineering Department, as a development trainee, targeted for the position well site petroleum engineer (Offshore). Training included conducting pressure surveys, perforation and acidisation, injection tests, directional surveys, well logging and other operations, preparation of weekly reports, operations reports and to coordinate with the Tool pusher and driller. Upon completion of well site training, was transferred to the planning and economics section. Obtained 18 months training in the economic analysis, budget and cost control and contributed to the preparation of annual planning documents. Transferred to reservoir engineering section and, trained in all aspects of reservoir engineering.

In 1991, Faisal was confirmed in the position of Reservoir Engineer. Job responsibilities included operations and studies of Idd El Shargi (North Dome) Arab C reservoir. Successfully completed a simulation study of this reservoir. Promoted to look after the North Field Phase 1 operations and studies from the reservoir point of view. Dealt with North Field gas reserves, well resumes, well testing, gas seepage, ROV surveys, monitoring annular pressures and samples. Successfully completed 2D simulation study of the Bul Hanine Arab D (Interval III) reservoir followed by another 3D simulation study for the same reservoir. Served as a member of the IS study team and Bul Hanine study team. Served as North Field Coordinator for all information required by Exploration and Production Departments to fulfill the new company's requirements for North Field Development.

In August 1992, was designated as Head of Petroleum, Planning, Economics and Contracts. Responsibilities included development of medium and long-term development plans for the department and also for the Technical and Operations directorates, including the Ras Laffan Project (now called RasGas) and Mesaieed Gas Processing Facilities. Carried out project economics and developed complex economic models to be used for strategic decision-making by the Management and Board of Directors. Economic models included conventional, joint venture and Production Sharing Models (such as Ras Laffan Port User Tariff Model, Qatar Gas Economic Model and ISND Production Sharing Model). Provided assistance to other departments on project economic profitabilities, budget, cost-control and contract administration.

Faisal was seconded to Arco Qatar from September, 1998 as Assistant General Manager. From April 29, 2000 due to corporate merging, Arco Qatar has now come under BP and Faisal is Assistant to the General Manager.

Faisal attended various courses, seminars and conference both in Qatar as well as outside Qatar. Significant one was the complete SIPM (Shell Co.) Phase I and II course, in The Hague, Holland. He is also the author of many reports during his tenure with QGPC, notably Bul Hanine Interval III Simulation Study, Idd-El-Shargi Reservoir Study and North Field Gas Seepage Study, besides other reports. He has presented papers during some international conferences, the recent being the 3rd International Conference on Oil, Gas and Petrochemicals in Qatar during October 2001, conducted by International Business Conferences.

Further to his academic pursuits, Faisal is also active socially. He is the chairman of the Society of Petroleum Engineers (SPE), Doha Chapter. He is the General Secretary of the Qatar Equestrian Club as he enjoys horseback riding. Being the Chairman of the Qatar Scientific Club, is actively involved in organising various scientific activities in Qatar. He is also the Honorary Chairman of the Qatar Toastmasters.

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List of Abbreviations used in CFM

Abbreviation	Description
API	AMERICAN PETROLEUM INSTITUTE
BCF	BILLION CUBIC FEET
BOO	BUILD OPERATE OWN
BOT	BUILD OPERATE TRANSFER
BPA	BP AMOCO
CAPEX	CAPITAL EXPENDITURE
CE	CASH EARNINGS
CFM	COMPREHENSIVE FINANCIAL MODEL
CF	CASH FLOW
CFO	CHIEF FINANCIAL OFFICER
CIRR	COMMERCIAL INTEREST REFERENCE RATE
COI	CASH OPERATION INCOME
CR	COST RECOVERY
DDA	DEPRECIATION, DEPLOYMENT and AMORTISATION
DROI	DISCOUNT RATE ON INVESTMENT
DSCR	DEBT SERVICE COVERAGE RATIO
EBIT	EARNINGS BEFORE INTEREST AND TAXES
EBITDA	EARNINGS BEFORE INTEREST, TAX DEPRECIATION and AMORTISATION
ECA	EXPORT CREDIT AGENCY
ECGD	EXPORTS CREDIT GURANTEE DEPARTMENT
EPSA	EXPLORATION AND PRODUCTION SHARING AGREEMENT
FOGEI	FOREIGN OIL AND GAS EXTRACTION INCOME
GDP	GROSS DOMESTIC PRODUCT
IDC	INDIRECT COST
IOU	INVESTOR OWNED UTILITY
IRR	INTERNAL RATE OF RETURN
JCC	JOINT CONSULATIVE COMMITTEE
LIBOR	LONDON INTERBANK OFFER RATE
LLCR	LOAN LIFE COVERAGE RATIO
LLR	LOAN LIFE RATION
LNG	LIQUIFIED NATURAL GAS

LPG	LIQUIFIED PETROLEUM GAS
MBOPD	METRIC BARRELS OF OIL PER DAY
MMBTU	METRIC MILLION BRITISH THERMAL UNIT
MMSCFD	METRIC MILLION STANDARD CUBIC FEET / DAY
MOD	MODULUS
MTBCF	MEAN TIME BETWEEN CRITICAL FAILURES
NPV	NET PRESENT VALUE
O&M	OPERATION & MAINTENANCE
OPEX	OPERATIONAL EXPENDITURE
P&G	PURVIN & GERTZ
PI	PROFITABILITY INDEX
PLR	PROJECT LIFE RATION
POD	POINT OF DISPOSITION
POI	PROFIT ON INVESTMENT
PRI	POLITICAL RISK INSURANCE
PSC	PRODUCTION SHARING CONTRACT
PV	PRESENT VALUE
QED	QUANTUM ELECTRO DYNAMICS
RCOP	REPLACEMENT COST OPERATING PROFIT
RDBMS	RELATIONAL DATABASE MANAGEMENT SYSTEM
ROACE	RETURNS ON AVERAGE CAPITAL EMPLOYED
RG	RasGas (Ras Laffan Liquefied Gas Company)
SACE	EXPORT AGENCIES OF ITALY
SCF	STANDARD CUBIC FEET
SEC	SECURITIES AND EXCHANGE COMMISSION
STRESS	STRUCTURAL ENGINEERING SYSTEM SOLVER
UOG	UNITED OFFSET GROUP
UOP	UNIT OPERATING PROCEDURE
USEXIM	US EXPORTS / IMPORTS
WI	WORKING INTEREST
WTI	WEST TEXAS INTERMEDIATE

CHAPTER 1

GENERAL INTRODUCTION

1.1 INTRODUCTION

Project financing is defined as the raising of funds 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 their equity invested in the project. Project financing represents an alternative to conventional direct financing (31a).

Project financing can be arranged when a particular facility or related set of assets is capable of functioning profitability, as an independent economic unit. If sufficient profit is predicted, the project finance company can then finance construction of the project on a project finance basis.

Since project financing is generally used to fund large-scale natural resources projects, this thesis uses RasGas as a case study. Rasgas, a newly formed company required a multi-billion dollar investment to develop the Qatar's North Field Gas Extracting and Utilisation Projects. These investments could not be financed from the country revenue at the time, and therefore, external project financing was required. Decisions have to be made regarding how much money is to be raised, what mixture of the securities is to be used, and what securities would be acceptable to the international investors. Criteria have to be established for a target capital structure for all new gas/oil extraction/utilisation projects. To arrive at all these requirements, a well developed Comprehensive Financial Model (CFM) is essential. This financial model should provide a comprehensive tool to evaluate new projects in the oil and gas industry. This thesis will try to develop, verify and validate such a tool.

1.2 BACKGROUND

It is essential in project financing to have a financial model to evaluate projects prior to committing funds. The investors ensure a detailed study of the cash flows of the project to ascertain profitability of the project. The terms of the debt and equity securities are tailored to the cash flow characteristics of the project. For their security, the project debt securities depend, at least partly, on the profitability of the project and, on the collateral value of the project's assets. Assets that have been financed on a project finance basis include pipelines, refineries, electric generating facilities, hydroelectric projects, dock facilities, mines and mineral processing facilities.

Project Financing typically includes three basic features that are in the form of an agreement or assurances by the party responsible for the financial aspects of the project.

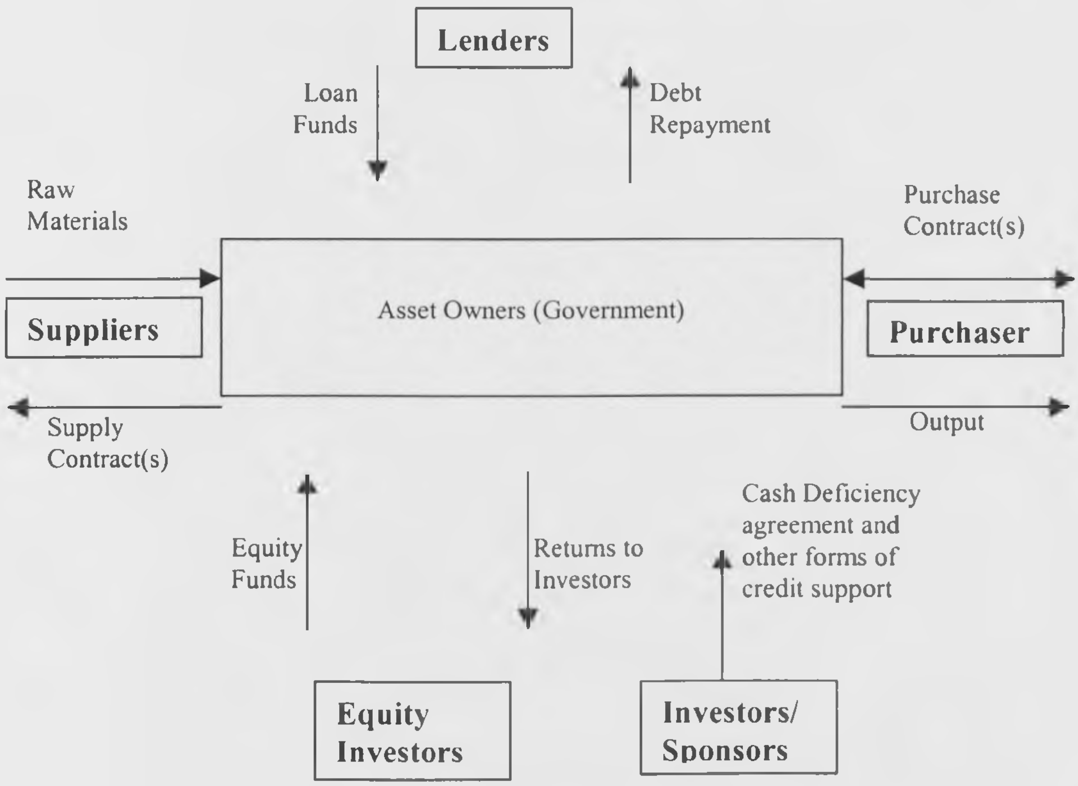
- Complete the project and make available all funds necessary to achieve completion.
- On project completion and commencement of operations, sufficient cash will be available to enable the project to meet all its operating expenses and debt service requirements even, if the project fails to perform on account of force majeure or for any other reason.
- If any disruption to operations occur and funds are required to restore the project to the operating condition, necessary funds will be made available through insurance recoveries and/or advances against future deliveries.

Project financing is different from conventional direct financing. In conventional direct financing, lenders to the firm look on the firm's entire asset portfolio to generate the cash flow to service their loans. The assets and their financing are integrated into the firm's asset and liability portfolios. Often, such loans are not secured by any pledge of collateral. The critical distinguishing feature of project financing is that the project is a distinct legal entity; project assets, project-related contracts, and project cash flow are segregated to a substantial degree from the sponsoring entity. The financing structure is designed to allocate financial returns and risks more efficiently than, a conventional financing structure. In project financing, the sponsors provide, at most, limited recourse to cash flows from their other assets that are not part of the project. Also, they typically pledge the project assets, but none of their other assets, to secure the project loans.

The term "Project Financing" is widely misused and probably even more widely misunderstood. "Project Financing" is *not* a means of raising funds to finance a project that is so weak economically that it may not be able to service its debt or provide an acceptable rate of return to equity investors. Briefly, it is not a means of financing a project that could not be financed on a conventional basis (31b).

Project financing requires careful financial engineering to allocate the risks and rewards among the involved parties in a manner that is mutually acceptable. At the centre is a discrete asset, a separate facility, or a related set of assets that has a specific purpose. Usually, this purpose is related to raw materials acquisition, production, processing or delivery. Recently, this asset is a power-generating station, toll road, or some other item of infrastructure. This facility or group of assets must be capable of standing alone as an independent economic unit. Operations, supported by a variety of contractual arrangements, must be organized so that the project has a high probability to generate sufficient cash flow to repay its debts.

Figure 1.1 - Basic Elements of Project Financing (31c)



A project must include all the facilities that are necessary to constitute an economically independent, viable operating entity. For instance, a project cannot be an integral part of another facility. If the project has to rely on any assets owned by others for any stage in its operating cycle, the project's unconditional access to these facilities must be assured at all times, regardless of events.

Beneficial aspects of project financing to a company with a robust proposed project are as follows:

- The project's output would be in such a strong demand that purchasers would be willing to enter into long-term purchase contracts and

- The contracts would have strong enough provisions that banks would be willing to advance funds to finance construction on the basis of the contracts.

Based on the above, project financing can be advantageous to a developing country when it has a valuable resource deposit, other responsible parties would like to develop the deposit, and the host country lacks the financial resources to proceed with the project on its own.

1.3 AIMS AND OBJECTIVES

Based on the authors experience, training, interviews and research, it became clear that there is no standard projects' evaluating tool to measure the profitability of new projects in the oil and gas industry and that a standard financial model will be essential in facilitating this evaluation.

The primary source of financing for the petroleum industry is the sale of oil and gas from successful projects (84a). The ownership rights to recoverable oil and gas in the ground vary significantly in various parts of the world. In most countries the petroleum resources are owned by governments, some exceptions being in the US and Canada. However, in both cases, it is a common practice to have someone other than the owner himself, undertake the exploration, development and production of these resources.

It is at the development drilling and facility installation stages that the oil company or host government is likely to be faced with a dilemma on financing. This is when it will look for different ways to finance the project. For the petroleum industry, various methods of financing projects are Bank Financing, Equity and Project Financing. The table below provides the pros and cons of these different methods of financing.

Table 1.1 – Pros and Cons of Different Methods of Financing

	Pros	Cons	Remarks
Bank Financing (Loans)	**Flexible and good for short-term borrowings**	**Very Costly due to bank fees and high interest rates**	**This type of Financing is generally good for small projects & companies**
Equity	**Fixed & acceptable rate of returns. Priority/assured**	**Liable of additional investment in case**	**Suitable for medium scale**

	supply of end product. Preference to supply raw material or provide services	**of cost overrun. Project failure trigger debt repayment. Construction period & early operation years leads to delayed and restricted dividends**	**projects**
Project Financing	**Provides Flexibility for future borrowings. Avoids committal of disproportionate amounts of borrowing capacity to a single project. Reduces effects upon borrowers credit rating. Isolates security & avoids impact on the operating company of cross default provisions.**	**Security of returns is the cash flow – involves risk. Investors may be vary or reluctant. Difficult to establish criteria to convince commercial lenders.**	**Suitable for oil & gas projects as the project returns will repay debts and fund the future project operation.**

As project financing is considered suitable for the oil and gas industry, the author realised that the disadvantages involved in project financing lie in the fact that there is no single comprehensive project evaluating tool in the industry. This tool would be in the form of a Comprehensive Financial Model that incorporates all essential elements and components related to the industry thus making it accurate, flexible and user-friendly. Such a tool would enable investors to get an unbiased picture of the proposed project and could be convinced to invest in it. They would be able to run the economic evaluation themselves, making necessary modifications to suit their requirements and check out the viability of the proposed project. This would generate transparent transactions and evolve a mutual trust between investors and the owner of the project.

The main aim of the thesis is to construct such a comprehensive financial model to facilitate the evaluation and development of new oil and gas projects. It is the intention of the author, to build a comprehensive financial model for new projects related to the oil and gas industry, focusing on the two main factors that are crucial to this industry and are related to each other. These factors being the price of oil and gas when it is produced and, the risk attached. The author's intention is to produce a model, which will be able to incorporate these fluctuations and give a long term look at the investment and return prospects of a new project development in the oil and gas industry.

Therefore objectives that need to be considered in order to realise this aim are as follows:

1. Review existing methods of project finance and financing LNG projects. The supply and distribution of infrastructure for oil and gas projects require project sponsors and buyers to make large, interdependent capital investments. For grassroots projects, substantial investments may be necessary for each link in the supply chain: field development; liquefaction plant and storage; ports and utilities; ships; receiving terminals and related facilities; and end-user facilities such as power stations or a gas distribution network. Huge sums required for these projects make their financeability critical to implementation.

2. Review existing financial models. It is important to secure information on existing financial models used to ascertain the viability of projects in order to build a comprehensive financial model. To achieve this, it is aimed to interview appropriate personnel from companies, which are already partners with and have shares in existing oil and gas ventures. The different models used will be investigated thoroughly to find out any limitations that exist. This would help incorporate necessary aspects into the comprehensive financial model.

3. Select and develop an innovative Comprehensive Financial Model (CFM). The main objective of this thesis is to propose, develop and provide an appropriate financial model to facilitate future financing and to accurately evaluate oil and gas ventures worldwide. This thesis will select the most appropriate principle of financial modeling.

4. Investigate, verify and validate the CFM utilising the RasGas (*Ras Laffan Liquefied Natural Gas Co.*) history data. RasGas is a multi-national company having various partners, one of the main being Exxon-Mobil. The reason for using Rasgas data is to investigate the essential elements of financial models (operational and financial) and to use the data to verify and validate the CFM by conducting a history match.

5. Make the modeling process quicker, easier and more accurate for the modeler and investor, to make the model as flexible, robust, comprehensible and user friendly as possible while taking into account all aspects and concentrating on the price and risk aspect related to the oil and gas industry.

In order to reach the above aims the thesis structure will review project finance in the oil and gas industry, specifically for LNG since Rasgas is a LNG company. Financial modeling will be discussed in general to consider what is essential for a comprehensive financial model. Main elements of financial model for the oil and gas industry, which are cash flow forecasting, pricing and risk and uncertainty, will be discussed. Various existing models will be reviewed, the CFM will be developed, verified and validated before concluding with some recommendations.

1.4 THESIS METHODOLOGY

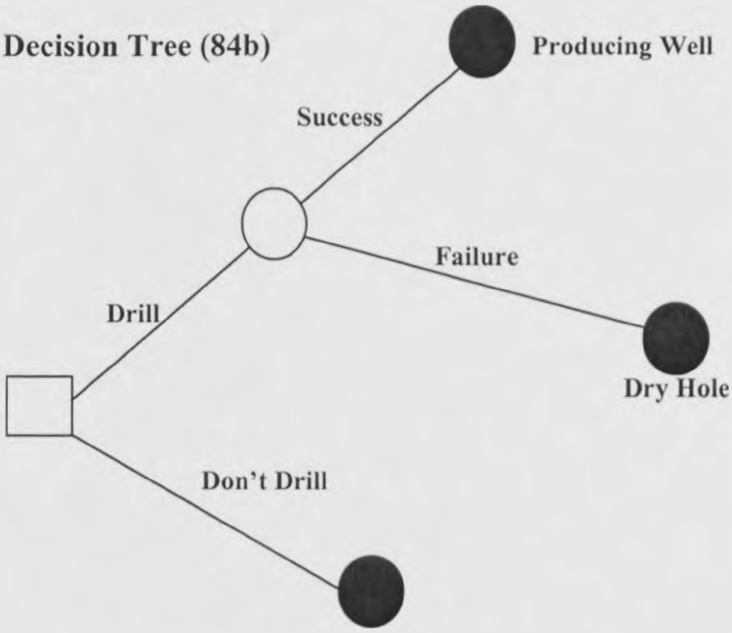
The thesis methodology consistent with the objectives, consists of two main activities. Those are the data acquisition and model structuring based on the economical/financial principles appropriate to oil and gas projects.

The technical and financial data gathering activities required to estimate the project capital requirements and project cash flows will consist of the critical review of the projects construction tenders and the projects technical specifications used on the stage of the projects design and construction. The discussions with the projects managers will be essential to gather the data required in order to forecast the project cash flows. Additional ways to gather data will be field studies that include visiting plants and facilities, questionnaires and interviews with personnel within the oil and gas industry and, attend seminars and courses on related subjects.

The Errors and/or Bias of the Cash Flows will be independently evaluated and compared to the same, seen by the Project Managers. Detailed discussions will follow and the points of differences will be analysed.

Decision trees are an excellent way of breaking down a highly complex decision problem into a series of simpler ones and also is a useful vehicle for examining the value of additional information to the decision process. Decision trees are constructed by diagramming all of the decision opinions and subsequent chance events associated with the particular alternatives. This allows the user to react to a series of 'what if' questions as well as to envision the range of possible outcomes of the project under study. The following figure shows a simple decision tree.

Figure 1.2 – Simple Decision Tree (84b)



Consider an exploratory drilling venture as depicted above. If we assume 65 percent probability of finding no production, the variables with respect to expenditure and outcome may be incorporated.

In the CFM, a decision tree analysis based on the Risk Evaluations will be performed according to the principles of economics. Results obtained could include: Payback, Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate of Return (IRR) and the Profitability Index (PI).

Expected financial market reactions to the public offering can be obtained based on the discussions with representatives of financial institutions. This methodology includes the original contribution to the knowledge of the multi-billion dollar project financing in the Oil and Gas Industry. The multi-billion dollar size of the investment and the financing required, to initialize the gas extraction and utilisation project, justifies in-depth study to develop the methodology and the computer simulated financial model to optimise and standardise the approach of financing oil and gas projects.

Microsoft Excel software is the proposed method to produce the CFM. Reason for opting for Excel is due to the fact that it is the most widely used software for financial and mathematical requirements worldwide and highly recommended in the oil and gas industry. Advantages of using Excel are:

- Easy user interface
- All business concepts/rules can be implemented without complex programming
- Concepts can be converted/implemented into sophisticated screens, menus and reports other development environment will be used. Changes in the concepts or logic can be easily implemented.
- As Microsoft office is widely used, distribution of this Financial model will be easy.
- Software upgrade is not needed. No Relational Database Management System (RDBMS) is required to present the thesis / prototype.
- Data entry for testing the module is easy which reduces the entry mistakes.
- Testing of the financial model can be done by any user, without any programming skills.
- Linking of modules is easy, yet the business rules and integrity is maintained.

1.5 LIMITATIONS AND SCOPE

Currently the oil and gas industry uses various financial models to evaluate new proposed projects. There is no specific financial model that would provide an investor or an entrepreneur an opportunity to evaluate the project to see the viability in terms of returns on his investment. The existing models face various limitations. Some are not flexible enough to accommodate various aspects required for any given project, some do not consider the fluctuating prices and need significant changes if there is any change in the price scenarios. Some of the models that this author came across do not fully consider the risk factors that are significant to the oil and gas industry.

Limitations of creating a comprehensive model include the economical and political scenarios present in the industry and also in a country. If the country does not support free enterprise, various restrictions that are in place could jeopardise the working of the model. Political factors play vital role in applying restrictions or keeping the economy free. Restrictions on foreign investments, funds flow into and out of the country hinders economic growth. Although fairly advanced, information technology is a field constantly developing and improving. With further development in this field, the financial model also can improve along with new technology and capabilities of more modern software.

The scope of the thesis is to provide a comprehensive financial model to the oil and gas industry concentrating on the price and risk aspects of the project. Limitations are instrumental in producing better results thereby increasing the scope of a project and also enhance the design and development of the CFM.

1.6 OUTLINE OF THE THESIS

The thesis carried out an overview of all aspects of financing LNG projects in Chapter 2. Financing grass roots LNG projects offers challenges. On the surface, a typical project ought to be inviting to debt investors, because of its attractive utility characteristics. The multiple sources of credit for the LNG business are discussed in this chapter. Further discussions include role of project sponsors, project finance, allocation of risk which is often seen as a hard to quantify factor, and also lenders' criteria and requirements as a lender has a different perspective on the LNG projects than the seller and buyer.

Chapter 3 on Financial Modeling discusses what a model consists of and how it is chosen and built. It details the need for financial modeling and its benefits. Concentrating on managerial strategy, stages of model development over project life and construction of a new financial model are the main contents of this chapter. Furthermore, the current cost model and proposed financial model is also included briefly. This is followed by a chapter detailing cash flow forecasting. Topics considered are cash flow estimation, identifying relevant cash flows, tax effects, changes in net working capital, role and benefits of information technology and finally providing some cash flow analysis examples.

Chapter 4 is about Cash Flow Forecasting. Cash flow forecasting is essential in financial modeling. The inflow and outflow of related funds each year is referred to as the cash flow stream. This chapter includes the cash flow estimate process, bias and options. It will try to identify the relevant cash flows, tax effects on cash flows, changes in the net working capital and also provide some cash flow examples.

Chapter 5 is about Pricing, one of the important elements of a financial model. This chapter will discuss the supply and demand relationship with prices, world oil pricing, the cyclic nature of crude oil prices, future crude oil prices and the effects of inflation on crude oil pricing.

Chapters 6 will focus on Risk Analysis and management. The risk analysis would deal with risk and uncertainty that would include the types of risk primarily being technical, economic and political. The characteristics of risk and uncertainty along with dealing with risks and oil and gas derivatives will be focused on.

It is essential prior to proposing and selecting the Comprehensive Financial model that existing models be reviewed, their flaws and advantages be highlighted in order to understand the need to produce the CFM. This will be done in Chapter 7. A case study will be done and documented in Appendix 2.

Chapter 8 will deal with the CFM. Unique requirements will be discussed. Explanation and methodology of the CFM will be provided. The case study results will be shown and the modules that will be included in the CFM will be documented briefly.

The CFM will be verified and validated in Chapter 9. Briefly the verification and validation process will be described. Verification and validation will be done by graphically comparing the results obtained using the CFM populated with Rasgas data and will be provided to an existing company to apply in their new project evaluation to obtain results.

Finally Chapter 10 will review the thesis to summarise if all aims and objectives have been met and provide a summary and recommendations for any further research in the future. Appendices will provide various existing models for comparison, the case study conducted by the author, transcripts of the interviews with key personnel in the oil and gas industry in Qatar, samples of the CFM modules and hard copy of the reviewed and analysed models.

CHAPTER 2

FINANCING LNG PROJECTS

2.1 INTRODUCTION

The purpose of this chapter is to understand LNG project financing. LNG projects are basically gas oriented and there is a new era of development in gas related projects, specifically in the middle-east region. Although the intention is to create the CFM for projects of the oil and gas industry, it would be essential to understand how recent developments have progressed in the financing of LNG projects being fairly new in the industry. The need for this chapter is also due to the fact that the case study conducted by the author is based on Rasgas data. Rasgas is a fairly new company in the State of Qatar that deals with all aspects of LNG as its main business.

2.2 PROJECT FINANCING

Before discussing financing of LNG projects, it is essential to review the benefits of and the various methods of project financing. The financial flexibility that project financing has, enhances shareholder value by giving the firm the opportunity to pursue growth opportunities which management will want to withhold proprietary information in order to maximise project value. Management's decision to resort to project financing can thus be interpreted as a positive signal regarding the attractiveness of the firm's proprietary investment projects (31d).

The inherent conflicts of interest between shareholder and lenders give rise to a variety of agency costs. Lenders deal with these agency costs by negotiating covenant structures that are contained in loan agreements. Covenants facilitate monitoring the borrower's financial performance. In addition, there are debt repayment provisions, such as sinking funds, that are designed to limit management's discretion to use cash flow that might otherwise be used to repay debt for other purposes.

Project financing can reduce these agency costs. A project has a finite life. Even the equity investors demand the distribution of free cash flow to the providers of the capital. Management's discretion to reinvest cash flow net of operating expenses – to the possible detriment of outside equity investors as well as lenders – is thus restricted contractually. Lenders have the senior claim on cash flow net of operating expenses. It is therefore generally easier to design a debt contract for a specific project rather than for the entire firm. This factor protects lenders against the asset substitution problem. For example, debt covenants can be tailored to suit the project's expected profitability and cash flow. If the targets are not met, violation of the covenants will trigger some form of contract re-negotiation. Also the sinking fund can be contingent on project cash flow. If the project performs better than anticipated, lenders will be repaid sooner, rather than having the cash flow invested by management in other projects, possibly to their detriment.

Project financing can enhance the effectiveness with which assets are managed. There is a link between the ownership structure of the firm and firm value. There are benefits that can result from giving managers a direct ownership stake in the firm. The purpose of such compensation programme is to align more closely the objectives of the firm's professional managers and its equity investors. Project financing nicely lends to management incentive schemes. Management compensation can be tied directly to the performance of the project. Profit sharing programmes are one such example. When managers have a direct share in the profits of the project, they can be strongly motivated to make decisions that enhance its profitability.

Various types of financing are:

<u>Construction Financing:</u> Bank Loan Facility, an alternative for construction financing is to have the project company or a special-purpose finance corporation issue short-term promissory notes or borrow short-term funds for construction directly from commercial banks. Under this alternative, security for the lending institutions will consist of the same completion undertaking and other contractual arrangements that long-term lenders will rely on for security in connection with the permanent financing. Typically, long-term lending commitments are arranged by the time the construction financing is put in place. Long-term lenders agree to "take out" the construction lenders, provided the project meets all its completion tests (31e).

<u>Direct Loans by the Sponsors to the Project Company:</u> A second alternative is to have each of the sponsors borrow its share of the required construction financing directly, on a short-term basis, from commercial banks, and then lend such funds to the Project Company. Following project completion, the project company arranges long-term financing on the basis of the long-term contractual commitments for the sale of project output and use of project processing facilities. The Project Company then repays its borrowings from the project sponsors out of the proceeds of the long-term financing. This

second alternative makes the project sponsors directly responsible for all the completion risk unless, they can arrange turnkey construction contracts to transfer this risk to the firms responsible for project construction.

Long-Term Financing: Investors are generally reluctant to commit funds more than two years in advance of takedown. Thus, for projects with lengthy construction periods, there will be some uncertainty as to whether permanent financing can be arranged before construction commences. In addition, especially for large projects that involve unproven technology, investors are often unwilling to commit to permanent financing without assurance that all the needed funding commitments have been obtained. In these circumstances, commitments covering all the funds requirements will have to be arranged at the same time, rather than having the project company conduct a series of financings during the construction period. However, when a project has a proven technology and a relatively modest capital cost, it is usually possible to finance a significant portion (or possibly all) of its cost at the beginning of construction, if the project sponsors so desire.

Private Placements: Long-term fixed-rate project debt is normally placed privately with sophisticated financial institutions, such as life insurance companies and pension funds. Direct placements avoid the cumbersome securities registration process that is required to affect a public offering. A private placement memorandum is prepared to describe the project and the security arrangements. It also provides a business description and a set of financial statements for each of the project sponsors. The maturity of the project debt would depend on the prevailing market conditions and would have to provide for annual sinking fund payments that probably begins the first year after completion of the project.

Equity Kickers: The inclusion of an equity kicker in a privately placed financing can broaden the market for the project" debt, lower the front-end fixed cost components of the financing, and induce lenders to accept less restrictive covenants and less demanding credit support. In effect, lenders receive an equity incentive to assume additional risk. Alternative forms of equity kickers include direct equity participation, net or gross revenue royalty payments (perhaps only of a limited duration), or one-time or multi-year contingent payments. The equity kicker feature is designed to raise the lenders' expected rate of return commensurate with the incremental risk they are being asked to bear (31f).

Withholding Tax Considerations: The existence of withholding taxes can influence the design of the financing plan for a project. Countries typically apply a withholding tax to dividend payments, interest payments, management fees, and royalty payments made to foreign entities. Often, the 'withholding tax rate' is governed by a tax treaty, the foreign recipient may not even be subject to withholding tax. Where tax treaties grant favourable withholding tax treatment to recipients in certain specified foreign jurisdictions, the project will have a tax incentive to raise funds in those jurisdictions (if funds need to be raised outside the host country) (31g).

2.3 FINANCING STRUCTURE

The most common structure for an LNG project is that of an Incorporated Joint Venture that is a separate company engaging in a business activity of the LNG supply chain on behalf of the shareholders. In practice, it often occurs that there are different companies sometimes with different ownership exist in Upstream Production, the Liquefaction Plant, the LNG Export Terminal, the LNG Carriers, and the LNG Receiving terminal and Re-gasification Plant. Joint ventures have proven successful in the LNG industry as it provides a mechanism to ensure that the interests of the exporting country are both recognised and realised through participation, often with a majority interest, by domestic private or public interests. This ensures that the legitimate sovereignty concerns are addressed through appropriate participation mechanisms for foreign partners. (72a)

Transnational LNG project sponsors have found joint ventures an effective means to manage investment risk while participating in a broad number of LNG projects. This approach assists the arrangement of limited recourse project financing and is used by transnational companies in joint ventures with other transnational firms. One example is Shell participating in actual and proposed LNG projects in Venezuela, Nigeria, Oman, Malaysia and Australia (73a).

LNG project sponsors may involve transnational firms, governments of exporting and importing countries, and large utility companies in the importing countries. Transnational firms typically have an investment portfolio approach that is similar to that employed by the managers of mutual funds where the exposure in a specific industry or geographical region is limited. In other words, a mutual fund will only invest a certain percentage of its assets in one industry or one company. Transnational energy companies will in a similar fashion limit the level of investment made in a given country. For example, Shell has limited its participation in the third phase expansion of the Malaysian LNG export complex at Bintulu, Sarawak. Instead, Shell has expanded the geographic scope of LNG operations to include Oman, Nigeria and probably a LNG expansion project in Australia. (82)

The reason for the participation of a government by a national oil company is that ultimately a government cannot be held liable for any debts or obligations and so on under the principle of sovereign immunity. Consequently, the commercial participation of sponsoring governments from the exporting and importing countries will be through partially or wholly owned state concerns as well as selected commercial enterprises. Incorporation and Joint Ventures is the vehicle by which private and public sector participation in support of progressing and LNG project to commercialisation can be realised. This has developed into a mature form through an evolutionary process in the past several decades.

The different types of project financing structures include, debt in the form of notes, debentures, bonds, subordinated notes, term debt secured by a particular asset, non-recourse debt, limited-recourse debt, warrants, options, tax-exempt industrial revenue bonds, capital leases, operating leases, service leases, bank loans, short-term notes and commercial paper. This debt, in turn, may be restructured or combined with interest rate swaps and options, and, currency swaps and options. The debt is supported by the financial viability of the project, direct guarantees, contingent guarantees, indirect guarantees and implied guarantees. Projects are structured using subsidiaries, unrestricted subsidiaries, nominee corporations, jointly owned corporations, general partnerships, limited partnerships, joint ventures and trusts. These borrowings, guarantees and entities can be combined in a variety of ways to produce a viable project financing.

To package and combine the undertakings of various parties interested in getting a project built (in such a way that no one party has to assume the credit responsibility for the project, while at the same time, providing a combination of guarantees and undertakings) will constitute a bankable credit. If a single strong credit (such as a government) agency will provide a guarantee, the task of structuring the transaction as a project financing for the remaining sponsors is much easier (72a).

The combinations of entities, guarantees, instruments and borrowings are limited only by the ingenuity of the architect of a project financing and the acceptability of the structure to investors and lenders. A Company considering project financing should review financial structuring methods used in other industries as well as its own industry. Some industries such as the petroleum industry have been successfully using various methods of project financing for many years. Structures used in one industry may be used, or may generate idea, for new structures applicable to other industries. And structures used for a project in one country may also be used effectively in another country despite difference in laws and tax consequences.

2.4 FINANCIAL CHARACTERISTICS OF LNG PROJECTS

LNG projects ought to be inviting to debt investors, because of the attractive utility characteristics. These include significant contributions by the owners, so that equity has a large stake in the success or failure of the project. Usually, the offer of the sponsor guarantees the debt through completion of construction; long and steady cash flow; strong, government-supported buyers with high political incentives to maintain the chain of supply/receipt of gas; minimal or zero foreign exchange risks and; relatively low 'external' risks (72b & 4).

These attractions however, can be balanced or outweighed by other, less attractive characteristics. High capital intensity, with almost all capital spent before there is any positive cash flow, long construction periods. Frequently, a long buildup period for volumes/revenues before anything like full capacity operation is reached. Consequent requirements that out-year cash flows be tapped for repayment of debt principal. These characteristics compel, ideally, a long debt amortisation period tailored to expected cash flow, combined with lengthy 'grace periods' for repayment of principal.

The changing nature of the LNG industry structure suggests that import finance of the 'traditional' type may not be available to launch a project. Indeed, the movement toward 'Independent Power Projects' (IPP), even if it is not in fact realised to the extent now being debated, is founded in part on governments avoiding, rather than contributing further to acquisition of capital required for new projects to supply electricity. Secondly, depending on the new consuming country, as participants, especially lenders recognise the risks represented by lower credit quality, and lack of confidence in performance and in hard currency availability, in comparison with that enjoyed in the past. Finally, the new IPP structures will present particular new challenges, as the IPP will represent a new, not necessarily creditworthy, intermediary between the LNG seller and the consumer (86a).

The broadest implication of the change in the structure of the consuming side of LNG is that, perhaps for the first time, gas sellers and buyers/users will need to work on a coordinated basis to achieve the debt capital required for the entire chain of investments, from wellhead to end-user. The reason for this must be explicitly recognised; the potential new buyers of LNG may not by themselves, have the international credit standing sufficient to tap the ready sources of debt capital in amounts required, either for themselves or for the projects supplying LNG.

The implications discussed above in turn lend themselves to develop a number of further steps, related not only to debt financing itself but also to commercial relations among various projects that should emerge from changes in the structure of the international gas business. These further steps are:

- The ‘LNG Chain’ from wellhead to re-gas facility needs to be extended.
- Given the reduction in credit quality assumed, the LNG sales contract must be fully ‘bankable’.
- The financial structures must be done in parallel and in coordination.
- In the case of IPP’s or similar arrangements, the capacity similar charge paid by the electricity buyer to the IPP must be structured so that an appropriate portion of it is directly accessible, and convertible to hard currency by the LNG project and its lenders.
- LNG and inland buyers (whether IPP’s or otherwise) will need to produce backers of adequate credit standing to support debt of both projects.
- All investors in the projects will have an interest in confirmation that payments will be received in a stable and freely convertible currency allowing effect receipt of dollars.

The multiple sources of credit for the LNG business are Import Financing; Export Credit Agencies / Commercial Banks; Supra-National Agencies and; International Capital Markets. A significant source of capital to the LNG project is already assumed – the very large capital contribution by the equity holders in the project. Not only do equity holders have a significant stake, but also they may be willing to guarantee debt through completion of construction. Assuming that the equity holders are large, creditworthy entities, this alone should offer a high degree of comfort to lenders (130).

Effectively tapping the capital markets will produce unaccustomed challenges to LNG projects and, their host and consuming governments. Access to this source of capital will require long-term ratings and the process may include a degree of disclosure of government affairs. This process is becoming increasingly familiar to governments around the world, and will in any event become necessary to permit the governments involved to be players in the international finance process for a wide variety of other purposes.

Given the extension of the credit arena across the LNG/electricity chain as well as the assumed lack of a single 'import finance' source, it is likely that future LNG projects will need to draw on multiple sources of credit to achieve their debt financing targets. This in turn absolutely requires that a multiple lending framework for all lending be imposed.

This common security structure is not something in which conventional bank lending is dealt with to any significant degree. Instead it is a deliberate establishment of a common security framework at the beginning of the financing effort, to which lenders subscribe. A multiple lending framework implies a good deal of adjustment in the ways which credit-providers have traditionally approached their tasks. Adjustments include:

- Early and unparalleled degree of cooperation between lenders and borrowers
- Lenders show greater flexibility and creativity in participating in financing solutions.
- Lenders re-examine the traditional due diligence and negotiation processes and, re-focus on commercial realities.
- Reduce or avoid duplication of effort which could arise in multiple financing, especially in the areas of legal representation and due diligence.

Based on the characteristics of LNG financing, the following points emerge.

- The new LNG markets may offer lower credit quality and greater exchange risk.
- Development of IPP business as a buyer of LNG will necessitate identification of the ultimate source of credit.
- Additional complexities in the credit of the consuming side. Lenders must accommodate the requirements and risks of credit for an integrated infrastructure industry.
- The 'import finance' approach may not be the model for the future.
- Due to riskier credits and possible unavailability of single-source import finance framework, it is important to conclude contractual arrangements for sales that are truly 'bankable'.
- Multiple lending sources to acquire debt financing at desired target level is essential.

2.5 ROLE OF PROJECT SPONSORS IN LNG PROJECTS

LNG projects are complex to finance since unlike many other energy projects the contracts holding the project together are not always within the project. The contracts may include the Buyer as well as the Seller and therefore involve concerns about the creditworthiness of the Buyer(s) as well. This is particularly important since the soundness of the contractual arrangements in the Sales and Purchase Agreement affect not only the financing terms but also the ability to even secure project financing (73b).

LNG project sponsors secure project financing on a consortium (group of companies) basis with each participant responsible for providing its share of equity to the joint venture company. Market lenders in LNG are fully capable of funding their own shares, or to borrow centrally, if required. However, this not the case for all participants. Lenders require security that the loans will be repaid and as a result, rarely endorse separate partner borrowings. Thus, the continuing standard arrangement will remain as all partners borrowing together as a consortium. Consortium financing necessitates that early on all participants reach mutual agreement on common financing objectives. That means early resolution of the following issues:

- Varying credit quality of partners resulting in guarantees of varied strength.
- Reconcile participants financing objectives.

- Conflict between a high royalty value for the gas and the economics of the joint venture.

The role of the project sponsors has to be considered from the standpoint of the relative role and strengths of the individual project sponsors. In LNG projects, the project sponsors are transnational oil companies with the State generally having a significant, often majority interest in the joint venture company through the agency of the national oil company. The fundamental role of the State in sponsoring a LNG project is to provide the following assurances:

- Necessary natural gas reserves will be made available for export.
- Necessary infrastructure (electricity, water, transportation) available.
- Future changes to regulation/fiscal regime will not impact the ability of the joint venture to repay its debts
- Economic interest of the private shareholders will be fairly treated in the future (72c).

Private shareholders provide different strengths ranging from LNG experience, technology, and marketing. As LNG project sponsors, the participants in addition, work to pool their strengths and capabilities, to "iron out" any differences between individual participants, to "pull together" to the common objective of progressing the LNG project from proposal stage to commercial operations. This requires working arrangements built on a high level of trust since proprietary and commercially sensitive information will be routinely shared (72d).

2.6 ROLE OF PROJECT FINANCE IN LNG PROJECTS

Project financing is essential in order for a project to proceed. One way to illustrate the importance is to present some typical gearing ratios for different parts of the LNG supply chain (ratios are based on projects in table 2.1).

- Upstream production facilities to the LNG plant inlet has project debt of 50 to 75 percent
- LNG plant 60 to 80 percent
- LNG export terminal 30 to 60 percent

- LNG carriers 70 to 95 percent
- LNG receiving terminal and re-gasification plant 30 to 60 percent
- Electric power plant 60 to 80 percent

In round terms, in the order of 70 percent of the capital requirements for the entire LNG supply chain are met through project debt, which are limited non-recourse loans or in some instances bonds issued through major capital markets. To understand exactly how this money is raised, it is helpful to consider the sources of the debt and which parts of the LNG supply change are amenable to financing by particular sources of debt.

The first step is with the LNG receiving terminal, the re-gasification plant, and the electric power plant along with the natural gas distribution system. These facilities are usually owned and the responsibility of the importing country (a utility company). Utility companies raise money through a combination of general borrowings for corporate purposes in the form of preferred shares, bonds, and sometimes project-specific debt. The sources of this money are the domestic capital markets, which are largely institutional funds.

LNG carriers (tanker ships) are financed on the basis of throughput and deficiency agreements that are the transportation equivalent of take or pay agreements for the LNG Sellers. The shipping company is paid a minimum amount, usually at least equal to the loan repayment schedules and the operational expenses, whether LNG carrier is used or not.

The source of project debt for LNG carriers is mostly Export Credit Agencies (ECAs). ECAs are governmental agencies that guarantee the exporter against defaults by a foreign importer in the reimbursement of his credit. The basic elements of export credits are, the privileged credit terms, either direct from a government agency or guaranteed by the agency. The coverage of the commercial, political and other risks inherent in exporting, are undertaken either by governmental or governmental connected agencies. Privileged credit terms specifically means a long term repayment period and privileged interest rates which may include a fixed rate at, or above the interest rate which the exporter government issues long term bonds. Coverage of the risks is through a credit insurance policy, which means the shipyards get paid once the ship is built and ready for delivery.

The construction of a LNG export terminal may include an entirely new harbour and facilities or it may be an extension to an existing harbour. In most instances, there is a significant involvement by the State, which generally supports the construction of necessary infrastructure from roads, electric power, water supply and treatment, and marine export terminals. A recent example is the State of Qatar construction of an entirely new seaport and city at Ras Laffan to support its LNG export programme, financing it through export credits and equity.

The LNG plant may be financed together with the upstream production facilities or separately and is the major focus of the efforts of LNG project sponsors. Project finance for the joint ventures have the following features:

- Long maturity for different loans and bonds to suit project cash flows.
- The lenders assume non-recourse project risks on a post-completion basis.
- The lenders benefit from partial protection against regional risks.
- The lenders assume integrated project risk for feedstock supply to LNG plant and LNG carrier delivery to Buyer.

With respect to separate financing of upstream production facilities and LNG plants, the decision is made on the basis as to whether there are separate joint ventures involved, for example Oman LNG, Qatargas; or whether it is an integrated joint venture for example, Rasgas. Although separate financing is more manageable and may be necessary if separate joint ventures are involved, disadvantages include duplication of effort, the need for extra coordination, risks of delays, and complex inter-creditor issues. The role of the project sponsors is to demonstrate to the Lenders that all participants are working together effectively to satisfy the concerns of the Lenders and that there is a level of predictability and risk comparable to other LNG projects. Then to secure the necessary project finance that typically funds 70 percent, (recently levels of up to 80 percent reported), of the LNG project, which can then proceed to construction.

2.7 LENDERS' CRITERIA AND REQUIREMENTS

Lenders have a different perspective on LNG projects than the Sellers and the Buyers. The Lenders will engage in a project risk assessment that will cover the following items, gas reserve and gas supply risk, construction and completion risk, technology and operational risk, LNG volume and price risk, transportation and environmental risk, interest rate and political risk (35a).

These criteria are not entirely complete when it comes to new LNG projects. Today, the challenging issues to lenders, are:

- Credit risk related to the emergence of new LNG Buyers.
- Price risk involving long term de-coupling of crude oil and LNG prices.
- Environmental risk as a new difficult to measure issue.
- Country risk is also difficult to measure and could be more weighted than economic considerations.

Lenders and financiers must address these issues or otherwise run the risk of absorbing these risks themselves. International Bank of Japan (IBJ) in its assessment cites the example of Nigeria where, all required capital had been raised by sponsors' equity and loans, without any third-party debt (as of 1996). Lenders also realise commercial benefits, albeit through loan repayment and interest, than through direct participation in the LNG project (72e).

Capital markets are the established money markets in countries like the USA and also some support from Western Europe and perhaps even Japan. The bond offering demonstrated that the market would accept billion dollar transactions and larger bond offerings as an alternative to ECAs and commercial banks are considered likely into the future. This has occurred since excess liquidity in the USA continues to persist with low treasure rates that will result in continued interest in bond offerings and other debt instruments from the so-called emerging markets. Investors could accept construction risk and increased price risk. The near investment grade projects are proving to be creditworthy with modest increase in margins (interest premium for risk). The investors will accept re-financing risk once a project is operating even when existing loans have not been retired. The project debt can have a higher credit rating than the host country.

Investors are willing to accept project setbacks and will continue to provide support and money for a wide range of reasons and this reflects a more integrated global economy.

Lenders' criteria and requirements may be summarised as confidence that the project economics and cash flow are sufficiently robust that the equity plus, interest repayments will be made on schedule over the amortisation (term of loan, years) period. Table 2.1 illustrates the significant role of Japan in the financing of LNG projects through Commercial Banks and ECAs. Again, it is necessary to name names in order to realise that there are relatively few agencies that deal with loans of one or more billion dollars. These firms do, of course, compete with each other when the financing opportunity is positive (robust cash flows) and this competition has led to better financing terms. This can be put as the premium above the LIBOR (London Inter-bank Offered Rate), which has generally a known premium offer USA treasury bills (t-bills) (86b).

Table 2.1 (86) **IBJ: Involvement in Major Gas Development and LNG Projects (as of June 28, 1996)**

Project (Year/Country)	*Major Sponsors/Promoters*	*IBJ Involvement*
Indonesia LNG (Original) (1974, US$ 1..547 M)	Pertamina, JILCO (Kansai Electric Power, Chubu Electric Power, Kyushu Electric Power, Others	Managing Bank of JEXIM joint finance for JILCO
Indonesian LNG expansion projects:		
• **Badak (1981 US$996M)**	JILCO, Pertamina	• Managing Bank of JEXIM joint finance for JILCO
• **Arun (1981, US$8-10M)**	INALCO (Tohoku Electric Power, Tokoyo Electric Power, Mitsubishi Corp.), Pertamina	• Managing bank of JEXIM joint finance for INALCO
• **Badak Capital Investment (Phase I & II) (1986-87, US$200M)**	Pertamina	• Agent and lead manager of syndicated project loan
• **Badak, Train E (1988, US$316M)**	Pertamina, Huffco, Total, Unocal	
Malaysia LNG (Sarawak LNG) (1980, US$1,233M)	PETRONAS, Shell, Mitsubishi Corp.	• Financial advisor for PETRONAS • Financial advisor for Malaysia LNG Sdn. Bhd. • Managing bank of JEXIM joint finance for PETRONAS • Participated in JEXIM joint finance for Mitsubishi Corp
North West Shelf Gas (Phase I) (1981, Australia, A$2,000M)	Woodside Petroleum Ltd. (WPL), BHP, Shell, BP, Chevron	• Lead manager of Euro-Syndicated project loan for WPL
North West Shelf Gas (Phase II) (1985, Australia, A$10,000M)	Woodside Petroleum Ltd. (WPL), (WPL),, Shell, BP Chevron, Mitsui/Mitsubishi (MIMI)	• Lead manager of EXIM co-finance syndicated project loan for MIMI
Thailand B Structure (1991, US$500M)	Petroleum Authority of Thailand (PTT), Total, British Gas	• Arranger and lead manager of Euro-syndicated project loan for PTT
Malaysia LNG Dua (1994, US$2,513M)	PETRONAS, Shell, Mitsubishi Corp., Sarawak State Government	• Lead arranger and coordinator
Qatargas (1994, Qatar, US$2,850M)	QGPC, Total, Mobil, Mitsui & Co., Marubeni	• Core bank and lead manager
Ras Laffan (1996, Qatar, US$3,405)	QGPC, Mobil	• Financial adviser for JGC who won the contractor's bid • Lead arranger

Table 2.2 (86)

OIL & GAS PROJECT FINANCING
Allocation of Project's Risks

No.	Project	Construction Risk	Operational Risk	Market Risk	Price Risk	Foreign Exchange Risk
1.	Pertamina-JNOC	Pertamina	Pertamina	Lenders	Lenders	No Risk
2.	1973 Bontang and Arun LNG Project	Pertamina	Pertamina	LNG Buyers	Pertamina	No Risk
3.	1981 Bontang and Arun LNG	Construction Contractor	Pertamina	LNG Buyers	Pertamina	No Risk
4.	1983 Arun #6 LNG Train	Construction Contractor	Pertamina	LNG Buyers (S.Korea)	Pertamina and Lenders	No Risk
5.	1986 Non Recourse Project Financing Bontang	Construction Contractor	Pertamina	LNG Buyers	Lenders	No Risk
6.	1987 Advance Payment (LPG)	Construction Contractor	Pertamina	Pertamina	Pertamina	No Risk
7.	1987 Second Dock Bonntang	Construction Contractor	Pertamina	LNG Buyers	Lenders	No Risk
8.	Bonntang Train E and F LNG Project (Non Recourse Project Financing	Construction Contractor	Pertamina	LNG Buyers (Japan + Taiwan)	Lenders	No Risk

Shown in Table 2.1 above is the International Bank of Japan (IBJ) role as LNG project financier in various projects around the world. The IBJ was involved in LNG projects in Indonesia, Malaysia, Australia, Thailand and also in Qatar. The IBJ involvement varied in different projects from joint financier to financial advisor and even core and lead bankers to certain projects.

Table 2.2 shows how project risk has been allocated as per historical projects. Most of the construction and operation risks were assumed by the owner of the project and the market risk was allocated to the buyers and in some cases the owner of the project. Price risk was predominantly allocated to the financier or lenders to the project.

2.8 SUMMARY

This chapter explains the role of project sponsors and the role of project finance in LNG projects. The purpose of reviewing the financing of LNG projects is that LNG is now getting quite popular as a clean and environment friendly hydrocarbon and in future will be widely used. The author conducted a case study on Rasgas LNG data and is reviewed in chapter 8.

CHAPTER 3

FINANCIAL MODELING

3.1 INTRODUCTION

In this chapter, the golden rules of financial modeling are outlined; understanding the need and benefits of a financial model, different stages of model development along with the timescale of the project is portrayed. Furthermore, model construction and the review of various types of models and their scope and limitations is presented. A brief outline of the proposed comprehensive model is discussed at the end of this chapter. Before setting out to create and develop a comprehensive financial model, it is essential to understand the elements of a financial model in general which will facilitate the aim and plan to build a comprehensive financial model.

3.2 FINANCIAL MODEL

In project finance, everyone's financial security rests on the future performance of a new undertaking. Therefore, a thorough review of various aspects of the project under a range of assumptions is a prerequisite for arranging debt equity funding. This is done with the help of a financial model. With the development of information technology, the computer can be programmed to run this model via macros. The results of such analysis can be used to determine whether a project is sound enough to pursue by giving an initial figure for project internal rate of return (IRR); establishing a finance structure that is sustainable by the project and; reassuring lenders and investors as to the attractiveness of the deal as a home for their funds (27a).

While every project will have unique features, and each spreadsheet package its own special techniques, certain principles apply generally to the construction of project finance models. There are basic 'Five Golden Rules' of financial modeling, listed below (55a):

- One Model for each project.
- Data in One Place.
- Consistent Formulae.
- No Circularities.
- Consistent Timeline.

"What is a Model?" This is an important question, since a true comprehension of the concept of modeling, as applied to the analysis of business problems, will enable the business manager to use financial models with confidence, and with a keen appreciation of both the strengths and the weaknesses of modeling techniques.

If a philosopher was questioned, "What is a model?" the answer could be "A model is a representation of a chosen reality". This definition is readily understood in the context of a physical model. For example, a plastic model of an airplane: the "chosen reality". In this case it is a particular type of airplane, and the result of assembling the plastic kit is certainly not a full size working airplane, but rather a "representation" which highlights certain features of interest, such as the shape, but ignores many others, such as the internal structure of the engines. But how does this definition apply to a more abstract context – in particular, how does this definition relate to a business management and the use of financial models? (14).

If the manufacturer of a particular type of airplane wished to interest a potential customer in his product, it is quite possible that he might use a model of his airplane to aid him in his task. By using the model, he could show to his potential customer the overall design of the aircraft, the position of the engines, perhaps even the layout of the seats. In this way, the potential customer's interest could be stimulated, and perhaps an agreement might be made to pursue the matter further. Subsequently, the customer might be accompanied by one of his engineers, who might ask technical questions, perhaps about the nature of the turbines in the engines. At this point, it is unlikely that the manufacturer would refer to the model used in the original discussion, for this model shows no detail concerning the engine structure. He might, however, have another model, a model only of the engine, which could be used to aid the technical discussions. The point here is that a model is useful only in so far as the particular representation embodied within the model meets a particular defined need.

When building the model it is important to be clear as to its function, not only in terms of the analysis to be performed and the results produced, but also as regards mode of use. Is the model going to be run by the modeler, processing data and providing outputs as required by third parties? If so, then the structure of the model could be rather different than would be required, if, for example, the people organising the deal want to be able to run the model themselves.

While the model should always be laid out to facilitate its use and development by another competent modeler in case of emergency, leave or job changes, this is rather different task to that of ensuring safe and easy access for a third party with a minimum understanding of the 'nuts and bolts' of the model. If it is possible to anticipate the data items that are likely to be varied during such use, it may be possible to prepare a single page that allows entry of relevant data items and provides a summary of the key results produced. The rest of the model can then be protected to prevent ill-conceived changes being made, which could produce anomalous results. Such a page can be prepared in the format of a 'Key inputs and results summary'.

As a project progresses from the early stages of basic feasibility assessment to final completion and drawing of funds, the contribution made by the model changes also develops.

The model provides a basic analysis, usually based on relatively raw, preliminary data and simplified financing assumptions, to establish whether a given project is worth pursuing further. The required output may be: (a) basic project IRR; (b) an indication of the tariff levels required to achieve appropriate returns; (c) the general level of returns achievable with anticipated revenue levels; or (d) indicative amounts of debt and equity required to fund the project.

Once a decision has been made to move from the very basic feasibility analysis, work will begin to establish the optimum financing structure for the project. This will consider the various types and amounts of funding potentially available, and the structures and levels of funding supportable by the anticipated cash flows. The analysis will probably use debt cover factors and equity returns to establish an appropriate debt: equity ratio. When the analysis has established the preferred financing structure, detailed work will be undertaken to establish facility sizes and to explore the robustness of the finance structure under a number of sensitivity assumptions. The facility sizes will usually be based on a case that incorporates some downside assumptions when compared with the anticipated base case; this is to ensure that funding is available to complete the project, even if things do not go precisely to plan. In addition to the main facility amounts, the model may be required to provide an indication of appropriate sizes for standby debt or equity facility amounts, and achievable repayment or return arrangements for such facilities.

As the details of the project structure are incorporated into the developing project documentation, they must also be included (in so far as they are relevant) in the model structure. This is to allow the figures to reflect correctly the currently understood structure of the project. The production of sensitivity analyses using the model allows the identification of any variables to which the key results are particularly sensitive. Issues that are critical to the economics of the project can thus be addressed in the structure of the deal, and key risk mitigated or eliminated.

As documentation is negotiated, the model must provide guidance as to a range of values and structures that might be offered or accepted without compromising the proposed funding and returns for the deal. If used in support of a competitive bidding process, the model must provide figures for inclusion in the bid such as tariff or total investment cost values, together with any supporting calculations required, and any specific variants requested as part of the bid or additionally offered by the bidders.

With the target finance structure and other project structures in place, the model must produce figures correctly reflecting these structures and other up-to-date data assumptions for use in raising funds. The documents produced in support of fund raising will usually incorporate results from a base case and from a number of sensitivity cases. The nature of the sensitivity cases will depend upon the precise structure of the deal, and will generally include a banking 'worst case', incorporating a number of downside assumptions, and possibly an 'equity case' showing the upside potential of the deal.

Once potential lender/investors have been approached, many will wish to analyse the project using a number of sensitivities of their own. Often, the originator of the invitations to lend to or invest, will use the original model to perform this activity. Occasionally, a loan agreement will include a requirement for periodic checks on, for example, loan cover factors, incorporating updated cost, revenue or macro-economic assumptions. Based on the results of such checks, constraints may be placed on loan drawings, or acceleration of repayments may be required. When a project involves a complex sale price agreement or similar calculated item, which may require adjustment in the light of actual, rather than projected, information, then a given version of the model may form part of the documentation, and may be run periodically to provide the actual tariff or other figures needed over time. (27b)

3.3 STAGES OF MODEL DEVELOPMENT OVER PROJECT LIFE

For any given project, a financial model will usually be required to fulfill several of the roles listed above, often developing through from the feasibility model to the final model used for fund raising. Given that detail and data are often acquired gradually over time, it is important that the first model should be structured to allow easy onward refinement to the final model. Thus, as details are incorporated, the effort invested contributes towards the goal of achieving a final model.

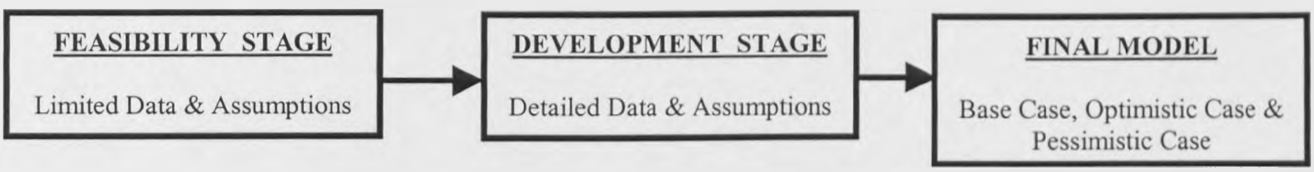
Although a the financial model will be run using a computer and assisted or automated by the use of macros, it is needless to say that the ultimate creator as well as user of the model is man. A person has to design and place it before a modeler who is well versed with the computer and software in use. Being computer literate these days is an essential requirement and hence usually the designer is also the modeler, which is quite beneficial as he knows what results he wants to model to generate and can build it in such a manner. The modeler will have to spend long hours to design, develop and integrate the model with macros to automate the calculation process incorporating various logical variables as required. He then has to populate the model with data, find out if the results are precise using other methods as the calculator or manual calculations. Next will be the checking and debugging process. It is highly impossible and impractical to get all macros working in one go. There will be some logical references and other formulae that are not performing as required, the problem areas will have to be defined and rectified. Finally the entire model needs to be well documented so that it can be used by other personnel in the company or can be presented to investors / bankers to run it using their sensitivities. All the above is a monumental task for the person creating the model, although once created, there is a satisfaction of achieving positive results.

In order to allow the model to provide the analysis required at each stage of the project and to develop smoothly over the project life, it is important for the modeler to be kept properly informed at all stages and given a wider understanding of the deal and the issues involved. Whenever possible, meetings should be attended to acquire and maintain a wider familiarity with the deal and the issues under discussion. This process helps to reduce the risk of errors and omissions. The implications of certain issues for the model may not be apparent to those unfamiliar with its structure and logic, and serious errors can arise simply because no one has communicated seemingly unimportant information back to the modeler.

When developing the model, it is important to bear in mind what stage the project has reached, and the level of detail available in the data; this information should then be used as a guide to the complexity of the model. The initial poor quality data will allow the model to be run and checked and indicative results to be obtained prior to provision of the better information. In the later stages of a deal, when detailed data and assumptions regarding the financial structure and so on are available, it may well become necessary and appropriate to model at a very detailed level.

There are three stages of model development (27c) as shown in the following figure:

Figure 3.1 – Development of a Model – Flow Chart



Feasibility Stage: This stage involves the assessment, if a project is worth pursuing. The model needs to be prepared quickly and must run with limited data and (probably) very general assumptions as to financing, timing of capital expenditure and operations. Depending on the nature of the project, the model may be required to give an indication of possible equity returns with reasonable cost and revenue assumptions, or of tariff levels needed to give reasonable levels of equity return. Here the model should be structured to allow easy development for further use. Even with limited data and assumptions available at this stage the structure and layout should be followed.

Development Stage: During the development of the project the model will be subject to considerable change. It will be much more complex than the feasibility model, incorporating detailed data and assumptions, and possibly reflecting more than one structure for particular calculations as more options are assessed and reviewed. At this stage the model must be able, at short notice, to reflect quite significant changes or additions.

Final Model: Once a final structure has emerged for the deal and the majority of the project documentation is in place, the model reaches a final form, established around a base case. The code of the model should require little change from this point on: cases will primarily be run to reflect final changes in data and to provide a range of sensitivity analysis. At this point the model may well be somewhat simpler than it was during the project development because, with the final structure established, alternative structures can be removed from the code. This simplification may, of course, be offset by the detailed reflection of data and agreements.

For raising finance, three cases (base case, optimistic case and pessimistic case) may be developed that incorporate a number of assumptions which will be used to establish the loan facility amounts, together with a selection of key sensitivity cases. The control and identification of the case being run becomes critical at this stage.

3.4 ESSENTIAL ELEMENTS OF A NEW MODEL

When confronted with the prospect of creating a new model, it can be hard to decide what to do first. The complexity of the first version should be appropriate to the level of detail in the available data. Running sensitivities provides a further checking mechanism for the model. As sensitivities are produced, compare the key output with the base case and other sensitivity values, and check that the change seems reasonable based on the data items varied for each case. Unanticipated outcomes should be checked and basic revisions made.

Aspects that need to be considered in the construction of a model are (27d):
Flexibility and Clarity, Layout, Timeline, Timescale, Consistent Signs, Currency Treatment, Circular and Iterative Calculations, Control and Identification of Sensitivities and Data.

Flexibility And Clarity. The model must be structured so as to allow major changes to the code to be made quickly, easily and with little risk of introduced error. Flexibility is critical to the model and should be incorporated to consider changing data, producing a variety of runs, allowing for development and revisions over project life.

Clarity of layout and labeling helps the modeler and any other parties using the model to navigate within the spreadsheet, and to identify the items they are looking for. Clear presentation also makes output more helpful, and facilitates auditing of figures.

Layout. The underlying layout of the model provides the essential framework. Basically this can be the same for the first feasibility model and the final project model. Layout includes the organisation of various sections, rows, columns and pages of the model within the spreadsheet. Proper guidelines can ensure that these elements are best arranged to support the development, use and presentation of the model.

Consistent use of an 'optimum layout makes best use of time and resources; Saves time when revisiting old models; Other modeler's work is easier to use if a consistent basic layout is adopted by all; and The early model will automatically be structured to allow development to the final model.

The layout of a model can initially be broken down into three main sections that are:

- Data – *numeric inputs, switches controlling its operation.*
- Calculations – includes but not be limited to *Worklines, Capital costs, Finance, Operations, Tax, Profit and loss, Returns, Cover factors, Cash balances, Balance sheet.*
- Reports – *Cash flow summary, Key inputs and results summary, Investment period sources and uses, Annual summaries.*

Additional sections may be required for specific projects – for example, those using a cost based tariff would require an additional tariff calculation section.

Timeline. The model provides an analysis of values in the context of their relationship over time. Hence the model has a timeline – a header that indicates the point in the analysis occupied by each column. This should clearly indicate the timing of each period and ideally should occupy the same rows in all pages of the spreadsheet to simplify print

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settings. The timeline should cover the whole project life. The length of time covered by the model should be determined with reference to the nature of the deal, the expected life of plant, the concession period, plus an additional period to allow for delays, other sensitivities, or negotiation of a longer period. Where no obvious limit applies, consider the declining impact of values distant in time on cover factors and returns, and select a sensible period.

Timescale. Generally initial data is often annual and final data would include monthly expenditure profiles, thereby what timescale should be selected? A six-month period will provide the best balance between practicality and accuracy, bearing in mind that monthly accuracy can readily be incorporated into a semi-annual model. Six-monthly periods usually work well with finance calculations, allow seasonal or other cash flow variation within the year to be reflected, and allow most projects lives to be modeled in a manageably sized model. Timescale should be consistent within the model, every column should represent the same length of time and a given column should always represent the same point in time.

Consistent Signs. The model will inevitably contain values that represent costs and revenues flowing from and to the project. Some of these appear to have an inherent positive or negative value in relation to the project. It is tempting to assign a positive or negative sign to such values throughout the model, with totals and sub-totals thus being able to sum together all relevant rows and achieve the correct calculated total value. However, that it is preferable to present all basis values in absolute terms, and add or subtract as required in the formulae that uses them. Thus the descriptive title of a row, and its context, will indicate whether a value is an addition to or deduction from project cash flows. Sub-totals, totals, net transfers to/from accounts, and other items, where it is specifically appropriate, may then show a mixture of positive and negative values, the meaning of which should be clear.

Currency Treatment. Usually, costs and/or revenues will be denominated in more than one currency, and the model must be able to cope with this. The most obvious approach is to prepare all figures in their underlying currency, then covert them as required when different currencies have to be combined for calculation purposes. There are however, advantages to adopting a rather different technique. Instead of including figures in a variety of currencies, the model can be produced in a single, presentation currency, with key figures being converted back into their underlying currency as needed for presentation in results sections. Obviously, careful thought is required when setting up the model on this basis to ensure that currency issues are properly treated. Treatment of currency issues for tax and accounting purposes will vary from country to country, and deal to deal in a given country.

Circular And Iterative Calculations. Although individually these may seem minor issues, there are a number of disadvantages to simply writing circular code. While it is often impossible to eliminate circular arguments from the model, there are techniques that allow such circular calculations to be solved using iteration of linear code. Using macros to solve circular calculations via successive approximation is one such technique. Elimination of the inherent circularity could be either impossible or impractical. Circular code can however be avoided, and control of the calculation achieved using successive approximation. This involves breaking a circular calculation at a suitable point and repeatedly entering and re-entering the value for a given element of the calculation, iterating towards a solution until a required level of accuracy is achieved. This of course reflects the operation of the built-in iteration provided by the spreadsheet package and is advantageous

Control And Identification Of Sensitivities. One of the key functions of the project finance financial model is the provision of a range of sensitivity analysis based around a defined base case. During development of a deal, given sensitivities are often repeated over time as data is refined and updated. Therefore, in addition to ensuring that models are written in a flexible way with full control from data, it is important to ensure that sensitivity cases can be readily and accurately repeated, that the base case can reliably be restored after each sensitivity, and that runs and associated printout can be reliably identified. The following suggests how these targets can be achieved.

- Use of switches
- Use of strings to automatically identify runs
- Automation and ‘storage’ of sensitivity cases

Data. In order to properly control and run a model, it is extremely important to keep track of the variables upon which any given run is based, and to be able to access such variables and change them with confidence that such changes will be logically and comprehensively reflected throughout the model. This is obviously much better supported, by having all data items entered in one area, where they can be easily located, reviewed and, as necessary, changed. The data section in itself automatically produces part of the documentation for the model. Review of the data will give a full picture of the numeric and, in the case of certain switches, some of the calculation assumptions of the model.

As for the model as a whole, it is helpful to follow a logical layout for the data section, making it easier to find given data items, particularly once the data section reaches the considerable size common in the later stages of complex deals. The layout can be on any basis, provided data is grouped into sensible categories, but it makes sense to roughly reflect the layout of the calculation sections of the model, with some specific additions. Some of the categories can be
Timeline data; Capital cost data; Finance data; Operating data; Economic data; and Tax and accounting data. Some of the likely problems could be *Wrong frequency, Nominal values, Too Complex, Too Simple, Various Documents, Confirmation.*

The above aspects are essential due to the following reasons. Flexibility and clarity is critical to the model in terms of both allowing development over the project life and of performing a variety of runs with any given version of the model. Consistent layouts make best use of time and resources specially when revisiting old models and also the early model will automatically be structured to allow development to the final model. Timeline is essential to cover the whole project life and to place values in time. Timescales is helpful to avoid problems with formulae address appropriate time periods in other areas of the model and also NPV and IRR calculations can easily be calculated over a given timescale.

Currency issues should be properly treated so that formulae can address any cell in the calculations without the risk of mixing amounts in different currencies and also auditing can be an easier process. Using macros to solve circular calculations help keep clear control over the calculations, control over the level of accuracy, have a clear audit trail and prevent irreversible propagation of errors throughout the model. Although the calculation remains circular, the code becomes linear.

3.5 CURRENT COST MODELING

The current practice for Qatar's LNG industry in raising loans of several billion dollars is:

- The lead or coordinating bank develops a computer model of the project with the aid of the financial advisor on either an Excel or Lotus spreadsheet.
- After the loan is secured, the lead bank periodically updates the computer simulation model to confirm that the provisions in the loan are being adhered to, which necessarily includes the actual historical cash inflows and outflows.
- An independent auditor confirms the historical values and forecast estimates as well as the consistency of calculations performed by the model with governing agreements.
- The operating company receives the model and performs a final check on consistency with current budget plans and actual results.
- The updated computer model is distributed to the Shareholders who perform an independent analysis based upon their anticipation of future prices and markets.

It is to be demonstrated that a general computer simulation model to develop the model capital structure is a feasible and realistic tool that would be used by decision makers to support continued orderly development of Qatar's North Field.

In order to stress the need for a comprehensive financial model, it is imperative to briefly look at the types of models and their limitations, if any. The following is the table of the aforementioned comparison.

Table 3.1 (14b) – Comparison Table of Various Types of Models

Model Type	Complexity	Benefits	Remarks
Investment Appraisal – Taking into account only the investment to a	Moderate	Very easy "What if…? Analysis. Quantification of risk	Likely to be one model for each investment project. May not be flexible

particular project, no account of reserves life.			enough to accommodate all oil and gas projects
Acquisition & Mergers – Model created specifically for the purpose of acquiring or merging with another company	Moderate to complex	Very easy "What if…? Analysis. Quantification of risk. Better information for negotiation. Analysis of synergy	Likely to be one model for each acquisition or merger prospect. This may be suitable for only such actions and not for new projects.
Budgeting – Model built taking into account the cash flow requirement in terms of Operating and Capital budget only.	Usually complex	Reduction in clerical effort. Ease of revision. Use of the same model by different budgeting units will lead to a consistency of approach and accuracy.	Would be more appropriate to the financial sector such as banks and exchange houses, not for new oil and gas projects.
Tax planning – Model considers the tax implications of the host state.	Simple to very complex	Exhaustive analysis of alternatives. Benefits can be quantified in terms of potential or actual tax savings.	These models are helpful for auditor or business houses to help tax computations. Not suitable for the oil and gas industry to evaluate new projects. However aspects could be incorporated into the proposed model.
Training – Only training aspects	Simple to moderate	Improved awareness of the possible	Sporadic according to training needs.

considered usually for a Service provide Organisation		implications of alternative financial decisions	Could be suitable for projects taking into consideration only manpower needs.
Financial planning – Model applying many of the above methods like tax planning, budgeting.	Simple to very complex, depending on the specific nature of the problem	Improved information leading to better financial decisions	Certain aspects to be incorporated in the proposed financial model
Forecasting – Incorporates all aspects like Operating & capital costs, reserves life, future sales.	Simple if restricted to techniques such as simple extrapolation, can become complex if use is made of advanced forecasting techniques.	Improved analysis of market. Reduction in manual effort. Improved treasury control. Early warning of cash flow problems. Accuracy.	Reasonably suitable for the oil and gas industry.

Besides studying the different aspects of financial modeling and comparing the benefits and limitations, a few financial models were reviewed and compared to get a better understanding as to the limitations of existing models. This will be done in chapter 7.

3.6 ROLE OF INFORMATION TECHNOLOGY AND BENEFITS OF THE COMPUTER

If financial models were built one hundred years ago, all calculations – additions, subtractions, multiplication and divisions – would have been done completely manually using techniques such as long multiplication. If the forecast were done five or ten years ago, the process would still be described as 'manual', although, in truth a better term would be 'semi-manual' since an electronic calculator would be used.

It is a fact that building a financial model, the cash flow statement is a laborious process. A much easier way would be to use a calculating machine capable of executing all the required operations in the correct sequence, so that all the user needs to do is enter the required data, press the appropriate button, and wait for the answers. A personal computer is the modern day tool and constant development and upgrades of relevant software is an advantage to financial modeling.

From the standpoint of financial modeling, a computer should be regarded simply as a more powerful desk calculator. But whereas a desk calculator can perform only one step at a time, a computer can store a sequence of instructions, and also all necessary data, so that all required operations may be carried out automatically, and the results printed out.

The sequence of instructions resides in the 'programme' within the computer and the skill of the computer programming comes down to the ability to create a set of instructions, which enables the computer to perform the required operations in the correct sequence. The crucial distinction made between data and logic has to be appreciated. In order to programme a computer to prepare, for example, a cash flow forecast, it is necessary to define all required logical operations, and construct a computer programme accordingly. Once the programme is written and tested, and the user supplies the appropriate data, the computer will calculate results.

The process of building a computer based financial model is consequently one of deciding on a complete and consistent set of logical rules appropriate to the problem; the process of using a computer based financial model is consequently one of selecting the appropriate data, and then applying that data to the predetermined logic. The separation of data from logic, as achieved by the use of a computer, gives the model user a very powerful tool for solving problems. The essential feature of a computerised model is that if a change is required to a single item of data only, this can be done easily. The logic of the problem is totally unchanged, in that all the fundamental relationships are exactly the same, and are independent of the data applied.

Using a computer based financial model, however, the situation is very different. The model within the computer, as expressed in terms of the computer programme, represents all the required logical relationships, and these have remained unchanged. All the user has to do, therefore, is to change the appropriate item of data, and to instruct the computer to use the revised set of data, and apply it to the original logic. The result of this exercise is a revised cash flow statement, which could well be calculated and printed literally within minutes.

This situation, in which different data is applied sequentially to the same logic, is extremely common, and is embodied in the now hackneyed phrase "What happens if....?". Almost all financial planning problems are concerned with "What happens if....?", and almost all such problems, for example "What happens if sales increase by 5%?", "What happens if inflation falls to 3%?", and so on, relate to changes of data, rather than logic, for any given problem.

As a consequence, if the relatively static logic of a problem may be held in a computer programme so that the business manager can use the same logic repeatedly on different data, the manager has a very powerful tool at his disposal for the solution of business problems.

Benefits of the Computer:

Since solving problems is an integral part of management, and computer based financial models can help solve financial problems, it follows that financial modeling, using computers, will become or rather has already become an increasingly important management technique.

The process of building a computer based financial model requires that complete logic of a particular problem is not only fully understood, but translated into a computer programme, which is then tested and documented, and made ready for use. Few financial problems are trivial, and many are very complicated indeed. As a consequence, some financial models may be correspondingly complicated to build. Nonetheless, building a good financial model is not necessarily an easy task, and is often time consuming. Successful model building requires a disciplined approach, is often very hard work but essential for the following reasons (70).

- The computer performs the calculations for the financial model extremely quickly, thus enabling management to spend time to exercise skill and experience in selecting the data to be used by the model, and interpreting the results.
- Once a computer programme has been fully tested it can be relied on for arithmetical accuracy and related concerns can be eliminated.

- Modern computers easily fit on a desktop, are completely independent and can be directly under the control of the user.
- The process of building a model requires that the particular problem be analysed in depth so as to derive an appropriate set of logical rules by which the problem can be solved. This inevitably gives a truly profound insight into the problem, such that there is a feeling almost of euphoria when a consistent and complete set of logical rules has been established.
- Confidence is the pleasant feeling that one gets when there is an insight into a problem. Various problem scenarios can be simulated and solved prior to any business meeting, thus confidently providing ready solutions if required.

3.7 PROPOSED COMPREHENSIVE FINANCIAL MODEL

The author aims to work and build a comprehensive financial model for new projects related to the oil and gas industry, focusing on the two main factors that are very crucial to this industry and are reasonably related to each other. These factors being the price of oil and gas when it is produced and the risk attached. The aim is to create a model that will be able to incorporate these fluctuations, and give a long-term look at the investment and return prospects of a new project development in the oil and gas industry. This in turn will have a positive impact on the keeping cost at a comfortable and low level and thus increasing the profitability of the project or venture. Chapter 8 will try to define the CFM and document the modules that would finally be incorporated in the CFM. The objective is to provide a comprehensive, robust, cost saving, accurate and user-friendly financial model.

3.8 SUMMARY

Financial modeling is an essential tool in any industry, however the significance in the oil and gas industry is quite high due to the fact that certain elements are constantly changing and some are based on estimated quantities. The topics in this chapter were essential to facilitate the development of the CFM. It was imperative to understand a financial model, the different stages in building the model, essential elements to be incorporated in any model and also to review the existing financial models.

CHAPTER 4

CASH FLOW FORECASTING

4.1 INTRODUCTION

This chapter reviews cash flow forecasting, as this is directly relevant to preparing a new financial model for the oil and gas industry. A financial model for projects of the oil and gas industry is unique as it needs to take into account the reserves forecast for the future years. Based on the reserves forecast and operating / capital expenditure forecast, the cash flow can also be predicted enabling a lender or investor to evaluate the project effectively. Cash flow forecasting is an integral part of a financial model in the oil and gas industry and hence is reviewed in this chapter.

Cash flow is explained using diagrams as well as sample tables. Cash flow estimation process, bias and options are discussed. Identification of relevant cash flows, cash flow versus account income, cash flow timing are reviewed in this chapter. Various aspects and affects on cash flow such as tax, changes in net working capital, role of information technology are reviewed. Cash flow analysis examples are also reviewed.

4.2 CASH FLOW

It is essential to establish what operations are considered to be cash transactions. Cash includes all expenditures, both capital and operating expenses, and all income. The total value of each transaction is recognised at the time that an exchange of values occurs. The exchange of values is usually goods or services for cash. Cash, can be represented by currency, cheque, bank draft, money order, or electronic transfer of funds. The net cash flow of an entity is the net sum, positive or negative, of all of the individual items of income and expense relating to that particular entity. The total of all of the inflow and outflow of related funds each year, over the life of an investment, is referred to as the cash flow stream produced by the capitalised investment (84c).

Cash flow should not be confused with account profits. On an annual, before tax basis, Net Cash Flow (NCF) may be identified as:

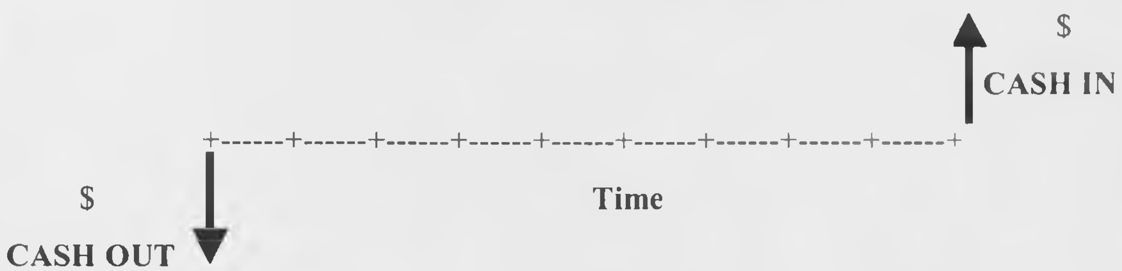
$$\text{NCF} = \begin{matrix}\text{NET}\\\text{ANNUAL}\\\text{REVENUE}\end{matrix} - \begin{matrix}\text{NET}\\\text{ANNUAL}\\\text{EXPENDITURES}\end{matrix}$$

Cash flow is extremely important to any commercial enterprise. A business can go bankrupt no matter how profitable the company books may indicate it to be, if the firm does not have sufficient cash to pay its bills. A frequent saying in financial circles is "Happiness is a positive cash flow"

The cash flow diagram is simply a graphical sketch representing the timing and direction of the money transfers. The diagram begins with a horizontal line, called the time line. The time line represents the duration of the financial exercise, and is divided into compounding periods.

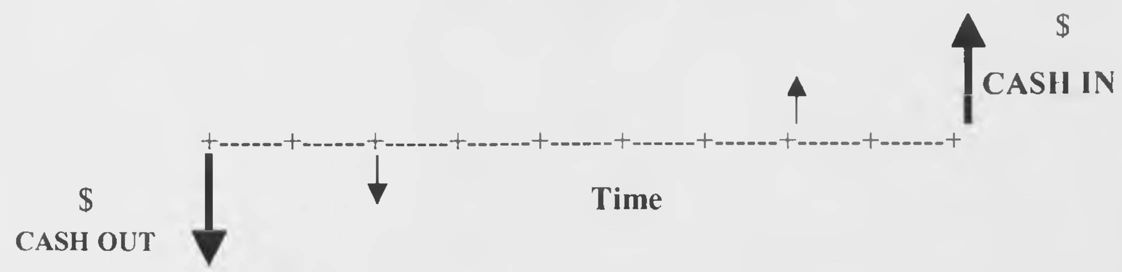
Consider a situation in which a sum of money is paid out at time zero. A different sum is received six year later. It may be more, due to receiving interest on the use of the money during the six years. This would be illustrated as follows

Figure 4.1 – Cash Flow Diagram (84d)



As an exercise, vertical arrows depict the exchange of monies. Money received is represented by an arrow pointing upward from the point in time when the transaction occurs; money paid out is represented by an arrow pointing down. Sometimes money is received and paid out within the same time frame. This may be handled either as a single arrow representing the net of the transactions, or by showing both the positive and negative arrows as help in keeping track of all the activity. This might be illustrated as follows

Figure 4.2 – Cash Flow Diagram (84e)



The arrow pointing up at the right hand end of the diagram indicates the money received at the close of the transaction even though there were also disbursements made at that time. The closing net cash is the algebraic sum of the two. Every completed cash flow diagram must include at least one cash flow, or disbursement, in each direction. However, cash flows corresponding to the accrual of interest are not represented by specific arrows in cash flow diagramming. The lengths of the arrows, positive or negative, may be drawn to scale representing the magnitude of the cash flows for the period. Even a rough "not to scale" sketch can be very useful in tracking cash inflows and outflows.

Table 4.1 (84f) - A Sample Cash Flow Forecast

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CASH INFLOWS													
Sales Volume, Units	2,000	1,700	1,800	2,100	2,300	2,400	2,500	2,200	2,000	2,000	1,900	2,000	24,900
Unit Price $	1.5	1.5	1.5	1.7	1.7	1.7	2.0	2.0	2.0	2.0	2.0	2.0	1.8
Sales Revenue, $	3,000	2,550	2,700	3,570	2,910	4,080	5,000	4,400	4,000	4,000	3,800	4,000	45,010
Cash Sales, $	300	255	270	357	391	408	500	440	400	400	380	400	4,501
Credit Sales, $	2,700	2,295	2,430	3,213	2,519	2,672	4,500	3,960	3,600	3,600	3,420	3,600	40,509
Bad Debts, $	54	46	49	64	70	73	90	79	72	72	68	72	809
Recoverable Credit Sales, $	2,646	2,249	2,381	3,149	3,449	3,599	4,410	3,881	3,528	3,528	3,352	3,528	39,700
Credit Length, months	1	1	1	1	1	1	1	1	1	1	1	1	
Cash from Credit Sales, $	2,300	2,646	2,249	2,381	3,149	3,449	3,599	4,410	3,881	3,528	3,528	3,352	38,472
Total Cash Inflow, $	2,600	2,901	2,519	2,738	3,540	3,857	4,099	4,850	4,281	3,928	3,908	3,752	42,973
CASH OUTFLOWS													
Cash Paid to Employees, $	684	684	821	821	821	1,027	1,027	1,027	1,027	1,027	1,027	1,027	11,020
NI and PAYE paid, $	418	418	418	501	501	501	626	626	626	626	626	626	6,513
Material Costs, $	1,080	1,260	1,380	1,440	1,500	1,320	1,600	1,600	1,520	1,600	1,600	1,440	17,340
Rent, $	100	100	100	100	100	100	100	100	100	100	100	100	1,200
Rates, $	50	50	50	50	50	50	50	50	50	50	50	50	600
Utilities, $	50	50	50	50	50	50	50	50	50	50	50	50	600
Other Overheads, $	60	70	30	40	80	40	30	20	50	60	50	40	570
Total, Non Labor Costs, $	1,340	1,530	1,610	1,680	1,780	1,560	1,830	1,820	1,770	1,860	1,850	1,680	20,310
Credit Taken, Months	1	1	1	1	1	1	1	1	1	1	1	1	
Non-Labor Costs Paid, $	1,500	1,340	1,530	1,610	1,680	1,780	1,560	1,830	1,820	1,770	1,860	1,850	20,130
VAT paid / (received), $	148	0	0	570	0	0	932	0	0	1,119	0	0	2,769
Corporation Tax Paid, $	0	0	0	0	0	0	0	0	2,500	0	0	0	2,500
Interest Paid, $	100	118	118	118	125	128	123	121	115	118	133	136	1,453
Total Cash Outflow, $	2,850	2,560	2,887	3,620	3,127	3,436	4,268	3,604	6,088	4,660	3,646	3,639	44,385
CASH BALANCES													
Opening Balance, $	-10,000	-10,250	-9,909	-10,277	-11,159	-10,746	-10,325	-10,494	-9,248	-11,055	-11,787	-11,525	-10,000
Cash Inflows, $	2,600	2,901	2,519	2,738	3,540	3,857	4,099	4,850	4,281	3,928	3,908	3,752	42,973
Cash Outflows, $	2,850	2,560	2,887	3,620	3,127	3,436	4,268	3,604	6,088	4,660	3,646	3,639	44,385
Closing Balance, $	-10,250	-9,909	-10,277	-11,159	-10,746	-10,325	-10,494	-9,248	-11,055	-11,787	-11,525	-11,412	-11,412

Spreadsheets are a basic tool for conducting economic analysis. Personal computers are now widely popular and used extensively. Improved software facilitates the spreadsheets to be automated by using macros. This is a great advantage in creating a comprehensive model. Once a model is created using macros and extensively tested, most of the errors will be eliminated.

The cash flow summary is a key report for project finance purposes, and can give a very full picture of the particular run being presented. The details of rows included in the cash flow summary will vary from deal to deal, reflecting the nature of the project, for example the industry type and the figures of particular concern for the project at a given time.

4.3 ESTIMATING CASH FLOW

The most important step in analysing a potential project is estimating its cash flows – the investment outlays that will be required and the net cash inflows the project will produce. Many variables are involved in cash flow forecasting, and various individuals and departments participate in the process. For example, the forecasts of unit sales and sales prices are normally made by marketing people, based on their knowledge or price elasticity, advertising effects, the state of the economy, competitors' reactions, and trends in consumers' tastes. Similarly, the capital outlays required for a new product are generally obtained from the engineering and product development staffs, while operating costs are estimated by cost accountants, production experts, personnel specialists, purchasing agents and so forth.

It is difficult to make accurate forecasts of the costs and revenues associated with a large, complex project; so forecast errors can be quite large. For example, when several major oil companies decided to build the Alaska pipeline, the original cost forecast was about $700 million, but the final cost was closer to $7 billion (13a). Similar or even worse miscalculations are common in forecasts of product design costs, such as the cost to develop a new personal computer. Further, as difficult as plant and equipment costs are to estimate, sales revenues and operating costs over the life of the project are generally even more uncertain, especially for new products or services.

The financial staff's tasks in the forecasting process include (a) coordinating the efforts of the other departments, such as engineering and marketing (b) ensuring that everyone involved with the forecast uses a consistent set of economic assumptions and importantly (c) making sure that no biases are inherent in the forecasts, as bad projects can be made to look good on paper. Besides obtaining unbiased point estimates of the key variables is only part of the forecasting process, data on probability distributions or other indicators of the risk inherent in projects are also essential.

It is almost impossible to overstate the difficulties one can encounter when forecasting cash flows. It is also difficult to overstate the importance of these forecasts. However, by observing certain principles, forecasting errors can be minimised.

Usually cash flows must be forecast many years into the future, and estimation errors are bound to occur. However, large firms evaluate and accept many projects every year, and if the cash flow estimates are unbiased and errors random, estimation errors will tend to cancel each other out. That is, some projects will have NPV estimates that are too high and some will have estimates that are too low, but the average realised NPV on all the projects accepted should be relatively close to the aggregate NPV estimate. Unfortunately, it is indicative that capital budgeting cash flow forecasts are not unbiased – rather, there is a tendency to be overly optimistic in the forecasts of pet projects, thereby revenue is overstated and costs understated. The end result is an upward bias in net operating cash flows and thus an upward bias in estimated NPV. In many cases the potential negative factors of a project are not objectively assessed (13b).

If this bias exists at a particular firm, then accepting a project with a zero estimated NPV will likely result in a loss, hence in a decrease in shareholders' wealth. Recognising that biases may exist, it is advisable to develop data on the forecasting accuracy and then consider this information in the capital budgeting decision process. Some companies lower the cash flow estimates when a forecast is suspected to be too rosy, while other companies increase the cost of capital, or hurdle rate, applied to such project submissions.

The first step in uncovering cash flow estimation bias, especially for projects that are estimated to be highly profitable, is to ask this question: what is the underlying cause of this project's profitability? If the firm has some inherent advantage, such a patent protection, unique manufacturing or marketing expertise, or a well-known brand name, then projects that utilise such an advantage may truly be extraordinarily profitable. However, in the long run above-normal profits will probably attract competition and thus be eroded. If there is reason to believe that competition is likely to increase, and if division managers cannot identify any unique factor that would support a project's continued high profitability, then senior management should be concerned about estimation bias.

Another problem that can arise in cash flow analysis is understating a project's true profitability by not recognising the value that may stem from strategic options. To illustrate, many investments have the potential to lead to a number of valuable opportunities (or options) that are beyond the scope of the original proposal. These options may include (a) the opportunity to develop follow-up products; (b) the opportunity to expand product markets; (c) the opportunity to expand or re-tool manufacturing plants; and (d) the opportunity to abandon a project. Some options involve a company's strategic entry into new products or markets, and the value of such an option is often called strategic value. Since strategic options are many and diverse, and since the timing of their use is uncertain, it is usually not feasible to incorporate them directly into a project's cash flow estimates. Conceptually, the true NPV of a project can be thought of as the sum of the traditional DCF NPV and the values of inherent strategic options:

$$\text{True NPV} = \text{Traditional NPV} + \text{Values of strategic options}$$

In some situations, it is possible to quantify the value of strategic options. For example, a firm was evaluating a project to build a new fabrication plant with a capacity of 10,000 units per week, had a conventional NPV of $10 million. The managers were able to identify two inherent strategic options for the project. (a) The new plant would create the option to close an older plant and consolidate its activities with more updated facilities and (b) the new plant would also create the opportunity to easily expand production to 20,000 units per week using technology now under development.

This is how they decided to handle the analysis. First, consider the option to consolidate manufacturing activities. The company estimated that a consolidation would result in a $2 million present value due to labour savings and a $3 million present value due to increased equipment efficiency, for a total NPV of $5 million. Further, they estimated that there is an 80% chance that this option would be exercised. Thus, the expected value of the consolidation option is 0.8($5) = $4 million. Regarding the expansion option, the company estimated that the probability of expanding the plant to 20,000 units per week capacity using the new technology is about 20%, and the value of the expansion would be $10 million, resulting in an expected NPV of 0.2($10) = $2 million. Thus, after considering the value of the strategic options, the company valued the new plant project at \$ 16 million. (As per formula stated above, \$10 + \$4 + \$2 = \$ 16 million)

Further, the range of potential NPVs runs from \$10 million, assuming that no options are exercised, to \$10 + \$5 + \$10 = \$25 million, assuming that both the consolidated and the expansion take place. In this situation, the value of strategic options was an added bonus to an already positive project, but in other situations the traditional NPV might be negative, in which case failure to recognise the value of strategic options could result in a project that should have been accepted, being rejected.

4.4 IDENTIFYING CASH FLOWS

Cash flows for a project are defined as the differences in the firm's cash flows for each period if the project is undertaken versus if it is not undertaken (13c). Defined in this way, the project cash flows are *incremental* or *additional* cash flows, that occur if the project is accepted.

Income statements are in some respects a mix of apples and oranges. For example, accountants deduct labour costs, which are cash outflows, from revenues, which may or may not be entirely cash (some sales may be on credit). At the same time, accountants do not deduct capital outlays, which are cash outflows, but they do deduct depreciation expenses, which are not cash outflows. In capital budgeting, it is critical to base decisions strictly on cash flows, or the actual dollars that flow into and out of the company during each time period (13d).

As noted above, the relevant cash flows for capital budgeting purposes are the incremental cash flows attributable to a project. Theoretically, it is possible to construct a firm's proforma cash flow statements with and without a project for each year of the project's life, and then to measure the annual project cash flows as the differences in cash flows between the two sets of statements. For example, if a firm is considering a new project that has a cost of \$1,000 and a 10-year life. If the project is undertaken, the operating cash flow statement in the left column of the following table is expected to result, while if the project is not undertaken, the firm's operating cash flows will be as shown in the middle column. The third column shows the changes resulting from the project, so the incremental projected net operating cash flow (NOCF) is \$298 per year for 10 years.

Table 4.2 (84g) – Sample Cash Flow Forecast Statement

	With Project	Without Project	Change
	$	$	$
Sales	1,600	1,000	600
Cash operating costs	600	400	200
Depreciation	200	100	100
Pre-Tax Income	800	500	300
Taxes (34%)	272	170	102
Net operating income (NOI)	528	330	198
NOCF = NOI + Depreciation	**728**	**430**	**298**

In financial analysis, timing of cash flows is important. Accounting income statements are for periods such as years or months, so they do not reflect exactly when during the period cash revenues or expenses occur. Because of the time value of money, capital budgeting cash flows should in theory be analysed exactly as they occur. Of course, there must be a compromise between accuracy and simplicity. A time line with daily cash flows would be costly to construct, unwieldy to use, and probably no more accurate than annual cash flow estimates because forecasting cannot be done well enough to warrant this degree of detail. Therefore, in most cases, it is simply assumed that all cash flows occur at the end of every year. However, for some projects, it may be useful to assume that cash flows occur semi-annually, or even to forecast quarterly or monthly cash flows.

In capital budgeting the concern is with those cash flows that result directly from the decision to undertake a project, or the project's incremental cash flows. Three special problems can occur when estimating incremental cash flows. They are:

Sunk costs are not incremental costs, so they should not be included in a capital budgeting analysis. A sunk cost refers to an outlay that has already occurred (or been committed). Since it has already occurred, it is an outlay that is not affected by the accept/reject decision under consideration. Suppose, for example, a company was evaluating a new plant to be built, as part of the analysis, the company had in year 'A' hired a consultant to perform a site analysis at a cost of $ 100,000. This amount was expensed for tax purposes in year 'A'. Now, is year 'A' expenditure a relevant cost with respect to year 'B' capital budgeting decision? The answer is No. This amount is a sunk cost; the company cannot recover it regardless of whether or not the new plant is built. It often turns out that a particular project looks bad (that is, has a negative NPV or IRR less than its cost of capital) when all the associated costs, including sunk costs, are considered. However, on an incremental basis, the project may be a good one, because the incremental cash inflows may be large enough to produce a positive NPV on the incremental investment. Thus correct treatment of sunk costs is critical to a proper capital budgeting analysis.

Opportunity costs The second potential problem relates to opportunity costs. All relevant opportunity costs must be included in a correct capital budgeting analysis. For example, a company already owns a piece of land that is suitable for the plant. When evaluating the prospective project, should the cost of the land be disregarded because no additional cash outlay would be required? The answer is No, because there is an opportunity cost inherent in the use of the property. For example, suppose the land could be sold to net $ 1 million after commissions and taxes. Use of the site for the plant would require forgoing this cash inflow, so the $ 1 million should be charged as an opportunity cost against the project. Note, though, that the proper land cost in this example would be the $ 1 million market-determined value, net of any taxes and fees, irrespective of whether the company had paid $ 500,0000 or $ 2 million for the property when it was acquired.

Effects on other projects (externalities) The third potential problem involves the effects of the project being analysed on the firm's other projects. For example, suppose a company is considering the production of a new product. Some of the customers the company predicts will buy the new product, are already using the company's older products. The profits generated by these customers would not be new to the company, but, rather, they would represent a transfer from an old product line to a new line. Thus, the new revenues produced by these customers should not be treated as incremental income in the capital budgeting analysis. On the other hand, the new product may create sales of related products of the same company. In this case, additional revenues projected from sales of these existing products should be attributed to the new project. Although often difficult to determine, effects on other projects must be considered. They should, if possible, be quantified, and otherwise at least noted, so the final decision maker will be aware of their existence.

4.5 TAX AND NET WORKING CAPITAL EFFECTS ON CASH FLOWS

Taxes can have a major impact on cash flows, and in many cases tax effects will make or break a project (13e). Therefore, it is critical that taxes be dealt with correctly. However, tax laws are extremely complex, and they are subject to interpretation and change. The financial staff can get assistance from the firm's accountants and tax lawyers, but even so, it is necessary for financial analysts to have a working knowledge of the current tax laws and their effects on cash flows. With regard to the Middle East region, specifically the GCC countries, royalty would also form part of the taxes. Royalty being a certain specific tax that has to be paid to the government that would be for the beneficiaries of the Royal Family.

As an example, an entertainment company buys a computerised inventory system for $ 100,000 and uses it for five years, after which it is scrapped. The cost of the video rental supported by the system must include a charge for the system, and this charge is called depreciation. Because depreciation reduces profits as calculated by the accountants, the higher a firm's depreciation charges, the lower its reported net income. However, depreciation is not a cash charge, so higher depreciation levels do not reduce cash flows. Indeed, higher depreciation levels increase cash flows, because the higher a firm's depreciation, the lower its tax bill.

Companies generally calculate depreciation one way when figuring taxes and another way when reporting income to investors: most use the straight line method for stockholder reporting (or "book" purposes), but they use the fastest rate permitted by law for tax purposes. Under the straight line method as used for reporting purposes, one normally takes the cost of the asset, subtracts its estimated salvage value, and divides the net amount by the asset's economic life. For an asset with a 5 year economic life that costs $ 100,000 and has $ 15,000 salvage value, the annual straight line depreciation charge is (100,000 – 15,000)/5 = $ 17,000.

For tax purposes, the cost of an asset is expensed over its depreciable life. Historically, an asset's tax depreciable life was closely related to its estimated economic life; it was intended that an asset would be fully depreciated at approximately the same time that it reached the end of its useful life. Higher depreciation expenses result in lower taxes, hence higher cash flows. Therefore when a firm has the option of using tax purposes straight line or the accelerated rates, it should generally elect to use the accelerated rates.

If a depreciable asset is sold, any profit, defined as the realised salvage value minus the then-existing un-depreciated tax book value, is taxed at the firm's marginal tax rate. For example, suppose a firm buys a 5 year class life asset for $100,000 and sells it at the end of the fourth year for $ 32,000. After 4 years, the asset's tax book value is equal to $100,000 (0.11 + 0.06) = $100,000 (0.17) = $17,000, so $32,000 - $17,000 = $15,000 is added to the firm's operating income and is taxed.

In this case, the tax depreciation charges over the four years exceeded "true" depreciation, and the excess depreciation taken, is "recaptured". Since depreciation reduces ordinary income, its recapture is taxed as ordinary income. Occasionally, the salvage value is less than the book value, and a loss is reported. In such cases, the sale produces a tax cash inflow, because the firm's taxable income and hence its taxes are reduced by the loss (13f).

Normally, additional inventories are required to support a new operation, and the new sales will also produce additional accounts receivable. Thus, both inventories and receivable will increase as a result of capital budgeting decisions, so the "investment outlay" for a new project must include the associated current assets as well as the fixed assets involved. However, accounts payable and accruals will also increase spontaneously as a result of the expansion, and this will reduce the need to raise capital to finance the project. The difference between the projected increase in current assets and in current liabilities is defined as the change in net working capital. The change associated with a project is normally positive, so some additional investment, over and above the cost of the fixed assets, is required. Entire change in net working capital does not require additional investment, because some of the increase in receivables represents profits, hence does not require financing. However, profit margins are normally just a few percentage points, so ignoring this factor does not lead to serious errors. In the unlikely event that the change in net working capital is negative, then the project would be generating an initial cash inflow from the change in net working capital that would reduce the project's initial outlay.

Net working capital changes may occur over several periods, so the increase (or decrease) could be reflected in cash flows for several periods. However, once the operation has stabilised, net working capital will also stabilise at the new level, and beyond this time no changes will occur until the project is terminated. At the end of the project's life, the firm's total working capital requirements should revert to prior levels, so it will receive an end-of-project cash inflow equal to the net investment in working capital.

4.6 SUMMARY

One of the most important elements in evaluating a proposed or existing project is estimating its cash flows. The investments required and the net cash inflow the project will produce. Net working capital changes occurs over several periods and hence the cash flows will be changed accordingly. There has to be flexibility in a model incorporating cash flows. This element will be considered and implemented while creating the CFM.

As the author intends to choose the forecasting principle in creating the Comprehensive Financial Model, it will have to take into consideration the forecasting of reserves and thereby assisting in the forecasting of operating and capital expenditure. Based on these input data, economics will be run to obtain IRR and NPV and facilitate in estimating and forecasting the cash flows for any new oil and gas venture.

CHAPTER 5

PRICING IN THE COMPREHENSIVE FINANCIAL MODEL (CFM)

5.1 INTRODUCTION

Pricing is one of the essential elements in financial modeling. Any business venture is undertaken with the intention of benefiting via profits. This indicates that the sale price of the end product is the most essential element based on which a project or venture can be evaluated. This makes pricing an important factor in financial modeling. In the oil and gas industry, product (oil and gas) prices fluctuate constantly based on the demand and supply situation. Hence the financial model has to be flexible to accommodate these fluctuations and yet provide accurate results to help ascertain viability of projects. Different scenarios need to be presented with varying prices in order for an entrepreneur to evaluate the feasibility and profitability of a project. Thereby the CFM is built with this essential aspect in the foreground. This chapter discusses the factors of crude oil prices, supply/price/demand relationship, world oil pricing, cyclic nature and marketing of crude oil, spot and cash markets, market participants, future of crude oil price, effects of inflation on crude oil pricing and also natural gas pricing being a preferred environment friendly hydrocarbon.

The CFM will take into consideration the fluctuating prices of products (oil and gas) of the industry and ensure flexibility is provided to make changes in the forecast of prices. This is essential in financial modeling as the price factor could change owing to various factors. As common knowledge, oil and gas are essential to modern day living as most of the machines are driven by these hydrocarbons. Also as noted in the world today, prices fluctuate with just a possibility of certain events. Provision has to be made in a financial model to predict the profitability of a project if such changes and fluctuations occur. It is intended to facilitate these provisions in the CFM.

5.2 CRUDE OIL PRICE FACTORS

"There are five factors that determine the price of crude oil" Ellis Jones, (55b). They are in the order of importance:

- Market (supply/demand)
- Quality (refining cost and yield)
- Location (transportation)
- Reliability (production rate)
- Availability (reserves)

The first three items in the above list currently have the greatest effect on crude oil price, but from time to time the last two will also exert an influence. Supply/demand must include both crude oil and petroleum products made from it. Crude oil quality reflects the products that can be refined from a particular crude oil and the cost to the refiner to do so. Location will determine the transportation cost to move crude oil and/or petroleum products from the point of production/refining to the customer. Reliability is controlled by production rate and productive capacity, while availability refers to reserves. Productive capacity influences prices in the short term while reserves influence prices in the long term.

5.3 THE SUPPLY / PRICE / DEMAND RELATIONSHIP

One of the old saying in the oil field is that "crude oil in the field tanks is like a fat steer on the range – it needs to be taken somewhere and made into something useful" (55c). After foodstuffs, crude oil is probably the world's most vital raw material both in terms of volume and value. Crude oil buying, selling and transport is a large and complex business. The worldwide movement of crude oil has to meet the disproportionate local demands of some of the most heavily populated parts of the earth to, the oil productive capacities located in other far removed parts of the world (39a).

The supply/price/demand relationship of the world's crude oil production is cyclic and complex. When oil prices are low, demand varies directly with the basic economic cycle country by country. When prices are high, it has been demonstrated that conservation measures by the consumer will cut back on demand. There are marked seasonal cycles of consumption – heavy gasoline demand for summer driving and heavy home heating loads in winter - which must be anticipated in planning refinery runs months ahead of time.

The unprecedented price volatility that has occurred since the "price shocks" of the 1970's and more particularly since crude oil began to trade as a commodity in the 1980's, has had a dramatic impact on the industry. The results have severely affected oil company profits, the revenues of oil exporting countries, and the availability of investment funds. This, in turn, has led to great ingenuity by the industry and the financial community in their efforts to manage price risk.

Timing of available crude oil supply can be an important pricing factor. Imported oil may take more than a month en-route on the high seas, even more if the owners of the cargo choose to "slow steam" to conserve ship's fuel, and perhaps to wait for an improved price at the receiving end of the voyage. The inverse can also occur in a declining market. This has led to extensive use of options and futures for price hedging for the longer haul crude (39b).

Long-range timing of available supply is also a principal factor in regard to the industry's exploration programme. High prices make funds available for new exploration. When prices plummet exploration is the first activity to be curtailed in order to preserve oil company profits under the western world's system of accounting. The long lead times, five to ten years, between exploration and discovery and actual production imposes another almost irreversible cyclic factor into the equation. High prices beget increased exploration, and supply, which can easily exceed overall demand.

There is no single benchmark price source for crude oil. The tremendous volume of trading in crude oils has evolved several major price references. These are Saudi Arabian Arab Light, West Texas Intermediate (WTI), Forties and Brent from the U.K. waters of the North Seas, Fateh from Dubai, and more recently the Urals-Mediterranean for the Russian production entering the western markets. Singapore quotations are also increasingly employed as a reference for crude oil pricing in the Far East (84h).

5.4 OIL AS A COMMODITY, OR IS IT?

Two schools persist on the question of whether crude oil is a commodity (84i), like wheat (Theory A), or a unique product whose price can be controlled, perhaps politically, (Theory B). The difference involves the amount of surplus crude oil supply at the particular point in time.

Several earlier efforts at futures trading in crude oil failed. Crude oil was not yet a commodity in the commercial sense. Two Chicago exchanges tried without success. Other efforts in New York were unsuccessful. In London the international petroleum exchange has succeeded in trading futures in gas oil and Brent crude oil. Also, successful commodity trading has been conducted in Singapore using Dubai and Brent crude as its marker, and in Rotterdam based on Brent but permitting a wide variety of substitutions of other crude in settlement.

A barrel of crude oil of itself is relatively worthless. As a raw material, crude oil's mixture of hydrocarbons, of greatly varying molecular weights, has great commercial value. Petroleum refining has to be done in sufficiently large industrial plants (refineries) so that even the smallest product volumes can have sufficient economy of scale to permit the whole refining process to be economically feasible.

In large oil companies, the internal value of each individual type of crude oil as a raw material is subject to intense study and computation by a group of experts. On the basis of laboratory distillations and statistical calculations, refinery engineers determine the optimum volumes and values of all the fractions of a specific crude oil, including for example, such attributes as the octane number and lead response of its gasoline fraction and the pour point of its diesel fuel component. The location of the production, its transportation requirements, and its eventual market also affect the value of a particular crude oil.

Pricing is influenced by the characteristics of a commodity. Although the geologist, geophysicist and petroleum engineer may tend to think of all crude oil as alike, the refining engineer knows differently. No two crude oil are physically identical. Consequently, the products that can be recovered and manufactured also differ significantly from one crude oil to another. Lighter (higher API gravity) such as Norwegian North Sea Ekofisk tends to have more gasoline by volume than heavy crude such as Persian Gulf Dubai Fateh which has proportionately more gas-oil (diesel) and residue cracking stock.

Crude oil from different sources is categorised according to the American Petroleum Institute, API gravity, and the weight percent of sulphur incorporated in the crude. The sulphur imparts undesirable odor to the refined products and also increases their corrosiveness (84j).

With these simple parameters at hand the refinery process engineer first subjects a sample of the crude oil to a laboratory distillation procedure recovering a series of "cuts". The refinery distillation cuts are then individually subjected to a number of physical tests. This information permits the refinery engineer to begin to obtain a feel for what he can make from the crude oil and the respective volumes of the products to be obtained. At this stage he can also begin to equate the total value of those products against the landed cost of the crude oil. This leads to a determination as to whether the particular crude oil represents a good purchase for the refinery.

In addition to the product yield of the crude, its sulphur content is an important factor, which will detract from its value. The amount of entrained water is an additional basis for discounting the price. In the international trade saltwater contamination is generally expressed in "pounds of salt per barrel" rather than "BS&W" (basic sediment and water) content as used in North America. All of these factors impact on the actual price that the refiner is willing to pay for each barrel of crude oil regardless of where in the world it is produced (54a).

Some of the other tests that may be conducted on the individual laboratory cuts include the Ni/Va (nickel/vanadium) content in parts per million, the P/N/A (paraffin/nephthene/aromatic) ratio, and the pour point of the heavier cuts. Nickel and vanadium are particularly detrimental to the catalyst life in certain stages of the refining processes. P/N/A is an index of crude oil type in the fraction and can be used as a guide to its response to specific refining processes. Pour point is obviously a matter or concern with respect to diesel fuels in the wintertime or aviation fuels at high altitudes. Each of the laboratory cuts and, in fact, the entire crude oil specimen, is made up of a great mixture of hydrocarbons.

5.5 WORLD OIL PRICING

Prices for crude oil in international trade are universally quoted in US dollars per API barrel of 42 US gallons at 60°F. The derivation of the 42 gallon measure goes back to the earliest days of the industry in Pennsylvania when oil was transported by wagon in used 50 gallon wine barrels. There was a good deal of spillage and the pattern of the trade was to pay for only 42 gallons at the destination without resort to further measurement. Producers soon learned to ship that way as well (53).

Some international statistics regarding production are quoted in metric tons. This method of measurement is derived from Europe, (crude oil is mostly received by oceangoing tanker), and weight (displacement) was an easier gauge. Actual monetary settlements are generally made in currencies other than US dollars. More and more often in the present state of the world economy, and most particularly in the developing world, settlements for crude oil imports involve barter arrangements for exportable goods from the purchasing country.

The term 'world price' occurs frequently in economic discussions of the petroleum business. In the eastern hemisphere it is often taken to mean the per barrel price paid for spot, or unscheduled tanker load purchases of crude oil in Rotterdam harbour. Elsewhere it may mean the OPEC posted price for "reference" Saudi Arabian Light Crude. In a number of oil importing industrialised countries 'world price' may refer to the actual, or historical cost of the average imported barrel of crude oil into that country. For the first seventy-five years of the industry after the Drake well in Pennsylvania, the prices of domestic North American and overseas crude oils each demonstrated a high degree of stability and similarity. Now, US and international crude oil prices move more or less together.

In the early days of the industry the price was seen to dip precipitously with each major new oil field. The most dramatic of these price drops come on the heels of the Spindletop discovery in 1901 and the East Texas Field in 1930 (69e). In both of these instances the price plummeted from well over one dollar a barrel to ten cents.

The world's petroleum industry has endured a cyclic supply/price/demand situation since its inception in the last century. Individual cycles of supply, demand and price operate simultaneously but not in unison. Often outside political and cooperative influences have obscured parts of the cycles.

By the 1930's, when demand for motor fuel had established a much larger and more stable domestic US industry, the price of crude oil held to a remarkably constant one dollar plus per barrel figure. For nearly forty years, until the early 1970's, the State of Texas through its railroad commission and the international major oil companies, dubbed as the "Seven Sisters", set the pace of the world oil business. Together they controlled over 80% of all the oil produced outside of North America. The railroad commission of Texas, an elected three man board, was the principal force stabilising the price of crude oil, both domestically in the US as well as overseas. Oil was still relatively easy to find and the industry maintained an exploration rate more or less designed to maintain a twenty year domestic supply (56a).

In 1928, chief executives of the Seven Sisters drew up a secret (not fully revealed until 1952) "As-if" agreement. By this agreement, the world's principal producers outside of the US agreed to cooperate in limiting production to balance demand; to freeze the market shares of each important product in each market; and incidentally, of course, their prices. Under this "Uniform C.I.F. Pricing System" prices throughout the world were quoted as if emanating from the Gulf Coast of the US even though they might be produced elsewhere much closer to their eventual market. This provided a nice "cushion" under company posted prices for the development of Persian Gulf supplies. However, it was observed that there was little evidence to support the view that the "as-if" agreements continued after the second-world war.

The stabilising influence of the Texas railroad commission and the Seven Sisters was markedly demonstrated during the closing of the Suez Canal in 1956. Although there was serious disruption of supply, particularly between the Persian Gulf and Europe, there was only the most minor price fluctuation or interruption of supply to the consumer, worldwide.

World War II and the industrial boom that followed, created rapid growth in demand for crude oil which temporarily obscured the traditional supply patterns. Oil prices in the US were tempered by increased imports of lower prices crude, primarily from the Middle East and Venezuela. Wartime demand for petroleum encouraged exploration in those areas.

By the latter part of the 1960's Texas production pretty well reached the state's capacity to produce and so the railroad commission's ability to set production, and indirectly to stabilise oil prices, diminished. Up until 1973 the US had been a net exporter of petroleum and its products.

5.6 OPEC INFLUENCE

All of this relative stability ended suddenly in October of 1973 when the OPEC countries forced their first substantial price increase to take advantage of peak energy demands in the western world coincident with open hostilities in the Middle East. This was a 70 percent increase to $5.11 per barrel. In December of that year OPEC had increased the posted price for Arab Light to $11.65 per barrel (84k).

OPEC (Organisation of Petroleum Exporting Countries) is an international organisation of eleven developing countries that are heavily reliant on oil revenues as their main source of income. Membership is open to any country which is a substantial net exporter of oil and which shares the ideals of the Organisation. The current members are Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela.

OPEC's domination of world pricing lasted for a decade. By 1979, however, the worldwide recession and the results of stringent conservation programmes throughout the western world produced a decline in demand each year until 1984 when a slight upward reversal was observed. OPEC's pricing also gave rise to an unparalleled push in the non-OPEC countries to find and develop their own indigenous supplies of crude oil. OPEC had produced half of the free world's oil in the 1970's. The growing non-OPEC production and OPEC's rather desperate effort to hold its price line by curtailing production created an unstable situation, which by the mid-1980's saw oil prices sliding and then tumbling to $10 at the end of 1985.

During the 1973 and 1979 crises, OPEC was able to raise prices and termed as "oil shock" by economists. At that time, demand was approximately 80 percent of capacity and OPEC controlled enough of the production to force the price rises. By 1986 the results of the new exploration and development stimulated by the first two "oil shocks" had deprived OPEC of their ability to set world oil prices.

A number of fundamental characteristics of crude oil's unique supply-demand relationship are outlined by Petro-Finance in their World Bank report (84l).

- Crude oil capacity is high in the early years of production and then rapidly falls. The discovery of major new fields or producing regions creates waves of new capacity, which are not sustainable over an extended period of time. These waves of capacity first operate to crowd out market shares of existing producers, thereby depressing prices, only subsequently to crest and then recede, in the absence of high and sustained rates of reserve replacement.

- Crude oil reserves are concentrated in producing regions and large fields within producing regions. The discovery of a new producing region generally triggers rapid exploration and development of the region. The resulting wave of new source production capacity is not necessarily related to the state of excess demand. In short, the crude supply function is lumpy or discontinuous. Rather than increasing smoothly with rising prices, (crude oil) supply capacity increases by fits and starts.
- The petroleum markets are intensely competitive and involve a large number of current and potential future producers. As prices rise, industry activity follows and arrests the decline of production from exiting sources, at the same time adding new reserves. Competition within the market ensures that no internal (or market) mechanism capable of smoothing supply exists. This process will continue so long as the price of oil remains at or above current replacement costs.
- The flow of capital to the petroleum industry follows the industry cycle. The cyclical upturn creates a ready pool of new capital available for investment in exploration and production. This flood of new capital derives from both the rising cash flow associated with production from existing capacity and from external capital markets. This capital leads to an increase in real investment but, also, rapid escalation of acreage acquisition and oil finding costs, as the demand for new acreage increases relative to available supply and as the demand for oil field equipment and services also escalates in comparison to supply.
- Petroleum supply responds to changes in oil prices only after potentially long lags attributable to at least two factors: the discovery and development of new supply sources is subject to long lead times, and industry price expectations are adaptive, slow to respond to changing conditions, and lag those conditions. Industry activity follows the cycle, creating a sustained overhang of capacity in the period immediately following a cyclical peak, and a sustained capacity shortage following a trough as activity lags behind the changing market (37a).

Transportation is also a factor in setting the demand for certain crude. Crude oil has been moved from the oil field to refineries by wagon, truck, rail car, pipeline, barge and tank-ship. Transportation costs vary with the means of transport and volumes. Political jurisdictions, and sometimes the physical characteristics of the crude oil, can also have an effect on its transportation. Transportation over land pipelines is the cheapest method. Crude oil that can be moved in sufficient volume by pipeline will out-compete crude which has to be moved overland by other methods. Pipelines require large investments, and once installed must be kept full, in order to realise their low throughput costs. Political and geographical are some of the problems facing this mode of transportation.

Oceangoing tankers handle intercontinental movements of crude oil to markets. Economy of scale is a factor here and several factors effectively limit the practical size of tank ships. Tankers enjoy freedom of the seas and under flags of convenience have wide latitude with respect to governmental regulation. There is a fair degree of flexibility in operating cost per tone mile depending on the tanker's speed, which the owner and, his captain control.

5.7 THE CYCLIC NATURE OF CRUDE OIL PRICES

One school of petroleum economist concentrates its price forecasting approach on the cyclic ups and downs of crude oil prices over the industry's 140-year history. The crude oil price cycles are basically a supply-demand relationship, which, in turn, results from the extent of exploration and development investment that concentrates in periods of high oil prices (54b).

Expenditures for exploration have more immediate impact on oil company profit than almost any other segment of its operation. Exploration is the first thing to curtail when oil prices and income decline. New exploration then awaits management's perception that improved prices will persist. This affects the supply situation of five to ten years at which time the demand cycle may be in an entirely different phase.

Oil companies have traditionally increased their exploration and development expenditures during price peaks. This has the effect of increasing supply with consequent price reduction. OPEC endeavored to prolong the price peak in 1980 by establishing quotas. The high prices encouraged unprecedented exploration and development in non-OPEC countries. Other political events of the time also served to accelerate the run up to the price peaks. The industry's cyclical changes are now being felt in ways that are more typical of normal commodity markets with prices more in keeping with short-term supply and demand.

The Middle East Economic Survey for December 6, 1982, in a report sympathetic to OPEC, suggested that the following forms of competition for market share either have, or might be tried, within OPEC:

- Straight price discounts;
- Extended credit terms;
- Netback processing deals by which the exporter gets the income realised from final product sales, after refining and freight costs are deducted;
- Package deals, whereby crude oil is sold at official prices but is tied to sales of refined products or NGLs (natural gas liquids) at discount prices;
- Sales made on a c.i.f. basis (i.e., the seller absorbs the freight costs);
- Improved fiscal terms for those companies still with an equity stake in production.

During this period of reduced oil prices OPEC has also had considerable difficulty within its organisation in handling the price differentials for crude quality. This is accentuated by the fact that its members produce a variety of types of crude oil. Traditionally high API gravity low sulphur crude brought premium prices. With the improvements in refining technology and dislocation of supplies most refineries have now invested the money to convert their processes to handle the supposedly cheaper lower gravity sour crude. This reduces the overall demand for the high gravity sweet crude, which its North African OPEC producers still feel, should command a premium price (50)

Inventory patterns also have a significant effect on the short-term supply/demand relationship. Inventories are fundamentally cyclic on a seasonal basis due to the variations in product demand. The large demand for motor fuels occurs during the summer months during which much of the necessary fuel oil production goes to shortage. The fuel oil goes to market during the cold weather months making room for gasoline buildups for the following driving season. Superimposed on this seasonal cycle are industry crude oil stocks, which increase when it is perceived that prices may rise. The increase and subsequent decrease in inventory levels, which can be of tremendous volume, tends to disrupt the actual production and demand relationship. Statistics on crude oil and products in storage around the world at any point in time are problematic at best.

In the high oil price period of, 1980-85, there was a great deal of effort toward reducing fuel consumption in automobiles and industrial usage in general. Large amounts were spent to permit substitution of alternate fuels. Now a majority of the largest industrial users in North America and Europe can switch on very short notice between fuel oil, coal or natural gas depending merely upon the price. Here again statistics on instant switching among alternate fuels are not the best. Crude oil future prices on the commodities exchanges are directly affected, however, by such statistics as are released periodically regarding both petroleum stocks and fuel substitution.

Once again the prices slumped in 1998 and towards the end of 1999 and early 2000, the oil market saw an increase in oil prices due to various factors. Based on the volatility of the price of this commodity, it is the aim of this thesis to provide a financial model taking serious consideration to this aspect along with that of risk involved. As such the CFM will include the price factor as an input data and link it via macros to obtain the profitability of the project. Thereby various scenarios can be portrayed with different price scenarios by only put the various prices in the price input column, and not making drastic changes to the running of the macros.

5.8 MARKETING OF CRUDE OIL

The buying, selling and trading of crude oil has undergone a number of changes during the industry's approximately 140-year history. The most profound changes have occurred during the past decade.

Crude Oil Postings:

Since the days following Col. Drake's well in Titusville, which was the start of the US oil producing industry, it has been the practice of the purchasers within the industry, normally the refiners, to publish "Crude Oil Postings". This is the price that the buyer making the posting is willing to pay for each barrel of oil and he takes, or "lifts", provided it meets the specifications for API gravity, sulphur content and BS&W (37b). These postings are the oil purchaser's way of paying everyone on a uniform basis. This both simplifies the buyer's book keeping and keeps him free of possible legal problems from a discrimination standpoint.

The situation has been somewhat different outside North America. For many years the producing companies, who were also the purchasers, made similar postings for the purchase of their production. In more recent times host governments have insisted that the crude oil prices for their country's production have to be the subject of formal agreement between the government and the producer. In the OPEC countries the price is established solely between governments. Thus, the seller makes the postings in these countries, rather than the purchaser.

North American agreements for buying crude oil from an individual lease or property according to a specified purchaser's current posting tend to be for thirty days at a time. There is sufficient competition among oil purchasers that there are remarkably few terminations of producer-purchaser agreements. Once the title to certain number of daily barrels is in the hands of the first purchaser there can be a fair amount of trading and exchange until the barrel is finally delivered to a specific refinery.

Long Term Commitments:

First commitments to buy oil for periods in excess of one year are rather unusual in the industry. A number of older concession agreements overseas did not have such provisions. These date from the days when oil was hard to sell and the host governments wanted to make sure that their oil would be produced and sold so that they would realize the income. A variation of this arrangement is the "Service Contract" type of agreement, popular in countries in which internal consumption of crude oil exceeds the country's domestic production. In these arrangements, such as has been popular in effect in Argentina, the operating company is paid a fee on the basis of each barrel found and produced. The company never actually takes title to the oil, and all of the production goes to the state oil company. This is sometimes categorised as long-term commitment for the sale of production. The fact that the operating company never legally has title to the oil has definite nationalistic political appeal. Early in the 1990s, Argentina dramatically reversed its policy on foreign ownership of its petroleum resources and now leads the region in privatisation (59).

In the domestic North American pattern of the industry the royalty owner has the life-of-the-lease right to take his share of the production in kind. Taking production in kind is not common, but there is ample precedence for doing so. Another long-term commitment situation may be involved in the case of carved-out production payments, in which a large volume of oil is in effect sold in place as a means of financing before it is actually produced. A long-term commitment ensures requiring the operator to produce the oil and market it, or sometimes to deliver it in kind to that account until the obligation is satisfied. Cost overruns and interests, in which the owner does not share in the costs of the operation, also fall marginally into this long-term commitment category.

Calls on Production:

As oil became a bit less plentiful on the world market in the later 1970s, another type of contractual arrangement became popular, know as "Call on Production". These arrangements are basically "First Rights of Refusal" for the purchase of all, or a specific portion of the production from a well, or an operation. These agreements have frequently been incorporated in host government takeovers of operating company interests overseas as a means of buffering the company from a sudden and complete loss of a sizable stream of its production.

Calls on Production can be important to domestic crude oil traders as a hedge, or protection against being caught with a commitment to deliver, with nothing to put into the pipeline. These calls are generally rather vague in respect to the price to be paid for the production, in the event that such action is actually taken. The price may be worked out as a separate negotiation generally related to published spot or commodity future prices for similar production.

Division Orders:

The division order for a producing lease is one of the major contract instruments employed in the domestic North American producing industry. This is a legal document, backed up by a full set of title opinions for the lands involved, in which all of the owners of interest in production of oil from the specified property certify and guarantee that:

(1) They are the legal owners of the oil; (2) they warrant title to those interests; (3) commencing at 7 am on the specified date the holder of the Division Order is authorised to receive and purchase oil from the property; and (4) to make payment in the precise manner which is spelled out.

The payment schedule is normally expressed as a decimal fraction to seven places and splits up the proceeds from the sale of production among the working interest owners, the royalty owners, the holders of overrides, production payments and any other claims to shares of the production. The price paid for the production under a Division Order is usually the subject of a separate letter agreement between the producer and the purchaser, who is holder of the Division Order. The order will indicate the price to be paid according to a specific posting. Settlement for the purchases is usually within thirty days.

In some cases these letter agreements may also spell out that the purchaser will install and provide a pipeline connection within, say 180 days, and recites the conditions for amortising the cost of the new facility. Typically, these charges might be 50 cents per barrel purchased for the first 100,000 barrels; which would then drop to 10 cents per barrel from the remaining life of the line. Division orders have to be modified and re-executed every time there is a change in ownership, or a production payment is finally paid off. Since very substantial amounts of money may be involved in the transactions covered by the Division Orders, great care, and the best legal talent is applied to their drafting and upkeep.

5.9 SPOT AND CASH MARKETS

There are two basic types of markets in crude oil: the "wet" barrel or cash market where oil is bought and sold in individual deals between buyer and seller, and the futures market where trades are made through a formal commodities exchange for some specified future delivery date. The term "Spot Market" is generally understood to denote a one time short-term transaction. Only the buyer and seller generally know the agreed prices for each tanker load of crude traded.

Between November 1985 and early April 1986, the price of West Texas Intermediate (WTI) crude oil fell from $32 to $10 per barrel. Fixed term contracts for the sale and purchase of crude became untenable. As a result, the spot market's role in pricing crude oil sales became an increasingly important segment of the petroleum industry. During the past several years spot and spot-related transactions for the sale and purchase of crude oil in the international market have grown from some fifteen percent of all trades in 1980 to over 85 percent.

The history of the development of most commodities in international trade has been to start from individual, or spot market, sales and then to evolve gradually to longer-term contracts as the markets become established. The world market in crude oil has had just the opposite history with long term purchase contracts giving way to spot sales as old concessionary agreements have been superseded by national oil company takeovers.

Spot trading takes advantage of the day-to-day changes in market conditions. The principal disadvantage of spot trading lies in the fact that neither the seller nor the purchaser can predict crude oil prices far enough ahead of time to do much effective planning. As a result, the industry trend now, practically undertaken by most companies, is to use a combination of contract and spot trading. The exact mix between contract and spot varies from company to company and from time to time.

Typically a spot sale in the international market involves an entire cargo of crude oil (84m). The trades normally originate at the source, which is the country of origin. Such a cargo of crude oil may easily be worth $10 million. These trades can hardly be considered as small business undertakings. Several of the larger trading companies buy or sell 200 Brent cargoes, worth in excess of $2 billion, in a month. Response time has to be fast. Prices in these international trades are invariably quoted in US dollars.

The majority of sales and purchase of crude oil in North America are now spot sales with no enduring contractual undertakings. Thousands of such sales take place domestically in North America every day. These are a normal outgrowth of the traditional simultaneous exchanges of crude oil that have been going on since the early days of the industry in Pennsylvania. Long before any consideration of crude oil as a commodity, the industry recognised that the physical delivery of a producer's oil to his own refinery, which might require moving it right past a competitor's refinery was poor economy. To solve this problem a series of physical crude oil exchanges have evolved to minimise the overall transportation expense. Frequent monetary or volume adjustments were necessary, and expected, in order to permit this traditional North American exchange, or trade system to work. These crude oil exchanges were generally tied to a contract term varying from several months to a year, or more, with continuing "evergreen" provisions.

Spot trading in North America has since evolved merely by dropping the contractual ties and letting the cash transactions take over. Spot sales are generally arranged by telephone in volumes of ten thousand to perhaps 100 thousand barrels per day until the total agreed upon amount is delivered. Although a very large number of contractual arrangements for crude oil sales and deliveries still exist in North America, most contain some provisions for frequent price re-determination on the basis of current market reports.

5.10 MARKET PARTICIPANTS

The players in the spot marketing of crude oil include (55d) - The Major International Oil Companies; Traders; Brokers and; Independent Oil Companies

Major Oil Companies:

Through the years the majors looked with some disregard upon any spot marketing of crude oil in the international market. Almost the entire supply of overseas crude oil emanated from large concession areas controlled by the "Seven Sisters". This changed during the Arab embargo in 1973 when traditional supplies were curtailed and the majors led a mad, but temporary, scramble for any available spot market supplies.

In more recent years the majors have come to rely on spot trading for a significant but constantly varying portion of their crude oil "slate." There is always a mismatch between the locations of a company's production and its refinery requirements. Spot trading serves to alleviate this problem. The general role of the majors in the spot market is to augment, or balance their crude oil supplies.

Traders:

Prior to the 1970's there was little opportunity and demand for professional traders in the international crude oil markets. During the early years of that decade, with the growing diversity and complexity of the market, a number of trading companies moved in to fill the gap. Following the 1973-74 crisis there were as many as 300 traders operating in Rotterdam alone. The number declined substantially until the next crisis following the Iranian revolution in 1979 brought renewed and more sustained activity to the spot market. In the current crude oil marketing environment a new type of trader has emerged. Investment houses now trade and arbitrage oil just as they deal in the more traditional commodities.

Traders assume the risk of taking title to the cargoes, or barrels they are trading. This is referred to as "taking up positions". Once a trader has taken title to a shipment of crude oil he must resell, exchange, or, arrange for its delivery and storage once it reaches its point of delivery. If the trader anticipates a price rise he may hold title to the shipment as long as he feels he can afford to do so. This is known as taking a "long position". Conversely, when prices are falling, the trader might choose to sell a cargo, or a pipeline batch shipment, without having arranged a resale or exchange, in the expectation of subsequently buying the necessary volumes at a lower price and thus pocketing the difference. This is referred to as "selling short". In another type of activity some traders will arrange with a refiner to process his oil for a fee after which the trader will sell off the products rather than the crude raw material.

The industry – major oil companies, NOC's and others – often use traders as intermediaries for their supply and/or crude oil marketing requirements. The principal trading companies, particularly those with close operational contacts in key producing and refining areas, coupled with crude oil shipping expertise, provide an important service function to the international petroleum industry.

Brokers:

Brokerage firms differ from traders in the fundamental distinction that brokers do not take title to the crude oil, but rather bring buyer and seller together, for which they receive a commission. All trading requires current, and if possible, future price information. Otherwise striking a bargain with any confidence is hardly possible. One fundamental problem with spot prices, since they do not emanate from a trading floor in a regulated exchange setting is that spot price data are necessarily incomplete. Brokers are generally a good source of current crude oil prices in contrast to the traders. The trader is understandably somewhat reluctant to disclose his purchase price to a prospective purchaser. The broker functions more or less from position of neutrality and does not have the same problem. It should be recognised however, that neither the trader nor the broker has any responsibility to report or publicise his dealings.

Independents:

The independent oil companies have always played a leading role in the international crude oil spot market. The significant beginning of the Rotterdam spot market coincided with the first production of Libyan crude oil by US independents in the early 1960's. US import restrictions at the time forced this production into overseas markets with little or no help from the "Seven Sisters". Rotterdam became a natural focal point for the spot sales of this Libyan production. As the embargo of 1973 ended, these same independents operating in Libya, with no where else to go, continued to sell more and more of their crude into the Rotterdam spot market (56b).

Other Spot Price Related Deals:

Tenders: In addition to the now conventional spot sales of cargoes or specific pipeline batches of crude oil, there are a growing number of tender sales. A tender sale involves a purchaser, frequently a government entity, who solicits bids for certain volumes of crude oil. These volumes are scheduled for delivery over a period of time at an agreed upon price. The price may be fixed for the term, or may be varied according to a pre-defined source of published price quotes.

Counter-Trade and Barter: Counter trade can take on a number of varying forms. There have been a series of straight barter deals between governments exchanging crude oil for Boeing 747 airliners, French Mirage jet fighters, lamb from New Zealand, vehicles from Japan and so on. Another related type of transaction might better be called counter financing. In these arrangements crude oil is the medium of exchange in return for which the seller agrees to take payment in exportable products of the purchasing country. In other instances crude oil again has served as the medium for paying off past debts as in the case of Iraq in its past obligations to Italy, France and India. Libya has also made payments in oil to the former USSR, Italy and India.

Crude Oil Swaps Agreements:

A wide variety of financial arrangements to manage and reduce crude oil price risk have evolved. Basically these techniques permit transfer of the price risk to others. The most firmly established of these are the forward and futures trades (84n).

Crude oil price swaps, which permit users to set a fixed price for the produced oil over prolonged periods in the future, are pre-eminent among this new generation of risk management techniques. These financial arrangements adapt the procedures that the international banking houses have developed over the years to deal with the long-term currency exchange risks. Oil swaps allow a widely diverse collection of buyers and sellers to exchange their varying exposures to long-term price risk over a specified, and generally prolonged, period of time. Most oil swaps are in the range of one to two million barrels and for periods of three years, or more. Longer periods are certainly possible if each party is satisfied with the credit worthiness of the other.

There are two elements incorporated in the traditional crude oil price swap. These are a producer's sales hedge and a purchase hedge for the end user of oil. A financial intermediary assumes the role of providing long term fixed prices to both parties. This is usually an investment bank house that employs the risk assumed from each party to offset the other. Legally the two deals are distinct. Each side of the arrangement is a separate contract. The pairing of two offsetting market positions may not be a simple matter, and may not happen simultaneously. It often happens that the firm, or institution, providing the swaps may simply hold the unbalanced risk of underwriting for its own account.

The volatility of crude oil prices in recent years and the very large amounts of money involved have led the financial institutions to adapt some of their international currency exchange risk reduction techniques to the crude oil market. The swaps arrangement is one of these.

In a typical swap arrangement a buyer is guaranteed a purchase price but agrees to pay the swaps intermediary any subsequent difference between the crude oil acquisition cost and a lower market price. On the other side of the transaction, the oil seller would agree to pay the swaps provider (financial intermediary), any difference between a guaranteed fixed price and any possible higher market level.

The two partially offsetting financial deals between the intermediary and the buyer or seller of the crude oil is the heart of the swap. Basically, both the buyer and seller of the oil have exchanged, or swapped, a floating market price with its inherent risk for a guaranteed price. The guaranteed fixed price may not be identical for both buyer and seller. The difference can provide the required financial incentive to the intermediary. It is also possible that the price difference may be the best that the intermediary is able to negotiate, and he takes over than portion of the market pricing risk.

Payments between the intermediary and the buyer and the seller, in opposite direction to compensate for the divergence between the contract and market prices are generally on a semi-annual basis. The compensation arrangement to the swaps provider varies from transaction to transaction. Airlines, railroads and shipping firms, for who fuel costs are the largest element of the operating cost, have been the biggest users of swaps from the start.

Most swaps transactions are for large amounts of oil, in the millions of barrels, and for periods of three years or more.

5.11 FUTURE CRUDE OIL PRICES

Forecasting crude oil prices over the productive life of an oil field has never been a particularly easy task. Economic theory tells us that in the long run prices will seek a level whereby the efficient firms will continue to replace their depleting reserves and earn a reasonable return on their shareholder's equity commensurate with the geological and financial risks involved. This may hold true ten, or more properly twenty, years into the future. Unfortunately, in the critical near term, the forecasting of world crude oil prices in order to arrive at predictions of cash flow, has become a little more than a guessing game with inordinately high stakes (84o).

Evidently, there was little difficulty in, or need for, long-term price forecasting during the period prior to the mid-1970's. This was the period when the actions of the "Seven Sister" oil companies, internationally, and the Texas railroad commission in the US served to maintain worldwide stability in crude oil prices.

The petroleum industry's experience in predicting future crude oil prices since the first oil price shock of 1973 has been one of continual and costly surprises. There is a general agreement among the leading forecasters that crude oil will be more valuable in the Twenty First century than it is at present. This thought is now showing some truth.

The costs of erroneously predicting in 1979-81 that crude oil prices would increase continuously for many years into the future has staggered the world's economy. The investments, loans and much of the industry's accelerated activity, all of which were based on these price forecasts, are characterised as one of the most expensive business blunders in history.

Basically, these faulty forecasts were the result of attempts at mathematically modeling crude oil price (a dependent variable) against time as the single independent (or determining) variable using linear regression. With such a model, and with oil price data from years 1974 to 1980, oil prices would appear to be headed for constant increase. It must be realised, however, that oil prices are influenced by many other independent factors. These include such items as conservation incentives, the state of the world economy (recession vs. growth), successful exploration and production in non-OPEC countries, wars between OPEC members, the substitution of alternate fuels for industrial and space heating and so on.

As the forecasters predicted that the price trend of the late 1970's would continue, they overlooked the effect of the rapid price increases on the consumer. The oil price shocks of the 1970's were the catalyst to improve energy efficiency throughout the world. Cars were built to use less gasoline, plants designed to conserve energy, homes were insulated to loose less heat in the winter and stay cooler in the summer. All of these things significantly reduced the demand for oil and gas, which could only be corrected by severe price decline. Not only was less oil required, but oil and gas also lost out to other forms of energy. The forecasters had failed to recognise the very high degree of interchangeability between gas, coal and residual fuel oil from petroleum.

Another difficulty has been trying to project when non-OPEC production will decline to the point that OPEC's production would again dominate the world's productive capacity. This would give the cartel renewed power to set oil prices. Investors willing to continue successful exploration for oil and gas in non-OPEC countries have delayed the time that this would occur. These investments continue to be attractive because new technology has lowered exploration and development costs and retarded productivity declines in existing fields.

The classic approach to forecasting crude oil prices traditionally has been by means of a much simpler mathematical model, which permits the stepwise derivations outlined below.

Table 5.1 - Traditional Price Forecasting Building Blocks (37c)

Block 1	Basic Economic Conditions
Block 2	Total Energy Demand Block
Block 3	Non-Oil Supply, Natural Gas / Coal / Hydro-Electric
Block 4	Crude Oil Demand – The Swing Fuel (Block 2 minus Block 3)
Block 5	Non-OPEC Oil – Maximum Production
Block 6	Requirement for OPEC Oil – The Sum of Uncertainties (Block 4 minus Block 5)

The inevitable frustration has led to a great deal of concern among the practitioners of price forecasting, and a new consensus, which is more defensive than real. It has become far easier in the present circumstances to justify one's price forecast on the basis that it is midway between Shell and Exxon than to try to explain that it is based on any new theory and insight into the world political and economic forces on crude oil supply and demand.

Nevertheless, some price projection is obligatory for any economic analysis. One acceptable approach may be to assume as a base case that the price will remain constant for the next year or so, and then to apply a series of deviations from that base assumption in a sensitivity analysis of the matter (37d).

Breakeven Crude Oil Prices:

Another type of sensitivity analysis that is often performed to supplement an analysis, which includes a forecast of future prices, is to determine the "breakeven crude oil prices". This is the minimum price that would have to be obtained for all crude oil sold from a project so that the project would just meet the minimum corporate investment criteria. It should be noted that "breakeven price" is constant over the entire project life, not escalated for inflation and in terms of the value of money of the day for each year of the project. The "breakeven price" should be compared to the expected price of oil over the life of the project. If it is significantly less than the expectation of future oil prices it is a desirable project. If the breakeven price is greater than the expected future price of oil, then the project is not a viable one. If the breakeven price is near the price forecast, this type of sensitivity analysis will be of little help in making investment decisions.

Another use of breakeven price is in screening of investment opportunities or in long range forecasting to determine when certain types of projects might become economic ventures. Such as what price of crude oil would be required for various enhanced oil recovery techniques, marginal discoveries, synthetic oil development or even certain ultra deep-water development.

Crude oil as a commodity has suffered from price inflation through the years. Throughout its history the price of oil has practically never kept up with inflation – a great boon for consumers, but of great concern to the exporting countries. The general trend of real oil prices declined until the first oil price shock of 1973. The real price of oil fell sharply during the 1980's but had regained part of that loss by early 1990, when oil was selling for $22 per barrel. During the 1990/1991 Middle East War, the actual (nominal) price of oil, in fact, exceeded the 1980 nominal price for a short period of time, but still fell short of the real 1980 price. It is reasonable to expect that these inflation effects will continue, superimposed on all of the other political and supply-demand factors (54c).

5.12 NATURAL GAS SALES

Natural gas is one of the world's principal fuels. It has long been looked upon as a by-product of the production of crude oil. The industrialised countries of Europe and North America make extensive use of natural gas. They utilise indigenous supplies fed to the local markets through vast networks of natural gas pipelines. Japan is the exception, having to rely on imported liquefied natural gas (LNG). Most of the other countries around the world have found gas in connection with their efforts to discover crude oil for domestic use and export. Although a potential market for natural gas exists, starting with electric power generation, the supply is always remote from the market. The tremendous capital requirement for pipeline construction, have precluded the proper development of this resource up until now. Some tremendous shut-in reserves of natural gas have been found in such places as the Algeria, Australia, Indonesia, Iran, Peru, Qatar, Russia and Trinidad.

In recent years natural gas producers have succeeded in developing direct sales spot markets among major gas users while employing the natural gas pipelines merely for transport. Essentially all of the long natural gas pipelines in North America have relied upon the "right of eminent domain" for permission to cross certain private lands. This right is afforded only to common carrier transport systems like railroads or public highways. Thus the long line natural gas pipelines can be required to transport any party's gas from point to point on their system for a reasonable fee.

Spot sales of natural gas also need a major interconnected pipeline grid crisscrossing the country so that exchanges can be affected. The industry is in the process of building pipeline "hubs" at key intersection points. These facilitate drawing gas, not just from producing wells, but also from storage facilities. The storage fields act just like gas wells and provide additional sources of gas supply. More than 100 hub projects have been announced in North America in recent years. Many of these are closer to where gas is consumed, which allows the commodity to move faster when demand peaks. Gas buyers can rent space in these storage fields, inject them with gas in the off-season when prices are cheaper and withdraw it during the winter.

In concept a gas hub, similar to Cushing, Okalahoma, or Scotland's Sullom Voe Terminal – the delivery points from which West Texas Intermediate (WTI) and Brent crudes, respectively, are traded in highly liquid spot and forward markets. As hubs spring up around the US, Canada and Western Europe, gas markets are developing a strong resemblance to the freewheeling crude oil trade. And as governments in other parts of the world move to privatise and breakup monopolies that typically buy and aggregate incoming gas supplies and move them to consuming centres, it is anticipated that "hubs" will spread to those areas, providing commodity type trading as well as profit opportunities for the hub owners.

5.13 SUMMARY

Various factors such as refining cost and yield, transportation, production rate, reserves and inflation determine oil and gas prices, these aspects are fairly stable and easier to predict. However, supply/demand is the most vital aspect that fluctuates the price of oil and gas and hence this has to be considered in detail while forecasting prices. Therefore, the research takes into account pricing as a crucial aspect in building the comprehensive financial model. Flexibility in the model is the key to accommodate these fluctuations. A project will take time to implement and during this time either political or natural factors may involve in the supply or demand of the end product to vary, affecting the sale price of the product. Hence it is essential to build various scenarios with different prices to evaluate the viability and profitability of the project. This aspect will be considered in the CFM. Provision is made to work out different scenarios with different prices. By considering this aspect, the proposed project can be evaluated using different sale price scenarios to evaluate the project and consider up to what price is profitable should an eventuality of a price decline arise.

CHAPTER 6

RISK AND UNCERTAINTY IN THE COMPREHENSIVE FINANCIAL MODEL

6.1 INTRODUCTION

An input causes an event, which has an output. This very simplistic model purely serves to show that by understanding the inputs and managing them we can influence the outputs. This in essence is the principal of risk management (66).

Risk is a condition in which there is a possibility of an adverse deviation from a desired outcome that is expected or hoped for. Risk could involve the possibility of loss or gain. Hence it is accepted as an opportunity, anticipating gain. Results of risks could be changes in the economy (price levels, consumer taste, income, and output). This would benefit society in the long run, giving an opportunity to adjust misallocations of resources.

One of the crucial aspects of financial modeling is taking into account the risk and uncertainty aspects of the oil and gas industry. There are different types of risks involved in this industry and risk management is essential. This chapter investigates the various types, characteristics and classification of risk, risk management and the intensity to the oil and gas industry. The CFM takes into consideration the various risk factors in the oil and gas industry and specifically to financial modeling for oil and gas projects. Risk management is essential to ensure the project is covered to protect the interests of both the host as well as the entrepreneur of the project.

6.2 RISK IN THE OIL AND GAS INDUSTRY

The petroleum exploration and production industry is characterised as a "risk business." The usual reference is to the geological risk of drilling non-productive wells. With the growing volatility of oil and gas prices, financial risk is also becoming an increasingly important factor. The traditional method of coping with risk has been through methods such as diversification, sheer size, and vertical integration of oil and gas production and downstream refining and marketing (3a).

The terms, risk and uncertainty, are frequently used almost interchangeably in everyday discussion, although can be differentiated. Uncertainty is used to characterise the fact that the eventual outcome of a decision or event is not precisely known, with the degree of uncertainty described by the probability that it will occur. This concept implies that the range of possible outcomes can be determined and that the probability of each occurring can be estimated. This approach to uncertainty permits application of the mathematical theories of probability to the decision making process.

Risk denotes that there is a possibility of incurring economic loss or reduced value. High-risk ventures are ones with a chance of a large loss, even if the probability of such an occurrence is small. It is possible for a project to be highly uncertain, but have a low risk, if failure would be inconsequential. Assessment of the probability of each anticipated outcome can be the most difficult part of including uncertainty in the decision making process. Such assessments will range from values based upon a complete knowledge of the system, such as casino type games of chance, to those where the probability of each outcome could be anywhere in the range of zero to one. Unfortunately, most situations encountered in the petroleum exploration and production industry are more in the direction of the latter type of probability assessment than the former. Frequently such probabilities are based on no more than a guess or a hunch.

Depending upon the availability of factual engineering data and knowledge of the economic as well as the physical environment, the range of probability for each outcome may be very broad or narrow. By categorising the decision-making situations under the three headings, viz. Certainty, Uncertainty and Risk, it is the opinion of the author that the best definitions employed are the following:

Certainty: Only one possible outcome

Uncertainty: Recognition that more than a single outcome is possible, with each outcome having a finite probability of occurrence (+/-).

Risk: Possibility of incurring economic loss or reduced economic value

High Risk: The chance of incurring a large loss, even if the probability of doing so is very small.

Outcome: One of the possible events that can take place.

Probability: The chance between 0% and 100% that a particular outcome will occur.

6.3 TYPES AND ALLOCATION OF RISK

There are various risks as shown in the following table.

Table 6.1 – Types of Risks (3b)

Technical	**Economic**	**Political**
Dry Holes	Inflation	Governmental Policy

Geological	Oil and Gas Prices	Government Regulations
Engineering	Gambler's Ruin	Laws
Storm Damage	Interest Rates	Nationalisation
Earthquake	Environmental	Environmental
Timing	Timing	Timing
	Exchange Rate	Exchange Rate
	Financing / Capital	Financing / Capital
	Supply / Demand	Taxation
	Operating Costs	Export / Import
		Personnel

As several of the various risks listed above may have simultaneous impact on a particular project it may be necessary to weigh them mathematically in order to obtain a proper overall approximation. The weighting applied to each of the several risks will depend upon the nature of the project being evaluated. Such risks are generally considered under three broad categories namely, technical, economic and political.

When evaluating exploration and production ventures there are three types of uncertainty, which are most significant. These are (a) uncertainty of occurrence, (b) uncertainty of magnitude and (c) uncertainty of rate of production. During the exploratory phase, uncertainty of occurrence is of major concern and will probably dominate exploratory evaluations, even though the other two uncertainties surely have an impact upon the possible successful outcomes. Once a discovery is made, uncertainty of magnitude, which includes both volume and value, and rate become the dominant uncertainties. These uncertainties will remain throughout the entire producing life of a project, but will diminish with time as producing performance is observed, becoming zero at abandonment.

Political risks involve the uncertainty arising from possible changes in the policies of regulatory authorities and the degree to which such changes may affect the project revenues. Regulatory considerations can be subdivided into fiscal and non-fiscal considerations.

The fiscal aspects primarily include continuity in the levels of local and national taxation, exchange controls and limitations on import and export of foreign and local currencies, changes in levels of custom duties on imported equipment and supplies, and possible imposition of locally denominated prices for production.

Non-fiscal political risks may relate to possible interruptions by regulatory authorities over environmental matters, disagreements over hiring or firing of local personnel, determinations of commerciality, or outright nationalisation. Matters such as the provisions for transfer of operator-ship and the potential for political unrest in the host country also fall under this category.

Economic risk also covers a very broad range of potential situations, not the least of which are the present and future levels of oil and gas prices. The physical nature of the project is also highly important. For instance, the principal economic risk associated with an infrastructure project may be confined to the possibility of capital cost overrun and timing of completion. Whereas in the case of a depleting asset, such as mining or petroleum production, the prime economic concerns will probably involve drilling and operating costs, inflationary effects and interest rates, as well as, the ever important product prices and demand over the life of the project add additional risk.

Technical risks involve the operational nature of the project checking if the procedure has been employed many times before or is it a brand new technique. Technical risks may include the capability and experience of the engineering talent assigned to the project. In the case of reserve estimation the degree of technical risk may involve the hydrocarbon volumes, which actually exist underground and whether the producing rates and ultimate recoveries projected by the engineers will actually be realised (35b).

The various general risks can be broadly categorised as Sponsor Related Risks, Government Related Risks and Shared (Sponsor and Government) Risks as shown in the table below.

Table 6.2 – Risk Categorisation

Sponsor Related	Government Related	Shared (Sponsor/Govt.)
Operating Risk	Political Risk	Force Majeure Risk
Participant Risk	Foreign Risk	Legal Risk
Completion Risk	Syndication / Underwriting Risk	
Engineering Risk	Funding Risk	
Market Risk		

Infrastructure Risk		
Environment Risk		

6.3.1 Sponsor Related Risks

Operating Risk: Also known as production or performance risk, it has interrelated components, which are technical, cost and management. *Technical Component:* if a known and proven technology is used, the facilities are projected to remain technologically competitive, and plant/project life is twice the funding life, then the financiers will take the technical risk. *Cost Risk Component:* Cost risks apply to labour and materials inputs, productivity and operating expenses (OPEX), including the effect of inflation. *Management Component:* The experience of the management is efficiently applying the given technology and controlling operating costs is crucial when considering the project operating performance of a project. The availability of a sufficiently trained workforce may also need close examination in some locations.

Participant Risk: This is also known as credit or sponsor risk. The stature of the other companies in the project may have an impact on the project financing, especially if other participants are weak financially or technically. If there is a weak or inexperienced participant in a joint venture, the lenders may require cross-guarantees. The main risk allocation structures to handle participant risk in a project financing are (25) Joint venture agreement, Contingent financial support, Financial ratios and Off-balance sheet.

Completion Risk: This is also called construction, development or cost-overrun risk. Broadly speaking, a lender expects the loan proceeds to be spent on building a project that is on time, at budget, and is capable of producing sufficient cash flow after completion of construction and commissioning to repay the loan comfortably. Financiers in project lending do not usually take the completion risk, and other financial support is necessary prior to completion.

Completion tests are becoming more complex as project financiers become more experienced in sizing up acceptable levels of risk and as sponsors realise the possibilities of risk shedding while limiting the impact on their balance sheets (64a).

Engineering Risk: Also known as design risk (35c), this poorly understood area is often counted as part of completion risk because engineering and design flaws become quickly noticeable as the project encounters difficulties in construction or start-up. The risk here revolves around the poor quality of the engineering / design work, which can also have a crippling impact on the cash flow stream well after the (excess) capital has been spent pre-completion to counter the hardware problem.

This risk can arise from poor professional advice or the selection of an inappropriate or inexperienced firm for the technology or location involved. Flaws in capital budgeting or poor design estimates are only coverable by outsiders under Insurance and Independent certification.

Supply Risk: This may also be known as the reservoir or reserve risk in resources financings, and as traffic or throughput risk for infrastructure projects. The inputs to the project need to be capable of being forecasted and incorporated into the cash flow projections. For a Build, Own and Operate (BOO) infrastructure project, this may be the traffic willing to pay the toll. Traffic studies are treacherous tools from which to build cash flows. The following risk allocation techniques can be used. Traffic/throughput study, Supply undertaking, Supply additions, Depletion protection, Collateral, Reserve weighting and Reserve insurance (35d).

Market Risk: This is sometimes called sales or price risk and is best defined as the gross revenue line in the cash flow. It is quantity times the price (35e). Market risk occurs, for example (a) when the sales price falls; (b) when market share drops (perhaps due to a shift in freight rates or due to a new entry by a lower-cost competitor); (c) when demand for a project ceases; or (d) when sales are lost due to deteriorating quality of the projects output.

Supports and risk allocation applicable here include Sales contracts, Merchant financing, Consumer financing, Buy-back clause, Advanced sales, Deficiency agreements and Throughput agreements.

Infrastructure Risk: This is also called transportation risk (86c). Infrastructure (other than that being developed in an infrastructure project itself) is a very important component of many projects, and financiers will need to be assured that the chosen infrastructure will remain technologically and economically competitive, especially in comparison with other existing or potential production centres.

Independent certification will assist the financier's absorption of this risk component. The types of risk allocations applicable here include FOB sales contracts, Pooler infrastructure agreements and Government commitments (29).

Environmental Risk: This risk must be addressed for projects in all parts of the world. A project financing cannot proceed without favorable assurance of environmental compliance from the local regulatory bodies with which the sponsors must deal. This risk category can also arise due to the location of the project. This is not simply a sub-set of political risk but a distinct risk aspect of project financing today. Some multilateral agencies (MLAs) will not even allow a project finance application in the door until it first gets an environmental tick.

Supports and risk allocation structures here centre on Rehabilitation guarantee, Pollution control bonds, Environmental management, Environmental insurance, Rehabilitation waiver, Pollution pool and Environmental warranty.

6.3.2 Government Related Risks

Political Risk: This is actually a mix of risk categories covering for example, expropriation, currency inconvertibility, regulatory and tax risks (64b). Each financier and rating agency has a continuing review process of country risk based on an evaluation of the political and economic outlook. Loans to sovereign borrowers in the country establish the market 'price' for the country itself. Political risk is one that the banks in their wisdom used to feel most equipped to handle. This is a prime motivation to invoke project financing because it brings a wider constituency to the forefront of a government's thinking on a project. Some of the main structures and risk allocation methods are Development agreement, Political Risk Insurance (PRI), War and insurrection residual, Tax indemnification, Offshore proceeds account, Currency inconvertibility agreements, Co-Financing and Local national participation.

Foreign Risk: Besides currency inconvertibility (a political risk), foreign exchange exposure can occur when project revenues differ from the currency of the project financing. Lenders usually avoid foreign exchange risk in project financing. The best hedge is to match the loan currency to the (underlying) currency in which the price of the product / tariff / toll is set. A further step is to match equipment purchases to the sales revenue currency. However, if a large loan is required, the available loan currencies may be limited. Supports therefore are Hedging, Swaps and Barter.

Syndication Risk: This may also be called financing or underwriting risk. Once the terms and conditions of the project financing have been negotiated and documented, the actual funding has some risks that should be understood. Of course, if the loan is from one financier then this risk category does not apply. However, by virtue of the usually large amounts involved, most projects involve a layering of financing or syndicate that has its own conventions. The arranger or lead managers (one to three banks) carry the negotiating responsibility with the borrower and the participating banks. The agent bank (usually one of the lead managers) arranges the documentation and loan disbursements. The lead managers arrange a syndicate of banks, first choosing the managers (two to six banks) and the co-managers (three to ten banks) the ranking of which depends on the amounts of the loan; and finally there are the participating banks. The capital markets follow a similar syndication pattern (86c).

Syndication risk arises when the banking syndicate is to be arranged. This is covered by an Underwriting agreement and Broad syndication. An Underwriting agreement stipulates that the lead financier(s) will provide all of the project financing required whether or not others are willing to join the syndicate later and participate in the risk. Broad syndication means the additions of financiers who have either a relationship with the purchaser, experience in project financing, experience of operating in the particular region and/or represent a diverse set of international financiers.

Funding Risk: Most bank project financings are funded on a floating rate basis due to the necessity for flexibility in drawdowns and repayment. If interest rates escalate uncontrollably, the available cashflow can be correspondingly reduced and may not be sufficient to repay principal when due. Financiers usually accept this risk indirectly in a project financing (16a).

The longer term fixed rate capital markets have been aggressively chasing long-term infrastructure and power projects. Co-financing from government or quasi-government entities such as ECAs or the World Bank may help to introduce fixed rate funding as well as longer maturities. This risk that interest rates will get out of hand is difficult to cover through supports and guarantees, although some techniques that can be applied are Interest make-up agreement, Interest protection agreement, Hedging, Swaps, Alternate funding, Supplier credits and Leasing.

6.3.3 Shared (Sponsor and Government) Risks

Force Majeure Risk: There are four types of force majeure risks (86d): (a) acts of man (strikes); (b) acts of nature (flood, earthquake); (c) acts of government (embargo); (d) impersonal acts (market freezes). Many force majeure events coincide with the other risk categories such as technical risk (water inflow) or political risk (government regulations), but lenders can accept some of the temporary force majeure risk through project financing. The exception of such risk will lead to a requirement for a flexible transaction.

Business interruption insurance is becoming more prevalent and is another way, favorably viewed by the financiers in a project financing, to cover force majeure risk. This is one of the risks seen to affect almost every project at some stage of its development or operation. Supports can come from Insurance and Deferral (16b).

Legal Risk: The burden of legal documentation usually rests on the financiers and its advisers. There is possibility that professional advisers may create risks in the document that can affect the tax position, tenure, security, enforcement and other attributes so heavily negotiated in the risk allocation process embodied in the project financing in the first place. Second opinions, judgments and experienced staff and advisers are perhaps the only way to mitigate this final risk category. The risk of professional advisers creating unworkable, faulty or unenforceable documentary structures is difficult to mitigate overtly, but some supports are available such as Title insurance and Legal opinions.

6.4 CHARACTERISTICS AND CLASSIFICATION OF RISK / UNCERTAINTY

The first characteristic of uncertainty is that it may be either objective or subjective. Uncertainties that can be accurately calculated ahead of time, as in the case of flipping a coin, are known as objective uncertainties. In these cases, there is no room for disagreement as to the probability of the outcome (23).

Describing the odds for rain next Wednesday is not so clear-cut. This represents a subjective situation. Armed with the same information, one forecaster may think the chance of rain is 30% while another weatherman may judge the odds to be 65%. Neither is wrong. Subjective uncertainty is always open to reassessment on the basis of new information, further study, or by recognising the opinion of other observers. Most uncertainties are subjective, and this is particular true of the oil business.

Subjective assessments of uncertainty are likely to change as additional information becomes available. The possible option of spending money for additional information, such as adding another seismic line, or waiting for more production data, in order to improve the risk assessment becomes part of the decision making process.

Most uncertainty quantification involves some degree of personal judgment. This can be due to any of several reasons. There may not be complete or adequate information on the situation; or, the situation may not be repeatable like the coin-flip; or it may be too complex to permit a finite answer. The recognition that a certain operation is risky involves a judgment. What one individual may consider unduly risky may not be so appraised by another person.

The second important characteristic of uncertainty is its adaptability to quantitative interpretation. This leads to the third characteristic of uncertainty, i.e., the possible choice of accepting or avoiding risk. This characteristic is particularly likely in decisions involving investments in the oil industry. In most cases the operator is not contractually required to develop a project and has the option of “walking away”. To the extent that individual judgments regarding the degree of a particular risk may differ (in magnitude, if not in nature), identical risks may involve dissimilar responses from different investors.

Risk identification will be readily agreed as an all-important first step. There are six major ‘branches’ of risk classification (3c). They are: (a) statistical; (b) modelers; (c) checklist; (d) project financing; (e) insurance; and (f) structural / jigsaw.

Statistical: The statistical set discovered probability theory and any risk discussion soon deteriorates into a mathematical jungle. Their use of terminology tells its own story: coin toss (binomial distribution); gamblers' ruin; Delphi (oracle) techniques; monte carlo simulations and random walks. These techniques inadequately represent the judgments necessary in an increasingly complicated and interrelated world.

Modelers: The risk modelers have turned to the computer to handle these interrelationships but soon find barriers because of 'simultaneity'. Certainly the computer has its uses to conduct various analyses (marketed as 'sensitivity' analysis), but very often one finds that this involves changing one or two variables at a time, all other things being equal. Unfortunately, in a modern and complex world, all other things do not remain equal. The statisticians will, no doubt, jump to their own defense by citing this very point as the reason probabilistic tool are necessary. But the interrelationship of risk is difficult to quantify and represent mathematically: in practice, specifying the co-variances tends to be the stumbling block.

Checklist: The checklist advocates, rely on a list of key points to audit and, QED, the risks are covered. Incredibly, for some of these, there is not even a discussion of what risk might be. This checklist approach is particularly rampant in the feasibility study business and is a major reason why less than 10% of feasibility studies presented for loan applications have provided satisfactory raw material on which to base a project financing decision. Less than 5% of these studies contain a risk discussion.

Checklists are useful but should not be the only technique applied. Their popularity springs from overspecialisation of team members. At least, the insurance industry recognises, 'it is impossible to develop a complete checklist' but then goes on to note, 'in any case it is far better for a responsible official to prepare his own questionnaire' – another checklist!

Project Finance: The project finance community discovered risk classification early in its development and has generally done the best job of defining the various risk categories and the methods of analysis applied to structuring their financing documentation.

Insurance: The insurance community treats risk quite differently from all the above. Its attention is generally focused on asset loss / reinstatement and the industry is fond of distinguishing between 'pure' and 'speculative' risk, wherein pure risk involves only the possibility of a loss. In general, pure risks are the only ones that can be insured, whereas speculative risks (where there is also the possibility of a gain) are uninsurable. But this is changing fast as insurance underwriters begin to discover that project 'speculative risk' insurance often rates a higher premium. Thus far, this is called 'business interruption' or 'specialty risk' insurance, which looks increasingly like project finance. In fact, these underwriters admit that they are acting as investment bankers and venture capitalists, dealing with risks the insurance industry considers uninsurable. However, a dictum of insurance is that the portfolio should comprise a relatively large number of independent (pure) risks. Otherwise claims tend to come in bunches. Besides keying off actual tables based on historical data, insurers – like the modelers – run foul of the overlap of risks.

Structural / Jigsaw: Finally, a structural / jigsaw approach has evolved from the protocols in Build-Operate-Own (BOO) / Build-Operate-Transfer (BOT) project financings. This method finds adherents among the lawyers who see the same template being used repeatedly. The theory goes that if each box on the project finance diagram is properly linked to the others with the relevant contract or documentation, then the risk allocation is completed, jigsaw style. Indeed, within each document is a highly structured allocation of risk – the party most capable of handling the risk should bear that risk – almost on a clause-by-clause basis, and almost in checklist style.

The CFM will propose to consider all aspects of risks that are related to the oil and gas industry. Basically the model will have to be built to ensure that the risk aspects are not embedded in the macros where changes will be difficult if the risk assumes reality. By keeping the risks, just as the price factor, within amendable reach without drastic changes to the model, will ensure flexibility to the model as well as reasonably accurate results.

6.5 RESIDUAL RISK MANAGEMENT

There are four fundamental approaches to coping with risk and uncertainty (86e). (a) diversification, (b) reduction of exposure, (c) avoidance, and (d) insurance. In the case of geological risk, diversification means participating in the drilling of ten wells instead of putting all of one's resources in a single prospect. This reduces exposure by taking a lesser interest in a greater number of ventures. If the risk is so great or the reward insufficient to justify the risk, it may be better to completely avoid the undertaking. Insurance does not reduce risk, but distributes it over time and shares it with others in the same insurance pool.

Vertical integration of crude production and downstream refining has also been an acceptable means of diversification. During the 1970s, the benefits of integration were seriously eroded by a number of nationalisations by the host country. This greatly increased the dangers of price risk during a time of high market volatility and unpredictability.

When uncertainties are great, and where there is no recognised method of quantifying the situation, decision-making becomes particularly difficult. As a start it may be helpful to identify the types of occurrences, which are contemplated. They are: (a) Mutually Exclusive (b) Independent (c) Dependent, Conditional or Contingent and (d) Sequential.

Many times there is even on experience to be drawn upon. Hunches and rumors, as well as personal optimism or prejudice, all too frequently play their part. Judgments of some kind must be made, the relative desirability of various possible outcomes must be visualised, and the whole process mentally integrated. One is forced either consciously or subconsciously to make assumptions and predictions in arriving at any "intuitive" decision.

Rules of thumb are often relied upon with some appropriate modification recognising the implied degree of uncertainty. For example, a normally acceptable payout standard of three years might be arbitrarily reduced to two years, as a screening basis for project selection in a high-risk situation. There are more reliable, albeit more complicated, techniques for handling decision making under uncertainty when adequate data are available.

6.6 OIL AND GAS DERIVATIVES

One of the greatest risks facing the petroleum industry is the price that will be received for oil and gas when it is produced. The other side of that coin is the price risk to the consumer. The individual consumer is little concerned over this risk, but major consumers such as the electric companies and airlines have a great concern with this major cost of their business (3d).

Oil and gas derivatives have been developed to provide "insurance" against wide swings in price. But as is the case for any insurance, there is a cost (premium) to be paid. In this case the cost is the price of the option, either to buy or sell the underlying asset, that is purchased to manage price risk.

Derivative contracts give one party a claim on an underlying asset (or its cash value) at some point in the future, and bind a counter-party to meet a corresponding liability. It may bind both parties equally, or offer one party an option to exercise it, or not. It might provide for assets or obligations to be swapped. It could be a complex derivative combining several elements.

Oil and gas options are a form of forward contract that convey to the holder (purchaser) the right, but not the obligation, to buy or sell a certain quantity of oil or gas at a specified price (strike price) on a scheduled date (settlement date). The value of an option depends on four elements: time, prices, interest rates and volatility. Crude oil options are traded on the NYMEX and reported regularly in the financial press. Options give producing oil companies a means of protecting themselves against downward price movements from a fixed price without foregoing the chance of increased profits if crude oil prices rise. These transactions deal in what are known as "paper barrels".

Any perceived value that a put or call option develops above its numerical, or intrinsic, strike price is known as time value. As the expiration date of the option approaches, time value elapses and only the intrinsic value remains. Each passing day erodes the option's time value. This works in favor of the sellers and against the buyers. Actually, most options, both calls and puts, finally expire worthless.

6.7 SUMMARY

A full understanding of who takes what risk and the general rules applied by project financiers can result in remarkably good project finance agreements without too much difficulty. An early dialogue with the financiers will serve to validate the sponsor's expectations of risk sharing in a project financing. A firm understanding of these objectives should be established, perhaps with the assistance of a financial adviser.

In relation to the comprehensive financial model, risk is the second crucial aspect that is considered important. Specifically, since this model is solely for the oil and gas projects, the fluctuation in prices is a major risk that needs to be kept in mind. This in turn is related to the supply and demand of the product. Operating cost would also be a factor based on the location of the project, as costs to import necessary material to build infrastructure could be high. The model is built to be flexible enough to provide "insurance" against wide swings in price. However, as for any insurance there is a cost (premium) to be paid, which in this case is the price of the option, either to buy or sell the underlying asset, purchased to manage price risk.

CHAPTER 7

ANALYSIS OF EXISTING FINANCIAL MODELS

7.1 INTRODUCTION

In order to understand the need to develop the Comprehensive Financial Model (CFM), it was necessary to review existing models, their methodology, advantages and disadvantages. This helped in ascertaining the problems that existed and paved the way to rectify or provide methods to arrive at a Comprehensive Financial Model. Eight models were reviewed and analysed. Four are explained in detail in this chapter and provided in Appendix 4. The remaining four were found to be deficient but are also shown in Appendix 4.

A member of the senior personnel in the oil and gas industry who used this model to evaluate projects in the company provided model No. 1. Model No. 2 is from the United Offset Group (UOG). Models No. 3 and 4 are from Arco, used by different sections to evaluate different projects. While conducting the interviews with personnel from these companies, the author learnt about these models and requested them in order to study them to help understand the need to create a single comprehensive financial model.

The author also conducted a case study on RasGas, to find out how the new projects were evaluated and understand from them the hurdles faced during the formation of this company and completion and commissioning of their new projects. RasGas data will be used to populate the CFM when complete, in order to verify and validate the CFM and will be documented in chapter 9. The purpose of the case study is documented in this chapter and the complete case study documented in Appendix 2.

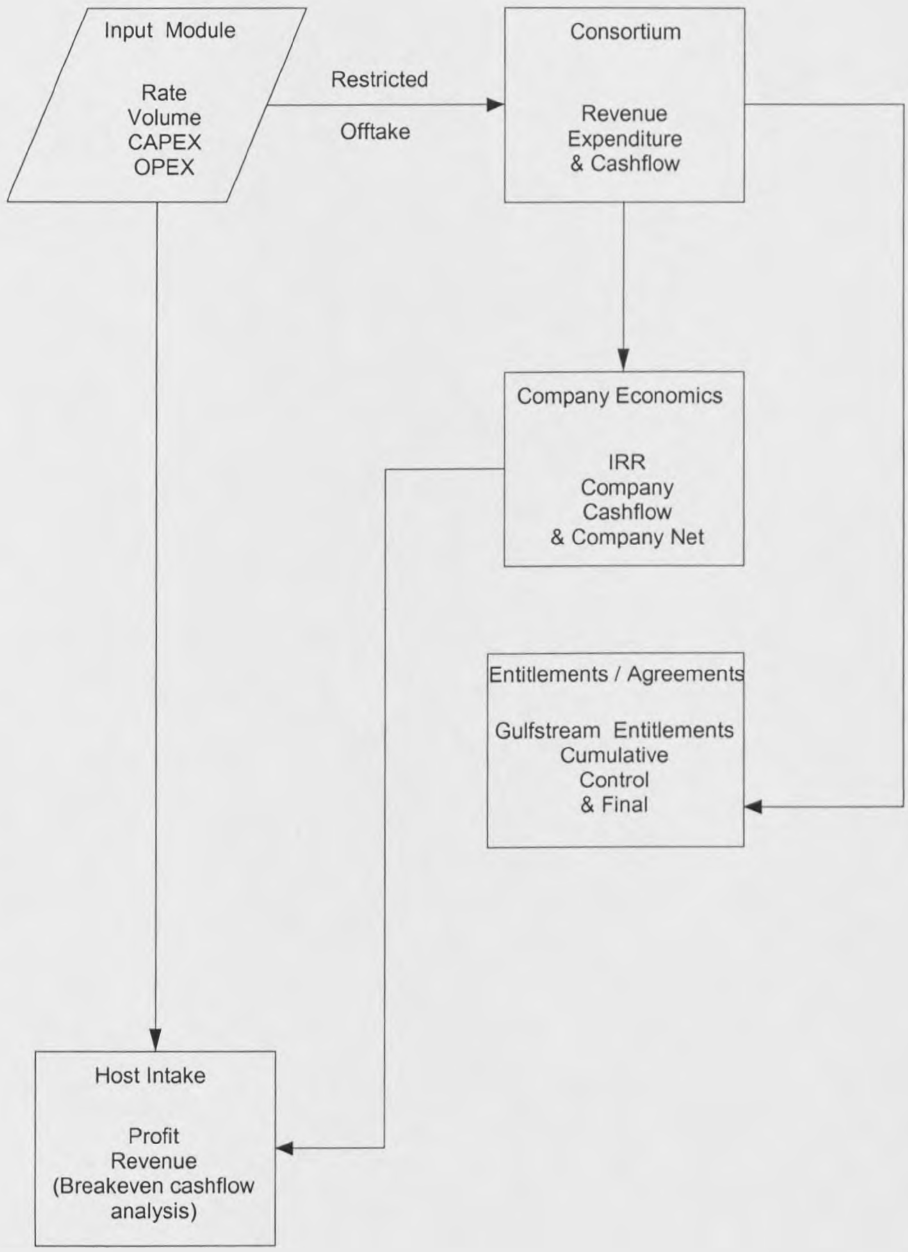
7.2 REVIEW OF FINANCIAL MODEL NO. 1

Financial model No. 1 is developed to calculate the consortium and company economics. The model mainly deals on the production and revenue aspects of the project. Any other financial criteria are not taken care of such as cash flow, fund flow and loans. Risk management, which is an important factor in these huge investment projects, is not taken into account.

There are no specific input or output sheets for the user to tryout what if scenarios before getting into the actual model. Data is not linked in this model, this makes the data entry confusing. On the whole this model is developed for a particular phase of the project and is not recommended for oil and gas project.

Flow chart and details of the worksheets for this model are documented below.

Figure 7.1 - Flowchart for Financial Model No. 1



Input Module: Details of the oil price and volume have been provided. The Drilling Capital Expenditure (CAPEX) and Facility CAPEX details are also displayed. Scenarios of restricted off-take and 25mbls off-take have been provided. Total forward CAPEX is the sum of Drilling CAPEX and total forward Operational Expenditure (OPEX) fixed /MM$. Field price and Brent MOD prices are also displayed.

Consortium Economics: The financial model scenario for restricted off-take 15mbls is explained. Cost oil barrels, Profit oil barrels, Cost oil revenue, Profit oil revenue, CAPEX, OPEX are provided for a period of 2000 to 2009. Cost oil barrels is calculated based on the input sheet's oil volume and 0.4, profit oil barrels is the product of oil volume of the Input sheet and 0.12. The product of cost oil barrel and field price provides the cost oil revenue. Profit oil revenue is the product of profit oil barrels and field price provided in the input sheet. Total revenue is the sum of cost oil revenue and profit oil revenue.

Total expenditure is arrived from the sum of CAPEX and OPEX. Net cash flow is arrived from the difference between Total expenditure and Total revenue, which is also, termed as final cash flow. Present Value (PV) (10%) is arrived by the net profit values of the final cash flow. Internal Rate of Return (IRR) is also calculated from the series of final cash flow.

Company Economics: Details like company cash flow, entitlements and company net are provided. Company cash flow is the product of final cash flow and 0.275 (27.5% of final cash flow). Entitlements are extracted from the entitlements agreement module and the difference between the entitlements and company cash flow provides the company net.

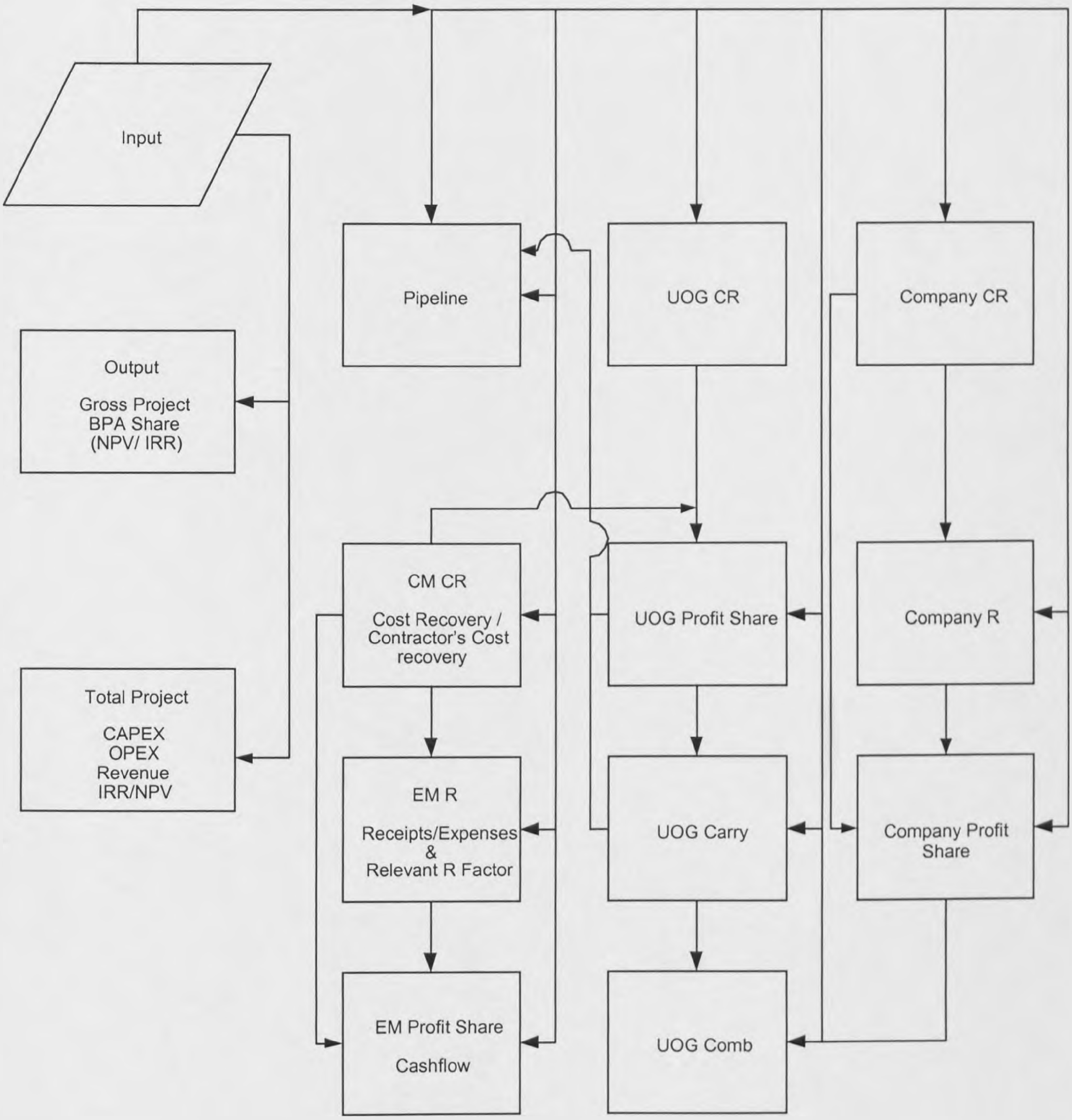
Entitlements / Agreement: Company un-recovered costs is provided and summed up to arrive at Total un-recovered costs. 27.5 % of CAPEX and OPEX, cost oil revenue are displayed, 55% of CAPEX, OPEX and cost oil revenue are also provided. OPEX proportion split is calculated based on OPEX at 55% and Cost oil revenue at 55%. Available for entitlements is the difference between cost oil revenue and OPEX at 55%. Cumulative un-recovered OPEX is the inverse of available for entitlements. A summarised table on entitlement, cumulative, control and final are provided.

Host Intake from Field: Profit oil in barrels and profit oil revenue is provided. Profit oil in barrels is calculated as 48% of the oil volume from the input-sheet. Profit oil revenue is the product of the profit oil in volume (barrels) and field price of the Input sheet. Profit oil revenue used for break-even cash flow analysis is calculated from the net value of the company economics and profit oil in barrels.

7.3 REVIEW OF FINANCIAL MODEL NO. 2

This model is of the United Offsets Group (UOG), an existing company in the oil and gas industry. This company is located in the United Arab Emirates.

Figure 7.2 - Flowchart for Financial Model No. 2



The above model is a project specific model as it only takes care of the revenue and shipping. As this model does not have a common aspect needed for an Oil or Gas project, it cannot be generally used. This project mainly deals with the Upstream, Downstream and Pipeline, Production and Pricing modules.

This model does not provide any details about the risk management, bond funding, tax depreciation and ratio analysis as these are required for any project to give a clear status of the financial aspects. Although the modules are linked, certain calculations are done manually without a proper input or variables module. Worksheet details are documented below.

Input: CAPEX details like drilling, offshore, LNG plant, pipeline, OPEX upstream, OPEX LNG plant and OPEX pipeline details are provided. Production details like sales gas, condensate mbd and LPG mbd are displayed. Price details of gas, condensate, LNG are also provided based on the variables in the output module. Tariff details are also provided. One-off entry fee United Offset Group (UOG) are also provided.

Output: Assumptions /variables of Plateau production, Price, sensitivities, Gross project and Bid Price Adjustment share are provided.

Total Project: Revenue details of Gas, Condensate and LPG are calculated based on the respective values in the input module. Total revenue is the sum of the above. OPEX is calculated from the input module. Cash flow details are calculated based on the difference between the sum of OPEX, Govt take, CAPEX and the total revenue. Discounted CF is the product of discount factor and cash flow. IRR is arrived from the cash flow details. NPV is calculated from the discounted Cash Flow (CF).

Pipeline: Assumptions of throughput, tariff, revenue, OPEX, depreciation, Replacement Cost Operating Profit (RCOP), Tax, CAPEX, cash flow, discount factor, discounted cash flow, NPV, IRR, government cash flow are provided. The above values are derived from Engineering Module Cost Recovery (CR), Input modules respectively. Discounted factor cash flow is the sum of discount factor and government cash flow. Total pipeline cash flow is the difference between sum of OPEX, CAPEX and revenue. Pipeline depreciation details are calculated from the pipeline cost and the period of depreciation at 15%. The sum of the year wise depreciation gives the total CAPEX recovery.

Cost Management Cost Recovery: Cost recovery parameters like gas, upstream price are provided. The sum of these results in gas rev. Liquids rev is the sum of condensate and LPG in the total project module. Costs are arrived from the CAPEX and OPEX parameters of the input module. A maximum available cost is the sum of gas revenue and liquids revenue at 40%. Cost recovered is the minimum of sum of total costs, un-recovered cost of the previous period with respect to maximum available costs. Excess cost recovery-petroleum revenue is the difference between cost recovered and maximum available cost of oil/gas.

Engineering Management R factor: Cumulative expenditures and receipts are provided. Total gas production is also displayed for the above period. Relevant R factor is also calculated based on the value of R like R<=1.25, R<=1.5 and >1.25 and R>15. (The R Factor is a measure of the level if disagreement between the (properly scaled) observed structures (F_{obs}) and calculated structure factors (F_{calc}). It is usually reported in %, for example, an R Factor of 0.18 is reported as 18%.)

Engineering Management Profit share: Details of contractor's revenue and expenses are provided, and the difference between this gives the contractor cash flow. Economics details like discount factor, discounted CF, NPV and IRR are provided. Company's cash flow is displayed at 30% of contractor's cash flow. Host cash flow, govt. cash flow and host upstream cash flow are also provided.

Engineering Management Comb: Total cash flow like contractor's upstream cash flow, contractor's downstream cash flow is displayed. Total company share is calculated based on 30% of the sum of contractor's upstream and downstream cash flow. Economics of the above are also provided in this module.

United Offset Group Cost Recovery: Cost Recovery (CR) from liquids like liquids rev, is calculated from the condensate and LPG of the total project module. Costs are arrived from the CAPEX and OPEX of the input module. Max available liquids cost is 100% of the liquids rev. recovered and un-recovered costs is the minimum value of the sum of un-recovered costs of the previous period and total costs with respect to maximum available costs of liquids. Excess cost recovery is the difference between max available cost liquids and cost recovered. Details of government take and contractor's take are also displayed.

United Offset Group Profit Share: Offset details like gas volume, total upstream revenue, govt take, cost of gas, OPEX, CAPEX, one-off entry payment, contractor's cash flow are displayed. The economics details like discount factor, discounted cash flow, NPV and IRR are also provided. Company share cash flow is the sum of 25% of contractor's cash flow and carry. Cash flow details like SP2, govt cash flow and total upstream cash flow are also explained.

United Offset Group Carry: SP1 is the percentage difference between UOG contribution and equity. The difference of UOG contribution and SP1 equity is displayed as SP2. Details of contributions, cumulative equity capital investment, equity capital inv. are provided. Details of UOG, SP1 and SP2 are provided with 10% pa dividend and above 10% dividend. UOG Project Investment Value and UOG share after 25% are also provided. Details of SP1 upstream carry and pipeline carry, SP2 carry plus dividends, upstream carry and pipeline carry are also provided.

United Offset Group Comb: Offset details like contractor's upstream cash flow, contractor's downstream cash flow are provided. Details of total company share are provided at 25% based on the contractor's upstream and downstream and the economics are also calculated.

Company cost recovery details like gas, upstream price, special terms, gas rev, condensate rev, LPG rev, upstream liquids rev, upstream costs, max available cost, cost recovered, un-recovered costs, excess cost recovery petroleum, excess CR to govt and contractor and contractor's cost recovery are calculated from the inputs module. Profit is the difference between sum of gas rev, upstream liquids rev and max available cost. Special terms details of the above are calculated from the total projects module. Total gas production, condensate and LPG are provided in the Company R module. R Gas and R Oil details are also provided.

United Offset Group Profit Share: Contractor's CR upstream, CR LPG plant, profit oil/gas upstream and profit oil LPG plant are provided. Upstream profit split details like total upstream profit, profit gas, Gas R factor, profit liquids, liquids R factor, contractor' share of profits, contractor's revenue and contractor's expense is provided. LPG plant profit split details like total LPG plant profit, contractor's share of profits at 38%, government, share of profits, contractor's revenue and contractor's expense are displayed. Company economics of company cash flow, host cash flow, government cash flow and total upstream cash flow are also calculated.

Company Comb: Total cash flow like contractor's upstream cash flow, contractor's downstream cash flow and total company share at 30% are provided. Company economics like discount factor, discounted CF are displayed. NPV and IRR are calculated from the discount factor and discounted CF.

7.4 REVIEW OF FINANCIAL MODEL NO. 3

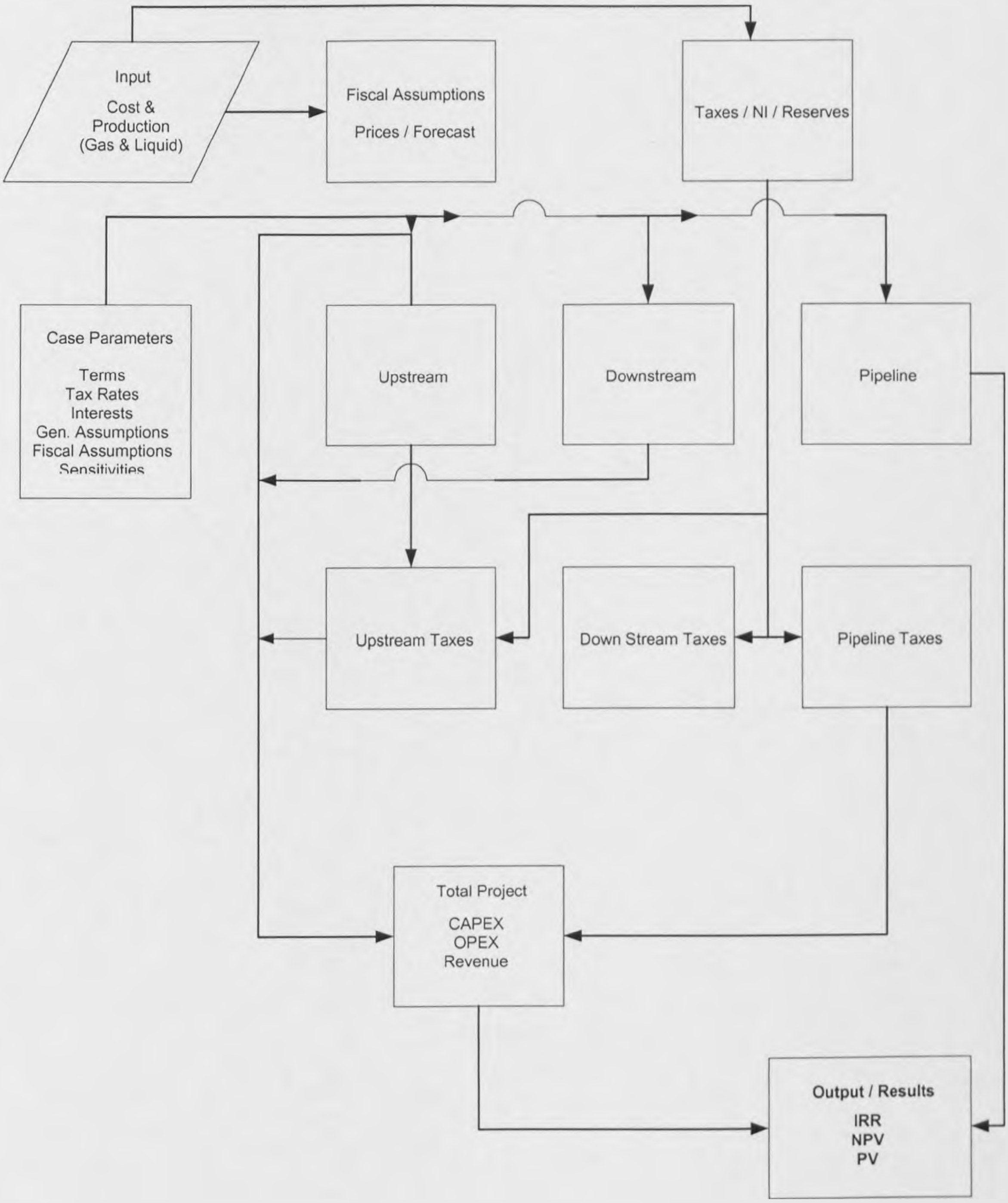
This existing model is one of the many models used in Arco, a company actively involved in the oil and gas industry. Arco is also involved in oil and gas projects in the Middle East.

Model No. 3 documents all the aspects but not in detail. Missing aspects include concepts like risk management, Bank ECA loan module, reserves volume and ratio analysis. This model provides details on fiscal assumptions on inflation liquid prices, gas prices/ tariffs. Input details on development costs, operating costs, downstream costs, pipeline costs and liquid / gas production costs.

Upstream details include various taxes such as local taxes, US safe harbour calculation and federal / state taxes. Downstream details like net profit, cash flow and net consortium details are provided. Specific data on pipeline and pipeline taxes are also provided. As this model is developed specifically for a particular project, a major rework is needed to accommodate all the other missing aspects.

Flow chart of model No. 3 is provided below followed by details of worksheets included therein.

Figure 7.3 - Flowchart for Financial Model No.3



<u>*Case Parameters:*</u> Information on all updates with the date and description are provided. Terms – Profit Tranches are provided per share at different levels (20%, 17.5%, 15%, 12.5% & 10%) for Oil and Gas. LPG plant details like special LPG terms, percent condensate in LPG plant, cost recovery cap, profit share of excess cost and profit share to contractor are provided. Tax rates – Tax rate details like US fit rate, US state tax rate, Qatar oil tax rate, pipeline tax rate, host P/L depreciation, Qatar general tax rate, excess FOGEI credits, US tax applied to Liquid outside EPSA and any provision available are

displayed. Interests – Details like investment interest (exploration / development), production interest, share of sunk costs, interest in Pipeline Company and Dubai interest in pipeline are provided.

General assumptions – Project start year, PV reference year, discount rate, purchase price tax, gross sunk costs, ARCO net from sunk costs, cost recovery percentages are provided. Price/Fiscal assumptions – Oil price forecast, generic forecast starting price, generic escalation rate, first year of cost escalation, Qatar condensate price quality, Qatar LPG price quality, Al-Rayyan price quality, C3, C4, LPG bbl/tonne, first year of gas price escalation are provided. Gas prices based on Dubai prices i.e. sweet sales price at Ras Laffan, inlet sales price at Jebel Ali are provided. P/L details like bas P/L tariff, secondary tariff, first year of secondary P/L tariff, first year of P/L tariff escalation are also provided. Sensitivities – Details of sunk cost, development drilling cost, facilities cost, pipeline cost, variable operating cost, fixed operating cost, liquids price, gas price oil tariff, gas tariff, oil production and gas production are provided. Assumptions on Pipeline sensitivities like pipeline cost and operating costs are also assumed.

Fiscal Assumptions: Details of Fiscal assumptions like inflation, liquid prices, gas prices/tariffs are calculated and provided. Inflation – Details of US Gross Domestic Product (GDP) deflator percentage per year, Inflation factor, Qatar gas escalation, pipeline escalation details are provided based on the first year of gas inflation of the price/fiscal assumptions of the case parameters module and the current year of inflation projection. Liquid prices – Liquid price forecasts, price forecasts $/bbl generic, stress, oil $/bbl, Al-Rayyan, Qatar condensate, Qatar LPG ($/bbl) and Qatar LPG $/tonne are provided. The above assumptions are provided based on the oil price forecast of the case parameter module.

Gas price / tariffs – Gas sales price, pipeline tariff and price to Dubai are calculated based on the index and P/L tariffs provided in the price/fiscal assumptions. Escalate with inflation and flat delivered prices are calculated from the Dubai prices (mtu/Standard Cubic Feet (SCF) and Metric Million British Thermal Unit (MMBTU)) of the price fiscal assumptions section of the case parameters module.

Input: Input details like development costs, operating costs, downstream costs, Qatar/Dubai pipeline costs, liquids production and gas production. Development costs like sunk cost, drilling in tang, drilling tang, drilling dry holes, facilities, offshore are provided. The sum of all these constitute the development cost. These details are arrived from the sensitivities details of the case parameters module. Operating costs like variable condense, variable gases, fixed, overhead are calculated based on the output details. Downstream costs are provided for facilities and OPEX. Costs details for facilities and OPEX are also provided. Liquid production details like condensate, C3, C4, Al-Rayyan are provided. Gas sales from Qatar in (Billion Cubic Feet (BCF) and MM/D) are also provided.

Qatar Up-Stream: Gross details of Gas Sales, Oil Sales, and LPG Sales and Condensate Production are provided (in MMSCFD, Metric Barrels of Oil Per Day (MBOPD) respectively). These are calculated from the volume of production. Un-inflated costs are calculated from the downstream module and special LNG terms of the case parameters module. Inflator cost is from the inflation factor of the fiscal assumptions module. Inflated price details are provided for gas, oil, LPG and condensate module. Gas inflated price is the product of gas sales price of the fiscal assumptions and gas price from the sensitivities of the case parameters module. Oil, LPG and condensate inflated price is calculated from the oil/LPG and condensate. Sales price of the fiscal assumptions and oil price from the sensitivities section respectively. Gross values for the same are also provided.

Net details of volume like gas sales, oil sales, LPG sales and condensate sales are provided. Inflated costs details like OPEX fixed, variable, drilling cost, facility, production bonus and sunk costs are provided. The values are calculated based on the inflator cost and the working interest. Net costs of liquids rev. and gas rev. are provided. Net cost oil details like maximum available costs (oil/gas), cost pool additions, sunk cost to be recovered, yearly cost recovery, sunk cost adjustment, cost recovery, excess cost (oil/gas), contractor excess cost (oil/gas) and govt. excess cost (oil/gas) are calculated from the net inflated costs of the upstream module and provisions provided in the case parameters module.

Qatar Upstream Taxes: Local taxes details like contractor entitlement, contractor cost recovery, Foreign Oil and Gas Extraction Income (FOGEI) revenue for remuneration and tax paid by QGPC are given. US safe harbour calculation details like gross income, cost recovery, tax basis of acquisition, un-recovered costs, Unit Operating Procedure (UOP) for un-recovered costs, Qatari tax paid, income, creditable portion and deductible portion are calculated. US federal and state taxes are provided.

Revenue is the gross income of US safe harbour calculation. OPEX is the sum of OPEX fixed and OPEX variable of the upstream module. Indirect Cost (IDC) is the product of drilling in-tang of the input module, working interest and inflators cost. IDC depreciation is based on the total depreciation. Tax details of facilities, facilities depreciation, P/L, P/L depreciation, UOP depreciation are calculated. Taxable profit is the difference between revenue, OPEX, total depreciation and deductible proportion.

USFIT tax payable is calculated based on the previous years loss balance, taxable profit and US fit rate of the case parameters module. Usable loss is calculated based on the sum of previous periods and the taxable profit for a period of 15 years. Used loss is calculated based on the taxable profit and the loss balance. Loss balance is the sum of usable losses and losses used.

Net excess FOGEI credits are the difference between creditable proportion and USFIT tax payable. 5 years credit carry forward details like usable credits, credits used and credit balance are provided. Usable credits are calculated based on the net excess FOGEI credits for a period of 5 years and credit balance of the previous year. Credits used, is the minimum of the net FOGEI credits and credit balance. Credit balance is the difference between the sum of usable credits and the sum of credits used. Remaining credits is the difference between net excess FOGEI credits and the sum of usable credits and credits used. Other tax details like US fit due, US state tax due and contractor AT cash flow are provided.

Qatar Downstream: Gross w/o multipliers details like rate, volume are calculated fro the LPG sales and condensate production for a period. Un-inflated costs for OPEX and facilities are provided. Gross revenue for LPG, condensate is the sum of volume and prices respectively. Net costs in volume of LPG sales and condensate sales are calculated. LPG sales, is the sum of net interest and LPG sales and condensate sales volume is calculated based on the net interest and condensate sales. Net cost oil details like maximum available cost, cost pool additions, yearly cost recovery, un-recovered costs, excess cost, contractor excess cost and government excess cost (oil/gas) are provided. Company economics details are calculated from the gross revenue, contractor revenue, contractor's expense and contractor's cash flow details.

Qatar Downstream Taxes: Break-up on local taxes, US safe harbour calculation, US federal and state tax details are provided. Revenue is the gross income of US safe harbour calculation. OPEX is the sum of OPEX fixed and OPEX variable of the upstream module. IDC is the product of drilling in-tang of the input module, working interest and inflators cost. IDC depreciation is based on the total depreciation. Tax details of facilities, facilities depreciation, P/L, P/L depreciation, UOP depreciation are calculated. Taxable profit is the difference between revenue, OPEX, total depreciation and deductible proportion.

USFIT tax payable is calculated based on the previous years loss balance, taxable profit and US fit rate of the case parameters module. Usable losses are calculated based on the sum of previous periods and the taxable profit for a period of 15 years. Losses used are calculated based on the taxable profit and the loss balance. Loss balance is the sum of usable losses and losses used.

Net excess FOGEI credits are the difference between creditable proportion and USFIT tax payable. 5 years credit carry forward details like usable credits, credits used and credit balance are provided. Usable credits are calculated based on the net excess FOGEI credits for a period of 5 years and credit balance of the previous year. Credits used are the minimum of the net FOGEI credits and credit balance. Credit balance is the difference between the sum of usable credits and the sum of credits used.

Remaining credits is the difference between net excess FOGEI credits and the sum of usable credits and credits used. Other tax details like US fit due, US state tax due and contractor AT cash flow are provided.

Qatar Total / Taxes: Contractor cash flow and QGPC cash flow are provided. Contractor cash flow is the sum of contractor cash flow of the Qatar upstream and Qatar downstream module. Contractor AT cash flow is the sum of contractor AT cash flow from the Qatar upstream taxes and Qatar downstream taxes module.

Qatar / Dubai Pipeline: Gross un-inflated costs for OPEX and facility are provided. Net volume of gas in / gas out and inflated costs of OPEX and facility are provided. Net cash flow details like Revenues, expenses, tax payable and contractor cash flow are provided. Revenue is the sum of product of gas out and tariff and discount volume if gas in volume is more than discount volume or the product of difference in gas in volume and discount volume or difference between the discount price and tariff based on the volume difference.

Expenses, is the sum of OPEX, facility and product of tariff and gas in volume. Tax payable is arrived from the total tax payable value of the Qatar/Dubai pipeline taxes module. Contractor cash flow is the difference between the revenues and expenses of the net cash flow. IRR are calculated from the revenue and the contractors cash flow and the discount rate of the net consortium. Qatar/Dubai pipeline taxes – Details of local taxes, US federal and state taxes are provided.

Project Total: Values / assumptions of oil reference, inflation, PV reference Date, working interest, net interest, percentage condensate outside EPSA, cost recovery cap, profit share of excess cost and profit share to contractor. Net consortium details like IRR, IRR real are also calculated. IRR nominal is calculated from the contractor cash flow.

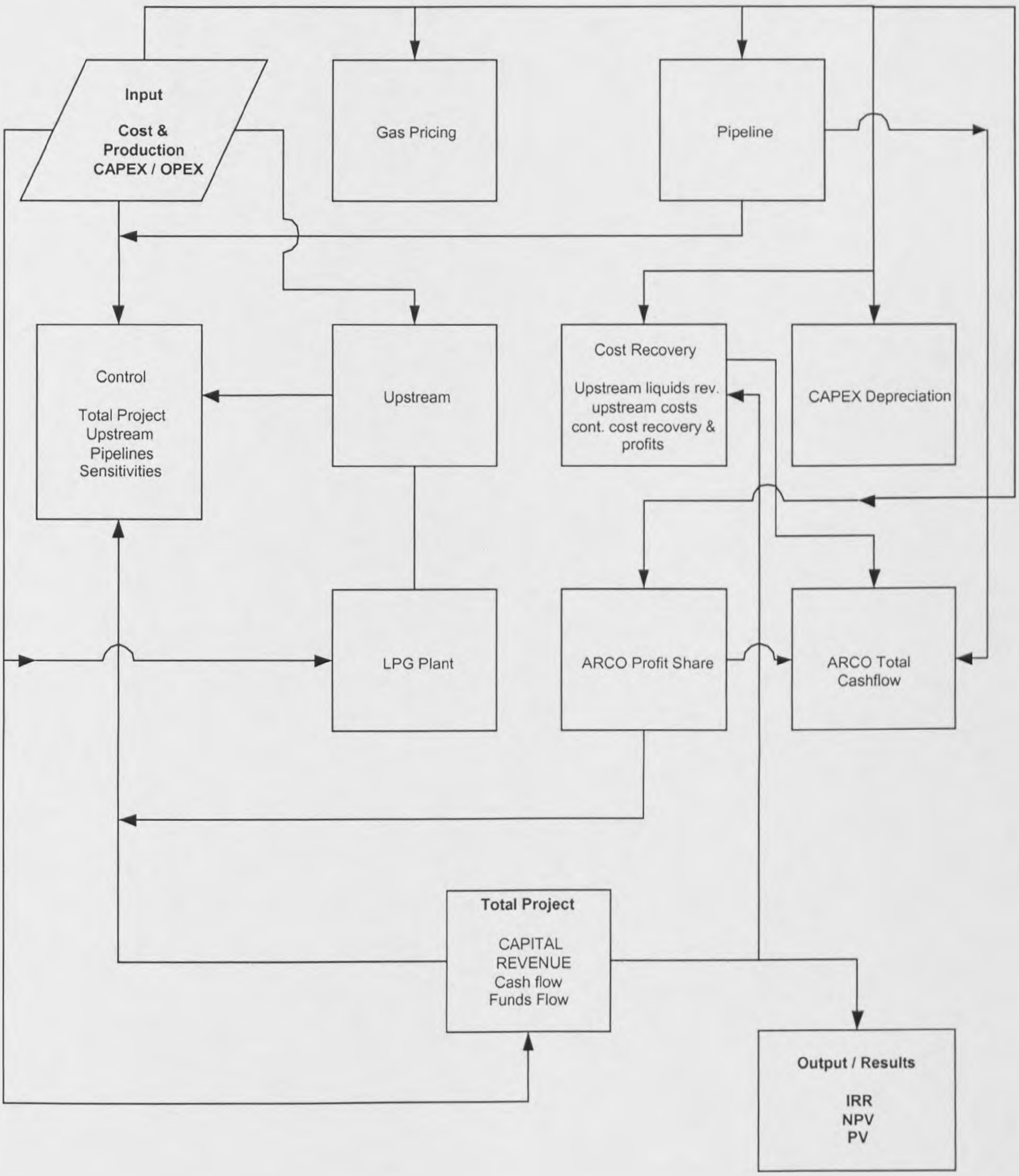
Qatar total: Taxes / NI / Reserves: Reserves details like total reserves, Working Interest (WI) reserves and SEC Reserves are calculated which comprises of the oil/condensates, gas and LPGs. Net income w/o pipelines comprises of the net production, OPEX, CAPEX, cost, CR, profit, sunk, OPEX, CAPEX, total, CR adjustment, purchase price, Depreciation, Depletion and Amortisation (DDA) base, expense, UOP, entitlement and net income.

Results: Details of Production Sharing Contract (PSC) revenue split, cost summary, pipeline summary, reserves summary (gross / SEC / WI), Qatar upstream net consortium, LPG plant, Qatar total and pipeline net economics are provided.

7.5 REVIEW OF FINANCIAL MODEL NO. 4

This is another existing model used in Arco and flow chart and working of the worksheets included therein are documented below.

Figure 7.4 - Flowchart for Financial Model No. 4



The input module provides CAPEX, OPEX, production, price and tariff details. Company economics like NPV, IRR, and CE and ROACE are summarised. Pricing details like applicable gas price, crude price and yearly gas prices are provided for the projection period. Total project module provides the details of financial summary of the total project like revenue, net profit, fund flow and net capital employed. As this model is also developed for a specific project, a major rework is required to generalise this model for its use in the oil and gas financing projects. The modules lack risk management, cash budgets, bond funding, tax depreciation, income statement and balance sheet etc.

Inputs: Information on sales price, sales price inflation, cost inflation, depreciation rate, debtors months, creditors months, tax paid in year, stocks months, cost of cap and tax rate are provided. Company economics like NPV, IIR, CE, and ROACE are calculated for Total project, pipeline and Upstream. CAPEX details like drilling, offshore, LPG plant and pipeline are provided for a period of 2000 to 2030. OPEX upstream, OPEX LPG plant and OPEX pipeline details are also provided. Production parameters like sales gas method, condensate (mbd) and LPG (mbd) are provided. Price structure for gas, condensate and LPG are provided.

Gas Pricing: Model price is 25% of increase greater than $15/bbl up to max $1.15. Minimum price, maximum price and first 5 yr base is given. Model price of FOB Dubai gas, applicable price of Joint Consultative Committee (JCC) and 3-month average and crude pricing are also provided. Yearly gas price is also provided for a period of 25 years.

Control and Total Project: Statistics of all control values are provided in this module. BP economics, BP share of NPV, QGPC share, Abu Dhabi government share and other partner share are provided. Revenue details like gas, condensate and LPG summary are given for a period of 2000 to 2030. Price index, cost index and discount factor are shown. Sales revenue, variable costs, contribution, fixed costs, depreciation, pre tax profit, Tax details are summed to get the net profit. Fixed assets, debtors, creditors, stocks, net working capital, capital employed are also provided. Funds flow is the sum of profit, depreciation, working capital and CAPEX. Details of NPV, IRR, CE, Disc payback and Returns on Average Capital Employed (ROACE) are provided.

Upstream: Gas revenue is calculated based on the gas production and HHV of the input module. Condensate is calculated based on the condensate production and condensate price of the input module. Sales revenue, variable costs, contribution, fixed costs, depreciation, pre tax profit, Tax details are summed to get the net profit. Fixed assets, debtors, creditors, stocks, net working capital, capital employed are also provided. Funds flow is the sum of profit, depreciation, working capital and CAPEX. Contribution is the difference between the sales revenue and the variable cost.

LPG Plant: Gas revenue is calculated based on the gas production and HHV of the input module. Condensate is calculated based on the condensate production and condensate price of the input module. Sales revenue, variable costs, contribution, fixed costs, depreciation, pre-tax profit, tax details are summed to get the net profit. Fixed assets, debtors, creditors, stocks, net working capital, capital employed are also provided. Funds flow is the sum of profit, depreciation, working capital and CAPEX.

Contribution is the difference between the sales revenue and the variable cost. Fixed cost is the sum of cost index and LPG plant OPEX cost from the input module. Depreciation is calculated from the fixed assets and depreciation rate provided in the input module. Pre tax profit is the difference between contribution, fixed cost and depreciation. Debtors, is the product of sales revenue and debtors for 12 months. Company economics like NPV, IIR, CE. Disc payback and ROACE are provided.

Pipeline: Price index, cost index and discount factor is arrived based on the details provided in the input module. Revenue is the product of throughput and tariff. Details of fixed assets, debtors, creditors, stocks, new working capital and capital employed are also calculated. Contractors' cash flow is the sum of profit, depreciation, working capital and CAPEX. Discount factor, discounted CF, cumulative PV and payback details are provided for contractors cash flow, govt. cash flow, pipeline cash flow, Abu Dhabi Row-tariff. Company economics details are also given for the above. Pipeline depreciation details are provided which sums up to total CAPEX for recovery.

ARCO R Factor: Total liquids for upstream, liquids for special terms and R factor oil and gas are provided. R factor of oil and gas are arrived from the gas terms and oil terms, which are calculated in the control module. A liquid for special terms is the difference between sum of condensate, LPG of the inputs module and total liquids for upstream.

ARCO Cost Recovery: Gas revenue is the product of gas (mmbtu) and upstream price. Upstream liquids revision is the sum of condensate revenue and LPG revenue. Upstream costs, is the sum of CAPEX like drilling, offshore, LPG plant and OPEX details like upstream and LPG plant. Max available costs oil / gas, 40% of gas revenue for cost recovery. Un-recovered costs, is the difference between the sum of previous periods' cost recovery, upstream cost and cost recovered. Profit oil / gas is the difference between the sum of gas revenue, upstream liquids revenue and maximum available cost of oil/gas.

ARCO Profit Share: Total upstream profit, Profit gas, Gas R factor, profit liquids and liquids R factor are provided. Contractor liquids revenue is the product of profit liquids and liquids R factor. Contractor gas revenue is the sum of profit gas and gas R factor.

Liquids and Gas percentage of profits, is the percentage of contractor's liquids revenue / gas revenue and contractors share of profits. Government share of profits is the difference between total upstream profit and contractors share of profits. Contractor's revenue is the sum of contractors CR LPG plant and contractors share of profits. Contractors expense the sum of CAPEX LPG plant and OPEX LPG plant of the inputs module.

Total cash flow details like contractor's cash flow, government cash flow, QGPC cash flow, and total upstream cash flow are provided with the company economic details. Company economics are calculated from the discount factor, discounted CF, cumulative PV and pay back.

ARCO Comb: Total BPA share are arrived from 100% of contractor's upstream cash flow and 25% of contractors downstream cash flow of the Arco profit share and pipeline modules. NPV, IRR, cash earnings (CE), Disc payback and ROACE are also provided based on the discount factor, discounted CF and cumulative payback. Discount factor is calculated from the discount factor of the previous period. Discounted CF is the product of total BPA share and discount factor. Cumulative PV is the sum of previous period's PV and current periods discounted CF.

CAPEX Depreciation: Based on the total CAPEX, depreciation details are provided.

7.6 ANALYSIS AND DISCUSSION OF THE EXISTING FINANCIAL MODELS

The above four models, now in use in the Oil and Gas industry, are analysed in order to prove there exists a necessity to develop the CFM. The financial domain is a world filled with stocks that trade only at certain times with discrete ticks. Usable models exist for some particular sector with particular trading rules, settlement conventions, and other practicalities but not for new oil and gas projects.

Fundamental assumptions and methods used by the existing models are a combination of Investment Appraisals, Financial Planning and Tax Planning strategies. These methods of financial modeling are not suitable for projects in the oil and gas industry as discussed in chapter 3 (section 3.8). Essentially, these models do not include forecasting principle, which is quite important for project evaluation in the oil and gas industry.

The advantages and disadvantages of the four reviewed models are shown in the table below.

Table 7.1 – Overview of the Existing Models

Model No	**Advantages**	**Disadvantages**
Model No. 1	Simple and moderate in size. Should be suitable for projects with limited offtake and without higher overhead costs	Not well designed. Would be difficult for a new user. Various worksheets not properly interlinked. Possibility of errors. Probably created focusing on a specific project. Not suitable as a general financial model for the oil and gas industry.
Model No. 2	Fairly well designed financial model. Incorporates various aspects needed for a successful model.	Does not exhibit the risk factor. Not very flexible for all oil and gas projects. Certain data, formulas are hidden, which could lead to suspicions. Working of the model not documented, hence only creator will be able to operate and provide the results.
Model No. 3	Complex model and incorporates many of the	Too complicated. Is not well documented for any user.

	required aspects for a financial model like tax rates, interests, oil price forecasts, escalation rates, gas prices, condensate quality, development and operating costs, downstream costs etc.	Possibly biased in favor of the host. Business rules not applied well. Contractor will need to further evaluate from his viewpoint. Not very flexible.
Model No. 4	Positively structured model incorporating sales prices, price and cost inflation, depreciation rate, taxes etc.	Quite a rigid model, does not incorporate the risk factor. More suitable for only specific projects or Production sharing joint ventures only. Also not well documented and could be confusing and complicated for a new user. Integration and interlinking of modules or worksheets not working well.

Model building is as much art and apprenticeship as engineering and science. It is possible to delineate some of the procedures involved in constructing a financial model. Some of the flaws or areas not taken care of or not fully implemented in the existing financial models are described below.

- Understand the securities, the markets and the way market participants think about valuation and risk factors.
- Isolate the most important variables that participants use to analyse value and risk.
- Decide which of these variables are susceptible to mathematical modeling.
- Separate the dependent variables from the independent variables. Also decide which are directly measurable and which are more in the nature of human expectations, and therefore only indirectly measurable.
- For some variables, the uncertainty in their future value has little effect and they can be treated as known to a good approximation. For other variables, uncertainty is

critical. Specify the variables that can be treated as deterministic and those that must be regarded as stochastic.

- Develop a qualitative picture that represents how the independent variables affect the dependent ones.
- Think about how to get the market values of independent observable variables, and how to deduce the implied values of indirectly measurable ones.
- Formulate the picture mathematically. Decide what stochastic process best describes the evolution of the independent stochastic variables.
- Consider the difficulties of solving the model, and then perhaps simplify it to make the solution as easy as possible. But only reluctantly give up content for the sake of an easy or elegant analytical solution.
- Develop a scheme for analytic or numerical solution and programme.

The existing financial models lack behind in the terms of design and development. Besides they are not properly documented. These problems are probably due to the following reasons.

- Not taking into account of all the factors that affect evaluation specially important elements like pricing and risk management.
- Assuming incorrect dynamics for a factor
- The model may be inappropriate under current market conditions, or some of its assumptions are invalid. For example, interest rate volatility is relatively unimportant in currency option pricing at low interest rate volatilities, but may become critical during exchange rate crises.
- A model may be correct in an idealised world (with no trading costs, say), but incorrect or approximate when realities (like market frictions) are taken into account. Thus the models would have been developed for a particular project or a part of the project, but not for a new Oil and Gas project.

The existing models may be “correct in principle” but the market may disagree in the short run. This is really another way of saying the model is limited, in the sense that it didn’t take other short-term factors into account (including market sentiment) which can influence price. Across an enterprise, risk is an umbrella of threats, whole sets of variables that are harder to capture, as companies grow more complex and diverse. Across any single line of business, risk may arise from macro and micro-economic factors, uncertain relationships with customers and suppliers and the effects of competition and regulation. Review of the existing models indicate that they lack the above aspects specifically risk management and pricing considerations.

The more complex a model is, greater the possibility of problems. Many models need the future value of some volatility or correlation. This value is often based on historical data. Historic data may provide a good estimate of future value. Risk and pricing factors are not considered in most of the models as the risks lie in the knowledge of the business. Besides, the applicability of the financial model; the mathematics and numerical analysis used to solve it; the computer science used to implement and present it; and in the transmission of information and knowledge accurately from one part of the model to the next are other important criteria that need to be considered in a effective financial model. It helps to be knowledgeable in all of these areas in order to notice an error and then diagnose it. The existing models are built without considering the above situations. The user interface of the existing models is not properly designed or requires a person experienced in using the model.

7.7 SUMMARY

Although the oil and gas industry has evolved and developed with time, there is no specific financial model that provides an investor or an entrepreneur an opportunity to evaluate the project to see the viability in terms of returns on his investment. Therefore, the need is to create such a specific, comprehensive, accurate and cost saving financial model for the oil and gas industry, to facilitate evaluation of new projects and even critically review existing projects.

It is safe to summarise that individually, the models reviewed in this chapter are not suitable for the oil and gas industry and cannot be used as a standard for all projects. Some are suitable only for a specific project and others do not have the flexibility required for a successful estimation of an oil and gas venture. During the review, it was found that some of the models are connected via macros to files in remote servers or mainframe facilities within the company. When the model is then copied to a CD, disk or laptop, the link file may not be copied. This denies the model from being flexible and portable, as it cannot be utilised in different places or even on a laptop. In many of the existing models, essential elements, for example prices and the risk analysis factors, required for a successful financial model are not incorporated. Besides, most of the models are quite complicated and would be a painstaking experience to ensure accurate results. This would create mistrust when it comes to comparing the results between various parties to a new venture especially when results differ and suspicions arise.

The most common drawback of all the reviewed models is that there is no openness and essentially they are not at all documented. Besides, most do not provide accurate results. The models need to be documented in order to facilitate a new user to know how and where to input the variables and then get the necessary results immediately. Though all do have drawbacks, certain advantages do exist in some of the models in terms of design and continuity and these will be considered positively in the comprehensive financial model.

CHAPTER 8

DEVELOPMENT AND ANALYSIS OF THE COMPREHENSIVE FINANCIAL MODEL FOR OIL AND GAS PROJECTS

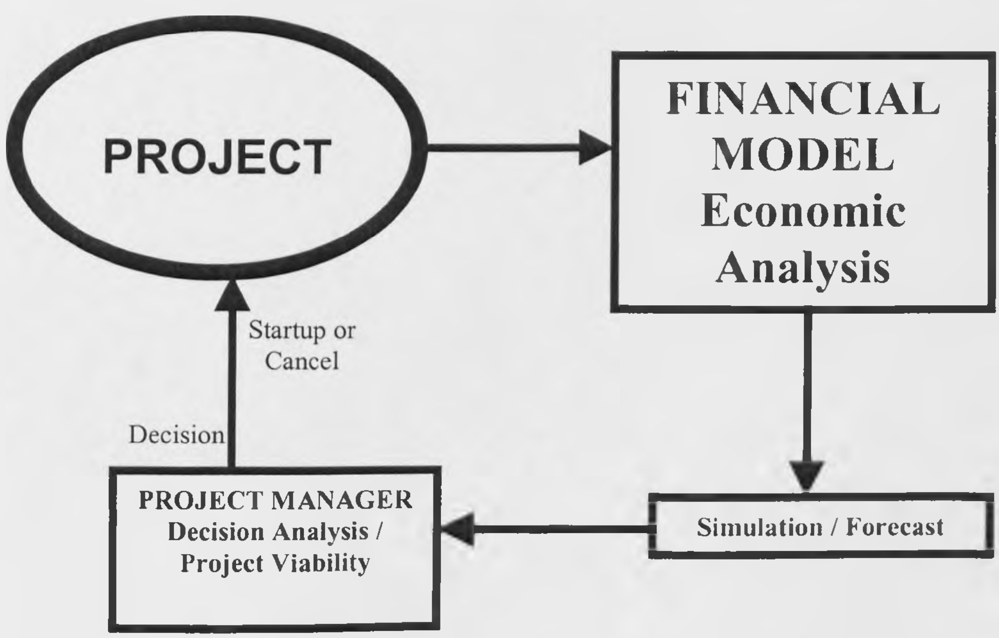
8.1 INTRODUCTION

This chapter explains the details of a prototype Comprehensive Financial Model (CFM) for the oil and gas industry projects. The CFM includes various components that form the final structure. Each component is an individual worksheet in the CFM workbook and these worksheets are called 'Modules'. The author explains each module included in the CFM. The CFM aims to provide a financial solution for the oil and gas industry from the planning, commissioning / installation, to production and revenue phase. The CFM aims to be unique, innovative, flexible, comprehensive, accurate, user friendly and above all the model will try to ensure efficient and effective cost savings. The Rasgas case study will further facilitate the developing of the CFM by conducting a history match with Rasgas data and also analysing the difficulties faced by Rasgas with their models. The reason for the case study is to investigate the essential elements of financial models, both from operational as well as financial point of view.

8.2 BASIC STRUCTURE AND REQUIREMENTS OF AN OIL AND GAS RELATED COMPREHENSIVE FINANCIAL MODEL

Project finance is essentially the raising of finance for a new project, secured against future revenues. Project completions, its successful and profitable operations are therefore key concerns for all lenders and investors. Elements that influence costs and revenues from the project are of interest when determining the financial structure. Hence analysis of the projected cash flows, under a range of assumptions, is a prerequisite for arranging debt equity funding.

Figure 8.1 – Role of a Financial Model

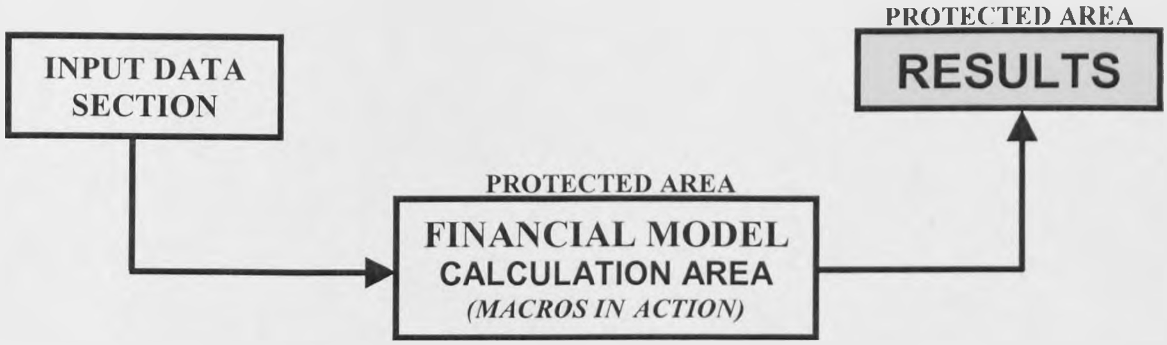


As shown in figure 8.1 above, to check the viability of any project, an economic analysis should be performed which will indicate the profitability. Only then a decision can be taken with regard to the start or cancellation of the project. The financial model is the tool to perform the economic analysis. Available data will have to be input into the financial model and a simulation will have to be run, forecasts made and this will provide relevant results. These results will then have to be analysed by the project manager, view different scenarios and then, take the final decision if the project is to be implemented or rejected. The CFM aims to be such a financial model for all oil and gas related projects. Currently various models are used, however, there is no single model in the oil and gas industry which can be used both by the host as well as the financier of the project.

A financial model should always be structured to be flexible and easy to understand. A person, other than the one who created the model, should be able to use, understand and reasonably make modifications to suit the project. This is necessary in case of emergency, leave or job changes and this requirement is rather a different task than that of ensuring safe and easy access for a third party with a minimum understanding of the model. After identifying the data items that are likely to be varied, a single page that allows entry of the relevant data items and provides a summary of the key results can be produced. The rest of the model can then be protected to prevent any changes being made, which could produce anomalous results. Such a page can be prepared in the format of a 'Key inputs and results summary'.

Figure 8.2 shows how a financial model should be simple and easy to understand. It should follow a basic idea of 'Input-MODEL-Results'. Only the input sheet would need to be used. The working area of the financial model as well as the results sheet can be protected in order to avoid accidental modifications that could lead to wrong results. Although protected, the working area that includes the macros should be well documented, as this area may need to be modified to meet any unique requirements of specific projects. With this layout, it is easy to understand how the financial model works and at the same time only the results need to be forwarded to higher management in order to make the final decision with regard to project commencement. The CFM basic layout is similar to the one shown in figure 8.2 and will thus be flexible and easy to understand.

Figure 8.2 – Basic Layout of a Financial Model Incorporated by CFM



Individual projects will have different features based on the industry requirements. Projects related to the oil and gas industry also have unique requirements that need to be incorporated in a financial model. These are:

- Reserves Forecasting
- Direct Operating Expenditure Forecasting
- Capital (Capex) Expenditure Forecasting
- Physical Volume of Oil/Gas Forecasting

All of the above requirements involve forecasting which is the basic methodology of the CFM. Most of the projects in the oil and gas industry are long-term and hence forecasts will have to be based on various aspects such as reservoir engineering studies, geological studies, field seismic data, infrastructure availability and market forces. Forecasts will need to be reviewed constantly and revised based on the above aspects.

Based on the unique requirements of oil and gas projects, forecasting is an essential element that needs the designing of the model to be very flexible. Due to various factors forecasts change and subsequently this has to be incorporated in the model to arrive at the profitability of the venture. Also unique to the oil and gas industry is the price changes of the end product, which is very volatile in nature. The price varies almost on a daily basis and forecasts have to be reasonable. Various factors are responsible for the price changes and the forecaster has to be constantly vigilant. Another unique aspect is the risk factor. Oil and gas business is quite a risky venture. If proper studies are not undertaken to ascertain reserves the project runs the risk of not being a profitable venture. Besides political, environment and natural risks could also impact the projects profitability.

Therefore risk management is very essential aspect to be considered in a financial model for the oil and gas industry.

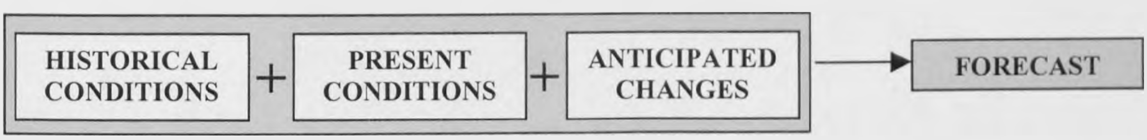
8.3 THE CFM METHODOLOGY

The principal methodology for this Comprehensive Financial Model is Forecasting. Forecasting is an essential part of the preparation of any economic evaluation. Since a forecast is based upon the best information available at a given time, it may be necessary to alter a forecast from time to time as information or conditions change. About the only thing that can be said about a forecast is that it is unlikely to accurately predict what will actually occur. It is a rare forecast that is proved to be completely accurate; it will be either optimistic or pessimistic. However, even though it is a foregone conclusion that a forecast will most likely be inaccurate to some degree, it is still necessary that the forecast be made. Without the forecast, a valid economic evaluation cannot be completed.

The main reason for choosing forecasting for the CFM is because this principal is unique and essential to many aspects in the oil and gas industry. Based on various elements, a trend of supply and demand of oil or gas has to be forecasted. Based on simulation and reservoir related studies, a forecast of the hydrocarbon reserves is made. These results will then help forecast production requirements over future years and based on forecasted prices the viability of the project can be pictured.

Forecasts are made based on related historical conditions that show the trend of a similar project combined with the present conditions that exist. Reviewing the trend shown based on historical conditions, the forecaster can then predict a future trend based on present conditions. This is depicted in a simple diagram below.

Figure 8.3 – General Forecast Flow Diagram



Numerous forecasts must be made during the preparation of a typical exploration and production evaluation. It is necessary to forecast the timing of oil and gas production. To convert hydrocarbon production to revenue, it will be necessary to prepare a forecast of the unit prices to be received as the products are sold. Finally it is necessary to estimate the magnitude and timing of capital and operating expenses, which will be incurred to generate the expected revenue. These costs must be considered both under economic conditions prevailing at the time as well as those projected for the future. Thus, it is important to forecast changes in prices due to inflation/deflation, supply/demand and, technological improvements.

Forecasting – what and how? Forecasting is an aspect or output of CFM based on the historical data from the case study. The modules operation variables and financial variables act as basic input for other modules, which forecast the important information like price and calculate the risk involved in the project. Based on the forecasted reserves and pricing the revenue is forecasted for a certain period.

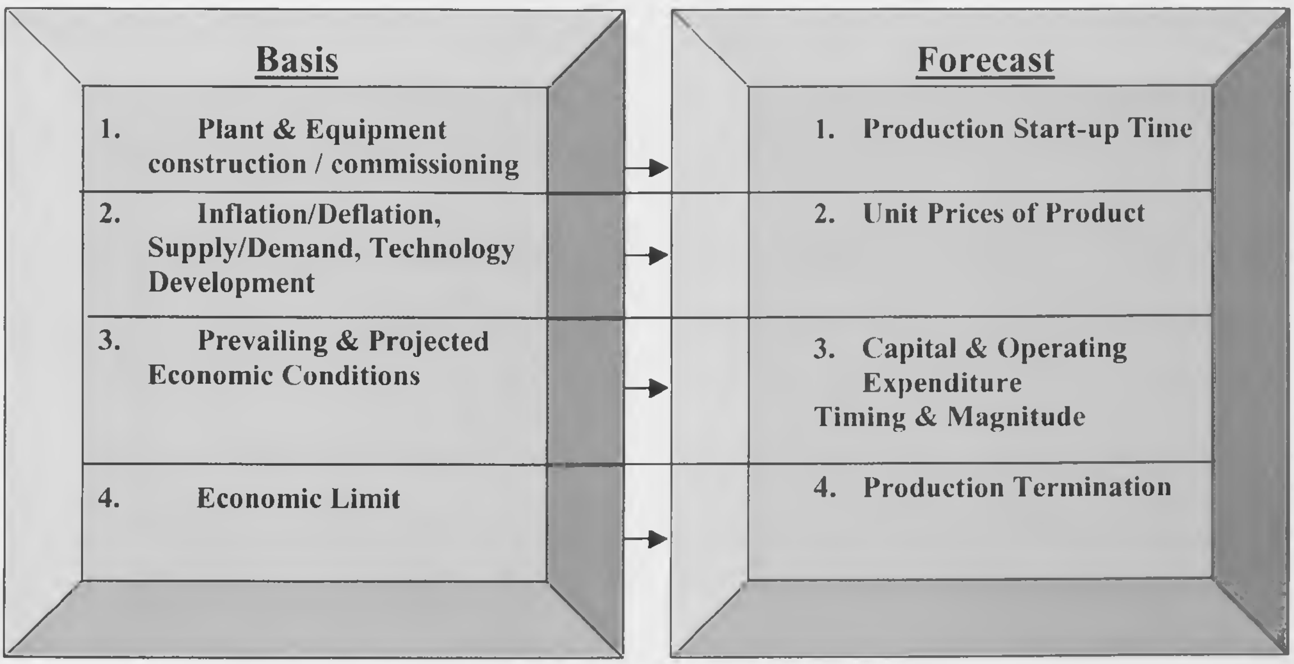
The cash budget costs forecast the royalties payable based on the reserves and revenue forecasts. Working capital forecasts the current assets (receivables) and liabilities (payable) based on the cash budget costs. The un-levered cash flow is calculated and forecasted using the operating cash flow and capital expenditures.

Bond-funding module forecasts the funds available from pre-completion and post-completion cash flow (total reserve funding available). It also forecasts the O&M account, debt service reserve account, build-up period reserve account to calculate and forecast the total income on reserves. Risk management forecasts the volume and pricing guarantee. Taxation module forecasts the Earnings Before Interest and Taxation (EBIT) and net taxable income for a period. Income statement, balance sheet, cash flow summary and ratio analysis forecasts the respective reports.

It is important to know when hydrocarbon production will terminate. In most cases, production will be abandoned before it would cease due to natural causes. Reason being that production will decline to a rate where it will cost more to produce than the hydrocarbons are worth. This is the *"Economic Limit"*. At the economic limit, the production costs are equal to the value of the produced hydrocarbons. To continue production beyond this point will cause economic loss. Calculation of the economic limit should be based upon the revenue remaining after payment of all royalty at the forecast market value of oil and gas at abandonment. Operating expenses should be limited to direct operating expenses at the time of abandonment, unless a savings in indirect expenses will be realised by the abandonment. It should not be necessary to make this calculation on an after income tax basis since zero profit should not incur an income tax liability. A reduction in direct operating costs will directly reduce the economic limit, prolonging the producing life of a well or field and add reserves (84p).

A typical oil and gas project would need some essential forecasts that are shown in figure 8.4 below. Based on plant and equipment construction a production start-up tentative date will have to be forecast. Aspects such as inflation/deflation, supply and demand of the end product and, technology development will facilitate a forecast of the unit price of the end product. Prevailing as well as projected economic conditions will lead to forecasting of capital and operating expenditure, when and how much. And finally the economic limit will be the basis to forecast if and when production will have to be terminated.

Figure 8.4 – Oil and Gas Projects Essential Forecasts Flow Diagram



Frequently it is necessary to make a forecast when little, if any, information is known on which to base such forecasts. This is commonly the case when analysing economics of an exploration prospect or the development of an exploration discovery. Under these conditions it is useful to identify a producing field, which seems to be similar to the prospect or discovery and can be used as a model for its evaluation. The producing field may provide the basis for a production model, expected reserves, oil-in-place, recovery efficiency, natural reservoir energy, or other information necessary to develop a production forecast. Capital and operating costs can also be forecast from experience of actual production operations. The best analogies are those of similar geologic age and setting, but do not necessarily need to be near-by.

The methodology invariable involves cash flow forecasting as well. This has been reviewed and discussed in detail in Chapter 4. What is a cash flow model? The statement of cash flow in any financial project is extremely important to management, lenders, and tax authorities as well as investors. The cash-flow statement is fairly new to the financial statements that companies report. In fact, it has only become a requirement since 1988. Currently every company filing reports with the Securities and Exchange Commission (SEC) is required to include a cash flow statement within their quarterly and annual reports.

Cash flow is similar to the income statement in that it records a company's performance over a specified period of time, usually over the quarter or year. The difference between the two is that the income statement also takes into account some non-cash accounting items such as depreciation. The cash-flow statement strips away all of this and provides the detail on how much actual money the company has generated.

Cash flow illustrates how the company has performed in managing inflows and outflows of cash. It provides a sharper picture of the company's ability to pay bills, creditors, and finance growth. Many of the items on this statement are also found in either the income statement or the balance sheet, but here, they're arranged to highlight the cash generated and how it relates to reported earnings. The cash-flow statement is divided into three parts:

- Cash from Operations, this is cash generated from day-to-day business operations.
- Cash from Investing, cash used for investing in assets, as well as the proceeds from the sale of other businesses, equipment, or other long-term assets.
- Cash from Financing, cash paid or received from issuing and borrowing of funds. This section also includes dividends paid. (Although it is sometimes listed under cash from operations.)

Net Increase or Decrease in Cash, increases in cash from previous year will be written normally, and decreases in cash are typically written in (brackets).

The cash flow statement requires just as much attention as the other statements. At the very least, look to see if the company is increasing cash over previous years.

8.4 PURPOSE OF THE CASE STUDY

Two references, Case Study Research – Design and Methods (91),. and Application of Case Study Research (92) have been very helpful to the author in conducting the case study. The case study was essential in order to get an idea as to the problems facing the oil and gas industry with regard to financial modelling. RasGas data was the best choice for various reasons. Mainly, RasGas is a recently developed project in the industry with focus on the gas reserves of Qatar. Secondly the proximity of the project and availability of the data made RasGas the instant and preferred choice as a case study. The complete case study is documented in Appendix 2. RasGas data will be used to perform a history match comparison in chapter 9 in order to verify and validate the CFM.

Results that lead to the development and improvising of the CFM are documented below. The case study was indeed essential and did generate results that emphasise the need for a Comprehensive Financial Model. The drawbacks and hurdles faced by RasGas project in generating a financial model benefited the CFM by implementing and including aspects that were essential to make the model robust, efficient and effective. The case study conducted by the author on the RasGas data has supported the need to create a Comprehensive Financial Model. Difficulties and inconveniences faced in the case study prompted the need for a CFM.

8.5 CASE STUDY RESULTS LEADING TO THE DESIGN AND DEVELOPMENT OF THE COMPREHENSIVE FINANCIAL MODEL

The author conducted a case study on the RasGas project, in order to ascertain the difficulties faced during the various stages of project implementation. This is provided in Appendix 2. Rasgas (Ras Laffan Liquefied Natural Gas Company Limited) is a Qatari joint stock company that was formed to engage in the business of producing and selling liquefied natural ("LNG"), condensate and other hydrocarbon products. The Company's business currently consists exclusively of the development, construction, financing and ownership of the Project. Any expansion of the Company's business beyond its activities with respect to the Project would consist of the development, construction, financing, ownership and operation of additional LNG Trains and associated onshore and offshore facilities in the North Field and at the site of the Onshore Facilities and activities related thereto.

The construction of trains required a portion of the financing to be supported by political and/or commercial risk guarantees or insurance issued by export credit agencies ("ECAs"). Under the terms of the Indenture, the Company was permitted to incur Senior Project Debt and any amount permitted to be borrowed in accordance with the Project Coordination Agreement, and was permitted to incur additional Senior Project Debt only if it satisfies certain financial ratios and if the incurrence of such Debt would not result in a Rating Downgrade.

The project is located in the State of Qatar and is subject to political, economic and other uncertainties, including the risks of war, expropriation, nationalisation, renegotiation or nullification of existing contracts, changes in taxation policies, currency exchange restrictions, international monetary fluctuations and changing political conditions.

Interviews with experienced key personnel of the oil and gas industry suggest that a financial model is necessary that incorporates various related aspects to make it a comprehensive and successful model. Also, based on the case study it is the view of the author that there were several areas that needed attention in terms of financial modeling for oil and gas projects. With the RasGas data, it was clear that they did have financial models. However different departments were using their own financial model with their own interests in the foreground. The operations department had their own model where emphasis was given only to the operations of the project. Similarly other departments such as Finance, Services and Planning had their own models. Besides the joint venture partners too had different models and this could seriously impact management decisions, in turn leading to costly errors being implemented.

Considering the case study, it is derived that a simulation model is necessary and the development in the following areas will be of immense importance for commercial success.

- Availability
- LNG off-take sensitivity
- Condensate/Gas Ratio Sensitivity
- Project Completion Date
- Export Commencement Date
- Delivery Commencement Date
- Build-Up Period
- Market Crude Oil Price

- Production Volumes
- Capital and Operating Costs
- Contractual Data
- Financial Structure
- Project Support
- Trigger Ratios
- Timing of the Financing
- Margin Fees and Premia - Libor – base rate for setting interest rate levels.
- Amortisation Schedule and Dividend Forecast

CFM is developed after researching and understanding the issues relating to markets, sales and operations. However, the veracity and usefulness of these projections will be completely determined by the quality and reliability of the underlying variables.

CFM is built considering the financial planning traps that arise when,

- Using financial forecasting as a substitute for business planning.
- Ignoring historic trends or performances at company, sector and national levels.
- Overstating market shares and growth, sales forecasts, and profit levels.
- Giving insufficient consideration to working capital requirements.
- Under estimating costs and delays likely to be encountered.
- Disregarding industry performance norms and competitors' responses.
- Breaching generally accepted financial guidelines and ratios.
- Making unduly optimistic assumptions about the availability of loans, trade credit, grants and equity.
- Seeking spurious accuracy while failing to recognise matters of strategic importance.

8.6 DESIGN, DEVELOPMENT AND JUSTIFICATION OF THE CFM

In chapter 7, four existing models were critically reviewed. None of those models could be considered a comprehensive tool for evaluating oil and gas projects. The author reviewed them in order to check for accuracy, flexibility and to understand the essential requirements in order to create a better and more comprehensive evaluating tool. Review of four existing models as well as the results of the case study helped the author design and develop the CFM. The following have been incorporated from:

- Inflation Rate (operating Variable) Input from Financial Model No. 1.
- Calculation of Taxable Income (Based on Local and International Taxes) from Financial Model No. 3.

- Calculation of Depreciation from Total CAPEX from Financial Model No. 4.

Most of the books and periodicals mentioned in the reference section were quite helpful in designing and developing the CFM. References 4, 14, 19, 27 and 37 have been very informative and references 13, 31 and 84 were used widely in order to understand various essential elements in project finance, financial modeling and relevant requirements to the oil and gas industry.

The author preferred EXCEL software for the CFM as this software is widely used not only in the oil and gas industry but in most other industries too. The author is well versed with the software and it was found to be suitable as the CFM would be just one workbook and all the components could be developed as an individual worksheet in the same workbook, thereby making integration very easy. Macros too can be included in a separate worksheet in the same workbook and the CFM does include the macros in a separate worksheet. With the worksheets 'link' with other worksheets within the same workbook, eliminates the possibility of linking errors. This will give the CFM flexibility to be used anywhere and at any time without having to ensure that other files are also copied along with it and no network problems to be faced. Data in the EXCEL format can be imported into any Relational Database Management System. Development of the CFM into integrated software is easy as VBA (Visual Basic for Applications) programming/syntax is used. The CFM is designed and developed using the Excel software and thus can be efficiently exported into any RDBMS, as Excel is compliant with all available RDBMS in the industry. By using Excel software, which is quite popular currently, the CFM aims to be a robust, comprehensive, flexible and accurate model.

How macros use Excel data? Macros are used for doing a set of calculations repetitively or automatically. In CFM, macros are used as follows

- Leverage calculator (CTRL+L)
- Print macros – Operating (CTRL+P)
- Print macros – financial (CTRL+Q)
- Print macros – Bank/ECA loans. (CTRL+R)

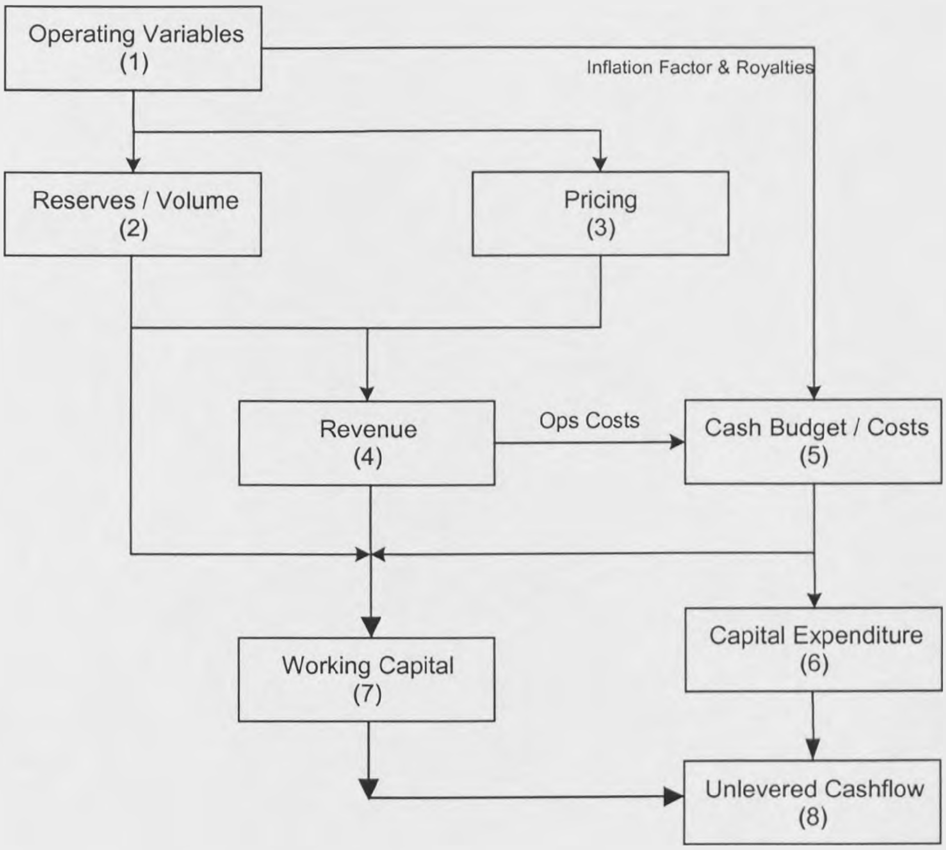
Leverage calculator calculates the target, initial and ending leverage. Target leverage is calculated from the percentage funded by equity that is provided as input of the financial variables. The leverage average can be taken from the above, which will be used to calculate the capital expenditure funded by Bank/ECA loans. Using this macro, the task is automated. So when the user changes the percentage funded by equity from the financial variables, the leverages get automatically calculated and applied across capital expenditure funded by Bank/ECA loans for the entire period. The macros can be allocated a key combination (shortcut keys), and when the user presses the key combination, this action is performed.

Print Macros in Operation, Finance and Bank ECA loans can be used for different purposes. For example the print macros in operation can be used to apply the values entered in the operating variables to the pricing, volumes, revenue and cash budget costs. For example, when the inflation factor value and linear decline rate is changed; the value is applied across the production of plant and field condensate in the reserves volume. The production value with the revenue rates calculates the revenue for plant and field condensate. Thus macros in EXCEL perform the pre-assigned tasks automatically on pressing the shortcut keys (also called as hotkeys), which can be assigned at the time of designing the macro (explained in detail in Appendix 1). The CFM widely uses these macros to perform all calculations once available data is key in the input section of the CFM.

One of the most important areas for any investor to look when researching a company is the financial statement. For any successful venture, financing is an essential component of sustainable development. It is essential to understand the purpose of each part of the financial statement and how to interpret it. The main source of input of the financial statement is from the productions/operations. Thus CFM is grouped mainly into Operating and Financial Variables Sections.

In the operating variables section, the basic component is the reserves/volume. Pricing provides the price of oil/gas to calculate the potential revenue. Then falls the Cash Budget-costs, which provides the operating costs and the royalties payable. Then the Capital Expenditure module provides the expenditure incurred in exploration and production. Working Capital provides the total assets and liabilities from the previous modules especially the reserves/volume and cash budget costs. The diagram representing the data flow of the Operating Variables Section of the CFM is presented below.

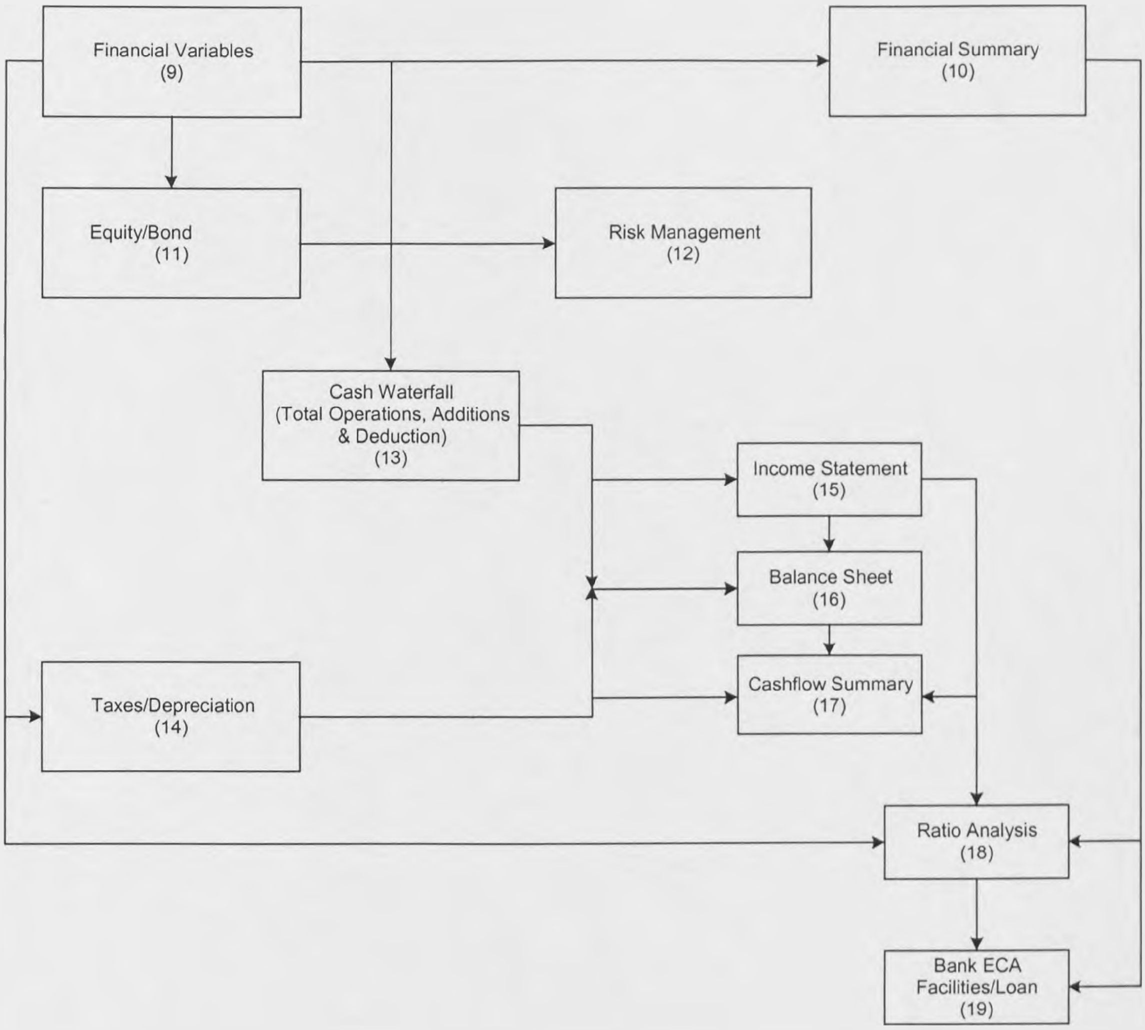
Figure 8.5 - Data Flow - Operating Variables Section



The financial models of CFM are designed to provide the investors a better understanding of the project in terms of operations and finance, and points out some key areas where they can improve based on different sensitivities. The balance sheet of CFM lists the assets, liabilities, and shareholder's equity. The income statement includes figures such as revenue, expenses, earnings, and earnings per share.

Apart from the fundamental financial analysis, CFM uses the technical analysis method, which evaluates securities by analysing statistics generated by market activity, past prices, and volume. The Financial section also outlines taxes and fees, bonds, banks and loans facility. CFM is designed to test and validate the volatile financial market for a better understanding. The diagram below shows the data flow of the Modules of the Financial Variables Section.

Figure 8.6 - Data Flow - Financial Variables Section



The CFM is developed to be a comprehensive tool in evaluating future oil and gas projects incorporating the various essential aspects of business in this industry. The case study was derived in order to be instrumental in providing areas of development essential in building the CFM. The design and development of the CFM was amended and modified based on the case study results in order to get the optimum results.

CFM calculations and formatting of the document is done through macros. Usually most of the formatting is repetitive and applied throughout the CFM. This makes macros very useful in performing these actions. All the modules (worksheets) of the CFM are integrated and data from both the Operating Variables and Financial Variables section are applied across all the modules of the CFM, for calculations that can be handled efficiently by customised macros.

The two major components of the CFM are the operational and financial variables, which acts as a baseline and provides basic data for the operation of the all the modules. Reserves volume, pricing, revenue, cash budgets, capital expenditure, working capital and unlevered cash flow constitute the operational component section. Equity/Bond funding, cash waterfall, tax depreciation, income statement, balance sheet, cash flow, ratio analysis and Bank-ECA loans constitutes the financial component section.

All the modules (worksheets) under these sections are interlinked and available in the same excel file. Links to external files may result in data loss and non-updates, which the CFM has overcome.

Although the modules are grouped in different heads (operating and financial), they are integrated so that, the output of the operating modules is taken as input for financial modules. A financial summary will be provided with all the cumulative results of the financial model.

"Module" – is a general term given for each component of CFM. As the existing models are designed for a specific project, they cannot be used for any other project, where a major re-work is required. A set of inputs are given for calculation and forecasting for both the operating and financial models. Altering the input data of these modules, affect the entire model. These input data can be altered during the verification and validation of the CFM. Altering the forecasting methods and time schedules can create different sensitivity scenarios. A series of charts will be provided in chapter 9 during the verification and validation process. This will show results of sensitivities on production and income. The CFM forecasts the price based on forecast inputs like Brent forecast, JCC forecast and Dubai forecast and the reserves-volume. Calculated values are provided for the current period and are forecasted for the future.

Company economics details like Internal Rate of Return, Net Present Value and discount factor are generated from the CFM. CFM can be used with real-time project data to prove its accuracy and efficiency. Comparisons can be made on the Rate of Return and NPV generated from CFM with respect to the actual data.

Comparing the CFM results with the results generated from the other models where the modules are secluded can do an accuracy check of CFM. The essential purpose of

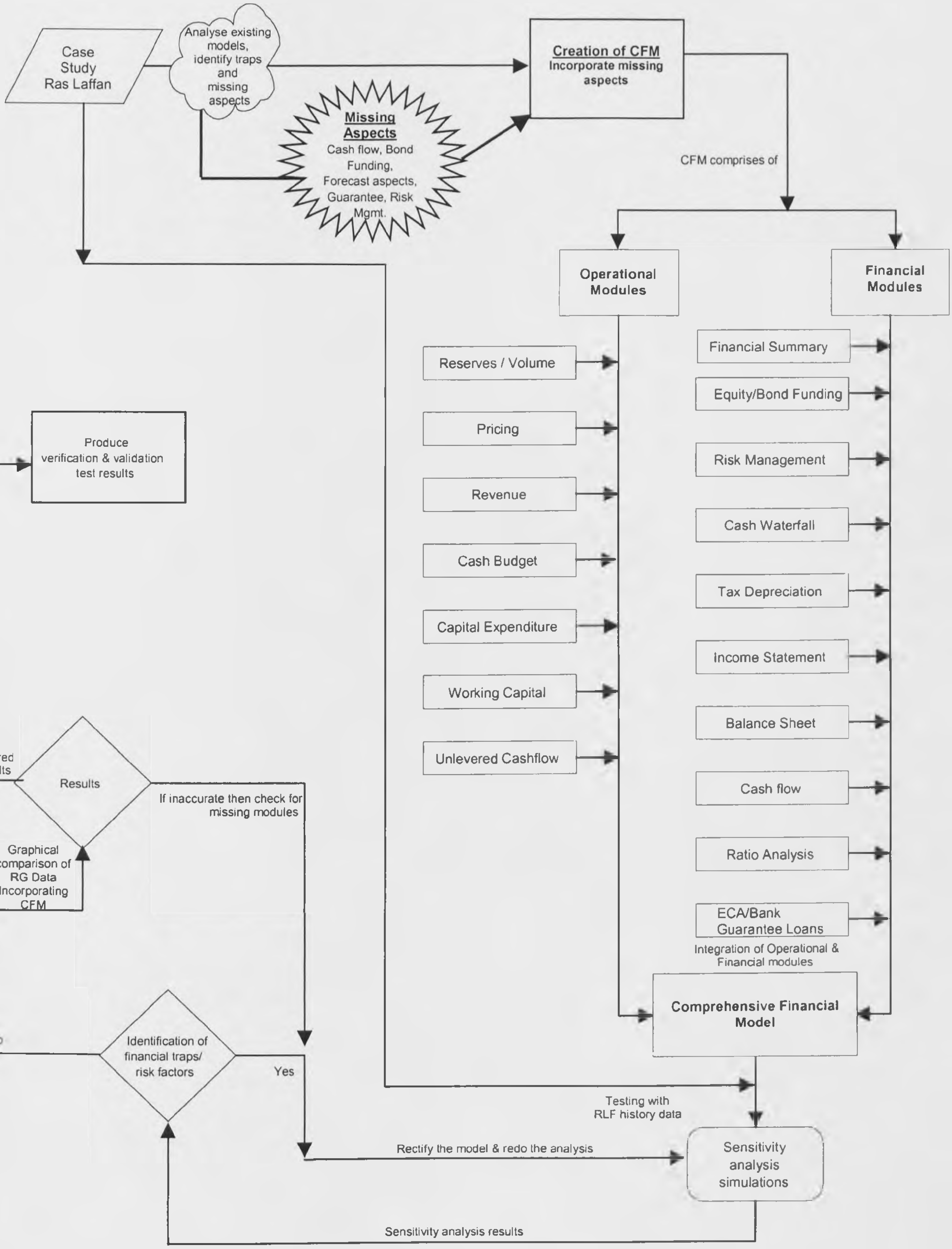
Comprehensive Financial Model is to persuade prospective investors and lenders that the anticipated return on investment justifies the risk. CFM considers and analyses the commercial viability of the project in the context of the business environment in the industry, the business environment of the host country, and the international business environment. It also provides a complete financial analysis of the project using forecasting methodology analysing all apparent risks. Ultimately, it establishes that the project is commercially and financially feasible, given the business environment and inherent risks.

Financial planning is a critical activity for every business irrespective of its age and size. For a new enterprise, the preparation of financial projections is integral to the business planning process. For larger companies, financial planning forms part of the annual budgeting and plays an important role in long-term planning, business appraisals and corporate development. Financial planning models are much more complex. They must accommodate multiple time periods (months, quarters and years) and handle hundreds of variables relating to sales and costs. The volume of data mounts up very quickly when each variable is multiplied by the time horizon. CFM takes into account the above and is entirely designed for accurate planning.

A comprehensive model can contain innumerable formulae with functions ranging from simple addition to complex conditional statements, for example if projected cash flow is positive, reduce the overdraft before adding any residual balance to the cash account. These formulas are necessary to maintain the integrity of data.

Financial models are used to compile forecasts and budgets; to assess possible funding requirements; and to explore the likely financial consequences of alternative funding, marketing or operational strategies. They are also used for business planning, raising finance, investment or funding appraisals, financial analysis and corporate planning. Used effectively, a financial model can help prevent major planning errors; identify or evaluate opportunities; attract external funding; provide strategic guidance; evaluate financial and development options and monitor progress. Figure 8.7 below gives the process that led to the design and development of the CFM. As shown, the case study and review of existing model helped the author design and develop the CFM incorporating what was essential in a comprehensive and robust financial model.

Figure 8.7 – CFM Design and Development Process



As shown in figure 8.7 above, the comprehensive financial model is designed to calculate and forecast the operational and financial aspects involved in a new oil and gas venture. The input of data is being done in two batches, which are the operating and financial variables. For the exploration and operation of oil and gas project, the operating variables are used to forecast reserves, volumes, pricing and revenue, capital expenditure, working capital, cash budget costs and un-levered cash flow.

The operating variables which provides the input data for the other modules are

- Technical data
- Operating Costs
- Royalty
- Capital Expenditure
- Condensate Decline Rates
- Pricing
- LNG plant production and Guarantee

Technical data provides the details like final acceptance certificate (date of getting the trains in commissioning and operation), operational reliability certificate, completion month and year. Other technical data comprises of initial stabilised field and plant condensate ratio (bbl/MMscf), wellhead gas production to volume ratio (MMscf/bn Btu), LNG conversion factor and sulphur yield. The LNG conversion factor, sulphur yield and plant condensate to wellhead ratio are required to calculate the total LNG, sulphur and plant and field condensate volumes.

Operating costs provides the inflation rate and sensitivity. Inflation rate is required to calculate the total operational costs of the train 1 and 2 with different sensitivities.

Royalty provides input details like royalty on condensate sales and feedstock gas royalty (per MMBtu). Capital expenditure input details are delay, beginning period number of the project, cost overrun (if in excess of contingency) for both the trains.

Condensate decline rates consist of field and plant linear decline rate (per year), hardwired (Yes or No).

Pricing input should provide details of all available market prices, where CFM forecasts as below.

Brent Forecast	1	if "2" or "3" then	Brent Price (1996)
JCC Forecast	1	if "3" then	Ratio JCC/Brent
Dubai Forecast	1	if "3" then	Constant Ratio Dubai/Brent
Field Condensate Forecast	1	if "3" then	Constant Ratio Field Cond./Dubai
Plant Condensate Forecast	1	if "3" then	Constant Ratio Plant Cond./Dubai

Where:

1=P&G Base Case

2=P&G Ratios

3=Constant Ratios

Annual escalation factor and sulphur price is required, to calculate the pricing of the above forecasts and sulphur pricing, which is provided in the CFM.

LNG Price guarantee inputs are required for risk management, which is one of the crucial aspects of oil and gas project. Sale and purchase agreement inputs the scheduled period, year and month with the 1st and 2nd buyer adjusted annual contracted quantity. LNG floor price, market price and escalation are required for pricing.

Thus the above forms the input for the operating modules. The operating modules provides details of the following

- Reserves / Volume
- Pricing
- Revenue
- Cash budget costs
- Capital expenditure
- Working capital, and
- Unlevered cash flow

Reserve / volume should provide detail on the reserves available for a particular period (forecast) for LNG, plant condensate, field condensate and sulphur yield. Pricing module has to provide the pricing details of LNG, Field condensate, plant condensate and sulphur based on the pricing forecast methods provided in the operating inputs/assumptions module.

A pricing module is required to forecast the prices based on the reserves and the forecasting methods. Thus the pricing module provides the prices for LNG, plant and field condensate and sulphur yield.

For any financial model, calculation and forecasting of revenue is necessary, thus the revenue module is incorporated in the CFM design. This revenue model takes input from the operating variables (forecast parameters), reserves-volume and pricing modules.

Provision to calculate the inflation factor for the operating period, overhead costs and other costs like royalties are required. Thus the above are calculated and forecasted for a period of twenty years using the cash budget-costs module. Royalty calculation should be based on gas royalty index, feedstock gas royalty, feedstock gas volume and, field and plant condensate royalty.

Capital expenditures involved in a project have to be provided to analyse the spending curve. Thus in the CFM, the Capital Expenditures like drilling, offshore exploration and setup, onshore plant and receiving facilities and venture are calculated. The onshore receiving and plant facilities has to include EPC contract, heat exchangers, LNG tanks, compressors, site preparation and project cost true-up.

Working capital has to be analysed for producing financial statements. Therefore in the working capital module, current assets and current liabilities are included.

Current assets should include all the receivables like LNG, field and plant condensate, which will provide the LNG and condensate inventory. In the CFM, these details are clearly provided and the reserves-volume, revenue and cash budget-cost modules provide the data required for the above calculation.

Financial Modules consists of

- Equity/Bond funding
- Risk management
- Cash waterfall
- Taxation and depreciation
- Income and expenses statement
- Balance sheet
- Cash flow summary

- Ratio analysis and Bank/ECA loans facility

Reserve account details have to be provided for any oil and gas project during the erection and commissioning. Reserve account should consist of principal drawdown from equity/bonds, upfront fees on equity/bonds, net equity/bond interest during construction and net cash from equity/bonds. In CFM the equity/bond funding provides the details of the beginning balance, deposit to account, shareholder infusion at completion, withdrawal from account and ending balance for the O&M account, build-up period reserve account and debt service reserve account.

Risk management is necessary for any multi-million dollar project, especially for any oil and gas venture, due to the nature of the project, uncertainties has to be taken care off. CFM incorporates the risk management by providing the details of LNG market price, price guarantee, LNG revenue differential and debt service shortfall. Subordinate loan details like principal and interest details are provided, as they are essential in calculating the details like beginning balance, drawdown, repayment and ending balance.

Taxation and depreciation is important for any venture. It should provide details like EBITDA and depreciation. Taxable income is the sum of EBIT (Earnings Before Interest and Taxes), interest expense and interest income. Taxable income and loss carry-forward provides the net taxable income. CFM incorporates the above tax expenses and taxes payable to provide the net taxes paid. Depreciation is an expense recorded to reduce the value of a long-term tangible asset. Since it is a non-cash expense, it increases free cash flow while decreasing the amount of a company's reported earnings. Depreciation and total depreciable assets are also calculated and provided in CFM up to a period till the depreciation is zero.

In essence, an income statement tells how much money a company brought in (its revenues), how much it spent (its expenses), and the difference between the two (its profit/loss), over a specified time. The profit and loss account is necessary which provides the income and expenses statement for a certain period, will be carried-forward to the balance sheet. Thus a detailed income statement as necessary is provided in CFM.

The balance sheet highlights the financial condition of a company at a single point in time. This is important, the cash flow and income statements record performance over a period of time, while the balance sheet is a snapshot in time.

Managers, creditors, and investors all need to familiarise themselves with the assets, liabilities and equity of a company. The balance sheet is the place to find all this handy information. It lists all of the assets held by a company in addition to the portion of those assets that are financed by debt (liabilities) or equity (retained earnings and stock). In short, Assets = Liabilities + Equity

The Assets include the cash balance, reserve accounts; bond proceeds account, net working capital and net fixed assets. Liabilities include accrued taxes and long-term debt. Shareholder's equity consists of paid-in capital, retained earnings and debt/paid in capital and debt. These form the main components of the balance sheet.

Cash flow summary is required to provide the cash flow from operations, cash flow from investment and cash flow from financing.

Ratio analysis isn't just comparing different numbers from the balance sheet, income statement, and cash flow statement. It is comparing the number against previous years, other companies, the industry, or even the economy in general. Ratios look at the relationships between individual values and relate them to how a company has performed in the past, and might perform in the future.

For example current assets alone do not tell a whole lot, but when divided by current liabilities it can be determined whether the company has enough money to cover short-term debts. Debt-Asset Ratio indicates what proportion of the company's assets is being financed through debt. Debt-Equity Ratio indicates what proportion of equity and debt that the company is using to finance its assets.

Bank / ECA loan details are required to calculate the interest payments due, ECA premium due, commitment fees due and other fees/costs due. Total drawdown and interest during construction and total debt service for the period from the erection and commissioning to the loan repayment period.

Thus all the above modules are integrated to complete the structure of CFM. The following Table 8.1 shows all the CFM Modules and Figure 8.8 shows the operational flow of the CFM. Although shown in the table below, the modules are in no particular order and are mentioned randomly.

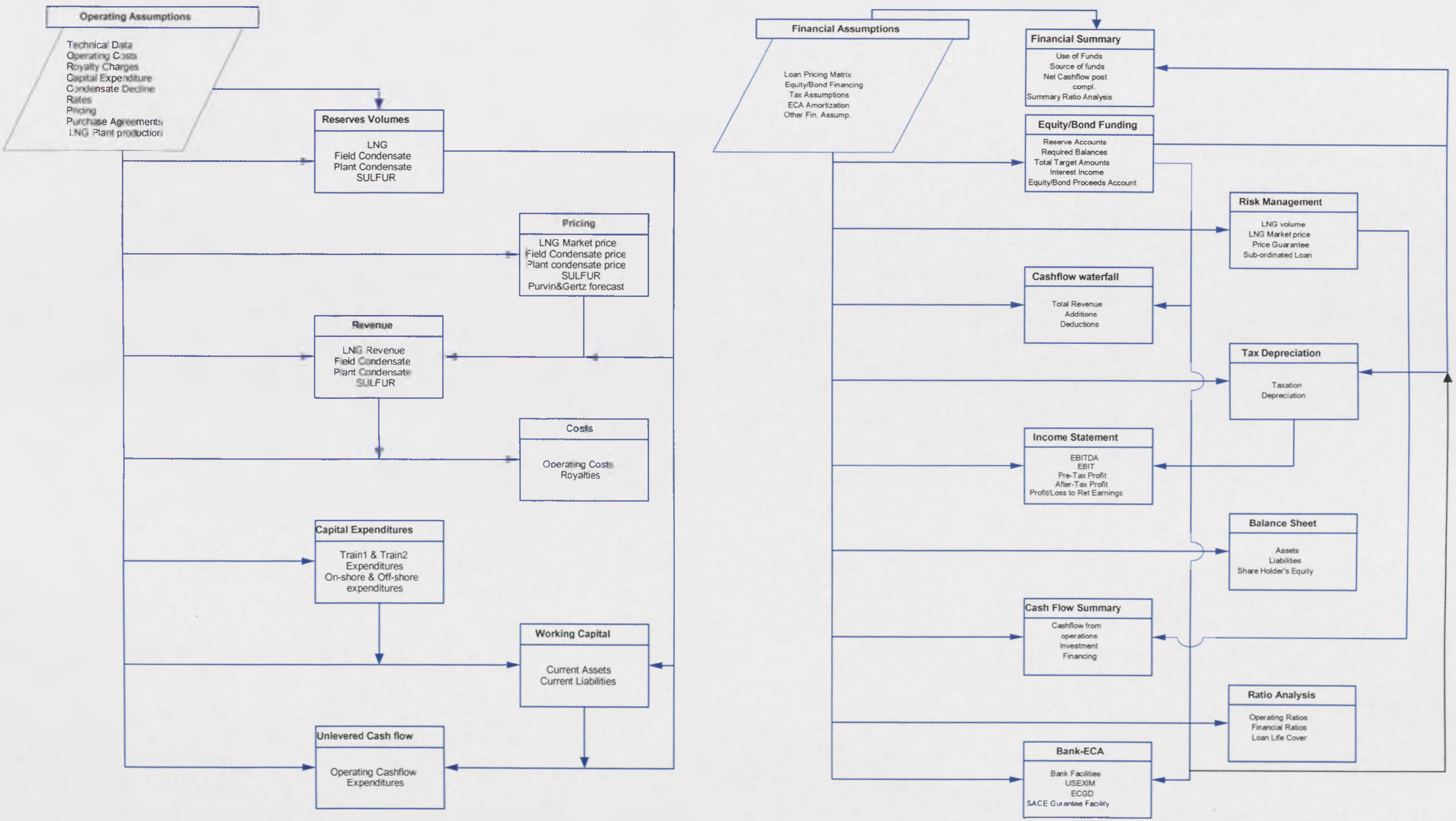
Table 8.1 – Modules of the CFM

Operating Variables
Reserves / Volumes
Pricing
Revenues
Cash Budgeting / Costs
Capital Expenditures
Working Capital
Unlevered Cash Flow

Financial Variables
Financial Summary
Equity/Bonds and Debentures
Risk Management / Guarantee
Cash Flow Waterfalls
Taxation and Depreciation
Income Statement
Balance Sheet
Cash Flow Summary
Ratio Analysis
Bank / ECA Facilities

The subsequent flowchart depicts the operational flow of the CFM.

Figure 8.8 - Comprehensive Financial Model – Operational-Flow Diagram



8.7 DATA INPUT SHEETS

An extract of the input sheet on different modules is provided below. As they input sheet acts as a source of input, the data is linked across all the modules and any change in the input values affect the entire model. The input section is divided into two categories as operational variables and financial variables input.

The fields with blue colour are the ones to be entered by the user as input. For example, changing the value of sulphur yield will affect the sulphur recovery volume in the reserves / volume. A section of same input sheets are provided below for both operational and financial variables input.

Table 8.2 – Data Input Sheets

OPERATING VARIABLES INPUT

TECHNICAL DATA

Final Acceptance Certificate:	Train 1	**01-Oct-99**	
	Train 2	**01-Oct-00**	
Operational Reliability Certificate:		***01-Apr-01***	
Completion Month (end of month)		3	
Completion Year		2001	
Initial Stabilised Field Cond. To Wellhead Gas Ratio		**35.5**	bbl/MMscf
Initial Plant Condensate to Wellhead Gas Ratio		**5.4**	bbl/MMscf
W/head Gas Prod. to LNG Volume Ratio (FOB Basis)		**1.1511**	MMscf/bn Btu
LNG Conversion Factor		**50.988**	MMBtu/ton
Sulphur Yield (tons/MMscf wellhead gas)		**0.31**	
Gas Heating Value at Plant Inlet		**1055.9**	Btu/scf
Percentage of Wellhead Stream Exempt from Feedstock Royalty (Fuel, Losses & Inerts)		**5.2843%**	

OPERATING COSTS (1995 $ Millions)

Inflation Rate	**3.0%**	Sensitivity	**1.5%**

ROYALTY CHARGES

Royalty on Condensate Sales	**9.0%**	
Feedstock Gas Royalty (minimum)	**$0.50**	per MMBtu
L (1993) / L (1995)	**1.00**	
P (1995)	**2.65**	

CAPITAL EXPENDITURES	
Delay (number of 6 month periods)	**1**
Beginning period number	**0**
Cost Overrun (in excess of contingency)	
Train 1	**0.0**
Train 2	**0.0**

CONDENSATE DECLINE RATES (see Volumes page)			
	Field	Plant	
Linear Decline Rate	**1.0%**	**1.0%**	per year
Hardwired (YES or NO)	**YES**	**YES**	

LNG Price Guarantee				
Price		*Thru*	Exposure Cap ($M)	**200.0**
1.90	$/MMBtu	**2009**		
1.65	$/MMBtu	**2014**	Interest Rate	**12.0%**

FINANCIAL VARIABLES INPUT

LOAN PRICING MATRIX		1	2	3	4
Facility	All	Banks	USEXIM	ECGD	SACE
LIBOR	7.00%	7.00%	7.00%	#N/A	#N/A
CIRR		#N/A	#N/A	6.56%	6.56%
Margin					
Pre-Completion		0.95%	0.80%	0.00%	0.00%
Post-Completion: 1-3		1.75%	0.50%	0.00%	0.00%
Post-Completion: 4-6		1.88%	0.50%	0.00%	0.00%
Post-Completion: 7-9		2.00%	0.50%	0.00%	0.00%
Bank Upfront Fee	1.60%	1.60%	1.60%	1.60%	1.60%
Bank Comm. Fee	0.50%	0.50%	0.50%	0.50%	0.50%
ECA Commitment Fee - 1		0.00%	0.13%	0.00%	0.00%
ECA Commitment Fee - 2		0.00%	0.63%	0.00%	0.00%
ECA Premium - 1		0.00%	2.02%	0.82%	2.39%
ECA Premium - 2		0.00%	3.70%	4.63%	3.00%
Eligible Sourcing		0.0	334.8	179.5	136.0
Premium Cover			100%	85%	85%
IDC Cover			100%	100%	100%
Maximum Loan Amount		382.6	395.7	212.3	157.3

EQUITY/BOND FINANCING					
Average Equity /Bond Interest Rate	8.07%	Equity/Bond Upfront Fees	1.20%	Total Amount	1200
Tranche 1 Amount	400	Tranche 2 Amount	800	Tranche 3 Amount	0

TAX ASSUMPTIONS		
Tax rate	35.0%	
Tax Holiday	12	years
Depreciation	15	years

8.8 SUMMARY

Design, development and construction of the CFM are discussed in this chapter. The CFM will be verified and validated in the next chapter. As per the aims and objectives of the author at the outset of the thesis, essential elements were incorporated during the design, development and construction phase. The case study on Rasgas was helpful in this phase. In the next chapter Rasgas data will be used to populate the CFM in order to verify and validate the accuracy and reliability of the CFM and to ensure aims and objectives have been met. This will also verify if the CFM is working in the manner required. The review of existing models was instrumental in ascertaining the requirements that were missing in existing models. Interviews with key personnel in the oil and gas industry, was also very helpful in constructing a model that is required by the industry in order for it to be a standard tool and practice.

Based on the review of this chapter and the study of existing financial models, the tentative direction is pointing towards the CFM being a future tool to be used in evaluating new projects in the oil and gas industry. It can also become the standard tool of the industry. The CFM could be a unique model since reviewed models do not have the integrated qualities of the CFM. The CFM could also be an innovative tool that is flexible enough to accommodate the volatile price element of the oil and gas industry. The next chapter will strive to prove these points.

CHAPTER 9

VERIFICATION AND VALIDATION OF THE CFM

9.1 INTRODUCTION

Verification and validation are the real tests that prove the credibility and accuracy of the results of the model. In this chapter Comprehensive Financial Model will be subject to verification and validation by running extensive comparison with RasGas historical data and also another company involved in the oil and gas business called CITO Petroleum. The purpose of verification is to determine whether the model is functioning as designed, while validation seeks to establish whether the information generated satisfactorily reflects the process variations and provide a suitable basis of evaluating options. This chapter will touch upon the verification and validation process, review various approaches to testing as an aid to verification and validation. The actual operational flow of the CFM is documented in chapter 8.

RasGas data is used as a historical match comparison with the CFM to check the accuracy and ensure proper results are obtained as per the aim of the CFM. RasGas data was monitored from 1997 to 2002. Certain limitations of the CFM are also documented in this chapter, further research is recommended as new ideas and technology becomes available.

9.2 VERIFICATION AND VALIDATION PROCESS

The verification and validation process seeks to establish if a product is fit to serve the purpose of its creation and existence. This is of particular importance with models, as models are essentially simplified abstractions of reality, incorporating simplifications and assumptions. The two terms, verification and validation are often confused or used interchangeably, however they are two distinct problems as summarised below (26):

Verification = "Are we building the product correctly"
Validation = "Are we building the correct product"

From a modeling perspective, the important question in verification is, whether the implemented model operates correctly. Verification focuses on the software implementation of the model, checking if the results are correct, or if there are design or coding errors that make the results seem improper. Validation assess how adequately the implemented model represents reality, answering questions such as, does the model capture the desired interactions, and are the results similar to what would be expected in the real world. Sometimes a verified model could still produce meaningless results.

Testing is the predominant technique used for verification and validation, and involves exercising the software using a number of test cases. The existence of defects or inadequacies is subsequently inferred from any operation or output anomalies. The primary activities that constitute the testing process are test planning, test case design, test execution and evaluation of test results. The test plan serves to organise the testing process, and is based on a test requirements checklist, which identifies what is to be tested. The test case design phase, involves the development of tests to ascertain whether the software meets the specified requirements. After the execution of the tests, the results are then evaluated using a variety of analytical techniques, ranging from simple comparisons to statistical methods.

In developing appropriate test cases, two basic approaches may be adopted. Black box testing and White box testing. Black box testing, also referred to as functional testing, involves devising a selection of input data and comparing the generated output with the expected outcome. In effect, the software being tested is treated as a "black box", whose behavior can only be determined by studying its inputs and related outputs. The main drawback of this approach is that test data may fail to reveal existing errors, and the tester is faced with the problem of deriving select inputs that have a high probability of causing errors (72).

In the White box testing, also referred to as glass box or structured testing, the tester uses knowledge of the internal structure of the software under investigation, to derive appropriate test cases. Tests are designed to exercise every path within the software, test decision / control points, and verify actions that are to be taken in special cases, such as in response to invalid input by the user. White box testing has the advantage of being systematic when compared to black box testing, it also allows test coverage that is the extent to which tests exercise the software, to be easily ascertained. However, despite its systematic nature, white box testing is not foolproof as it is generally impractical to implement tests that exhaust every possible combination of paths available.

Testing may be monolithic or incremental in nature. Monolithic testing involves testing the various components of the software together as a single entity. The major drawback of this approach is that it is very difficult to determine which component is responsible for a fault. In contrast incremental testing involves incorporating and testing a successive number of components, such that at each test stage, faults are likely to be due to the new component, or in the interface between the old component and the new one. In implementing an incremental testing regime, the method of integration or inclusion of successive components, is generally dependant on the development approach adopted.

In all but the most simplistic cases, testing can never be complete. The time constraints on the testing period, couple with the infinite number of possible tests, limits the tester to executing a representative sample, that provides a satisfactory level of confidence. The testing carried out by the author, as part of the verification and validation of the model is discussed in the following sections.

9.3 GRAPHICAL COMPARISON OF EXISTING MODELS WITH CFM

To verify the process of the CFM and to accurately compare results between existing models and the CFM, it is imperative to graphically compare the CFM results with results obtained from existing models reviewed in chapter 7. RasGas history data is taken as base and populated across all the models and the comparisons are documented below. RasGas operates on different models for individual departments and values are manually incorporated for results. This is eliminated in CFM as it has additional integrated facilities. This comparison provides the difference in achievable results.

The verification and validation must be considered in all phases of the system development. Since the developers may not perform some aspects of the verification and validation, it is critical that verification and validation plans be clearly identified and documented.

The term risk factor is used in deference to the old adage " if it can go wrong, it will go wrong". The risk factor represents areas where it "will go wrong" and if there is any deficiency in planning and common sense. Based on the comparison of CFM with respect to other models the risk areas can be identified efficiently and incorporated in the CFM.

These comparisons carry out a first set of analysis to demonstrate the validity of the concept and the associated methodologies. Different levels of analysis are carried out to verify the functionality of the model. Streamlining of the model and test philosophies for future development is crucial in reducing the time, and hence the investment, needed for their development whilst still keeping the degree of risk under control.

The verification will identify whether the technical and economic roles of the technology infrastructure are adopted, impact scenarios, impact and cost data, impact characterisation and estimation. The verification process also helps to identify and characterise nature of impacts, estimate the collected data's feasibility. The quantitative estimates are done using the

- Net Present Value
- Benefit Cost Ratios and
- Rate of Return

The verification of the model helps in analysing the performance metrics across projects and within individual models. As all the expense allocation is done in the same model, discrepancies between the model and historical data may be readily tracked down and corrected. The verification process includes many interactions with other model sand the ones with at least few integrated modules are taken for comparison.

The verification process itself will uncover several discrepancies in the accounting and reporting methods. Since financial aspects are conserved throughout the model, conflicting operational or financial data is uncovered, and can be reconciled. The verification of the model provides an excellent method to generate operation values for accurate financial prediction. When coupled together, operation and financial prediction provides a comprehensive look and the financial payoff of proposed capital improvements.

The comparison process where the data from different models are compared side-by-side results from different runs, entities and time periods produces informative reports.

Based on the comparisons below, it is clear that the model, in absolute dollars, is very sensitive. The question of whether the approach to financial planning is efficient over time. In creating a speculative model such as this, it is important to determine the sensitivity of the model to the key parameters used. If offset by a significant amount on key data, does this change the fundamental conclusions. Since forecasting technological advances is risky at best, it would be reassuring to know that our basic conclusions about the necessity of oil and gas financial planning is based on the values used for the model.

In developing CFM, a series of development milestones should be used to measure the working and to provide a series of decision points. These milestones should each represent stages of development that would provide an improvement in the state-of-the-practice. The output of these comparisons would clearly accomplish the required milestones.

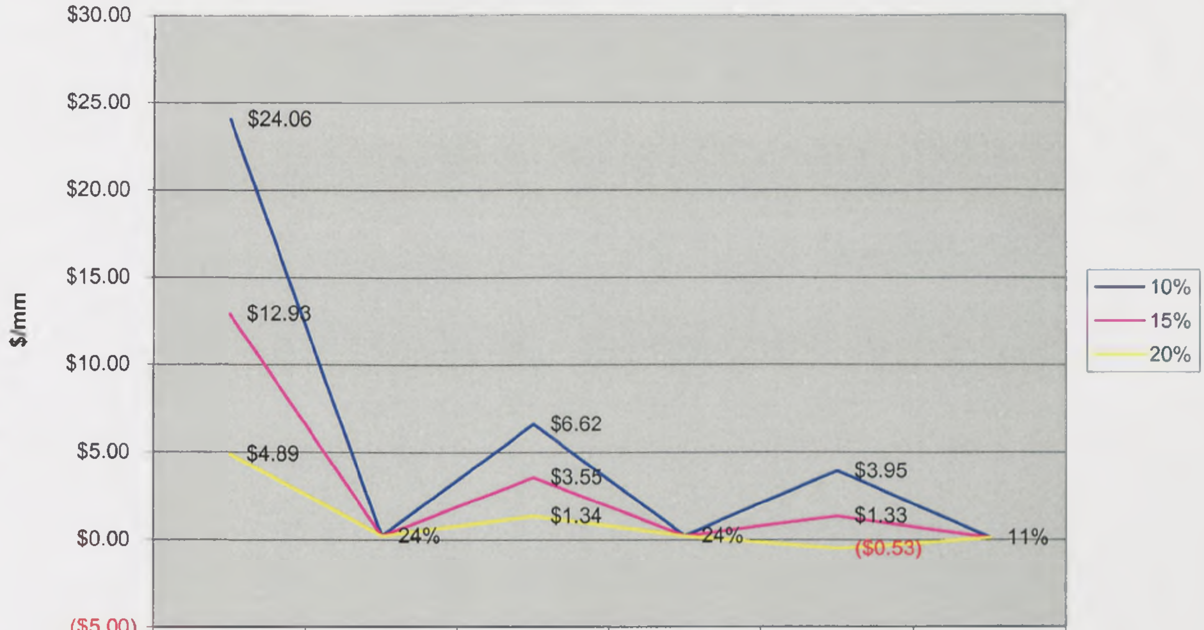
The analysis presupposes that the underpinning provided by the CFM continues; the risk profile of oil and gas projects would be substantially increased without it, unless there was an alternative "certainty to market" mechanism or practice. The comparisons of CFM with the other models provide the details of portfolio of projects. Payback, undiscounted profit-to-profit investment ratio, net present value, present value profiles, discounted profit-to-investment ratio, discounted cash flow rate of return and appreciation of equity rate of return.

These are calculated using the values from royalty tax systems, production sharing contracts, contractor's take, government take, state take, calculation of net cash flow, contractor's take throughout the world, sensitivity to total cost, comparison of net present value of hypothetical projects under different fiscal systems.

Many studies have been undertaken within the category of technical verification. A number of these representative studies are included under the business and financial analysis categories. Common themes of these projects include cost benchmarking owner costs against key producers, benchmarking non-production costs against key performance indicators and industry cost curves. The investment and revenue analysis included in the CFM on various oil and gas processes identifies the breakeven values that could be provided on both a cash cost and full cost basis.

The comparisons below prove that the CFM on proper usage will increase the productivity and help standardise the model library. As it is integrated with all the modules, this arises as a powerful tool for modeling and evaluating any oil and gas project.

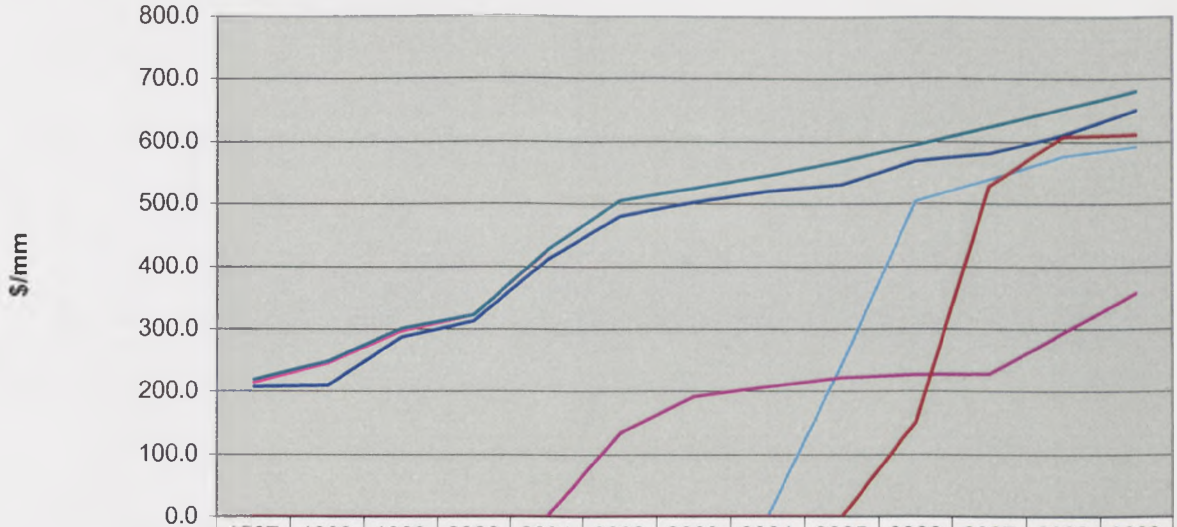
Figure 9.1 - Company Economics of CFM - Scenario (Restricted offtake 15mmbls)



	PV	IRR	PV Bef. Entitlements @ 27.5%	IRR Bef. Entitlements @ 27.5%	PV with entitlements	IRR with entitlements
10%	$24.06	24%	$6.62	24%	$3.95	11%
15%	$12.93	24%	$3.55	24%	$1.33	11%
20%	$4.89	24%	$1.34	24%	($0.53)	11%

The above chart shows the PV at 10%, 15% and 20% with the IRR details calculated from the fund flow. Company economics are provided for CFM with different sensitivities. The above plot of CFM is taken as a base and will be compared with the existing history data below, individually wherever applicable. Based on the cash flow year, Discount factor is calculated. PV bonus is the product of Bonus and discount factor. PV calculation is arrived from the discount factor and total cash flow. Internal rate of return (IRR) is calculated based on the natural algorithm of series of total cash flow. PV is calculated from the sum of PV calculation values.

Figure 9.2 - Revenue Analysis



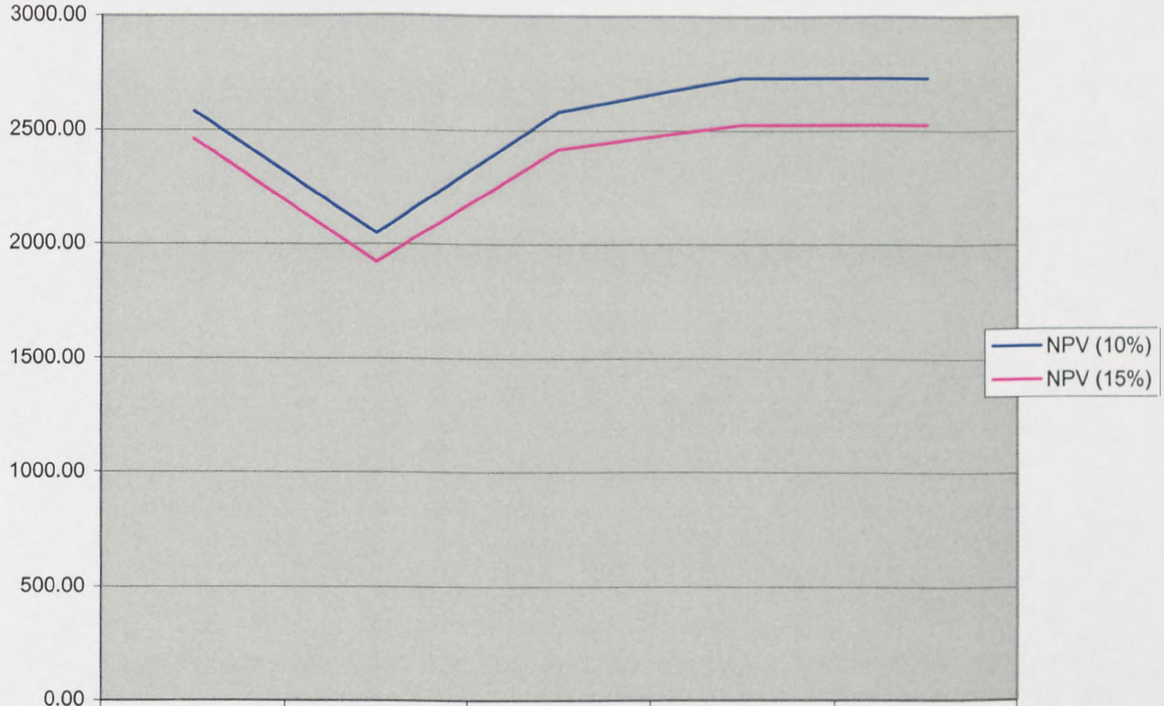
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
FM1	207.0	210.0	287.0	312.3	410.0	480.0	502.3	520.6	530.9	568.0	580.2	610.0	650.4
FM2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	243.7	504.0	539.4	574.9	591.7
FM3	0.0	0.0	0.0	0.0	0.0	134.1	192.2	207.1	222.6	227.2	228.5	293.5	357.0
FM4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.0	528.4	608.2	611.9
RG Data	214.6	245.8	297.4	322.0	424.5								
CFM	219.4	248.3	301.2	322.3	425.8	505.3	524.6	544.9	568.1	594.4	623.3	652.3	681.1

Year

Revenue analysis across all the financial models and history data with respect to the CFM is graphically represented. The history data from the existing RasGas Project is taken and populated in the CFM. Results are a close match verifying the working of the CFM. The CFM eliminates the manual work involved in the financial calculation for integrating the investment / expenditures generated by individual models from respective departments. From the eight models reviewed, calculation and comparison of revenue analysis is possible only against the above four selected models. Cost oil barrels, Profit oil barrels, Cost oil revenue, Profit oil revenue, CAPEX, OPEX are provided for a period of 1997 to 2009. Cost oil barrels is calculated based on the Input sheet's oil volume and 0.4, Profit oil barrels is the product of oil volume of the Input sheet and 0.12.

The product of Cost oil barrel and field price provides the Cost oil revenue. Profit oil revenue is the product of profit oil barrels and field price provided in the input sheet. Total revenue is the sum of Cost oil revenue and Profit oil revenue. Thereby the revenue analysis is generated.

Figure 9.3 - NPV (10%) comparison WRT CFM



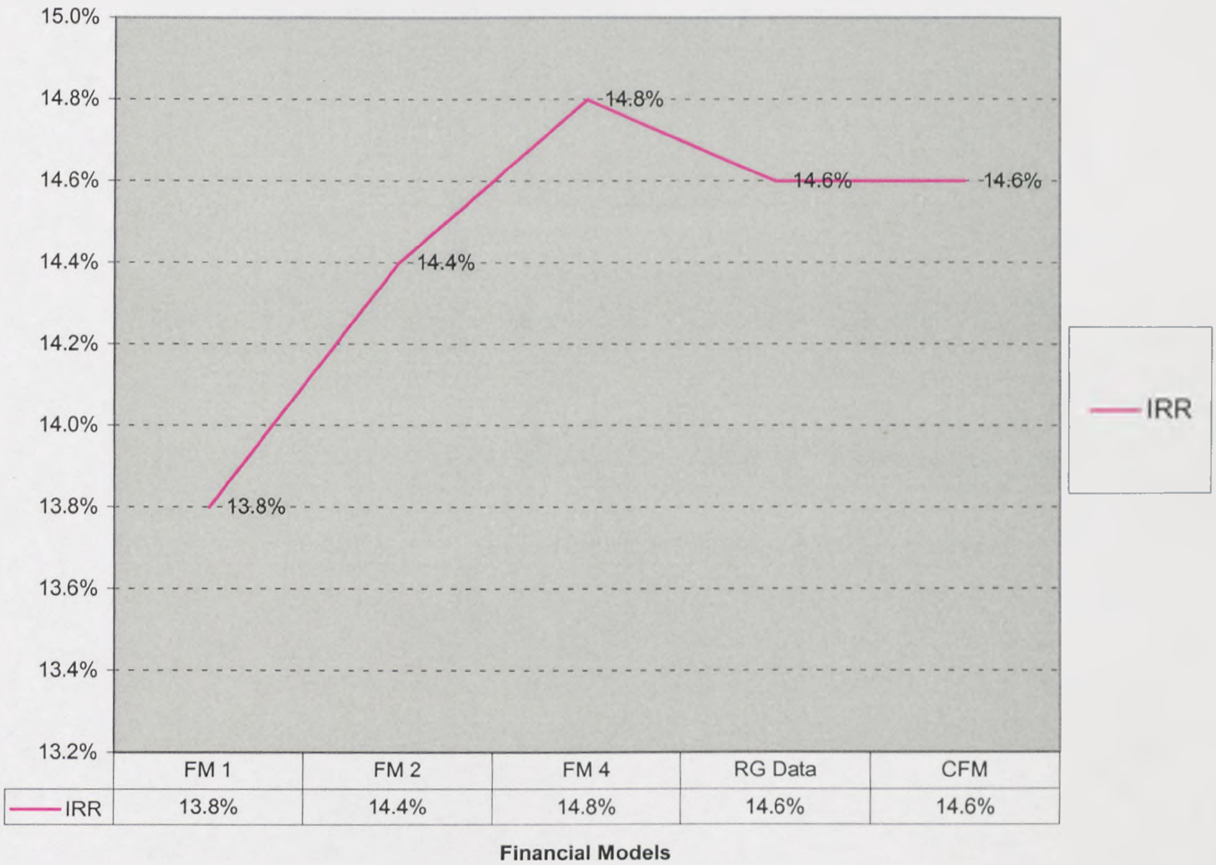
	FM 1	FM2	FM 4	RG Data	CFM
NPV (10%)	2579.50	2044.73	2579.50	2727.60	2727.60
NPV (15%)	2460.00	1921.35	2417.00	2524.36	2524.36

Financial Models

The above chart represents the Net Present Value (NPV) across all the financial models and history data with respect to the data from the CFM. The Net Present Value shown here is for a particular project and CFM data with respect to RasGas project's history data at different sensitivities (10% & 15%) respectively. The above shown NPV when calculated from the CFM (populated with RG history data) and RG actual history data produces closely matching results. However these are attained more easily with CFM process.

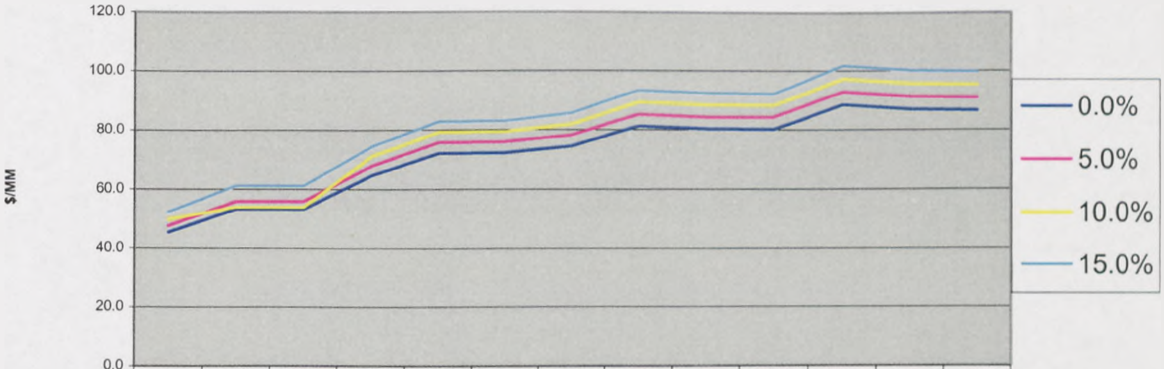
Cash flow details are calculated based on the difference between the sum of OPEX, Govt take, CAPEX and the total revenue. Discounted cash flow is the product of discount factor and cash flow. NPV is arrived from the discounted cash flow at different percentages.

Figure 9.4 - IRR (10) comparison WRT CFM



Interest Rate of Return, which is calculated from the funds flow that is arrived from the sum of profit, depreciation, working capital and capital expenditure, is shown for the different financial models. RasGas history data is taken as base case for verifying the CFM accuracy. Only financial models 1, 2 & 4 are designed to generate the Internal Rate of Return whereas RG history data (actuals – base case) for a particular project, is matching closely with CFM. Advantage of the CFM though is that all the modules are integrated. As RasGas, doesn't have an integrated model, the CFM produces the desired results eliminating the pitfalls in the individual models of RG.

Figure 9.5 - Total Operating Costs of CFM based on sensitivity Index

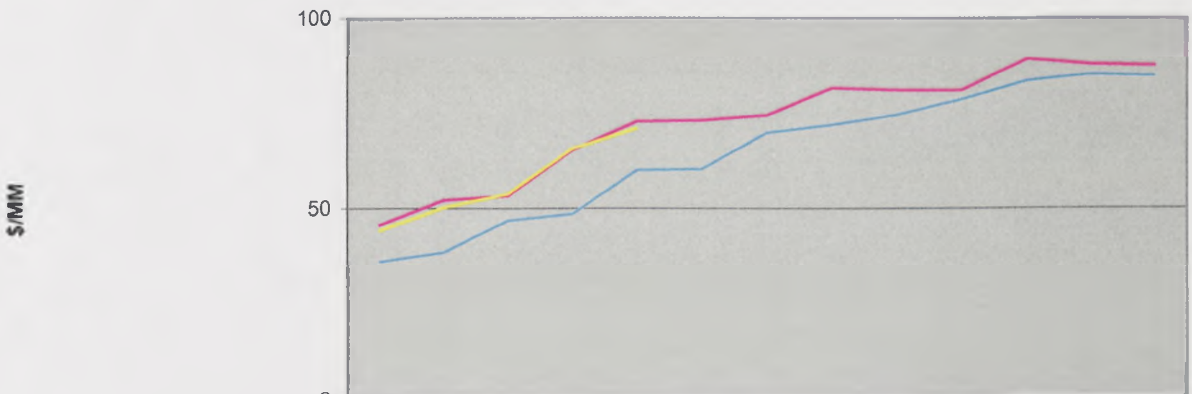


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0.0%	45.1	53.0	53.0	64.6	72.0	72.2	74.4	81.2	80.2	80.1	88.3	86.9	86.5
5.0%	47.4	55.7	55.7	67.8	75.6	75.8	78.1	85.2	84.2	84.2	92.7	91.3	90.8
10.0%	49.6	53.8	53.8	71.0	79.2	79.4	81.8	89.3	88.3	88.2	97.1	95.6	95.2
15.0%	51.9	61.0	61.0	74.3	82.8	83.0	85.5	93.3	92.3	92.2	101.5	100.0	99.5

Year

The above chart displays the total operating costs of CFM based on the different sensitivity levels. Operating costs consists of overhead, offshore and LNG for all Trains. It also includes royalties like feedstock gas royalty, field condensate / plant condensate royalty and gas royalty index to LNG prices. These details are used to calculate operating costs, based on the operating cost inflation factor at different sensitivities. The operating cost scenario is compared with the existing models history data and RasGas Actual data.

Figure 9.6 - Total Operating Costs based on sensitivity Index WRT CFM



	1	2	3	4	5	6	7	8	9	10	11	12	13
Sensitivity Index - All FMs	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CFM - 1%	45.6	52.1	53.3	65.2	72.7	72.9	74.3	81.4	81.0	80.9	89.1	87.8	87.4
RG Data - 1%	44.2	50.1	53.8	65.5	71.0								
FM4 - 1%	36.1	38.4	46.7	48.4	59.9	60.2	69.8	71.8	74.5	78.5	83.4	85.1	84.7

Year

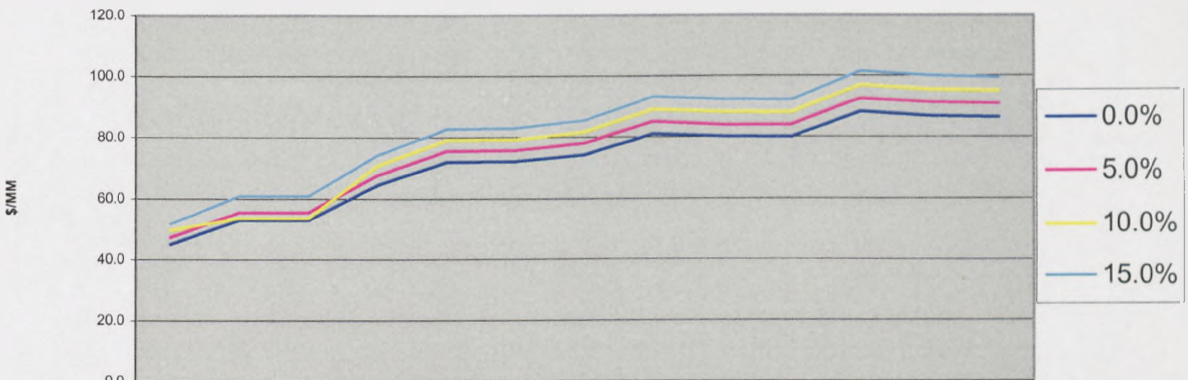
Operating cost details based on the sensitivity (1%) and inflation rate input variable, is displayed with respect to the CFM. The data from the CFM is compared with the RG history and future forecast data and showed as accurate with respective to the other model. Only financial model-1 calculates the operating costs and is not available in the other reviewed models.

Inflated price details are provided for gas, oil, LPG and condensate module. Gas inflated price is the product of gas sales price of the fiscal assumptions and gas price from the sensitivities of the case parameters, Oil, LPG and Condensate. Inflated price is calculated from the Oil/LPG and Condensate sales price of the fiscal assumptions and oil price from the sensitivities section respectively. Gross values for the same are also provided.

Sensitivity Charts - Actual:

Plots for CFM with different percentages of sensitivity.

Figure 9.7 - Total Operating Costs based on sensitivity Index - CFM

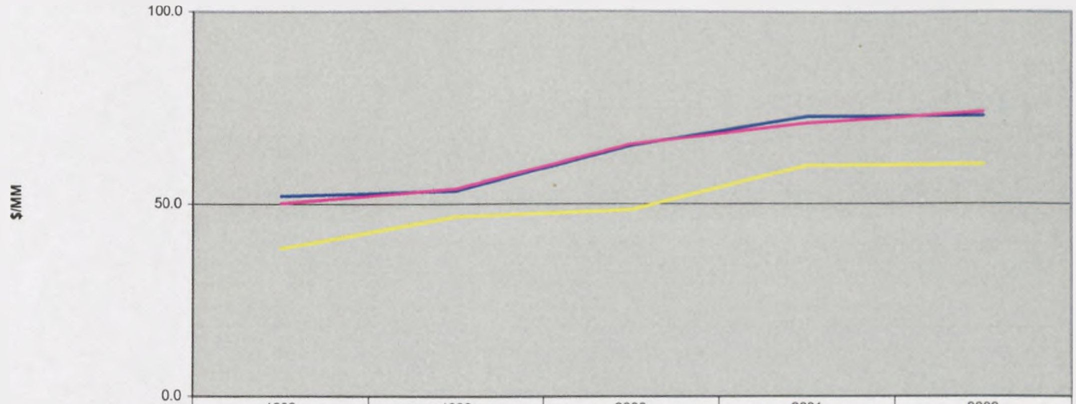


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0.0%	45.1	53.0	53.0	64.6	72.0	72.2	74.4	81.2	80.2	80.1	88.3	86.9	86.5
5.0%	47.4	55.7	55.7	67.8	75.6	75.8	78.1	85.2	84.2	84.2	92.7	91.3	90.8
10.0%	49.6	53.8	53.8	71.0	79.2	79.4	81.8	89.3	88.3	88.2	97.1	95.6	95.2
15.0%	51.9	61.0	61.0	74.3	82.8	83.0	85.5	93.3	92.3	92.2	101.5	100.0	99.5

Year

The above plot shows the operating costs of CFM based on different sensitivities (viz. 0, 5, 10 & 15%). Values of the chart are used as base for comparison with other financial models, whereas the CFM is compared using the RasGas history and future forecast data as base. The above chart for actual operating costs is given from 1997 to 2009. Sensitivities Chart of CFM with respect to RasGas data and other models (RasGas history data is used for population).

Figure 9.8 - Total Operating Costs based on sensitivity Index WRT CFM



	1998	1999	2000	2001	2002
CFM - 1%	52.1	53.3	65.2	72.7	72.9
RG Data - 1%	50.1	53.8	65.5	71.0	73.9
FM8 - 1%	38.4	46.7	48.4	59.9	60.2

Year

The above chart shows the operating cost at 1-% sensitivity for the actual period from 1998 to 2002. The plot value of the CFM has been compared with RasGas history data as base case. Operating costs include liquid production and gas production with Royalties, pipeline tariff for CAPEX and OPEX (upstream / pipeline). The above chart is similar to Fig 9.7, but it shows the plot only for the actual period of 1998 to 2002 and gives a closer look at the actual period values. Fig 9.7 is a cumulative plot showing the total operating costs based on sensitivity from 1997 to 2009.

9.4 VERIFICATION OF THE COMPREHENSIVE FINANCIAL MODEL

The graphical comparison in the previous section show that the results are quite accurate when operated with the existing RasGas history data. These results verify that the CFM is more comprehensive, flexible and the ideal tool for project evaluation in the oil and gas industry.

Running a number of sensitivity analysis simulations helps to identify the inter-relationships within the business and the volatility of the financial data. Quick and simple entry allows for the financial and operational analysis in less time. This process addresses the verification and validation of the theory and practice thereby ensuring a high-quality Comprehensive Financial Model. The process includes quality assessment, proof of correctness, testing and limitations of verification and validation methods.

Testing processes includes black box, structural, dataflow analysis, partition analysis and coverage. System testing comprises of integration of all the modules, regression, N-version, tool, reliability and performance. Testing is the process of executing programmes with the intension of finding errors (80). If any errors are found, necessary modification to the model or programme can be carried out to ensure trouble free performance before finalising the programme.

Operational flow of the data is documented below (flow chart provided in Chapter 8, figure 8.6), thereby proving and verifying that the CFM has been designed, developed and structured as per the aim of the author which is to provide a comprehensive tool to the oil and gas industry to evaluate future projects. The objective was to create only one comprehensive model for use by all parties involved in any oil and gas project. This objective is accomplished as is verified below.

The two major components of the CFM are the operational and financial variables, which acts as a baseline and provides basic data for the operation of the all the modules. Reserves volume, pricing, revenue, cash budgets, capital expenditure, working capital and unlevered cash flow constitute the operational component section. Equity/Bond funding, cash waterfall, tax depreciation, income statement, balance sheet, cash flow, ratio analysis and Bank-ECA loans constitutes the financial component section.

Reserves volume takes all the input from the operating variables based on the trains in operation, which is used for calculating the wellhead production volume, plant and field condensate and sulphur recovery. Pricing module uses the variables of prices provided in the operating variables and calculates the LNG floor and market price, field condensate, plant condensate price and sulphur price. Purvin and Gertz forecast is made on the above prices based on the variables.

Revenue module is directly proportional to the production volume and pricing that are obtained from the respective modules and gives a detailed statistical report on the revenue on LNG, plant and field condensate and sulphur yield. Cash budget involves two main groups like operating costs and royalties, which are taken from the operating variables for the current period.

Capital expenditure, involves the facilities like drilling, offshore, onshore plant and receiving facilities and venture for the trains in operation. Offshore parameters like plat form and pipelines are also provided in detail. Onshore parameters like EPC contract, exchangers, LNG tanks, compressors, site preparation and project cost are calculated. Working capital involves the current assets and liabilities, which are derived from the revenues, reserves volume, pricing and operating variables respectively.

All the calculated data from other modules provide the unlevered cash flow for a particular project at a defined period. Financial summary provides the net cash flow for post completion and the summary ratio analysis of the project based on the data from the bond funding, risk management, cash waterfall, tax, income and balance sheet statement.

Risk management as one of the key modules of CFM, provides details on LNG volume, market price, LNG revenue differential and debit service shortfall. Provides statistics on the subordinated loan details like principal and interests that enables the project to analyse the risks involved. Income statement is established based on the data from revenues and production costs. Pre-tax profit is arrived from the interest expense and interest income and tax expenses. Based on the pre-tax profit and dividends paid, profit to retained earnings is generated. Income statement is the main source of calculating the tax depreciation for the assets used in the project.

Ratio analysis takes the input data from the financial variables and operating variables to provide the respective ratios and loan life coverage ratio. Bank –ECA module takes the data input from the financial variables and provides details of the bank and loan facilities available for the oil and gas projects.

Verification of the Comprehensive Financial Model brings out certain advantages over other financial models. All the modules of the CFM are integrated, so that data application and validation is accurate. Modules are interlinked and hence any data change will be incorporated and updated across all the modules simultaneously. Thus interlinking of the modules reduces major programming work or tedious data conversion or transfer process. Links to external files may result in data loss and non-updates, which CFM can overcome. Business rules are deployed at all the stages and alteration in the rules is made easy. Data in the excel format can be imported into any Relational Database Management System.

Development of the CFM into integrated software is easy as VBA (Visual Basic for Applications) programming/syntax is used.

The above indicate that the CFM is operating smoothly and the macros, which are also recorded and documented, in a separate worksheet in the CFM, are working well. To also prove the point of flexibility, the significance of the macros being available in the CFM as a separate worksheet, enables a user to modify the model to suit the requirements of the specific project. The working macros are not hidden and will not prove to be a hindrance to the further development of the CFM. A detailed description on working with macros is provided as Appendix 1.

9.5 VALIDATION TEST OF THE COMPREHENSIVE FINANCIAL MODEL

The Comprehensive Financial Model is proposed to be a financial solution for the Oil and Gas Industry from the Planning, Commissioning and Installation to Production and Revenue phase. Since the CFM includes both all essential operating and financial variables it is quite comprehensive in nature. Necessary changes to prices or reserves based on latest estimates make the CFM flexible to incorporate these fluctuations without major hurdles. The inclusion of macros and formulae to process calculations ensure accuracy, efficiency and reliability. The CFM can be copied onto a diskette or used individually on any computer thus making it quite portable. Finally but most importantly it is user friendly as it is well documented and the user has to input data onto the input datasheet only. Also, the macros are also transparently provided in the macro sheet within the CFM workbook enabling easy access for minor modifications that may be required based on the situation.

The CFM incorporates all the essential components required of a financial model for the oil and gas industry, is flexible as business concepts can be incorporated easily, less time consuming and physical errors by the user can be reverted or corrected easily. The document can be shared among different users as all the objects are embedded in the same document. Distribution of the document is easy, as the application is very compact and can be accommodated in any type of distribution media. The CFM is designed and developed using the Excel software and thus can be efficiently exported into any RDBMS, as Excel is compliant with all available RDBMS in the industry.

In order to validate that the CFM is operating as per original plan and achieving the desired results, a comparison is made with the RasGas history data. Following are the results of the comparison provided graphically.

Table 9.1 - Revenue Analysis Details		
Year	RG	CFM
1997	214.6	219.4
1998	245.8	248.3
1999	297.4	301.2
2000	322.0	322.3
2001	424.5	425.8

Fig 9.9 Revenue Analysis

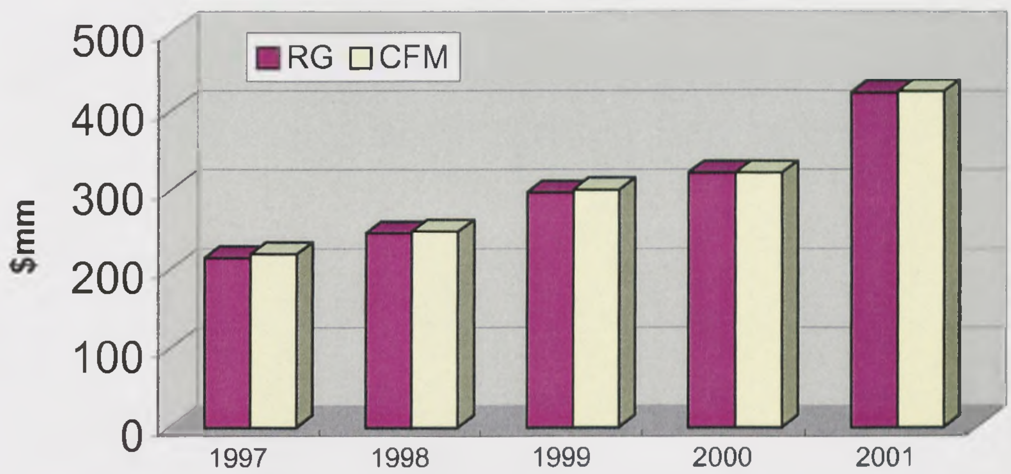


Figure 9.9 provides comparison of the revenue analysis between the RasGas actual data and the RG data populated in Comprehensive Financial Model. The above comparison is provided for a period of 1997 to 2001, i.e. actual and forecast.

Table 9.2 - Production Cost Details		
Year	RG	CFM
1997	44.2	45.6
1998	50.1	52.1
1999	53.8	53.3
2000	65.5	65.2
2001	71.0	72.7

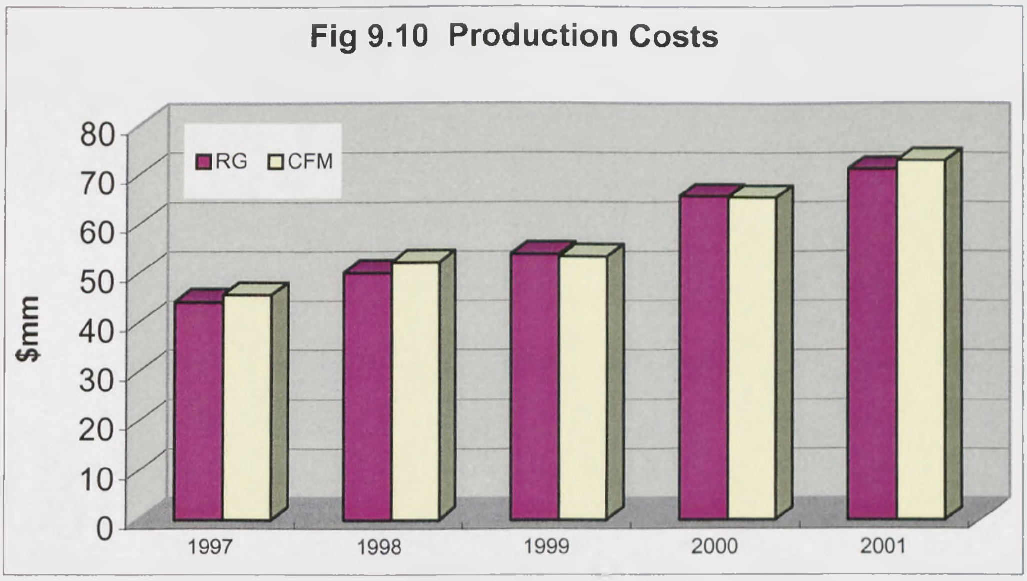


Figure 9.10 shows comparison of production costs between the RasGas data and the Comprehensive Financial Model for a period of 1997 to 2001 (actual history comparison and forecast). The above chart is arrived after populating the RasGas history data in CFM and compared with RasGas actual history. Thus the plot proves to be accurate and efficient in producing the desired results.

Table 9.3 – Gross Project Net Present Value

	RG	CFM
@ 10%	2,727.60	2,727.60
@ 15%	2,524.36	2,524.36

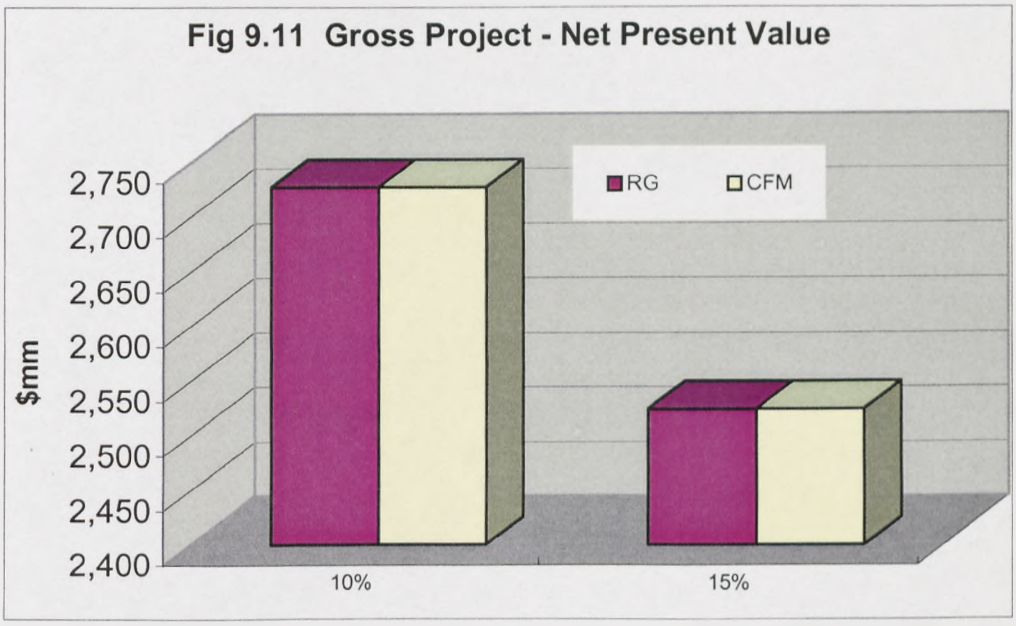
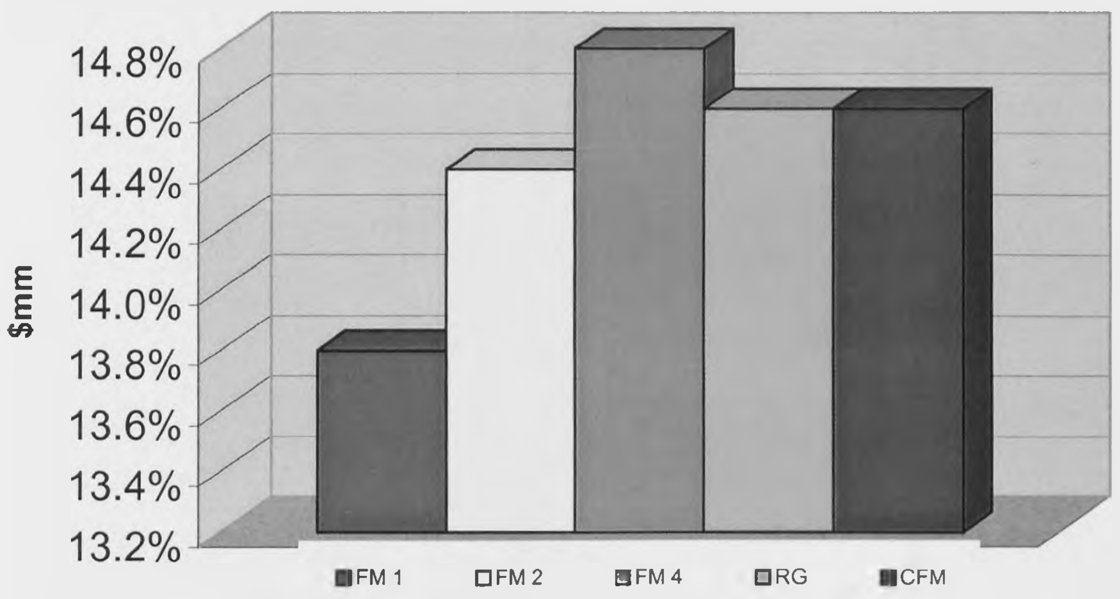


Fig 9.11 provides the Net Present Value of the gross project attained from CFM and compared with the RasGas history data as base case.

Table 9.4 - Gross Project Internal Rate of Return (IRR)					
	FM 1	FM 2	FM 4	RG Data	CFM
	13.8%	14.4%	14.8%	14.6%	14.6%

Fig 9.12 Gross Project - Internal Rate of Return



The above plot shows the Internal rate of return attained from the CFM and other models for the RG data, which is populated across all the models. The results of the above comparison validate that the CFM is operating and producing the desired results.

9.6 REAL TIME APPLICATION OF CFM

Continuing the Validation of the CFM, a comparison is made in an oil project related scenario to emphasise that the CFM is for both oil and gas projects. The CFM is analysed and tested with "what if scenarios" for its efficiency and reliability. CITO Petroleum is the company that tested the CFM in their real-time conceptual project.

Scope of this conceptual project is to carryout an Asset Registering, Strategic maintenance studies and shutdown planning work for Gap Analysis project at RasGas and QP Dukhan Oil and Gas fields. The Dukhan field includes 520 oil, water and gas wellheads. This project is to enhance the field's capabilities, or design out operational and maintenance problems based on the site visits, field analysis and library documentation.

CFM financial module is used in this project for calculating and forecasting the cash flow, risk management analysis, taxation and ratio analysis. Operational and Financial variables are taken as base for input of values from the operational and financial sectors. This provides the actual cost, profits and risk involved in the project, which helped to align with the variables in the forecast. The CFM is also used to analyse the bank facilities, income statement and balance sheet.

CFM's financial module has been populated with data for the project period of 1999 to 2001. The assumption variables like pricing, finance and other variables like percentage funded by equity, final period cash flow, and build-up period reserve account and dividend payments. Detailed summaries like capital expenditures, finance fees, interest during operation are obtained from CFM as total uses of funds. Net cash flow details like project's operating cash flow; income and distributions are also calculated using CFM.

While evaluating intangibles and revenue enhancement, if uncertain, they will require a higher discount rate, and thus, lower value. This produces the same short-term bias as in the case of normal NPV, which is accounted in CFM.

Moreover, there is a question of whether or not the option value in the analysis should be obtained using the traditional pricing method. If that is the case, the option need not be discounted, since time and risk are included in the calculation of the option value. Finally, options inherent to the project can interact with each other because they are all dependent on the same underlying asset, and as such, can change in value.

CFM flexibility goes beyond the switch use option because it deals specifically with future possibilities. The binominal tree process determines the terminal values of the project at different states of the world (ups and downs in value). The present value of the project and the mid-point values are not yet determined. These values depend on the terminal values in each module of CFM.

When the expansion possibility of CFM is encountered, the net present value of the expansion is added to the previous value; contracting is the opposite where the value is due to savings. The defer option depends on the maximum value between the value of undertaking the project now or its discounted expected value in the next time step.

In traditional option valuation, we would only expect up and down relationships. Caution must be exercised when interpreting these results because this is not a test of the behavior of options but a test of the behavior of CFM, which includes real option. All the combinations of flexibilities are studied and incorporated where the value of the risk free rate changes from 1% to 3%, 5%, 7% and 9% and the variance from 3% to 10%, 25% and 30%.

CFM methodology of financial decision-making overcomes many limitations of traditional approaches. Uncertainty in risk factors like interest and exchange rates, prices, or cash flows is taken into account by generating representative scenarios for their possible future outcomes. All possible constraints are also incorporated in the development of the CFM. Moreover, possible correlations between interest rates and volumes as they are observed for saving deposits and non-fixed rate mortgages can be exploited more appropriately than in static methods like the replicating portfolio approach.

In CFM, the calculation of the price-sensitivities and hedge-ratios of derivative securities with respect to fluctuations in market prices is re-formulated as a framework. To compute the sensitivity (market risk) of a financial security, the *probabilities* of the simulated paths around the uniform distribution is priced and then disturbed. This is different than the classical approach for calculating sensitivities, which consists in fluctuating the *parameters* that define the dynamics of the model (spot prices, local volatilities, drifts)

Table 9.5 Sample Bank/ECA Facilities Worksheet

FACILITY 1: BANK FACILITIES		
LIBOR		
Margin		
Interest rate		
	Actual	Maximum
Loan Amount	359.1	359.1
Percentage of Cap Ex Drawdowns		30.1%
Bank Upfront Fee		1.600%
Bank Commitment Fee		0.50%
ECA Commitment Fee - 1		0.000%
ECA Commitment Fee - 2		0.000%
ECA Premium - 1 (upfront)		0.000%
ECA Premium - 2 (pro rata)		0.000%
Maximum Outstanding Loan Balance		**100.0%**

CFM characterises theoretically the computed hedge-ratios and sensitivities in terms of statistical moments of the simulated cash flows. These simulated figures are taken as a sample while preparing data for the CFM's real-time application. CFM shows that the sensitivities computed are in excellent agreement with the CFM base data and RasGas data, and with the approximate analytic formulas incorporated in all the modules. The advantages of the present method for computing sensitivities are:

- It can be effectively and efficiently applied to most of the industries because it is non-parametric, and developed generically.
- It does not require multiple recalibration of the model or discrete differentiation, and
- It is simple to implement.

Table 9.6 Sample Balance Sheet

SOURCES OF FUNDS	TOTAL		2001	2001	2002	2002
Senior Project Debt						
- Bank Facilities	359.1	10.7%	0.0	0.0	0.0	0.0
- ECA Guaranteed Tranches	765.2	22.8%	0.0	0.0	0.0	0.0
- Capital Markets Debt	1,200.0	35.8%	0.0	0.0	0.0	0.0
Total	2,324.3	69.3%	0.0	0.0	0.0	0.0
Withdrawl (Deposit) from Bond Proceeds Account			0.0	0.0	0.0	0.0
Shareholders Commitments	1,029.0	30.7%	24.0	10.8	23.7	23.2
Total Funding for Project Costs	3,353.3	100.0%	24.0	10.8	23.7	23.2
Pre-Completion Cashflow	411.4		0.0	0.0	0.0	0.0
Total Sources of Funds	3,764.7		24.0	10.8	23.7	23.2

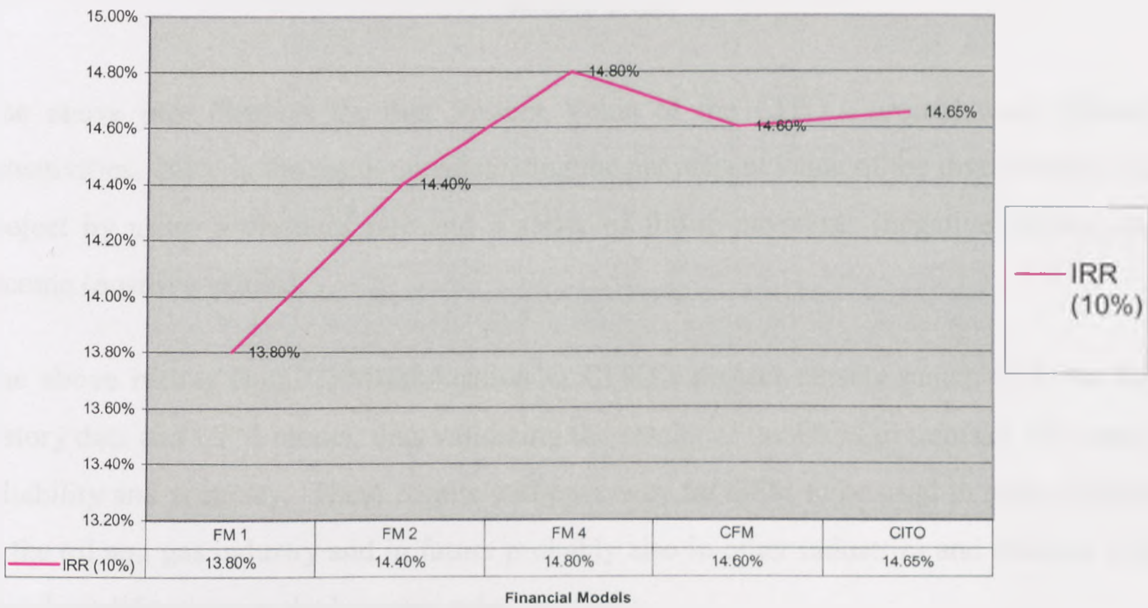
BALANCE SHEET (US$ millions)						
YEAR	2000	2000	2001	2001	2002	2002
MONTH	6	12	6	12	6	12
ASSETS						
Cash Balance	0.0	0.0	112.8	0.0	0.0	0.0
Reserve Accounts	47.9	266.8	387.6	240.1	236.8	235.9
Bond Proceeds Account	0.0	0.0	(0.0)	(0.0)	(0.0)	(0.0)
Net Working Capital	9.8	12.7	15.8	15.8	19.7	19.7
Net Fixed Assets	3,000.0	3,026.2	2,998.5	2,886.8	2,775.0	2,663.2
Total Assets	3,057.7	3,305.7	3,514.8	3,142.7	3,031.6	2,918.8
LIABILITIES						
Accrued Taxes	0.0	0.0	0.0	0.0	0.0	0.0
Current Portion of Long-Term Debt						
Bank/ECA Loans	0.0	59.4	119.8	121.3	122.3	123.8
Bonds	0.0	36.4	72.7	72.7	72.7	72.7
Subordinated Loan	0.0	0.0	0.0	0.0	0.0	0.0
Long-Term Debt						
Bank/ECA Loans	934.3	1,003.8	1,004.5	943.7	882.2	819.9

	Bonds	1,200.0	1,163.6	1,127.3	1,090.9	1,054.5	1,018.2
Total Liabilities		2,134.3	2,263.2	2,324.3	2,228.6	2,131.8	2,034.6
SHAREHOLDERS' EQUITY							
	Paid-in Capital	1,006.0	1,006.0	1,029.0	1,029.0	1,029.0	1,029.0
	Retained Earnings	(82.7)	36.5	161.5	(114.9)	(129.2)	(144.8)
Total Equity		923.3	1,042.5	1,190.5	914.1	899.8	884.2
Total Liabilities and Shareholders' Equity		3,057.7	3,305.7	3,514.8	3,142.7	3,031.6	2,918.8
Debt/Paid-in Capital + Debt		68.0%	69.2%	69.3%	68.4%	67.4%	66.4%
Balance check		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

The CFM has been used and analysed at all the stages of the projects of CITO Petroleum. All the modules are interlinked and the financial sections take data from the assumptions. Based on the tax depreciation and cash flow of the project, the income statement, balance sheet is generated. Output of the CFM is shown graphically to compare the economics of these conceptual projects.

Internal Rate of Return

Figure 9.13 - IRR (10) comparison WRT CITO's Project

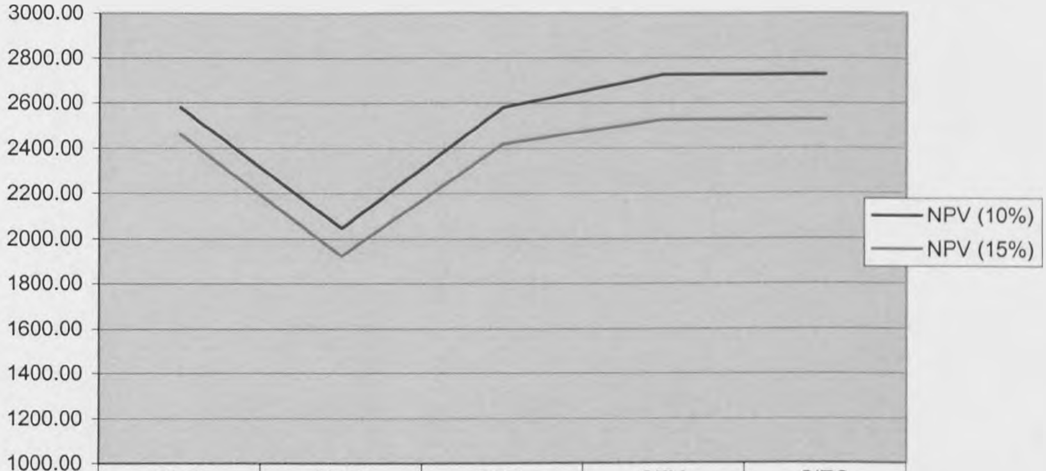


The IRR above is derived from the Company economic details applied in the CFM, in CITO's project. IRR is calculated based on a series of project cash flows as they are for an annuity at regular intervals. The internal rate of return is the interest rate received for an investment consisting of payments and income that occur at regular periods. The ratio of

Internal Rate of Return calculated through CFM from CITO's history data matches closely with actual results thus proving the applicability of CFM in new projects.

Net Present Value

Figure 9.14 - NPV comparison WRT CITO's Projects



	FM 1	FM 2	FM 4	CFM	CITO
NPV (10%)	2579.50	2044.73	2579.50	2727.60	2726.10
NPV (15%)	2460.00	1921.35	2417.00	2524.36	2524.36

Financial Models

The above plot displays the Net Present Value of the CITO's project with different sensitivities. NPV is the result on calculating the net present value of the investment in the project by using a discount rate and a series of future payments (negative values) and income (positive values).

The above results from CFM application in CITO's project closely match with the RG history data and CFM model, thus validating the results of the CFM in terms of efficiency, reliability and accuracy. These results will pave way for CFM to be used in other projects in the oil and gas industry and in future probably also in other industries and markets with trivial modifications to the business rules and logic.

The following has been concluded from the application of CFM;

- Simplest way of data population.
- Allows "What if..?" analysis, which helps to analyse different criteria / norm.
- Performs all calculations in less time - a major cost saving element.

- Generate graphical representations easily by linking to any of the popular report-writers.
- Alteration of business rules based on the industry can be carried out without any major programming changes.
- Easy to understand and customise, in other words flexible.

9.7 SUMMARY

The verification and validation process seeks to establish if a product is fit to serve the purpose of its creation and existence. The CFM verification and validation process provided a positive and comprehensive result that proves these points. History match with RasGas data and also real time application of the CFM for CITO's project has successfully proved the reliability, accuracy and efficiency of the CFM. The reason for using Rasgas data is to investigate essential elements of financial models that are the operational variables and financial variables.

The CFM is structured into two distinct components that are the Operational Variable section and the Financial Variable section. Graphical comparisons done above in section 9.3 prove that the CFM increases the productivity and will help standardise the model library. As all the modules are integrated the CFM will becomes a powerful tool for modeling and evaluating any oil and gas project. Historical data from RasGas was populated in the CFM and results are a close match. The CFM eliminates the manual work involved in the financial calculation for integrating the investment / expenditures generated by individual models from respective departments. Thus the verification portrays that the CFM is designed and constructed in the right direction of being smooth flowing and user friendly.

Validation tests done above in section 9.4 provide positive results. Two test were conducted, one with the RasGas history data and the second with CITO Petroleum's project. These tests positively show that the CFM is the right model for project of the oil and gas industry as it critically takes into consideration the fluctuating prices of oil. Figures 9.9 to 9.12 above show that the CFM provides consistent results when populated with Rasgas data. Figures 9.13 and 9.14 show matching Internal Rate of Return and Net Present Value respectively when the CFM was used for CITO Petroleum's project as a real time application.

Risk analysis and management elements have been considered in the CFM. Consideration and incorporating price and risk elements into a model for the oil and gas projects is the essential requirement to make a model successful. Thus validation of the CFM shows that it is efficient, reliable and accurate. It is also comprehensive thereby ensuring it is cost savings in various ways.

Some of the working advantages include but are not limited to the following.
Once initial assumptions have been entered, they can be readily altered to evaluate alternative scenarios. For example, CFM could be used to explore the extent to which future sales can be increased while holding borrowings within predetermined limits; to assess the effects of varying selling prices and/or volumes on net profits; or to determine the optimum level and mix of future funding for the industry's business. CFM provides technical support to realise opportunities; attract external funding; provide strategic guidance; evaluate financial and development options; monitor progress and risk management.

The CFM reduces the tedium of carrying out numerous repetitive calculations; simplifies the alteration of assumptions; and improves the presentation of results. Moreover, the results can be filtered for a particular period i.e. actual and forecast without much alteration. As the modules are linked, browsing across modules is an uncomplicated task. All the operating and financial variables used in the CFM are coloured in blue, which helps the user to easily identify the variables for evaluating / calculating different sensitivities. The outputs of the operating module from its variables are taken as input for the financial computing, and since is available in the same module reduces the process time intake. This process of integration also increases the efficiency of CFM and the modules can be maintained efficiently.

This chapter has successfully verified and validated the CFM and thereby provides support to the modules included therein. Based on the results obtained in this chapter, the CFM has reasonably realised the objectives of being comprehensive, flexible, reliable, accurate, user friendly and become a unique financial tool to evaluate new projects in the oil and gas industry.

CHAPTER 10

CONCLUSIONS

10.1 THESIS REVIEW

The oil and gas industry is a mature industry. Oil is the predominant product, however the trend shows a shift to LNG (Liquefied Natural Gas) as it is more environment friendly. Significant exploration has uncovered vast potential gas fields in many parts of the world. This will enable many new projects to open up. Although oil is still very much in demand, in future the demand for LNG will go up as is evident with the expansion of already existing projects as well as new planned projects. The GASTECH conference held in Qatar during October 2002 showed that many companies are interested to invest and be partners in new LNG projects.

Currently, the oil and gas industry currently uses various financial models to evaluate and analyse new and existing projects. Many of these models are not very efficient and lack various aspects essential in this industry. Therefore the author intended to pave the way in selecting and developing a Comprehensive Financial Model (CFM) for the benefit of the industry. The aim was to create a standard tool to be used for all projects. The model would have to be flexible to incorporate changes to operational and financial variables on a specific project basis without major changes to the entire structure.

The author conducted a case study on Rasgas since this was a new company formed with the onset of the LNG development in Qatar. Also existing financial models were reviewed in order to understand the requirements of the industry and the drawbacks that exist. Various books and periodicals were referred to. Several interviews were conducted with various key personnel in the oil and gas industry as well as the banking sector. A study of macros was essential since integration of modules included in the CFM would be macro driven. The CFM was then designed and constructed based on the requirements as shown in chapter 8.

The findings of the thesis and resulting conclusions are detailed in the following section.

10.2 CONCLUSIONS

The aim of the thesis was to create a Comprehensive Financial Model as a single standard tool to evaluate projects in the oil and gas industry. Research, interviews and investigations revealed that such a tool did not exist, although there were various financial models used individually. Review of the case study as well as the existing but deficient financial models concluded that there was a need to create a Comprehensive Financial Model that could be used as a standard practice in the industry. The design and development of the CFM supported the philosophy of having a single standard tool to facilitate evaluating oil and gas projects. The significance of this philosophy is that it will create a feeling of mutual trust between partners to a project and will eventually lead to cost savings due to various factors.

In order to realise the aim of this thesis the author identified five primary objectives, detailed in chapter 1, which have now been realised. During the course of developing the thesis further findings of significance were identified by the author, and the full conclusions of the these are presented as follows.

1. Review existing methods of project financing and LNG financing: Various methods of project finance and financing of LNG projects was reviewed in chapter 2. There are six methods of project financing, construction financing, direct loans by sponsors to the project, long-term financing, private placements, equity kickers and withholding tax considerations. There are also different structures of project financing which include debt in the form of notes, debentures, bonds, subordinated notes, term debt secured by a particular asset, non-recourse debt, limited-recourse debt, warrants, options, tax-exempt industrial revenue bonds, capital leases, operating leases, service leases, bank loans, short-term notes and commercial paper. This debt, in turn, may be restructured or combined with interest rate swaps and options, and, currency swaps and options. The debt is supported by the financial viability of the project, direct guarantees, contingent guarantees, indirect guarantees and implied guarantees. Projects are structured using subsidiaries, unrestricted subsidiaries, nominee corporations, jointly owned corporations, general partnerships, limited partnerships, joint ventures and trusts. These borrowings, guarantees and entities can be combined in a variety of ways to produce a viable project financing.

   LNG projects ought to be inviting to debt investors, because of the attractive utility characteristics that include significant contributions by the owners, so that equity has a large stake in the success or failure of the project. Usually, the offer of the sponsor guarantees the debt through completion of construction; long and steady cash flow; strong, government-supported buyers with high political incentives to maintain the chain of supply/receipt of gas; minimal or zero foreign exchange risks and; relatively low 'external' risks. LNG is basically gas oriented and due to the worldwide trend shifting to the LNG since it is environment friendly, the author reviewed financing LNG projects. A broad implication of the change in the structure of the consuming side of LNG is that, perhaps for the first time, gas sellers and buyers/users will need to work on a coordinated basis to achieve the debt capital required for the entire chain of investments, from wellhead to end-user. The reason for this must be explicitly recognised; the potential new buyers of LNG may not by themselves, have the international credit standing sufficient to tap the ready sources of debt capital in amounts required, either for themselves or for the projects supplying LNG.

2. Review existing financial models (used by Prospective Investors). This objective was realised in Chapter 7. Four existing models were critically reviewed. Strategic comparisons were made, documented and also graphically represented. Calculation of implied volatility, hedge, and sensitivity parameters, Sensitivity analysis with respect to market data, insight into complex contracts by means of graphical exploration, rapid modeling, configuration, and parameterisation are incorporated in the Comprehensive Financial Model. Discrepancies and problem areas in the existing models is reported below.

- Not all the operational and financial components required for new oil and gas venture are available.
- Assumptions / variables are provided only for a particular project and not general use in any other project.
- Financial statements like Balance sheet, income statement, taxation and depreciation are not covered.
- No provision for budget allocation is available.
- Essential factors like pricing and risk are not considered
- Loan and available credit facility details and calculation not supported
- No ratio analysis is provided which is required for comparing the existing business with respect to the market conditions.
- Depreciation of assets is not shown explicitly in the model, instead the amount is provided directly.

- Unlevered cash flow, which is calculated from the operating cash flow and capital expenditures are not provided in the existing models.
- Financial summary, as a result of the bond funding, balance sheet, profit and loss account are not provided.
- Models are not properly integrated. Data from one module to another goes manually. For example, to calculate the company's cash flow, Total revenue, Opex, government take and CAPEX are required. In the existing models, there are no proper links, which makes the calculation complex.
- No proper user interface or design. For example, the models lack a proper input section, which provides data to other modules or worksheet.
- No proper documentation is made available for understanding and further developments and hence modifications to suit other projects is not possible.

It was found that all the existing models were different from each other and mostly built to accommodate the project in hand. They were not flexible to use for any other project, were sometimes biased towards the host, accuracy was a concern as hidden formulas could be missed. They were all not well documented hence would be difficult for a new user. Price and risk factors were missing from all the reviewed models.

The CFM incorporates all these missing aspects. As shown in Chapter 8 and 9 the CFM has a data input sheet and then produces the desired results. All operating and financial components essential in a financial model for oil and gas projects is included in the CFM. Financial statements, budget allocation provisions, pricing, risk management, credit facilities, ratio analysis, asset depreciation, unlevered cash flow and financial summary are all included in the CFM. All these worksheets or modules are inter-linked within a workbook and hence this provides accurate results.

3. Select and Develop an Innovative Comprehensive Financial Model. This is the main objective of the thesis. Many financial models did exist, however a standard tool to evaluate projects in the oil and gas industry was not available. Through research and investigation the author found out that there was a need to develop such a tool. Personnel interviews suggested that it was a good idea to have such a

tool in the industry. The thesis contribution is that the path has been initiated to create a comprehensive and essential financial tool. Investigations, research, interviews, the Rasgas case study and real time application of the CFM for CITO Petroleum project was helpful to realise the objective of the thesis. The CFM need not necessarily be the final step in this idea of one single comprehensive tool to evaluate oil and gas projects. The path is open to further research, improvements and development of technology can take the CFM to greater heights of accuracy and automation.

A financial model should always be structured to be flexible and easy to understand. The idea of having one financial model to use to evaluate all oil and gas projects needed extensive research in order to be realised. After reviewing the existing financial models and conducting the case study on Rasgas, the modules to be implemented within the CFM came to be realised. The case study helped understand the difficulties faced setting up a new project and requirements that were missing or that would not only simplify the process of evaluating a new project but also be provide accurate results. This in turn would be time saving leading to cost effectiveness. CFM is developed after researching and understanding the issues relating to markets, sales and operations.

From the several methods of financial modeling, the choice for CFM was the forecasting method. This was considered the most suitable method for the Comprehensive Financial Model especially for the oil and gas industry. Most of the projects in the oil and gas industry are long-term and hence forecasts will have to be based on various aspects such as reservoir engineering studies, geological studies, field seismic data, infrastructure availability and market forces. Forecasts will need to be reviewed constantly and revised based on the above aspects

Elements that influence costs and revenues from the project are of interest when determining the financial structure. Unique requirements of oil and gas related projects incorporated in the CFM include reserves forecasting, direct operating expenditure forecasting, capital (capex) expenditure forecasting and physical volume of oil/gas forecasting. Also unique to the oil and gas industry is the fluctuating prices as well as the risk element. Based on market forces and estimates a realistic price forecast for the end product would have to be made and input into the CFM in order to obtain the viability and profitability of a project.

CFM calculations and formatting of the document is done through macros. Most of the formatting is repetitive and applied throughout the CFM that makes macros very useful in performing these actions. All the modules of the CFM are integrated and data from both the Operating Variables and Financial Variables section are applied across all the modules of the CFM, for calculations that can be handled efficiently and effectively by customised macros.

The author reviewed various books and periodicals, which were very helpful in understanding the whole concept of project finance, financial modeling as well as oil, and gas related project requirements in a financial model. The most useful books were references 4, 13, 14, 19, 27, 31, 37 and 81, although most others too were very informative.

From the four existing models that were reviewed the author incorporated the following and reworked them into the CFM:

Codes / Logic	**From Existing Model No.**
Inflation Rate (Operating Variable) Input	1
Calculation of Taxable Income (based on Local And International Taxes)	3
Calculation of Depreciation from Total Capex	4

4. Investigate, Verify and Validate The CFM utilising the Ras Gas (*Ras Laffan Liquefied Natural Gas Co.*) history data. Verification and validation are the real tests that prove the credibility and accuracy of the results of the model. The verification and validation process seeks to establish if a product is fit to serve the purpose of its creation and existence. The CFM was successfully verified and validated in chapter 9. Rasgas data was used to populate the CFM and a history match was conducted in order to verify the obtainable results. Also a real time application of data was done with the help of CITO Petroleum. Similar to the Rasgas data, CITO Petroleum used the CFM to evaluate their existing projects in Qatar. Both verification and validation provided positive results. In order to realise this objective the author has conducted a case study, which is documented in Appendix 2.

The verification identifies whether the technical and economic roles of the technology infrastructure are adopted, impact scenarios, impact and cost data, impact characterisation and estimation. The verification process also helps to identify and characterise nature of impacts, estimate the collected data's feasibility. The quantitative estimates are done using the

- Net Present Value
- Benefit Cost Ratios and
- Rate of Return

The CFM incorporates all the essential components required of a financial model for the oil and gas industry, is flexible as business concepts can be incorporated easily, less time consuming and physical errors by the user can be reverted or corrected easily. The document can be shared among different users as all the objects are embedded in the same document. Distribution of the document is easy, as the application is very compact and can be accommodated in any type of distribution media. Based on results obtained in chapter 9, it is concluded that the CFM has been successfully verified and validated as being comprehensive, flexible, accurate and user-friendly.

The CFM will not only be helpful in evaluating new oil and gas ventures, but also be instrumental in significantly reducing costs by being able to provide a precise tool in forecasting the financial requirements of a project, thereby limiting the need to block or borrow additional capital amounts. Main foreseen reasons for cost savings are, but not limited to:

- Reduction in time consumed to run different models by different groups like the financer, host government, banker and new potential partners)
- Effectively reduces the need for additional manpower to conduct economic models

- Accuracy in the model will eliminate checking and further verifying results
- Finally, it will be a standard practice in the industry

The CFM will continue to be a tool used to monitor the performance of the infrastructure once it is commissioned. This would help decide if the project continues to be optimum in returns or whether it is to be decommissioned in the future, as this model uses cash flow forecasting and looks into the future capabilities of the project. By precisely providing data on the financial requirements or forecasted needs of a project, it would enable a project to benefit considerably in terms of saving unnecessary expenditures.

5. Make the modeling process quicker, easier and more accurate: The use of macros to integrate modules within the CFM workbook ensure that the modeling process is quicker, easier and quite accurate. The CFM is designed and developed using the Excel software and thus can be efficiently exported into any RDBMS, as Excel is compliant with all available RDBMS in the industry. By using Excel software, which is quite popular currently, the CFM was built to be a robust, comprehensive, flexible and accurate model. The use of macros facilitated the model to be linked and integrated between the different operational and financial variable sector and also among all the modules included therein. As all the macros are also included in the same workbook, the CFM is not only very flexible, but also user friendly since it is well documented. As the CFM is clear, comprehensive, user-friendly, flexible and accurate, this creates a sense of trust between partners to a project. The investor will be able to run the economic viability of the project and be confident of trustworthy and accurate results.

* Considering the flaws in the other models, the CFM is designed in a way that the output values like Internal Rate of Return (IRR) and Net Present Value (NPV) can be compared against the other equity investors or other business. The CFM debt and equity are less risky as it is using a variety of equity and interest rate sensitivities.

* With the development of the CFM, using the latest systems will result as a powerful tool for projects' financial analysis. Different case scenarios can be generated with not much effort by just altering some input values. The

complications that arise in a manual calculations or even in an incomplete system is eliminated by using the CFM as the CFM automates calculations thereby making forecasts efficient and accurate as explained in chapter 8 and 9.

The main purpose of this thesis has been successfully achieved by creating a Comprehensive Financial Model that is quicker and easier for all concerned parties and ensuring that the model is as flexible, robust, portable, comprehensible and comprehensive as possible while taking into account all aspects and concentrating on the price and risk aspect related to the oil and gas industry.

The CFM results would be IRR and PI with relation to dollar per barrel of oil or unit of gas comparing it with the market price and risks involved. Hence the major focus of the financial model would be the pricing and risks aspects that have to be taken into consideration.

The Comprehensive Financial Model, although verified and validated, does have some limitations. It may not be suitable for certain economies that are not free or open to outside influences. The model is suitable for the oil and gas industry, but may not work well for other industries. And finally, regional factors and political platforms will also play a major role in the success of this model. It is much less painful to deal with a flaw in a business at the planning stage, than later on when commitments have been made and the business has started trading. CFM offers comprehensive facilities for doing sensitivity analysis using linked sheets and by changing individual values. A clearer picture of the actual and the forecast is attained by the design and working of the CFM. It is imperative to stress that this model is a start in the direction of creating a Comprehensive Financial Model and is definitely a solid base for any further development in this area. The main advantage of building this CFM model is that it can be fine-tuned to meet very specialised requirements is proved by this analysis. CFM proves that it is developed keeping in mind of "what-ifs", the kind of threats to the solvency and profitability of the industry and the catastrophe exposures / risks that exist.

10.3 RECOMMENDATIONS FOR FURTHER RESEARCH

Any tool or creation in life is subject to improvement as years pass by. It is common understanding that equipment, facilities, infrastructure development or basically everything in life today is not the same as it was many years ago. They change or rather improve with time based on available technology at the time. In the same way, the author understands that the CFM can also be subject to improvement based on further requirements in the oil and gas industry. Recommendations for further research in this area can include, but are not limited to:

- Improvement in computer technology and software can make the CFM more flexible and accurate, inter-linking, macros building and other aspects can be improved, simplified and further eliminate the possibility of errors.

- Only usage of any item can improve it further. It is recommended that the CFM be extensively used in order to avail of the existing advantages and integrating further requirements of the industry.

- Research methods of making the CFM flexible enough to be incorporated as a standard tool for all industries and not only for the oil and gas sector.

The Comprehensive Financial Model is constructed keeping in mind the various aspects essential in the oil and gas industry. Highly volatile prices of the end products in this industry, specifically oil and its related derivate, which is gas, is the most essential ingredient in this financial model. Besides this, the various risks related to the oil and gas industry is also taken into account. Hence it is recommended that the Comprehensive Financial Model should be used as a Standard tool to evaluate new projects in the oil and gas industry. As its usage grows, it will definitely provide the opportunities to improve this model as further requirements become clearer to the users of the model. Furthermore, this model can be used as a base foundation for not only further development of a financial model only for the oil and gas industry, but could be a major standardised tool for various other industries as well.

10.4 SUMMARY

A Comprehensive Financial Model was essential to evaluate projects in the oil and gas industry. The main idea was to create one model that was flexible enough to be used by various parties involved in the project including prospective joint venture partners. It can be safely summarised here that this objective is met. The Comprehensive Financial Model is designed and developed taking into consideration the important aspects related to the oil and gas industry, the two main elements being the price factor and risk management. The case study, documented in Appendix 2 was beneficial in creating the CFM.

In order to achieve the aim of the thesis, the author provided a general introduction to project finance and financing of LNG projects. This was essential since the case study was on Rasgas, a LNG company. Essential elements of financial modelling of project in the oil and gas sector were review, these being cash flow forecasting, pricing and risk and uncertainty. Different financial models were reviewed to obtain their advantages and disadvantages in order to provide some basis to select and create the CFM. Finally the CFM was verified and validate by conducting a history match with Rasgas data and also CITO Petroleum current projects.

The author would like to close the thesis by stressing again, the advantages seen in the Comprehensive Financial Model:

- All the modules of the CFM are integrated, so that data application and validation is accurate, which is very important. Data from the Comprehensive Financial Model is applied across all the modules and is ascertained to be more accurate when compared with the other existing financial models.

- As the modules are interlinked, any data change will be incorporated and updated across all modules simultaneously. Besides it is not linked to any other workbook or to the main frame of any company thus making it very flexible to changes without loosing it accuracy.

- The model has openness and does not have any hidden concepts to hide for any particular party to the venture. This creates a sense of trust between all parties to the project in so that they can verify the results without any painstaking efforts.

- The model also ensure smooth communications between the hosts, governments, bankers, credit agencies and financiers, as it is comprehensive and includes all elements related to the oil and gas industry essentially required to create a accurate and solid financial model.

- Business rules are deployed at all the stages and alteration in the rules is made easy.

- Data in the excel format can be imported into any Relational Database Management System. Development of the CFM into integrated software is easy as VBA (Visual Basic for Applications) programming/syntax is used. This will ensure easy and enable further study and development to improve and fine-tune the model to reach far greater heights.

Although mentioned at the end, the most important and significant advantage foreseen is the cost saving element. This will be the end result as it will save a lot of time consumed to verify the model, besides it will require limited manpower to conduct the verification process.

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APPENDIX 1

Working With Macros

Introduction

Macros are written in order to be able to automate repetitious work that needs to be done. By having the computer do the work automatically, this will eliminate mistakes and get the work done far faster.

What is a Macro?

A macro is a built-in tool that can be used either to automate repetitious, everyday tasks, to make an application easier for someone else to use, to control data validation, or to insert values into cells. Excel makes this task easy. There is no need to know a computer language to create a macro, just turn on the macro recorder, work through the process that needs to be automated, and turn the recorder off. Then, whenever the workbook is opened that has that macro, it will run to perform that task. The Macros created can be simple or complex. First simple macros are shown and then added complexity. Keep in mind that the only cap on creativity with Macros is the person creating them!

Building a Macro

There are two ways to build a macro. One way is to record a series of operations that are performed in Excel using the macro tool bar. Another way to create a macro is to type out the code in a *Module* and to save that code. *Visual Basic* is the language that Excel Macros are written in, but the beauty is that one does not have to know Visual Basic in order to create a macro. Simply perform the operations in Excel and it translates the information into Visual Basic!!

Of course some Excel functions are already easy to use, so there is no need to make a macro for them. For example, if the sixteen worksheets that Excel automatically sets up in a workbook are not needed, instead of creating a macro to delete the extra sheets, change the default number of sheets under the General tab under Tools/Options. However, if the operations or actions performed lead through the same steps over and over, then a macro is required to automate that task.

Before recording a macro, work through the process to get the procedure organised. If, however, an error is made when recording the macro, like leaving a step out, the macro can be edited to correct this.

Recording a Macro

Creating a macro within Excel is a three-step process: start the macro recorder, perform the actions to be recorded, and then stop the macro recorder. There are two ways to start the macro recorder: Select the *Tools* menu, select *Macro* and *Record New Macro.* Or, click on the *Record Macro* button on the Visual Basic toolbar (pull up the toolbar by selecting it under *View/Toolbars* or by right-clicking on the toolbar area and selecting *Visual Basic*).

A dialogue box will appear that will ask to name the new macro, and may also give a brief description of its function. Macro names must begin with a letter, and can include letters, numbers, and underscores, but no spaces or other punctuation. A keyboard button can be designated to run the macro. Finally, select where the macro will be stored. There are three storage options. By default, the macro will be stored in the folder called *Personal Workbook* Folder. Otherwise, it can be saved in the current workbook or in a new workbook.

If this is a macro to be used in other workbooks, then it should be saved in the personal workbook. Otherwise, the best option is to save the macro in the current workbook. Keep in mind that if it has to be edited future macros should be saved each one in a different workbook, because Excel stores all the macros in the *Personal Workbook* folder as one macro with a number of sub-routines. After clicking *OK*, every operation performed will be recorded in this macro (from entering data, formatting cells, opening a file) until the macro is turned off. Turn off the macro by clicking on the *Stop* macro button, either the button on the Visual Basic toolbar or the freestanding one that will appear on the screen when the macro is recording.

For Example, turn on the macro recorder, then select cell A1 and hit the *Bold* button and type your name. Then stop the recorder by pressing the stop button. Now, to run the macro just created, select a different sheet other than the one the macro was just created in and select the key assigned the macro, or go to *Tools*, *Macro*, then select *Macro*.

Reading Macro Language

What is seen in Visual Basic can be complex. Macros are stored under a separate sheet, usually with the name Module1, unless more than one module sheet is created or renamed. While it is not essential to be an expert at computer language, it is advantageous to become familiar with reading macro language so that editing macros to perform a slightly different task or to correct a mistake in the macro is easy.

To get a look at the code go to *Tools/Macro* then *Macro*. Select the macro that needs editing and press *Step into* or *Edit*. This will go into Visual Basic with a view of the code. The first lines of a macro are the lines of the macro command itself, beginning with the word "Sub" and the name given to the macro followed by parentheses that Visual Basic automatically inserts. The green apostrophes seen are for descriptions and comments. Add other helpful comments throughout the macro by beginning the statement with an apostrophe. The macro begins with the term "*sub*" and ends with the term "*end sub.*"

It is easiest to read macro language from right to left. For example, the first line that appears in the code is the *Range*: Range("A2"). Select Range is the name of an object in Excel, in this case it is the name of an object, an absolute cell reference of cell A2 (other objects might be: "ActiveCell", "Application", or "Workbooks"). The following also appear:

ActiveCell FormulaR1C1 = "xxx" which could be read as "xxx is the formula for the Active Cell." Each object in Visual Basic is followed by a *method*. The Method is just the command that is need to happen in the object, whether the object is a range cell for an absolute reference or the object that is the active cell. Each object supports a different list of methods (or actions). Finally, every object has a set of properties. A property is set by following the object with a '=' sign, and what's on the right side of the equal sign is a property. In the piece of code above, it is read to say that the object is the active cell (the cell selected) has the method, formulaR1C1 and the property of having the string 'xxx' in the cell.

Making Macros Easy to Use

Macros can be run macros in three other ways besides through the Tools/Macro menu selection. First, a keyboard command can be assigned to run a macro. Under *Options* of the *New Macro* window (or select Macros under Tools, and click on Options after selecting an existing macro), there is a box to enter a keystroke for that particular macro. When the shortcut key box is selected, the shift key in the command can be included. For example, to start a worksheet formatting macro, hold down the *Control* and *Shift* keys, and hit *F*. A shortcut key is a quick way to start a macro, but if numerous macros are created, it may be difficult to remember the keystrokes for each one. Assigning a macro to a keystroke may be good when a property is required to toggle on or off.

A second method is to assign the macro to a toolbar button. To assign a macro to a toolbar, choose the *View* menu and click on *Toolbars* (or click on any toolbar with the right mouse key). Select a button that is not already on a toolbar that is used, and drag it to a toolbar. While holding down the control key, click on the right mouse button. Select *Customise*, and then select *Assign Macro*. Customised toolbars and buttons can be created. When changing the function of the button, also change the status bar message for this button, which can be done in the *Macro Option* dialogue box. A third method of easing access to a macro is to assign it to the menu bar. When a macro is selected, select *Tools*, *Menu Editor*, and click on *Add to Menu* from the list in the upper left of the window.

With menu items, put an "&" character before the letter that is to be the shortcut key (care should be taken not to use a key that has already been assigned). Insert the main menu name (usually at the end of the list); then insert submenu names in the areas provided. If different kinds of macros-formatting macros and calculating macros, have Macros on the menu bar, then Format and Calculate as submenu items, and then the name of the macros under these submenus. Assign macros to menus or to shortcut keys when first created or later. It is easiest to assign a macro to a toolbar button after it is created.

Having Macros Available with Different Workbooks

When a macro is created, it will only run when the workbook is open unless the storage location of the macro is changed. At the bottom of the Macro Options window (or the Record New Macro/Options window), it is possible to change where the macro is stored.

If the *Personal Macro Workbook* is selected, then the macro will always be available when working on the computer (but not if the file is copied for someone to use on another computer).

The Personal Workbook is saved in the Excel Startup file, so it opens when Excel opens. Usually it is hidden, but after saving a macro to it, select the Window menu and select *Unhide*. NOTE: if the Excel programme runs on a network, it probably won't store the Personal.XLS on a network drive. It should then be saved to the hard drive, and open it whenever Excel is opened.

Editing Your Macros

Editing macros is similar to editing any other Windows document. It is possible to cut, copy, or paste highlighted text just as normally done. One consideration in editing a macro is keeping it easy to read. If a command line is too long, break it by inserting an *underscore* (_) character where there is a space and hitting enter. The underscore character tells Excel that the following line is a continuation of the preceding line. Breaking lines can be especially helpful with *With* statements. A With statement can allow performance of a number of operations on the same selection (sometimes, Excel will automatically create a With statement) which makes the macro run faster.

An example would be:

```
With Selection
.HorizontalAlignment = xlCentre
.VerticalAlignment = xlCentre
.WrapText = False
.Orientation = xlDownward
End With
```

This example centres a label both horizontally and vertically and orients it so that it is turned on its side.

Step Into Command

Sometimes, it may be required to watch a macro work to see what problems may occur. With the Visual Basic toolbar, click the *Run Macro* button and select the concerned macro to watch. Then, click the *Step* button; the Debug window appears (which can be resized to see a worksheet window beneath it). The command line in the macro that has a border around it is the *next* one that will be run. Click on the *Step Into* button to watch the macro work through each line of the macro.

Expanding or Changing a Macro

If there are small changes to be made to the macro, it will probably be easiest to change the code directly in Visual Basic. On some occasions, however, more may be require dot be done. In earlier versions of Excel all that was needed to be done was to go to 'Mark text for Recording' then work through the necessary procedures to add to the existing macro. That feature is no longer supported in current versions of Visual Basic. Instead, create a temporary macro and work through the new features to be added to the relevant macro, then simply copy and paste them from the temporary module to the module that needs editing.

For instance, if a macro is created that inserts a title into a cell. The cell is formatted but the title doesn't have the appropriate font type. To fix this, create a temporary macro within the same folder as the macro to edit and select the cell with the title. Now, format the title the way required. Then simply go into the Visual Basic editor, copy the code beginning with '*With Selection*' and ending with '*End With*' and paste everything in between into the macro that is to be changed.

Properties and Methods

Understanding properties and methods will help to understand how a macro works. A property is an attribute of an object. Objects can include workbooks, worksheets, values, labels, almost everything in an Excel workbook; whether a file has been saved or not is a property of that file. The four attributes in the 'With' statement above all deal with properties (the horizontal alignment property is centered, the wrap text attribute can be either true or false, and so on). Again, the syntax for a property is an = sign with a space before and after it.

Methods are actions that tell Excel to perform (like cutting, copying, and pasting). The syntax for a method is :=. With methods, an argument is also essential (in parentheses) to tell Excel how to perform this action. For example, to have Excel auto fill the months of the year, with January in cell B2, the code would read:

```
Selection.AutoFill Destination:=Range("B2:M2"), Type:=xlFillDefault
```

The argument here is the range where auto fill is to occur (B2:M2). While this code may look like gibberish, Excel did all this work while the Macro Recorder was on.

Making Macros Really Work By Inserting Pieces of VB Code Relative References

While creating some macros is as easy as turning on the macro recorder and working through the process, sometimes it is necessary to give Excel some extra information to really make the macro work correctly. For example there are two worksheets that have similar layouts, and a macro is required that searches through the data for particular values. Unfortunately, the number of rows on the two tables are different. Therefore, having a macro that moves to a particular cell to continue a search will not work unless those cells have the same relationship in each worksheet. Excel makes this problem easy to correct; as the macro is beginning to record, select *Use Relative References*. This will change the selections in the macro from an absolute (like A134) to a reference that is relative to the previous selection in the macro. For example, the macro is to select the next cell down in a column, the code will read:

```
ActiveCell.Offset (1, 0).Range("A1").Select
```

This code can be tricky to read. Range("A1") is reference that Visual Basic inserts. In this case A1 is not really A1; when the cell selection is changed, Excel treats the moving cell as the first cell in the first column of a "virtual workbook." Think of it as a relative starting point. The phrase "Offset (1, 0)" means that from the starting point, move one row down in the same column. So the code above can be read "From the current cell, select the cell one row down in the same column". If the offset were two columns over in the same row, the code would be Offset (0, 2); moving to the previous column would be Offset (0, [-1]).

Using relative references can be especially helpful when updating an archive file. As each set of information for a month is appended, the first blank row of the archive file changes. With *absolute* references it is possible to overwrite whatever information is appended the previous month. With *relative* references, the macro is told to move to the end of the data (hit the end key and the down arrow), and then hit the down arrow again to move to the first blank row.

Do . . . Until and If . . . Then Statements

Many actions in a spreadsheet are performed unconsciously. Looking down a column of data, stop when no more data is in that column, and then move up to the top of the next column and look down that column, and so forth, until the target is located.

A macro isn't going to know to stop at the end of a column of data or in the last column of a spreadsheet unless told to stop. Once told what to do, however, the macro can become very powerful. For example the macro is required to bold all values in a spreadsheet that are greater than 25%. Looking through the worksheet would quickly become tedious. However, a macro can analyse a value, bold it if it meets the criteria, move down to the next value, analyse it and so forth until it reaches the end of the column, then move up to the top of the next column, and continue. These actions are performed by inserting

Do . . . Until loops.

```
Do Until ActiveCell = ""
Do Until ActiveCell = ""
If ActiveCell &gt; 0.25 Then
With Selection
Selection.Font.Bold = True
EndWith
End If
ActiveCell.Offset (1, 0).Range ("A1").Select
Loop
Selection.End(xlUp).Select
Selection.Offset (1, 1).Range("A1").Select
Loop
```

Notice that there are two loops; the first one tells Excel to do everything else in the macro until it comes to a column that has no data (""). The nested loop tells Excel to continue searching for values of greater than 25% until it gets to a cell in the column with no data. The two lines before the last loop of the macro tell Excel to go back to the top of the column, then move one row down and one column to the right (this assumes that the first row has a label in it instead of data).

Notice that the actual analysis is done with an *If . . . Then* statement. This simple statement can cut down the work immensely by letting Excel take over tedious tasks. Follow *If* by the criteria that is required, then follow the criteria with *Then* and the action that is required to be performed. Often it helps to break the action up among separate lines for easy reading. By becoming familiar on how the *If . . . Then* statements work, it will become easy to add further codes to the existing *If . . . Then* in the same way a code is added while editing macros.

Using Input Boxes

If part of the macro uses information that changes often, like a date, instead of editing the macro before each time it is run, change the appropriate line of the macro to have an input box ask for an entry from the user. An example would be a macro that archives monthly data; change the line from:

Selection.FormulaR1C1 = "Mar 94" to: Selection.FormulaR1C1 = InputBox("Enter the date in MMM-YY format"). This change will cause a dialogue box to appear while the macro is running, allowing you to enter the new date.

Changing Go To Commands

To ease using macros, sometimes it may be required to have *Go To* commands instead of selecting a certain cell or range of cells. Using the Select command is always relative to what was selected before (when using relative references); with *Go To* commands, the previous selection doesn't matter. So if a macro charts different rows of information, instead of copying each row to a staging area to chart it; use *Go To* to return to the last row copied instead of to the first row in the series. In fact, a command line: Application. GoTo is only needed to return to the previous selection. From that point, move to the next row down in the series using relative references.

A final note: since macros quickly become complicated to read (and debug if there is an error), it is a good practice to keep macros small. Instead of having one macro both format a worksheet, then perform calculations, it would be better to keep these as separate procedures. After ensuring that the macros work properly, then nest them in a larger macro, making them sub-procedures. A sample of nested macros would be:

```
'
' Update Macro
' This macro formats the selected worksheet and calculates the total.
'
Sub Update ()
Format
Total
End Sub
```

One other benefit to having nested macros is that the same nested macro work in different larger macros. Then, there is no need to recreate the procedure. This benefit is especially helpful when setting up personal standard functions.

Macro Types and Uses

The sequence statistics macros perform some common sequence statistics tasks on a sequences alignment: They calculate the amino acid composition of the sequences, count the occurrence of different amino acids at given positions, determine the consensus sequence, sequence variability and frequency of the most abundant amino acid.

The renumbering macros take a number of PDB-Files in a directory and extract the sequences, chain and residue labels into separate worksheets. The user can then process (gap) the sequence alignment manually or export it to gap it automatically with programmes such as the GCG module PILEUP and re-import the sequence alignment into the EXCEL workbook. Further macros will then change the chain and residue labels of the PDB files according to a common numbering scheme indicated in the header row (for sequence alignments shorter than 250 amino acids) or in the header column (for sequence alignments longer than 250 amino acids) of the alignment and re-export the PDB coordinate files.

The accessibility macros import multiple residue accessibility files (.rsa-files) generated by NACCESS into EXCEL, extract the sequences from these files into a sequence alignment and color-code the alignment according to side-chain accessibility. Contact residues at interfaces can be identified by calculating the residue accessibilities of the isolated components of a complex as well as of the entire complex and calculate the relative and absolute differences in solven accessible surface area.

Macros in the CFM

Using the macros in the CFM, data can be imported from other applications or exported to other databases. This effectively avoids complex programming work. Without any tedious programming, CFM can communicate with other databases.

If a macro is required to select a specific cell, perform an action, and then select another cell relative to the active cell, a mix of relative and absolute references can be made when the macro is recorded. This property is used in CFM when calculating the Bank-ECA loans in the Ratio Analysis and Bank-ECA modules.

The macros used in the CFM act as an interface, which provides data from the variables sections to the other modules, and for formatting the calculated data. Thus, any changes made in the calculations are reflected across all the modules.

APPENDIX 2

CASE STUDY - By Faisal F. J. Al-Thani
The Ras Laffan Liquefied Natural Gas Co. (RasGas)

The recent financing of the Rasgas LNG project established many precedents likely to have a major impact on the financing strategy of future LNG projects. Following is the case study of the Ras Laffan Liquefied Natural Gas Company (Rasgas), which shows that project financing is more effective than traditional financing. The reason that Ras Laffan Liquefied Natural Gas Company is used as a case study is due to the fact that this is a multi-national company (Exxon/Mobil) which will be useful in evaluating the limitations that they face with the financial models they use and their most essential needs in a comprehensive model. Secondly, since they are based within the location, it would be easy to have access to key personnel to gain knowledge and data for the proposed work

INTRODUCTION

The State of Qatar, following independence in September 3, 1971, began to assess how to maximise the benefits of finite, non-renewable crude oil and natural gas reserves for the benefit of its people. In 1975, the Government of Qatar assumed responsibility for the operation and management of its hydrocarbon reserves and resources for that end. While initially projects were funded by the State of Qatar, selected Operators were invited through various Joint Venture Projects and Production Sharing Agreements to provide advanced technology and investment capital to expedite development of known hydrocarbon accumulations and high risk exploratory drilling of unexplored, subsurface geological formations.

Early on, it was recognised that the super-giant North Field had the potential to provide long-term resource revenues well after relatively less abundant and diminishing crude oil reserves were completely produced in the early decades of the next century. Thus, long-term economic growth within the State of Qatar is heavily dependent upon the successful exploitation of the large natural gas reserves by various gas utilisation projects to generate export revenues. In this context, the North Field Phase 1 development to satisfy domestic demand, and a proposed second development to satisfy increasing domestic demand are more restricted in scope and do not require application of the model capital structure.

The commercial developments in Qatar to date have focused on LNG projects whereby the natural gas is purified, and liquefied at cryogenic temperatures for transportation by LNG carrier ship to foreign buyers. Other proposals are a regional pipeline grid supplying electric power plants throughout the Gulf Cooperation Council (GCC, comprised of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) states, markets in Pakistan and India, as well as long distance pipelines to Europe. A recent, speculative proposal, is to convert natural gas to synthetic petroleum liquids, termed GTL (gas to liquids), is also being investigated.

All these projects have the common elements of purification of the natural gas by at large-scale processing plants followed by delivery to the end user by pipeline or LNG carrier. The GTL projects are a modification in the sense that the natural gas is converted to synthetic petroleum liquids and then moved by product carrier. Compared to crude oil, natural gas cannot be produced at the wellhead and then sold to the end user without these intermediate steps. This has the result of natural gas markets taking longer to develop by comparison to crude oil coupled with a relatively greater need for specialised, high-cost facilities.

The delay in the full utilisation of large-scale natural gas reserves is not unique to Qatar and is in fact regional in nature. Very little of the natural gas from the Middle East region has been exported. The reasons for this are many and are primarily linked to the former energy policies, geographical location, economics of gas transportation, and the size of local gas markets.

Thus, in this context, the model capital structure developed for LNG projects can be applied to pipeline projects, where the international pipeline is the analog to LNG carriers while for GTL projects the synthetic petroleum liquids correspond to LNG. Proceeding further, one can then discuss the application of the model capital structure to different market regions. For LNG, the market regions are North East Asia (Japan, Korea, and

Taiwan), South Asia (India), and west of Suez (short term contract sales to Spain, Turkey, and the USA).

To put future capital demands of around US$ 100 billion into perspective, that represents roughly 1000%, or ten times, the current Gross National Product (GNP) – need to double check precise value – of the State of Qatar. Thus, the computer simulation model to develop the model capital structure for sustained North Field development will be addressing a major, current, so-called "real world" problem for the State of Qatar that will place a perceptible demand on global capital available for fossil fuel energy projects.

THE RAS LAFFAN LIQUEFIED NATURAL GAS CO. LTD.

Ras Laffan Liquefied Natural Gas Company Limited is a Qatar joint stock company that was formed to engage in the business of producing and selling liquefied natural ("LNG"), condensate and other hydrocarbon products. The Company is 70% owned by Qatar General Petroleum Corporation ("QGPC"), a company wholly owned by the State of Qatar, and 30% owned by Mobil QM Gas Inc. ("Mobil QM"), a company wholly owned by Mobil Corporation ("Mobil"). The government of the State of Qatar (the "Government") has granted the Company the right to drill for and produce natural gas within a specified location in Qatar's principal gas field (the "North Field") and to sell a specified quantity of LNG and additional quantities of related hydrocarbon products for a period of not less than 25 years. The North field is estimated to be one of the largest known non-associated gas fields in the world, with proved and probable gas in place that is estimated to exceed 370 trillion standard cubic feet (approximately 63 billion barrels of oil equivalent ("BOE"). The Company believes that the North Field is, and for the foreseeable future will remain, the most significant natural gas reserve in the world for the production of LNG.

QGPC engages in all phases of the oil and gas industry in Qatar, including the exploration, production and sale of crude oil, natural gas, LNG and other hydrocarbon products. The State of Qatar's total crude oil production in 1995 exceeded 454,000 barrels per day, of which approximately 418,000 barrels per day accrued to the account of QGPC. The State of Qatar's total natural gas production in 1995 was 1,072 million standard cubic feet per day, all of which accrued to the account of QGPC. As of June 30, 1996, QGPC's consolidated total assets were approximately $7.1 billion. QGPC's consolidated total revenues and consolidated net profit for the six months ended June 30, 1996 were approximately $1.9 billion and $412 million, respectively. QGPC owns a majority of the shares of several companies engaged in the oil and gas business in Qatar, including the National Oil Distribution Company (NODCO), Qatar Petrochemical Company (QAPCO) and Qatar Fertiliser Company (QAFCO). QGPC is also a majority participant in another LNG project (the "Qatargas Project") which has begun to deliver condensate and which is expected to begin delivering LNG to Japanese customers in January 1997. In anticipation of the Company's development and construction of its first liquefaction process trains ("LNG Trains") and the development and construction of the Qatargas Project and other projects, QGPC has constructed new port facilities at Ras Laffan at the cost of approximately $975 million, which began initial operations in September 1996.

Mobil is one the world's largest integrated oil and gas companies. In 1995, Mobil was involved in exploration and producing activities in 35 countries on five continents, had producing operations in 16 of those countries, had ownership interest in 20 refineries in 12 countries, and marketed petroleum products in over 100 countries. Mobil's total production of hydrocarbons in 1995 amounted to approximately 1.6 million BOE per day, and natural gas accounted for approximately 50% of Mobil's total hydrocarbon production and reserves in 1995. With net proved reserves of approximately 6.6 billion BOE as of December 31, 1995, Mobil had more than an 11 year supply of hydrocarbons in 1995 at its then current rate of production. In 1995, Mobil replaced approximately 106% of its oil and gas production with new proven reserves. As of September 30, 1996, Mobil's consolidated total assets were approximately $46.2 billion. Mobil's consolidated total revenues and consolidated net income for the nine months ended September 30, 1996 were approximately $58.5 billion and $2.3 billion, respectively. Mobil has been involved in the LNG business since 1971 and is one the largest exporters of LNG in the world today. In addition to its interest in the Company, Mobil currently owns (through separate subsidiaries) 30% of an Indonesian LNG company that operates one of the largest LNG projects in the world and ten percent of the Qatargas Project. Mobil is one of the largest producers and marketers of condensate in the world. Mobil QM's business consists solely of its ownership interest in the Company.

The Company, QGPC and Mobil QM have entered into a Heads of Agreement with two Japanese trading companies, Itochu Corporation and Nissho Iwai Corporation (collectively, the "Trading Companies"). Pursuant to the Heads of Agreement, Itochu Corporation and Nissho Iwai Corporation will purchase a qualified participating interest in the Company of four percent and three percent, respectively, to be represented by a new issue of fully paid equity shares of class "B" capital stock of the Company. In addition, the Trading Companies have agreed to:

- Assist the Company in marketing its LNG in Japan
- Provide QGPC with a loan facility to assist QGPC in funding its share of equity contributions to the Company
- Make cash equity contributions to the Company.

The Company has entered into a 25 year sale and purchase agreement (the "Korea SPA") for the sale of approximately 2.4 million metric tons of LNG per year to Korea Gas Corporation ("KGC"). KGC, which is owned 50% by the Republic of Korea, 34.7% by the state owned Korea Electric Power Corporation and 15.3% by regional Korean governments, has been importing LNG since 1986 and is currently the sole importer of LNG into Korea. While any portion of the Senior Project Debt is outstanding, all amounts payable to the Company by KGC, pursuant to the Korea SPA, will be paid in dollars and deposited into an account to be maintained in the United States and will be distributed in accordance with the Finance Documents described herein.

Pursuant to the Korea SPA, KGC is required to take and pay for (or pay for if not taken) calculated quantities of LNG delivered to it by the Company FOB the port of Ras Laffan. The price payable by KGC for such quantities of LNG will be the greater or a market-based price and a minimum price. The market-based price is designed to incorporate an energy component that varies in accordance with the average price over a three-month period of specified oils imported into Japan and a fixed component that escalates on a yearly basis, and to reflect the incremental cost of transporting LNG from Qatar to Korea (relative to the cost of transporting LNG from Indonesia to Korea). The minimum price is \$2.50 per MMBTU (in 1993 dollars) and escalates at three percent per year until the Deemed Debt Repayment Date.

The Korea SPA provides that the price provisions contained therein may be modified, at the election of KGC, if and when the Qatargas Project concludes pricing negotiations with certain Japanese purchasers of LNG. Under these circumstances, KGC would have a one-time option to elect one of the specified modified pricing arrangements that would result in one or more downward or upward revisions to the minimum price and transportation adjustment provisions in the Korea SPA. Each of these options provides for the elimination of the minimum price provisions from the Korea SPA in the event that these provisions are eliminated in such Japanese sale and purchase agreements. The Korea SPA also provides that the market-based price provisions contained therein may be modified, at the election of KGC, if the Company enters into a long term sale and purchase agreement on or prior to October 15, 1998 for the sale of LNG on FOB terms to an LNG buyer in Japan or Taiwan that contains a more favorable market-based price provision than that contained in the Korea SPA.

KGC has agreed to construct, or arrange for the use of, unloading, receiving, storage and re-gasification facilities at Korean unloading ports sufficient to enable it to fulfill its obligations to take delivery of the quantities of LNG specified in the Korea SPA and to construct LNG tankers that, with certain limited exceptions, will be dedicated to the shipment of LNG produced by the Company. From 1991 to 1995, KGC invested approximately $2.1 billion in a nationwide trunkline and facility expansion project that involved the development, construction and expansion of unloading, receiving, storage, re-gasification and distribution facilities, including a second LNG receiving terminal. In addition, KGC recently awarded contracts to Korean shipyards and Korean ship owners / operators for the construction and chartering of four LNG carriers that it expects to use for the transportation of LNG purchased from the Company. It is estimated that the cost of constructing these four ships will be approximately $1 billion.

The Company has entered into a lump sum contract with a joint venture consisting of JGC Corporation and the M.W. Kellogg Company for the engineering, procurement and construction of one or two LNG Trains and related onshore facilities (collectively, the "Onshore Facilities"). JGC and M.W. Kellog have performed engineering, procurement and construction work with respect to six and seven LNG projects, respectively. In addition, the Company has entered into a lump sum contract with a joint venture consisting of McDermott-EPTM East, Inc. and Chiyoda Corporation for the engineering, procurement, fabrication and installation of offshore platforms, and a lump sum contract with Saipem S.P.A. for the engineering, procurement, fabrication and installation of offshore pipelines (such platforms and pipelines and their associated facilities, the "Offshore Facilities").

The construction contract for the Onshore Facilities requires JGC and M.W. Kellogg to construct one LNG Train and its associated facilities and gives the Company the option, which it may exercise on or before March 1, 1997, to require JGC and M.W. Kellogg to construct a second LNG Train and its associated facilities. The Company has not yet exercised this option. Each LNG Train constituting the Project has been designed with a nameplate capacity of approximately 2.6 million metric tons of LNG per year and a one LNG Train Project is expected initially to produce approximately 6.2 million barrels of field and plant condensate per year. The Company believes that, within a period of three years after the completion of an LNG train, the LNG Train may be capable of producing as much as 115% of its nameplate capacity.

The sponsors of the Project and their affiliates have made or expect to make certain commitments in respect of the operation of the Project. Pursuant to a Project Services Agreement, each of QGPC and Mobil Qatar Management and Technical Services, Inc. ("Mobil QM&TS") have agreed to provide to the Company, either directly or through their affiliates, personnel and services, including technical advice, engineering services and training programmes. In addition, both QGPC and Mobil QM will provide to the Senior Project Lenders a several commitment (*pro rata* in accordance with its ownership interest in the Company) to lift and purchase from the Company specified quantities of condensate under certain limited circumstances (each such commitment a "Condensate Offtake Commitment"). The State of Qatar will guarantee QGPC's obligation in respect of its Condensate Offtake Commitment, and Mobil will guarantee Mobil QM's obligation in respect of its Condensate Offtake Commitment.

The Company's business currently consists exclusively of the development, construction, financing and ownership of the Project. Any expansion of the Company's business beyond its activities with respect to the Project would consist of the development, construction, financing, ownership and operation of additional LNG Trains and associated onshore and offshore facilities in the North Field and at the site of the Onshore Facilities (the "Project Site") and activities related thereto. Any such additional LNG Trains and facilities (the

"Expansion Facilities") beyond the first two LNG Trains and their associated facilities will not constitute part of the Project.

The Company currently has the right to produce and sell ten million metric tons of LNG per year and additional quantities of related hydrocarbon products for a period of not less than 25 years. Pursuant to the Finance Documents, the Company may, with the consent of the Government and upon the satisfaction of certain conditions, transfer to an affiliate a portion of these rights, so long as the company retains the right to produce and sell five million metric tons of LNG per year and those quantities of related hydrocarbon products associated therewith. If the Company transfers all or a portion of these rights, it may not have sufficient concession rights remaining to construct any Expansion Facilities.

FINANCIAL PLAN

The Company estimates that the total cost of constructing a one LNG Train Project will be approximately $2.5 billion and that the total cost of constructing a two LNG Train Project will be approximately $3.4 billion. The Company is in the process of negotiating commitments with a commercial bank group to finance a two LNG Train Project. Those commitments will require that a portion of that financing be supported by political and/or commercial risk guarantees or insurance is issued by export credit agencies ("ECAs"). The Company is seeking to obtain commitments from the ECAs of the United States, the United Kingdom and Italy with regard to the terms of such guarantees and insurance in the context of a two LNG Train financing. This Offering is not contingent upon obtaining financing from commercial banks or financing, guarantees or insurance from ECAs, and there can be no assurance that the Company will obtain any such financing or that, even if the Company obtains such financing, its terms will not differ in material respects from the terms described herein. Because of the strategic importance of the Project to both the State of Qatar and Mobil, QGPC and Mobil QM will make certain commitments regarding their minimum ownership interests in, and equity contributions to, the Company, and will guarantee their proportionate shares of the repayment of the Senior Project Debt if the Project has not passed a specified completion test by a certain date.

QGPC and Mobil QM will have the right to sell their shares of the Company's capital stock to a wholly-owned affiliate of their respective parents or if, among other things:

- At all times

- The State of Qatar and Mobil own, directly or indirectly, in the aggregate, on a fully diluted basis, not less than 51% of the outstanding shares of the Company and

  Each of the State of Qatar and Mobil owns, directly or indirectly , on a fully diluted basis, not less tan 21% of the outstanding shares of the Company
- Prior to the Indenture Completion Date
- Such sale does not result in a Rating Downgrade and

  In the event that the Company enters into the bank and ECA facilities described herein, such sale is approved by the Inter-creditor Agent, acting pursuant to the Inter-creditor Agreement.

In addition, both QGPC and Mobil QM will provide to the Senior Project Lenders a several commitment (*pro rata* in accordance with its ownership interest in the Company) to make equity contributions and/or unsecured, subordinated loans ("Shareholders Loans") prior to the Indenture Completion Date,

- if the Bank/ECA Facilities are not in effect, when required to do so under the Joint Venture Agreement pursuant to which the Company was established and
- if the Bank/ECA Facilities are in effect, of a certain minimum amount on or before the date of each advance under the Bank/ECA Facilities (each such commitment, a "Shareholder Commitment").

Both QGPC and Mobil QM will also provide to the Senior Project Lenders a several guarantee (*pro rata* in accordance with its ownership interest in the Company) requiring the payment to the Senior Project Lenders of all amounts outstanding in respect of the Senior Project Debt (including the Bonds) in the event that either the Indenture Completion Date has not occurred on or prior to the Indenture Guaranteed Completion Date or, prior to the Indenture completion Date, an event of default is not remedied within 60 days of the receipt by the Completion Guarantors of notice of the event of default and any of the Senior Project Debt is accelerated as a result thereof (each such guarantee, a "Completion Guarantee"). In order to achieve the applicable Indenture Completion Date, the Project will be required to satisfy certain completion tests, including tests designed to demonstrate the physical and operational integrity of the Project and tests that require the Company to satisfy certain financial ratios. In order for QGPC, Mobil QM or any other shareholder of the Company to transfer interests in the Company in accordance with the Finance Documents prior the Indenture Completion Date, any new shareholder will be required to assume its pro rata portion of the obligations under the Completion Guarantees and Shareholder Commitments.

QGPC's obligations in respect of its Shareholder Commitment, Completion Guarantee and certain other documents will be guaranteed by the State of Qatar and Mobil QM's obligations in respect of its Shareholder Commitment, Completion Guarantee and certain other documents will be guaranteed by Mobil.

The Company currently expects that a two LNG Train Project would be financed with the proceeds of this offering, equity contributions, and monies borrowed under the Bank/ECA Facilities, as described above. In order to accommodate a financing structure that may include Bank/ECA facilities in addition to Capital Markets Debt, the Company will enter into a Project Coordination Agreement with certain ECAs, Facility Agents, the Bond Trustee, a Security Trustee and an Inter-creditor Agent, which will contain, among other things, affirmative and negative covenants and events of default applicable to the Bank/ECA Facilities. Under the terms of the Indenture, the Company will be permitted to incur Senior Project Debt not to exceed the greater of $1.2 billion and any amount permitted to be borrowed in accordance with the Project Coordination Agreement (so long as the Company reasonably believes it will be able to satisfy the conditions associated with the Indenture Completion date on or prior to the Indenture Guaranteed Completion date), and will be permitted to incur additional Senior Project Debt only if it satisfies certain financial ratios and if the incurrence of such Debt would not result in a Rating Downgrade.

RISK FACTORS

As this is a case study, some of the statements constitute the time during the inception of the company. As of now these statements may not be valid as they would have been overcome and the related problems solved. These statements are provided to give an overview of the risk factor involved during the early stages of building a new project/company for the oil and gas industry.

Certain statements below that are not historical facts, constitute "forward-looking statements". Such forward-looking statements involve known and unknown risks, uncertainties and other factors which may cause the Company's actual results to differ materially from results expressed or implied by such forward-looking statements. Such *risks, uncertainties and other factors include, but are not limited to, the matters described below.*

Limited Recourse Obligations

With the exception of the Shareholder Commitments, Completion Guarantees, Condensate Offtake Commitments and Parent Guarantees, the Senior Project Lenders, including the Bondholders, will have no recourse to the shareholders of the Company or their affiliates (other than the Company). In addition, with the exception of the Completion Guarantees and the Parent Guarantees in respect thereof (and, in any event, following the termination of these guarantees), the obligation to make payments of principal of and interest on the Bonds and the other Senior Project Debt will be an obligation solely of the Company.

The Company's sole assets are its interests in the Project (which is currently under construction), the Project Documents and the other assets and agreements related to the operation of the Project, and the Company will not receive any material revenues until the company begins to produce condensate and the company's first LNG train commences deliveries under the Korea SPA. Following the termination of the completion guarantees and the parent guarantees in respect thereof, these assets, including the cash flow of the company, will be the sole sources of funds for the payment of principal of and interest on the senior project debt, including the bonds. Operations and maintenance expenses, Qatari taxes and royalties payable to the State of Qatar will be payable prior to the payment of debt service with respect to the senior project debt, including the bonds. No assurance can be given that revenues generated by the project will be sufficient to pay operations and maintenance expenses, Qatari taxes, royalties payable to the State of Qatar and the principal of and interest on the senior project debt, including the bonds.

Reliance On a Single Customer or Few Customers

The company has entered into a long term LNG sale and purchase agreement with KGC for the sale of approximately 2.4 million metric tons of LNG per year, and the company currently is negotiating other long term LNG sale and purchase agreements with several potential purchasers. There can be no assurance that any other these negotiations will result in the execution of one or more additional long term sale and purchase agreements. Moreover, because there are a limited number of LNG customers, the company would, even upon the execution of additional long term LNG sale and purchase agreements, be likely to have few LNG customers. Accordingly, the company will be dependent upon KGS's fulfillment of its obligations under the Korea SPA for a considerable portion of the company's revenues and any material failure by KGC to fulfill such obligations could have a material adverse effect on the company's ability to make payments of principal of and interest on the senior project debt, including the bonds.

Korea SPA Pricing Risks

The pricing provisions currently contained in the Korea SPA may be modified, at the election of KGC, if the Qatargas Project concludes an agreement with certain Japanese buyers with respect to pricing. The Korea SPA contains two options, either of which may be exercised by KGC within a specified time period following the conclusion of such an agreement. KGC may exercise either of these options and may make that election only once. Either option essentially would grant KGC "most favored nations" status with respect to these Japanese purchasers, such that the relevant pricing provisions in the Korea SPA would track increases or decreases to those in the sale and purchase agreements between the Qatargas project and such Japanese buyers (the "Japanese SPAs). one options permits KGC to adjust the minimum price provisions either on a one time basis or each and every time an adjustment is made to the minimum price provisions in the Japanese SPAs. The other option permits KGC to adjust its minimum price provisions each and every time and adjustment is made to the minimum price provisions in the Japanese SPAs and to adjust the transportation cost discount that is applied to the market LNG price provisions of the Korea SPA every month. Both these options provide for the elimination of the minimum price provisions from the Korea SPA in the event that these provisions are eliminated in a Japanese SPA. The Qatargas project entered into two Japanese SPAs and currently is negotiating the pricing provision under those contracts. Although QGPC and Mobil each have an interest in the Qatargas project, no assurance can be given that they will exercise any voting rights to maintain such pricing provision at any particular level. Accordingly, the price paid by KGC for LNG purchased under the Korea SOA may be modified one or more times, and the minimum price provisions could be eliminated entirely (thereby requiring the sale of LNG to KGC to be made exclusively in accordance with the market pricing provisions contained in the Korea SPA), for reasons beyond the control of the company.

If the minimum price provisions are eliminated from the Korea SPA (or if the minimum price is lowered) sales of LNG there under will be made (or will be more likely to be made) in accordance with the market price provisions contained therein, which are based primarily on the average price of specified oils that are imported into Japan. Furthermore, the market price payable by KGC may be reduced due to an increase in the transportation cost discount pursuant to one of the options described above. Historically, the market for oil ahs been volatile, and it is likely to remain volatile in the future. Prices for oil are subject to wide fluctuations in response to market uncertainties, changes in supply and demand, international political conditions, the price and availability of alternative fuels, overall economic conditions and other factors, all of which are beyond the control of the company. Accordingly, a modification to or the elimination of the minimum price provision in the Korea SPA would render the prices under the Korea SOA more uncertain. Because the sale of LNG to KGC constitutes a significant portion of the company's revenues, such a modification, including but not limited to the elimination of the minimum price, could have a material adverse effect on the company's ability to pay principal of and interest on the senior project debt, including the bonds.

Korea SPA Force Majeure Risks

The Korea SPA requires KGC to take and pay for (or pay for if not taken) certain calculated quantities of LNG. However, this obligation may be suspended upon the occurrence of specified force majeure events. If all or any portion of the LNG required to be delivered by the company in any given year is not delivered by the company (or, if delivered, is not taken by KGC) as a result of the occurrence of any such force majeure event, then KGC will not be required to pay for such LNG in the year in which the force majeure event occurs. Instead, KGC's obligation to pay for such LNG will arise only when, and to the limited extent that, the Korea SPA permits or requires the addition of amounts required to be taken and paid for (or paid for if not taken) during a subsequent contract year. As such, the occurrence of a force majeure event that suspends KGC's obligations in respect of the purchase of a significant amount of LNG could have a material adverse effect on the company's short or long term revenues under the Korea SOA, and could, therefore, impair the company's ability to make payments of principal of and interest on the senior project debt including the bonds.

Operating Risks

The project is under construction and therefore has no operating history. As with any complex facility, operation of the project will involve many risks, including the breakdown or failure of equipment or processes, the performance of equipment at levels below those originally demonstrated (whether due to misuse, unexpected degradation or design or manufacturing defects), failure to keep on hand adequate supplies of spare parts, operator error, labor disputes, and catastrophic events such as fires and other similar events, many of which are beyond the control of the company. The occurrence or continuance of any of these events could increase the cost of operating the project and/or reduce the amount of LNG, condensate and other hydrocarbon products available to be sold.

Although the Contractors have provided certain guarantees and warranties as to freedom from defects in construction, these guarantees and warranties are limited to an obligation to re-perform engineering, purchasing, construction and other services to remedy equipment defects. In addition, there can be no assurance that the project will continue to operate at its design specifications after the expiration of these guarantees and warranties.

The company will be obligated under certain Finance documents and Project documents to obtain and keep in force comprehensive insurance with respect to the project, including all risk property damage insurance, third party liability insurance, and business interruption insurance. However, the company will not be obligated to maintain any of the insurance that is required to maintain under the finance documents if the inter-creditor agent determines, in accordance with terms of the inter-creditor agreement, that such insurance is not available to the company on commercially reasonable terms. The terms of the inter-creditor agreement will provide that the Bondholders are not entitle to vote on this determination. There can be no assurance that such insurance coverage will be available in the future on commercially reasonable terms or at commercially reasonable rates or that the amounts for which the company is insured, or the proceeds of such insurance, will compensate the company fully for its losses. In the event there is a total or partial loss of the project, there can be no assurance that the insurance proceeds received by the company in respect thereof will be sufficient to satisfy all indebtedness of the company.

Furthermore, in the event of a total or partial loss to the project, certain items of equipment, such as heat exchangers, LNG storage tanks and refrigerant compressors, may not be easily replaced because they are sufficiently large and project specific such that replacement units generally are not readily available. Accordingly, notwithstanding that there may be guarantee coverage, warranty coverage or insurance coverage, the remote location of the project, the large size of some of the equipment, and the extended period needed to manufacture replacement units could give rise to significant delays in replacement.

Closing of Bank/ECA Facilities

The company is still negotiating many issues with the Banks and ECAs with respect to their extension of credit and other support for a two LNG Train project. None of the banks or ECAs have obtained final credit or underwriting approval in respect of the Bank/ECA facilities described herein. The banks are in the process of obtaining such approvals. Not withstanding any such approvals, none of the banks or ECAs has agreed to the finance documents described herein. There can be no assurance that the company will reach any agreement with regard to any or all of the Bank/ECA facilities or that, even if the company obtains such financing, its terms will not differ in material respects from the terms described herein. The indenture will permit the finance documents (other than the indenture and the Bonds) to be amended or modified without a vote of the Bondholders on or prior to the Bank Financial Closing so long as the company provides a certificate (which must be delivered in good faith) to the effect that such amendment or modification could not reasonably be expected to have an indenture material adverse effect and will not result in a rating downgrade.

State of Qatar; Sovereign Action

The project is located in the State of Qatar and is subject to political, economic and other uncertainties, including the risks of war, expropriation, nationalisation, renegotiation or nullification of existing contracts, changes in taxation policies, currency exchange restrictions, international monetary fluctuations and changing political conditions. The finance documents will not require the company, and the company does not intend, to maintain insurance against such risks. The company has been advised that Qatari law expressly provides that t concession to benefit from or exploit public state property may be cancelled before the expiration of its term by a decree, and that the beneficiary may be compensated by a payment which represents all or a part of the cost which it incurred in connection with the granting of the concession. The company has been granted concessions to benefit from or exploit both the project site and the contract location, each of which is private property of the State, which concession may be cancelled by the State exercising its inherent authority.

The government traditionally has played a central role in the development of Qatar's hydrocarbon reserves, and has exercised, and continues to exercise, significant influence over certain other aspects of the Qatari economy. Accordingly, future actions by the government concerning the economy or the operation and regulation of nationality important facilities such as LNG facilities could have a significant effect on the company. There can be no assurance that future developments in the State of Qatar will not have material adverse effect on the project's operations and the company's revenues.

In addition, although most of the North Field underlies Qatari territory, a portion of the North Field underlies the territorial waters of the Republic of Iran. Qatar and Iran concluded a maritime border agreement in 1969, and boundary between the two countries is not disputed. Nevertheless, it is possible that a dispute not presently foreseen could arise between the State of Qatar and the Republic of Iran regarding the boundary between the tow states as it relates to the North Field or the amount of gas contained therein to which each state is entitled.

The State of Qatar is a foreign state. Consequently, it may be difficult for investors to obtain or realise upon judgments of courts in the United States against the assets of the State of Qatar. The State of Qatar has waived or will waive its sovereign immunity in respect of proceedings brought against it with respect to the transactions contemplated by certain operative documents to which it is party. To the extent that the State of Qatar has not waived its immunity under an operative document, enforcement of a judgment or an arbitral award against the State of Qatar may be further subject to laws providing defenses to sovereign states against enforcement or foreclosure of assets.

Regional Risk

The State of Qatar is located in a region that is strategically important and that has, at times, been politically unstable. Regional was, such as the Gulf War of 1991, or other forms of instability in the Middle East that may or may not directly involve the State of Qatar could nevertheless have an adverse impact on Qatar's ability to engage in international trade. The State of Qatar, like its neighboring states, relies heavily on the ability to send and receive ships through the Straits of Hormuz. The blockage of the Straits of Hormuz could adversely affect the ability of the company and its customers to transport the LNG, condensate and other hydrocarbon products that will be produced by the project, and could, therefore, have a material averse impact on the company's revenues and its ability to make payments of principal of and interest on the senior project debt, including the bonds.

Dissolution of the Company

Pursuant to the terms of a Joint Venture Agreement between QGPC, Mobil QM (the "Joint Venture Agreement") and the Articles of Association of the company, the company will be dissolved automatically upon the bankruptcy (as defined in the US internal revenue code of 1986) of any of its Shareholders.

Although it is a condition precedent to the indenture completion date that either the dissolution provision be deleted or amended, no assurance can be given that a shareholder may not become bankrupt or that the remaining shareholders would vote to continue the company. If the company were to be dissolved, under Qatari Law, a liquidator would be bound to discharge the liabilities of the company in full or pro rata out of the available assets as of the date of a winding up resolution of the shareholders or of a winding up order issued by a Qatari court. Thereafter, there may not be a source of repayment of the bonds (other than the completion guarantees if the completion guarantees are in effect).

Related Party Transaction; Conflicts of Interest

The Qatargas Project, whose liquefaction facilities will be adjacent to the project site and which eventually will have the capacity to produce up to six million metric tons of LNG per year, is owned 65% by QGPC and 10% by an affiliate of Mobil. Pursuant to the Sharing Agreement that the company has discussed entering into with Qatar Liquefied Gas Company Limited, the project and the Qatargas project may share certain facilities, services and data. The effectiveness of the Sharing Agreement, if entered into, will require the consent of a variety of third parties, including the lenders to the Qatargas project. There can be no assurances that such lenders would consent to the Sharing Agreement or that the company and the Qatargas project ever will enter into the Sharing Agreement. If the company does not enter into the sharing agreement, it will need to construct or otherwise arrange for the use of certain facilities that it intended to share with the Qatargas project.

In addition, QGPG, in its capacity as port authority with respect to the Ras Laffan port, has entered into agreements that allow both the project and the Qatargas project to use the port of Ras Laffan. Furthermore, QGPC also is leasing the project site to the company. No assurance can be given that conflicts of interest may not arise between the two projects or between QGPC, in its capacity as the port authority pursuant to the port users agreement or the manager of the Project site in accordance with land lease and the company.

Corporate Disclosure and Accounting Standards

There is less public information available about the company, QGPC, Mobil QM and the State of Qatar than is regularly published by, or about, similar entities in the United States or certain other countries.

QGPC's financial statements for the years ended December 31, 1993, 194 and 1995 and for the six months ended June 30th 1996 were prepared on a consolidated basis in accordance with the requirements of the council of ministers decision, which differs in certain significant respects from the U.S. GAAP. Mobil QM financial statements were prepared in accordance with generally accepted accounting principles adopted by the international accounting standards committee, which also may differ in certain significant respects from U.S. GAAP. Accordingly, the financial statements of QGPC and Mobil QM may contain information different than that which would have been contained in the financial statements of such companies had their financial statements been prepared in accordance with U.S. GAAP.

Absence of an Established Market for Bonds

Prior to the offering of Bonds, there has been no market for the Bonds. Although the purchasers intend to make a market for bonds, they are not obligated to do so and any market making may be is continued at any time without notice. Moreover, if a market for the bonds does develop, the bonds could trade at prices that may be higher or lower than the initial offering price thereof depending upon a number of factors, including prevailing interest rates, the company's operating results, events in Qatar or elsewhere in the Middle East, and the market for similar securities. If a market for the bonds does not develop or continue, purchasers may be unable to resell the bonds for an extended period of time, if at all. Consequently, a purchaser of the bonds may not be able to liquidate its investment readily, and the bonds may not be readily accepted as collateral for loans.

COMPUTER SIMULATION MODEL

AREA FOR THE DEVELOPMENT OF SIMULATION MODEL

1. **Availability** – means the number of days during which the facilities are extracting the gas / condensate mix. Typically, this is 333 days based on:
   - Average planned shutdown of 13.3 days based on a three-year cycle of 5 days, 5 days, and 30 days.
   - Upstream availability of 96.8%
   - LNG plant availability of 95% per train.

2. **LNG offtake sensitivity** – means a modification of LNG offtake quantities during the Build-Up period to plateau rate (governed mostly by the actual delivery date or availability of other LNG carriers). In practice, during this ramp-up period, short-term sales to other buyers can be made, provided it is demonstrated to the banks and the long-term buyer (who supported the SPA) that there will be no effect on reliability of contractual deliveries.

3. **Condensate/Gas Ratio Sensitivity** – the actual condensate content of natural gas in the North Field varies with area location and depth. Thus, for different concession areas within the North Field, actual condensate content and individual well gas production rates do vary. Individual contract areas are generally ten kilometers by ten kilometers with a one kilometer buffer region between each area. The basis for this was detailed numerical reservoir simulation studies that demonstrated this strategy to optimise the long-term reserve recovery in the North Field. Full details of the modeling results and ongoing updates are not available.

4. **Project Completion Date** – latest date has to match the latest possible date for the starting point of repayment.

5. **Export Commencement Date** – separate dates for condensate and LNG. Condensate production can begin earlier than LNG, as fewer facilities are required. Gas produced that cannot be used by the LNG plant is fed to the domestic gas grid within Qatar. There is also provision in the event of a production upset for the domestic gas grid to provide gas to the LNG plant on an interim basis until gas production operations are restored.

6. **Delivery Commencement Date** – first date of gas delivery to the LNG plant.

7. **Build-Up Period** – the dates for the Start and End of this period are defined by the LNG SPA. Their only use is to determine LNG offtake sensitivity in the event that short term contracts and the necessary LNG carriers are secured.

8. **Market Crude Oil Price** – published crude oil price used in the LNG price formula. LNG pricing, in general, is based on crude oil delivered to Japan with adjustment for transportation costs to other buyers.

9. **Production Volumes** – LNG, field condensate produced by separation from the feedstock gas prior to entry into the LNG plant, plant condensate produced during the purification and liquefaction process, and sulphur (recovered during purification). Independent technical consultants confirm the validity of these estimates used by the coordinating bank.

10. **Capital and Operating Costs** – these include the costs to construct the project in accordance with the EPC (engineering, procurement, and construction) contract. It should be noted that all LNG projects are put out for competitive tender and as a result the costs are known and defined prior to arranging financing. Operating costs are estimates although sufficient world experience has been gained that such estimates are reliable (although always confirmed by an independent technical expert).

11. Contractual Data - This includes:

- revenue sharing arrangements, examples are production sharing agreements, royalty schedules, applicable tax rates and tax holidays (if applicable)
- bonuses, payable to the State of Qatar upon completion of a specified task
- all are defined contractually
- For the purpose of the general model, an integrated scheme including both production and LNG processing facilities will be used. The State of Qatar has built export port facilities.

12. Financial Structure

- The financing plan – consistent with the provided in the project underwriting term sheet.
- Maximum commitment for each loan facility – maximum loan – any additional costs have to be paid by a cash call to the Shareholders.

13. Project Support

- Cash flow deficiency support (in the event that revenues are not sufficient to meet the minimum repayment schedule, Shareholders are liable to make up the difference).
- Cross-subsidy – extra funds from other revenue streams (LNG versus condensate) are made available to meet the minimum debt repayment targets for loans where the revenues are inadequate.

14. Trigger Ratios

- Prepayment mechanism – defines under what circumstance a loan is prepaid.
- Target amortisation – compares to minimum amortisation, which defines the minimum repayment required at any one time.

15. Timing of the Financing

- Signing of credit agreements (triggers payment of upfront fees).
- Starting point of repayment (defined as per term sheet)
- Initial repayment ate (defined as per term sheet)

16. **Margin Fees and Premia - Libor – base rate for setting interest rate levels.** Officially, London Inter Bank Rate. Margins and interest rates – actual costs of the loan Fees and premia – other charges by lead lenders

17. **Amortisation Schedule -** Varies by loan – refers to term or number of years over which the loan is repaid. Price Forecast, Production Forecast, and Amortisation Schedules
    - Price Forecast for Marker Crude oil
    - Production forecast (start with contractual build-up schedules)

18. **Dividend Forecast**
    - Cash payments (dividends) made to Shareholders

********************* ***End of Case Study*******************

APPENDIX 3

RESULTS OF THE INTERVIEWS

In order to get a feedback as to the problems facing the current models, interviews were conducted with key personnel from the oil and gas industry. The author enlisted the help of some Qatari Students from the School of Economics, University of Qatar. Some of the faculty of the University were also interviewed for the purpose of assessing the need for a comprehensive financial model for oil and gas projects. The results are projected in the table below. Apart from the interview results shown below, the author sees an excellent opportunity to further interview relevant people at the upcoming 4th International Gas Conference to be held in March in Qatar.

The interview was conducted by using five basic questions. This would help to evaluate the requirements of a new financial model for the oil and gas industry. The questions were:

Question 1 : In your opinion, what are the problems facing your current Financial Model?

Question 2 : What is the basis of your Financial Model and Who developed?

Question 3 : When was the last time your Model was updated?

Question 4 : What is your opinion on the forecasting principle of building a Financial Model?

Question 5 : Any other comments?

The results are documented in the following page:

Comprehensive Financial Model

Position Title	***Company***	***Question 1***	***Question 2***	***Question 3***	***Question 4***	***Question 5***
Qatar General Petroleum Corporation	Financial Analyst, Project Finance	Too complex to understand	Forecasting. Developed in-house	2 years	Good	A good financial model needs to be developed that is not very complex and can be used by any new person to the firm.
Qatar General Petroleum Corporation	Manager Financial Accounting	Very Rigid. Not much room for changes	Financial Planning. In-house	Not sure	Not sure, but think it is the best	The oil and gas industry should have 1 model to evaluate projects and this should be used by all firms. This model should be flexible enough to make changes according to the requirements of the project.
Qatar General Petroleum Corporation	Manager, Project Evaluation & Planning	No problem	IRR and PI. Self	3 years	This is a good principle for the model to be based on.	Although I have no problems with my model, it is necessary that this industry have an appropriate model which incorporates all the aspects concerned. This way all projects can be evaluated by any third party and compare it at any given time.
Qatar Liquefied Gas Company Ltd.	Project Manager – Trains 1 & 2	Not well documented, difficult to use, specially for a new	Investment Appraisal. Borrowed from another company.	Probably 3 years or more	Forecasting is good for the oil & gas industry, however not	Since the oil and gas industry is similar worldwide and prices of these products are controlled, there should be only one model that should exists which incorporates all the prices and risks factor, however should be able to change according to the geographic

		employee.			for others.	situation of the project.
Qatar Liquefied Gas Company Ltd.	Deputy Treasury Manager	No problem	IRR and PI. Self	3 years	This is a good principle for the model to be based on.	Although I have no problems with my model, it is necessary that this industry have an appropriate model which incorporates all the aspects concerned. This way all projects can be evaluated by any third party and compare it at any given time.
Exxon-Mobil	Director, Project Finance	Does not take price changes and risks involved.	Financial Planning. In-house	Already in place when I joined.	Could be complex in the long run	Right now, each company uses its own model to evaluate projects. However, if a comprehensive model exists (which is flexible enongh to change according to the requirements of the concerned project) through which all projects can be evaluated, then comparison is very practical. In order to invite financial investments, the host company can always evaluate a project in a positive manner. However, if a model of international standards exists, then the investing company can always double check to confirm if the project is viable.
Exxon-Mobil	Senior Planning Advisor (Qatar	It is quite complex and can be	Forecasting is the main basis	Probably a year old	This is a good principle to	As mentioned, our model is quite complex and can be fully understood only by a person who is working with it. It takes a lot of effort to document the

	New Business Development)	understood only by few			build a Financial Model	working of this model and also very difficult to convey the mechanisms of it output. Also it is quite rigid and has not much room for flexibility. A single financial model for all oil and gas projects is the need of the hour.
Exxon-Mobil	Accounting Manager	Rigid and Controlled	Based on current prices & developed by self	4 years	Forecasting is better than current prices	Essentially, a single comprehensive financial model for the entire oil and gas industry is very essential. This would eliminate room for error and should also be very flexible.
Wintershall	Manager New Ventures	Can be used for any project and directed towards specific industry	Considers mainly risk management and current prices	Two years although is modified as required	Forecasting is good as it takes into account not only current, but future prices as well.	A financial model has to be focused on just the aspect that it is meant to be dealing with. In other words, there should be a specific model for a specific industry. Hence it is imperative that a specific model be created for the oil and gas industry taking into account all the required elements like prices, risk factors and royalties if any.
Wintershall	Acquistions / New Ventures	Needs lot of repairs to suit oil and gas	Current prices and risks involved	Probably couple of years	Excellent, taking future aspects is	Basically, a fresh and new financial model is essential that is specifically related only to the oil and gas industry. This would be beneficial in many

		project			logical	ways to both the host of the new project and also to facilitate investors adjudge the viability of the project.
Arco Qatar	Finance Manager	Not too many problems, however it does lack flexibility	Forecasting principle, developed in-house by the financial analyst	3 to 4 years, although modified from time to time	It has worked just fine for us and definitely is good for the oil and gas industry.	A single most comprehensive model is essential for the oil and gas industry. It would be very helpful if such a model is developed and utilised as a standard in the oil and gas industry world wide.
Arco Qatar	Commodity Manager	Works reasonably well, could need a facelift.	Considers future aspects of the industry and hence uses forecasts.	Probably more than 2 to 3 years	Forecasting is the best base of a financial model for the oil and gas industry.	A good model should incorporate all factors related to the industry it is built for. As such, there should be one for each industry or sector. Am sure a new model for the oil and gas industry is quite essential with all the developments that are ongoing and predicted for the future.
Arco International	Manager, New Business Ventures	None right now, but the model does	Forecasting principle, probably built	Several years ago	Not only because we use it, but the	It would be wise if a single comprehensive financial model is created only for oil and gas projects. As this would be unique only for the oil and gas

		seem a little outdated and could use some modifications	in-house		nature of the oil and gas industry, requires it.	industry, all aspects could be considered to make this model user friendly, flexible due to the volatile price changes and also consider all the risks aspects involved in this industry. This would benefit both the host of the project as well as new investors.
Professor	School of Economics, University of Qatar	NA	NA	NA	Good	Right now as there is no standard model to evaluate oil and gas project worldwide, we just have to show the students the different models used for different projects. Some could be quite complex and not well documented. However, if a comprehensive and flexible model could be created only for oil and gas projects, which could be manipulated according to the price change and risks of each project, that would be of great help in educating the new generation economist.
Student	School of Economics, University of Qatar	NA	NA	NA	Presume this is the best method	A consistent and comprehensive financial model related only to the oil and gas industry would be very beneficial for us students as we are situated in an oil and gas producing and exporting nation. This model would enable us to prepare to enter into this industry

						and study more about it right from our academic years and be able to be more fruitful employees of this industry and better citizens of our country.

The above are some of the interviews documented in order to get an idea of the inclination of the people interviewed. However, many more interviews were conducted over the past couple of months and the main concept of the results suggested that all were unanimous in their desire of a new comprehensive financial model be created which is specifically suitable just for the oil and gas industry. They expressed their concerns as to the current existing models being not too flexible and also many not being well documented and since different models were used by different operators, it was difficult to get a specific result for any given project. Below is a list of people **(from the oil and gas industry)** interviewed who cited a strong need for a new and fully dedicated financial model only for oil and gas projects world wide.

Name of Company	**Position of Person Interviewed**
Qatar General Petroleum Corporation	Asst. Manager – Planning, Economics and Administration
Qatar General Petroleum Corporation	Asst. Manager – Exploration
Qatar General Petroleum Corporation	Head of Planning, Corporate Planning
Qatar General Petroleum Corporation	Senior Business Planner, Corporate Planning
Qatar General Petroleum Corporation	Senior Planning, Economics and Contracts Engineer
Qatar General Petroleum Corporation	Financial Analyst, Project Finance
Maersk Oil Qatar	Manager, Project Finance
Chevron Overseas, Qatar	Financial Analyst

Arco Middle East & Central Asia	Regional Exploration Manager
Arco Qatar	Operations Manager
Arco Qatar	Engineering Manager
Arco Qatar	Business Manager, Project Management Team
Arco Middle East & Central Asia	Legal Vice President
Arco Middle East	President
Arco Global Procurement	Manager, Strategic Sourcing
BP Amoco	Technical Manager, Middle East New Business
BP Amoco	Regional Manager, America's
BP	Commercial Analyst
BP	Business Development Manager, Global LNG Gas and Power
BP	Deputy BP Chief Representative
Exxon-Mobil	Vice President, New Business Development and Planning
Exxon-Mobil	Vice President, Administration
Exxon-Mobil	Manager, Industry Analyst
Exxon-Mobil	Study Manager
Wintershall	Manager, Reservoir Development
Wintershall	New Business Manager
Wintershall	General Manager

Bankers' Views On A New Comprehensive Financial Model For The Oil and Gas Industry:

Based on the interviews conducted with Personnel from Major Banks, both international and local, the results have been quite unanimous and consistent in stating the overall need for a comprehensive financial model for oil and gas projects world wide. Bankers expressed their need to have a single comprehensive model for oil and gas projects as it would be beneficial to them also. The main reason being that they would be able to independently assess the viability of the proposed project or venture and based on the IRR or PI be able to rightly judge the merits of successfully providing financial aid or support to the project, without relying on third party assessment of the project. This would eliminate quite of few risks involved with project financing of new or existing oil and gas ventures. Listed below are some of the banking personnel interviewed that led to the unanimous above results.

Name of Bank	**Position of Person Interviewed**
Qatar National Bank	Manager, Corporate Banking
Al-Ahli Bank of Qatar	Credit Manager
Doha Bank Limited	Assistant Manager, Investment Department
Qatar International Islamic Bank	Manager, Corporate Finance and Retail Banking
Qatar International Islamic Bank	General Manager
Mashreq Bank	General Manager, Doha Branch
Mashreq Bank	Manager, Risk Management, Doha Branch
Arab Bank plc	Assistant General Manager
National Bank of Abu Dhabi	Deputy Head of International Banking
ANZ Grindlays (Grindlays Qatar Bank)	General Manager

ANZ Grindlays (Grindlays Qatar Bank)	Relationship Manager Business Bank
First Union National Bank	Vice President & Regional Manager – Middle East, North & West Africa
Standard Chartered	Manager, Priority Banking, Doha Branch
Standard Chartered	Manager, Corporate Banking, Doha Branch
Standard Chartered	General Manager, Doha Branch
HSBC	Corporate Banking Manger, Doha Branch
HSBC	Corporate Banking Supervisor, Doha Branch
Union de Banques Arabes et Francaises – U.B.A.F.	General Representative, Dubai Office
The Export – Import Bank of Japan	Director General, Loan Department (Natural Resources Development)
The Export – Import Bank of Japan	Deputy Director, Loan Department (Natural Resources Development)

Personnel From Private Companies:

Members of the private sector did not have much to emphasise the need for a comprehensive financial model for the oil and gas industry, however they were quite unanimous in expressing their desire to be able to have access to one if it existed or was created. The reason being that their Financial Analysts would be able to consider the projects viability specially when it comes to bidding for contracts or supply of materials for the construction and commissioning of any new or existing oil and gas ventures. Being situated in an oil and gas producing / exporting country and region, access to such a model would be deemed necessary for all private companies and contractors who would wish to have dealing with this industry in the country or region.

Name of Company	**Position of Person Interviewed**
Ministry of Finance, Economy & Commerce, Qatar	Legal Expert

Mannai Corporation	Chief Executive Officer
Qatar National Navigation & Transport Co. Ltd.	Assistant Chief Executive, Commercial & Technical Services
Al-Ahlia Investment Co.	Business Manager
ABG Exploration Limited	General Manager, Middle East
Origin Middle East	Business Development Director
Deminex, Germany	Head of Cost Engineering
Intervest, Independent Investment Consultants	Regional Director
Mitsui & Co., Ltd	General Manager, Doha Office
Mitsui & Co., Ltd	Assistant General Manager, Doha Office
Mitsui & Co., Ltd	Assistant Manager, Doha Office
Nippon Ysen Kaisha (NYK) Line	Director
ABB Vetco Gray (Pte) Ltd.	District Manager, Qatar

APPENDIX 4

EXISTING FINANCIAL MODELS

In order to verify the working of the CFM and validate the results, eight existing models were reviewed and analysed. Four comparable models were documented in chapter 7 of the CFM and the remaining four that are less significant are documented in this Appendix. All eight models are provided herein.

1. REVIEW OF FINANCIAL MODEL NO. 5

Output: Development costs like sunk costs; drilling in tang, drilling tang, drilling dry hole, facilities and offshore details are provided. Operating costs (upstream and downstream) such as condense; gas, fixed, and overhead are provided. Downstream details like facilities and OPEX are also provided. Pipeline costs as facilities and OPEX are also provided. Details of liquid production are displayed. Gas sales production is also provided which is calculated from the Top (100%) and btu/scf.

Liquids Calculation: Liquids calculation like average condensate yield, Condensate mmb and Condensate mbd are provided. Average LPG yield, LPG mmb, C3 mmb and C4 mmb details are also provided.

2. REVIEW OF FINANCIAL MODEL NO. 6

Capital: Capital details like Bonus, Wintershall and Carry are provided.

Cash Flow Impact: Details of bonus, Wintershall, GS carry and total are provided. The exposure is arrived based on the total cash flow. Discount factor is calculated based on the cash flow year. Present Value (PV) bonus is the product of Bonus and discount factor. PV Wintershall is the product of Wintershall and bonus. PV GS carry is the products of GS carry and discount factor. PV calculation is arrived from the discount factor and total cash flow. Internal rate of return (IRR) is calculated based on the natural algorithm of series of total cash flow. PV is calculated from the sum of PV calculation values. IE is calculated based on the net present value of the exposure value.

Net Income Impact: Gas ARCO Working Interest (WI), is the impact of writing off the MOA, bonuses, and the Wintershall bonuses. Sum of Carry interest and Gas ARCO WI is the Total impact.

3. REVIEW OF FINANCIAL MODEL NO. 7

Cash Flow Impact: Details of EPSA Company, pipeline, carry, swing storage margham and totals are provided. The exposure is arrived based on the total cash flow. Margham harvest and swing details are displayed. Discount factor is calculated based on the cash flow year. PV bonus is the product of Bonus and discount factor. Exploration and Production Sharing Agreement (EPSA) ARCO WI is the product of EPSA Company and bonus. Pipeline is the product of pipeline and discount factor. Swing storage margham is the product of itself and discount factor.

Economics: Internal rate of return (IRR) is calculated based on the natural algorithm of series of total cash flow. PV is calculated from the sum of PV calculation values. IE is calculated based on the net present value of the exposure value.

4. REVIEW OF FINANCIAL MODEL NO. 8

W/S Carry: Details of total WinterShall (WS) cash flow are provided for a period. Breakdown of 1998 PV disc factor is calculated based on the Disc rate at 10%. PV10 is also provided based on the available CR and production payment. Gross WS cost recovery is also provided. These details are arrived when linked to a model with 27.5% working interest and the project start period is a specific date. Production payment is also provided for a period, which is calculated form discount rate, and the period.

ADVANTAGES and DISADVANTAGES OF THE REMAINING FOUR REVIEWED MODELS

Model No	Advantages	Disadvantages
Model No. 5	None	Too simple. Does not include many required aspects of a financial model for the oil and gas industry. Poorly documented.

Model No. 6	None	Too simple and undocumented for the oil and gas industry. Possible used for only a single, specific project.
Model No. 7	None	Does not include various factors of the oil and gas industry for a successful financial model. Not at all flexible. Again, possibly for a created for a specific small – medium sized project
Model No. 8	None	Undocumented and not well designed. Not suitable for the oil and gas industry.

Hard copy of all the eight reviewed models is provided below.

FINANCIAL MODEL No. 1

Rate & Cost Summary

Case: Opt POD 4New+2 Rd

Total Forward CAPEX=	$97.5	$2.40 per bbl oil
Total Forward OPEX=	$183.5	$4.52 per bbl oil

Restricted offtake 15mbls

Year	Oil		Drilling CAPEX		Facility CAPEX		OPEX
	Rate BOPD	Vol MMBO	Drlg MM$	Comments	Fac MM$	Comments	Fixed MM$
1995			$21.3				
1996	3,030	1.11	$25.1		$5.1		$6.5
1997	19,850	7.25	$21.3				$28.5
1998	20,725	7.57			$10.0	Perm Fac Engr'g	$28.0
1H99	17,049	3.11	$17.[illegible]	ALR-14,15 Delineation	$3.[illegible]	Opt POD Engr'g	$14.[illegible]
2H99	18,700	3.42	$2.0	Equipment Orders	$3.0	Engr'g/Tender	$14.0
2000	14,000	5.11	$11.3		$31.5	Constr/Install	$33.5
2001	15,000	5.48	$5.0		$31.5		$26.0
2002	15,000	5.48	$5.0				$22.0
2003	15,000	5.48	$5.0				$22.0
2004	15,000	5.48	$3.2				$22.0
2005	15,000	5.48					$22.0
2006	12,732	4.65					$22.0
2007	9,969	3.64					$22.0
2008	7,993	2.92					$22.0
2009	4,344	1.59					$22.0
2010							$22.0
	Total through 2006=	59.6	$116.2	Field Life	$84.1		$260.5
	Total 2H99 to 2006=	40.6	$31.5	Forward	$66.0	Forward	$183.5

Company Economics

Scenario Restricted offtake 15mbls

Price Forecast

Brent MOD	16
Field	14.71

	Company Cashflow	Entitlements	Company Net
2000	-10.2	0.0	-10.2
2001	-5.7	0.2	-5.8
2002	4.1	0.6	3.5
2003	4.1	0.6	3.5
2004	4.6	0.6	4.0
2005	5.5	0.5	4.9
2006	3.7	0.3	3.4
2007	1.6	0 0	1.6

2008	0.1	0.0	0.1
2009	0.0	0.0	0.0
2010	0.0	0.0	0.0
		2.7	

PW 10 before entitlements	$0.55
IRR before entitlements	11%
PW 10	($1.22)
IRR	0%
	($1.77)

FINANCIAL MODEL No. 2

Input Sheet

		2001	2002	2003	2004	2005	2006	2007	2008	2009
Capex										
Drilling		0	10.9	68.2	68.2	7.7	0	0	0	0
Offshore		19	43	270.6	270.6	30.8	0	0	0	0
LPG Plant		0	15.3	95.9	95.9	10.9	0			
Pipeline		0	3.2	27.4	241.5	51.8	0	0	0	0
Opex upstream		0	0	0	0	18	35	35	35	35
Opex LPG plant		0	0	0	0	5	9	9	9	9
Opex pipeline		0	0	0	0	4	8	8	8	8
Production										
Sales Gas mmscf/d						331.0	687.0	738.3	789.2	814.7
Condensate mbd						14.9	30.6	32.5	34.5	35.3
LPG mbd						7.8	16.1	17.3	18.4	18.9

	Sensitivities	2001	2002	2003	2004	2005	2006	2007	2008	2009
Production	1									
Sales Gas mmscf/d		0.0	0.0	0.0	0.0	331.0	687.0	738.3	789.2	814.7
Condensate mbd		0.0	0.0	0.0	0.0	14.9	30.6	32.5	34.5	35.3
LPG mbd		0.0	0.0	0.0	0.0	7.8	16.1	17.3	18.4	18.9
HHV	**982**									
Price						1.198	1.198	1.198	1.198	1.198
Gas $/mmbtu	1					1.198	1.198	1.198	1.198	1.198
Condensate $/bbl	**14.00**					14	14	14	14	14
LNG $/bbl	**64%**					8.94	8.94	8.94	8.94	8.94
Tariff						0.27	0.27	0.27	0.27	0.27
$/mmbtu	1					0.27	0.27	0.27	0.27	0.27
One-off entry fee (UOG)		0.0								
Capex	1									
Drilling		0	10.9	68.2	68.2	7.7	0	0	0	0
Offshore		19	43	270.6	270.6	30.8	0	0	0	0
LPG plant		0	15.3	95.9	95.9	10.9	0	0	0	0

Pipeline	1	0	3.2	27.4	241.5	51.8	0	0	0	0
Opex	1									
Upstream		0	0	0	0	17.5	35	35	35	35
LPG Plant		0	0	0	0	4.5	9	9	9	9
Pipeline	1	0	0	0	0	4	8	8	8	8

Output sheet

Assumptions

Plateau Production		
Gas	mmscf/d	814.7
Condensate	mbd	35.3
LPG	mbd	18.9
Price		
Gas	$/mmbtu (avge)	1.085
Condensate	$/bbl	14.00
LPG	$/bbl	8.94
Upstream total capex	($m)	834
Upstream opex per year	($m)	35
Pipeline capex	($m)	323.9
Pipeline opex per year	($m)	8

Results

		Gross Project
Upstream		
	NPV	1951.87
	IRR	31.3%
Pipeline		
	NPV	92.86
	IRR	15.8%
Total		
	NPV	2044.73
	IRR	28.7%

Sensitivities

Production		1
Gas Price		1
Oil Price		1
Pipeline Tariff		1
Capex		
	Upstream	1
	Pipeline	1
Opex		
	Upstream	1
	Pipeline	1

FINANCIAL MODEL No. 3

TERMS

Oil Terms		Gas Terms	
PROFIT Tranches		PROFIT Tranches	
Mstb/d	Share	MMscf/d	Share
0	20.0%	0	20.0%
25	17.5%	130	17.5%
50	15.0%	260	15.0%
75	12.5%	390	12.5%
100	10.0%	520	10.0%

Cost Oil/Gas Percentage	40.0%
Excess Cost Oil/Gas Percentage	10.0%

TAX RATES

US FIT Rate	35.0%
US State Tax Rate	0.0%
Qatar Oil Tax Rate	35.0%
Pipeline Tax Rate, Foreign	0.0%
Host P/L Dpreciation Years	14
Qatar General Tax Rate	35.0%
Excess FOGEI Credits	y
US Tax Applied to Liq Outside EPSA	y
0.25% Provision (1=y)	

LPG Plant

Special LPG terms? No=0,Yes=1	1
Percent Condensate in LPG Plant	8.2%
Cost Recovery Cap	40.0%
Profit Sh of Excess Cost	32.0%
Profit Share to Contractor	32.0%

INTERESTS

Investment Interest, Exploration	27.50%
Investment Interest, Development	27.50%
Production Interest	27.50%
Share of Sunk Costs	0.00%
Interest in Pipeline Company	0.00%
Dubai Interest in Pipeline	0.00%

GENERAL ASSUMPTIONS

Project Start Year	1991
PW Reference Year	1999
Discount Rate	10%
Purchase Price Tax Value, $MM	13.0
Gross Sunk Costs, $MM	0
ARCO Net from Sunk Costs, MM$	0.0
Cost Recovery - Expl Priority?(f,l,p)	p
Signature Bonus, $MM	5.0

Al Rayyan liquids in profit tranches	1
2nd project cond. in profit tranches	0

PRICE/FISCAL ASSUMPTIONS

Oil Price Forecast(LRP,stress,gen)	lrp		
Generic Forecast Starting Price $/BBL	16.00		
Generic Escalation Rate %/YR	2.0%		
First Year of Cost Escalation	2000		
Qatar Condensate Price Quality % of WTI	85%		
Qatar LPG Price Quality % of WTI	80%		
Al-Rayyan Price Quality % of WTI	100%		
C3, bbl/tonne	12.40		
C4, bbl/tonne	10.89		
LPG, bbl/tonne	11.75		
First Year of Gas Price Escalation	2004		
Gas Prices			
Dubai Prices	$/MCF	BTU/SCF	$/MMBTU
Sweet Sales Price at Ras Laffan, $/Mscf	0.883	982	0.899
Inlet Sales Price at Jebel Ali, $/Mscf	1.176	982	1.198
P/L			
Base P/L Tariff, $/MCF	0.294		0.299
Secondary Tariff, $/MCF	0.245		0.249
First Year of Secondary P/L Tariff	2008		
First Year of P/L Tariff Escalation	2050		
Third Tariff	0.215		0.219
Fourth Tariff	0.118		0.12
Fifth Tariff	0.118		0.12
Discounted tariff	0.098		0.1

SENSITIVITIES

Qatar Sensitivities	
	Factor
Sunk Cost	1.00
Devel Drilling Cost	1.00
Facilities Cost	1.00
Pipeline Cost	1.00
Variable Operating Cost	1.00
Fixed Operating Cost	1.00
Liquids Price	1.00
Gas Price	1.00
Oil Tariff	1.00
Gas Tariff	1.00
Oil Production	1.00
Gas Production	1.00
Pipeline Sensitivities	
Pipeline Cost	1.00
Operating Cost	1.00

FINANCIAL MODEL No. 4

Input Sheet	2000	2001	2002	2003	2004	2005	2006
Capex							
Drilling		0	0	10.9	68.2	68.2	7.7
Offshore		0	19	43	270.6	270.6	30.8
LPG Plant		0	0	15.3	95.9	95.9	10.9
Pipeline		0	0	3.2	27.4	241.5	51.8
Opex upstream		0	0	0	0	0	18
Opex LPG plant		0	0	0	0	0	5
Opex pipeline		0	0	0	0	0	4

Production	ARCO profile	331.0
Sales Gas mmscf/d		800.0
Condensate mbd		14.9
LPG mbd		7.8

	2000	2001	2002	2003	2004	2005	2006
	Sensitivities						
Production	1						
Sales Gas mmscf/d		0.0	0.0	0.0	0.0	0.0	800.0
Condensate mbd	1	0.0	0.0	0.0	0.0	0.0	36.0
LPG mbd		0.0	0.0	0.0	0.0	0.0	18.8
HHV	982						
Sales Gas mmbtu/yr		0.0	0.0	0.0	0.0	0.0	286.7

Price		Price into pipeline	0.950
Gas $/mmbtu	1	Price at Dubai	1.170
Condensate $/bbl	**16.00**		16
LPG $/bbl	**64%**		10.22

Tariff	**Pipeline**	0.22
Abu Dhabi ROW Tariff		0.05
$/mmbtu	1	0.22

One-off entry fee (UOG)	0.0	0.0

	2000	2001	2002	2003	2004	2005	2006
Capex	**1.25**						
Drilling		0	0	13.625	85.25	85.25	9.625
Offshore		0	23.75	53.75	338.25	338.25	38.5
LPG plant		0	0	19.125	119.875	119.875	13.625
Pipeline	1	0	0	3.2	27.4	241.5	51.8
Opex	**1.25**						
Upstream		0	0	0	0	0	21.875
LPG Plant		0	0	0	0	0	5.625
Pipeline	1	0	0	0	0	0	4

Output Sheet

Revenues	2000	2001	2002	2003	2004	2005	2006
Gas		0.0	0.0	0.0	0.0	0.0	
Condensate		0.0	0.0	0.0	0.0	0.0	210.4
LPG		0.0	0.0	0.0	0.0	0.0	70.1

CALCULATIONS

Price Index	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Cost Index	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Discount Factor	1.000	0.953	0.867	0.788	0.716	0.651	0.592

ABBREVIATED FINANCIAL SUMMARY

	2000	2001	2002	2003	2004	2005	2006
Sales Revenue		0.0	0.0	0.0	0.0	0.0	280.5
Variable Costs		0.0	0.0	0.0	0.0	0.0	0.0
Contribution		0.0	0.0	0.0	0.0	0.0	280.5
Fixed Costs (Opex)		0.0	0.0	0.0	0.0	0.0	31.5
Depn		0.0	0.0	0.0	0.0	0.0	97.9
Pre Tax Profit		0.0	0.0	0.0	0.0	0.0	151.0
Tax		0.0	0.0	0.0	0.0	0.0	0.0
Net Profit		0.0	0.0	0.0	0.0	0.0	151.0
Fixed Assets		0.0	23.8	113.5	684.2	1469.1	1484.7
Debtors		0.0	0.0	0.0	0.0	0.0	0.0
Creditors		0.0	0.0	0.0	0.0	0.0	0.0
Stocks		0.0	0.0	0.0	0.0	0.0	0.0
Net Working Capital		0.0	0.0	0.0	0.0	0.0	0.0
Capital Employed		0.0	23.8	113.5	684.2	1469.1	1484.7
ROACE		0.0%	0.0%	0.0%	0.0%	0.0%	10.2%
Profit		0.0	0.0	0.0	0.0	0.0	151.0
Depn		0.0	0.0	0.0	0.0	0.0	97.9
W Cap		0.0	0.0	0.0	0.0	0.0	0.0
Capex		0.0	-23.8	-89.7	-570.8	-784.9	-113.6
Funds Flow		0.0	-23.8	-89.7	-570.8	-784.9	135.4
Funds Flow		0.0	-23.8	-89.7	-570.8	-784.9	135.4
Discount Factor	1.000	0.953	0.867	0.788	0.716	0.651	0.592
PV Funds Flow		0.0	-20.6	-70.7	-408.9	-511.1	80.2
Cumulative PV		0.0	-20.6	-91.3	-500.1	-1011.3	-931.1
Payback		0	0	0	0	0	0

NPV	**2579.5**
IIR	**31.2%**
CE	**255.1%**
Disc Payback	**2009**
ROACE	**69.6%**

Sum of all years

Sales Revenue	17321.7
Variable Costs	0.0
Contribution	17321.7
Fixed Costs	1543.5

Depn	1320.1
Pre Tax Profit	14458.1
Tax	0.0
Net Profit	14458.1
Fixed Assets	20942.2
Debtors	0.0
Creditors	0.0
Stocks	0.0
Net Working Capital	0.0
Capital Employed	20942.2
ROACE	69.6%
Profit	14458.1
Depn	1320.1
W Cap	0.0
Capex	-1638.9
Funds Flow	14139.3

FINANCIAL MODEL No. 5

Stream Days	358
Wellhead Grossup	1.1625
Percent C3	59%

Inputs

Year	Average Cond. Yield	Condensate MMB	Condensate MBD	Average LPG Yield	LPG MMB	LPG MBD	C3 MMB	C4 MMB
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000								
2001								
2002	39.5			20.6				
2003	39.5	10.9	29.8	20.6	5.7	15.5	3.3	2.3
2004	39.1	11.6	31.8	20.5	6.1	16.7	3.6	2.5
2005	38.6	12.3	33.6	20.5	6.5	17.9	3.8	2.7
2006	38.3	13.0	35.6	20.4	6.9	18.9	4.1	2.8
2007	38.0	12.9	35.3	20.3	6.9	18.9	4.1	2.8
2008	37.8	12.8	35.1	20.3	6.9	18.9	4.1	2.8
2009	37.5	12.7	34.8	20.2	6.8	18.8	4.0	2.8
2010	37.2	12.6	34.6	20.1	6.8	18.7	4.0	2.8
2011	37.0	12.5	34.4	20.1	6.8	18.7	4.0	2.8
2012	36.9	12.5	34.3	20.0	6.8	18.6	4.0	2.8
2013	36.3	12.3	33.7	19.9	6.7	18.5	4.0	2.8
2014	36.1	12.2	33.5	19.9	6.7	18.5	4.0	2.8
2015	35.9	12.2	33.3	19.8	6.7	18.4	4.0	2.8
2016	35.7	12.1	33.2	19.8	6.7	18.4	4.0	2.8
2017	35.5	12.0	33.0	19.7	6.7	18.3	3.9	2.7
2018	35.3	12.0	32.8	19.6	6.6	18.2	3.9	2.7
2019	35.1	11.9	32.6	19.6	6.6	18.2	3.9	2.7
2020	34.9	11.8	32.4	19.5	6.6	18.1	3.9	2.7
2021	35.2	11.9	32.7	19.4	6.6	18.0	3.9	2.7
2022	35.0	11.9	32.5	19.4	6.6	18.0	3.9	2.7
2023	34.8	11.8	32.3	19.3	6.5	17.9	3.9	2.7
2024	34.5	11.7	32.0	19.2	6.5	17.6	3.8	2.7
2025	34.3	11.6	31.9	19.2	6.5	17.8	3.8	2.7
2026	34.1	11.6	31.7	19.1	6.5	17.7	3.8	2.7
2027	34.2	11.6	31.8	19.1	6.5	17.7	3.8	2.7
2028	34			19				
2029	34			19				
2030	34			19				

NEW FIELD GAS DEVELOPMENT KEY ASSUMPTIONS

Qatar - Costs and Production

1998 $

Development Costs, MM$ (Upstream and Downstream)

Year	Sunk Costs	Drilling Intang	Drilling Tang	Drlg Dry Hole	Facilities	Offshore
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998					19.0	
1999						
2000		25.0	10.7		152.0	33.6
2001		61.8	26.5		376.8	83.2
2002		21.7	9.3		132.2	29.2
2003						
2004						
2005						
2006						
2007						
2008						
2009						
2010		10.5	4.5			
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						
2019		10.5	4.5			
2020						
2021						
2022						
2023						
2024						
2025		10.5	4.5			
2026						
2027						
2028						
2029						
2030						
Totals/Max		140.0	60.0		680.0	146.0

Operating Costs, MM$ (Upstream and Downstream)

Year	Variable Condens	Variable Gas	Fixed	Overhead
1991				
1992				
1993				
1994				
1995				
1996				
1997				
1998				
1999				
2000				
2001				
2002				
2003			49.0	
2004			49.0	
2005			49.0	
2006			49.0	
2007			49.0	
2008			49.0	
2009			49.0	
2010			49.0	
2011			49.0	
2012			49.0	
2013			49.0	
2014			49.0	
2015			49.0	
2016			49.0	
2017			49.0	
2018			49.0	
2019			49.0	
2020			49.0	
2021			49.0	
2022			49.0	
2023			49.0	
2024			49.0	
2025			49.0	
2026			49.0	
2027			49.0	
2028				
2029				
2030				
			1,226.0	

1998 $

Downstream Only, MM$

Year	Facilities	Opex
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998		
1999		
2000	48.8	
2001	120.8	
2002	42.4	
2003		10.0
2004		10.0
2005		10.0
2006		10.0
2007		10.0
2008		10.0
2009		10.0
2010		10.0
2011		10.0
2012		10.0
2013		10.0
2014		10.0
2015		10.0
2016		10.0
2017		10.0
2018		10.0
2019		10.0
2020		10.0
2021		10.0
2022		10.0
2023		10.0
2024		10.0
2025		10.0
2026		10.0
2027		10.0
2028		
2029		
2030		
	212.0	260.0

1998 $

Pipeline Costs

Costs, MM$

Year	Facilities	Opex
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998		
1999		
2000	9.7	
2001	132.8	
2002	181.4	
2003		8.0
2004		8.0
2005		8.0
2006		8.0
2007		8.0
2008		8.0
2009		8.0
2010		8.0
2011		8.0
2012		8.0
2013		8.0
2014		8.0
2015		8.0
2016		8.0
2017		8.0
2018		8.0
2019		8.0
2020		8.0
2021		8.0
2022		8.0
2023		8.0
2024		8.0
2025		8.0
2026		8.0
2027		8.0
2028		
2029		
2030		
Totals/Max	324.0	200.0

Liquid Production

Year	Condens MMB	C3 MMB	C4 MMB	Field MMB
1991				
1992				
1993				
1994				
1995				
1996				
1997				
1998				
1999				
2000				
2001				
2002				
2003	10.9	3.3	2.3	
2004	11.6	3.6	2.5	
2005	12.3	3.8	2.7	
2006	13.0	4.1	2.8	
2007	12.9	4.1	2.8	
2008	12.8	4.1	2.8	
2009	12.7	4.0	2.8	
2010	12.6	4.0	2.8	
2011	12.5	4.0	2.8	
2012	12.5	4.0	2.8	
2013	12.3	4.0	2.8	
2014	12.2	4.0	2.8	
2015	12.2	4.0	2.8	
2016	12.1	4.0	2.8	
2017	12.0	3.9	2.7	
2018	12.0	3.9	2.7	
2019	11.9	3.9	2.7	
2020	11.8	3.9	2.7	
2021	11.9	3.9	2.7	
2022	11.9	3.9	2.7	
2023	11.8	3.9	2.7	
2024	11.7	3.8	2.7	
2025	11.6	3.8	2.7	
2026	11.6	3.8	2.7	
2027	11.6	3.8	2.7	
2028				
2029				
2030				
	302.5	97.6	67.8	

TOP	100%
btu/scf	982

Gas Production

Year	Gas Sales from Country,MM/D
1991	
1992	
1993	
1994	
1995	
1996	
1997	
1998	
1999	
2000	
2001	
2002	
2003	661.9
2004	712.8
2005	763.7
2006	814.7
2007	814.7
2008	814.7
2009	814.7
2010	814.7
2011	814.7
2012	814.7
2013	814.7
2014	814.7
2015	814.7
2016	814.7
2017	814.7
2018	814.7
2019	814.7
2020	814.7
2021	814.7
2022	814.7
2023	814.7
2024	814.7
2025	814.7
2026	814.7
2027	814.7
2028	
2029	
2030	
	814.7

FINANCIAL MODEL No. 6

Capital

	Bonus	Wintershall	Carry	Total
				0.0
1999	22.5	2.7	11.5	36.7
2000		13.7	125.8	139.4
2001		2.3	126.9	129.2
2002		0.0	14.7	14.7
2003		7.0	0.0	7.0
2004		7.0	0.0	7.0
2005		0.0	0.0	0.0
2006			0.0	0.0
Total	**22.5**	**32.7**	**278.8**	**334.0**

Cash Flow Impact

	Bonus	Wintershall	GS Carry	Total	Economics		Exposure	Discount Factor	PW Bonus	PW Wintershall	PW GS Carry	PW Calculation
1999	(22.5)	(2.7)	(11.5)	(36.7)			(36.7)	0.9516	(21.4)	(2.6)	(10.9)	(34.9)
2000	0.0	(13.7)	(125.8)	(139.4)			(139.4)	0.8611	0.0	(11.8)	(108.3)	(120.0)
2001	0.0	(2.3)	(126.9)	(129.2)	IRR =	7.0%	(129.2)	0.7791	0.0	(1.8)	(98.8)	(100.6)
2002	0.0	2.9	5.9	8.8			0.0	0.7050	0.0	2.0	4.2	6.2
2003	0.0	(2.5)	41.8	39.3	PW =	($48.4)	0.0	0.6379	0.0	(1.6)	26.7	25.1
2004	0.0	(2.3)	45.3	43.0			0.0	0.5772	0.0	(1.3)	26.1	24.8

2005	0.0	6.6	48.8	55.4	IE = -0.20	0.0	0.5223	0.0	3.5	25.5	28.9
2006	0.0	0.0	50.2	50.2		0.0	0.4726	0.0	0.0	23.7	23.7
2007	0.0	0.0	49.9	49.9			0.4276	0.0	0.0	21.3	21.3
2008	0.0	0.0	49.4	49.4			0.3869	0.0	0.0	19.1	19.1
2009	0.0	0.0	49.0	49.0			0.3501	0.0	0.0	17.1	17.1
2010	0.0	0.0	29.3	29.3			0.3168	0.0	0.0	9.3	9.3
2011	0.0	0.0	21.8	21.8			0.2866	0.0	0.0	6.3	6.3
2012	0.0	0.0	21.6	21.6			0.2593	0.0	0.0	5.6	5.6
2013	0.0	0.0	19.0	19.0			0.2347	0.0	0.0	4.5	4.5
2014	0.0	0.0	17.6	17.6			0.2123	0.0	0.0	3.7	3.7
2015	0.0	0.0	17.5	17.5			0.1921	0.0	0.0	3.4	3.4
2016	0.0	0.0	17.4	17.4			0.1738	0.0	0.0	3.0	3.0
2017	0.0	0.0	17.3	17.3			0.1573	0.0	0.0	2.7	2.7
2018	0.0	0.0	17.2	17.2			0.1423	0.0	0.0	2.4	2.4
2019	0.0	0.0		0.0			0.1288	0.0	0.0	0.0	0.0
2020	0.0	0.0		0.0			0.1165	0.0	0.0	0.0	0.0
2021	0.0	0.0		0.0			0.1054	0.0	0.0	0.0	0.0
2022	0.0	0.0		0.0			0.0954	0.0	0.0	0.0	0.0
2023	0.0	0.0		0.0			0.0863	0.0	0.0	0.0	0.0
2024	0.0	0.0		0.0			0.0781	0.0	0.0	0.0	0.0
2025	0.0	0.0		0.0			0.0707	0.0	0.0	0.0	0.0
2026	0.0	0.0		0.0			0.0640	0.0	0.0	0.0	0.0
2027	0.0	0.0		0.0			0.0579	0.0	0.0	0.0	0.0
Total	(22.5)	(14.0)	254.8	218.3				(21.4)	(13.6)	(13.4)	(48.4)

Net Income Impact

	Gas, ARCO WI	Carry Interest	Total Impact
1999	0.0	0.0	0.0

2000	0.0	1.2	1.2
2001	0.0	14.1	14.1
2002	(1.2)	28.4	27.2
2003	(2.5)	30.7	28.2
2004	(2.7)	29.6	26.9
2005	(2.8)	28.0	25.1
2006	(2.9)	25.9	22.9
2007	(2.9)	23.4	20.5
2008	(2.9)	20.7	17.8
2009	(2.2)	17.8	15.6
2010	(1.8)	14.6	12.8
2011	(1.6)	13.1	11.5
2012	(1.6)	12.2	10.6
2013	(1.6)	11.2	9.6
2014	(1.6)	10.4	8.8
2015	(1.6)	9.7	8.1
2016	(1.7)	8.9	7.3
2017	(1.7)	8.1	6.4
2018	(1.7)	7.1	5.5
2019	(1.9)	6.1	4.2
2020	(1.7)	4.4	2.7
2021	(1.7)	3.2	1.4
2022	(1.7)	1.8	0.0
2023	(1.8)	0.2	(1.5)
2024	(1.8)	0.0	(1.3)
2025	(2.1)	0.0	(2.1)
2026	(1.8)	0.0	(1.8)
2027	(1.0)	0.0	(1.0)
Total	(50.5)	330.6	280.1

FINANCIAL MODEL No. 7

Cash Flow	EPSA Company	Pipeline	Carry	Swing Storage Margham	Total	Economics	Exposure	Margham Harvest	Margham Swing	Discount Factor	EPSA ARCO WI	Pipeline	Carry	Swing Storage Margham	PW Calculation
1999	(19.4)	(0.4)	(36.7)	0.0	(56.6)		-56.55453	5.5	5.5	0.9516	(18.5)	(0.4)	(34.9)	0.0	(53.8)
2000	(125.8)	(3.9)	(139.4)	0.0	(269.1)		-269.0898	2.6	2.6	0.8611	(108.3)	(3.4)	(120.0)	0.0	(231.7)
2001	(126.9)	(35.2)	(129.2)	0.0	(291.3)		-291.2770	1.5	1.5	0.7791	(98.8)	(27.5)	(100.6)	0.0	(226.9)
2002	7.0	(4.2)	8.8	6.2	17.8	IRR = 9.4%	0	0.0	6.2	0.7050	5.0	(2.9)	6.2	4.4	12.6
2003	44.0	6.5	39.3	5.6	95.5		0	0.0	5.6	0.6379	28.0	4.2	25.1	3.6	60.9
2004	47.6	7.0	43.0	5.5	103.1	PW = ($20.6)	0	0.0	5.5	0.5772	27.5	4.1	24.8	3.2	59.5
2005	51.2	7.5	55.4	5.2	119.3			0.0	5.2	0.5223	26.8	3.9	28.9	2.7	62.3
2006	52.8	7.7	50.2	5.0	115.8	IE = -0.04			5.0	0.4726	24.9	3.6	23.7	2.4	54.7
2007	52.4	7.0	49.9	4.8	114.2				4.8	0.4276	22.4	3.0	21.3	2.1	48.8
2008	51.9	6.4	49.4	3.2	110.9				3.2	0.3869	20.1	2.5	19.1	1.2	42.9
2009	51.5	6.4	49.0	3.1	109.9				3.1	0.3501	18.0	2.2	17.1	1.1	38.5
2010	25.9	6.3	29.3	3.0	64.6				3.0	0.3168	8.2	2.0	9.3	1.0	20.5
2011	23.3	6.3	21.8	3.0	54.4				3.0	0.2866	6.7	1.8	6.3	0.9	15.6
2012	23.0	5.9	21.6	2.9	53.5				2.9	0.2593	6.0	1.5	5.6	0.8	13.9
2013	20.4	4.2	19.0	2.8	46.4				2.8	0.2347	4.8	1.0	4.5	0.7	10.9
2014	19.0	2.9	17.6	2.8	42.2				2.8	0.2123	4.0	0.6	3.7	0.6	9.0
2015	18.9	2.9	17.5	0.0	39.3					0.1921	3.6	0.6	3.4	0.0	7.5
2016	18.8	2.9	17.4	0.0	39.0					0.1738	3.3	0.5	3.0	0.0	6.8
2017	18.7	2.8	17.3	0.0	38.8					0.1573	2.9	0.4	2.7	0.0	6.1
2018	18.6	2.8	17.2	0.0	38.6					0.1423	2.6	0.4	2.4	0.0	5.5
2019	17.9	2.8	0.0	0.0	20.7					0.1288	2.3	0.4	0.0	0.0	2.7
2020	18.4	2.8	0.0	0.0	21.2					0.1165	2.1	0.3	0.0	0.0	2.5

2021	18.4	2.8	0.0	0.0	21.1	0.1054	1.9	0.3	0.0	0.0	2.2	
2022	18.2	2.7	0.0		21.0	0.0954	1.7	0.3	0.0	0.0	2.0	
2023	18.1	2.7	0.0		20.8	0.0863	1.6	0.2	0.0	0.0	1.8	
2024	18.0	1.9	0.0		19.9	0.0781	1.4	0.2	0.0	0.0	1.6	
2025	17.2	1.9	0.0		19.1	0.0707	1.2	0.1	0.0	0.0	1.3	
2026	17.8	1.9	0.0		19.7	0.0640	1.1	0.1	0.0	0.0	1.3	
2027	9.6	0.9	0.0		10.5	0.0579	0.6	0.1	0.0	0.0	0.6	
Total	426.6	62.3	218.3	53.3	760.5		3.2	0.1	(48.4)	24.5	(20.6)	(0.0)

FINANCIAL MODEL No. 8

	Total W/S Cash Flows
1998	0.0
1999	(2.7)
2000	(13.7)
2001	(2.3)
2002	2.9
2003	(2.5)
2004	(2.3)
2005	6.6
2006	0.0
2007	0.0
2008	0.0
2009	0.0
2010	0.0

WS CARRY

				1998 PW Disc. Fact.	PW10 01/01/1998	PW10 01/01/1999	Gross WS Cost Recovery	Available C.R. $
Pre-develop cost reimbursement	0.604							
Cary Amount	18.1							
Carry Percentage	3.02%							
Disc Rate	10%							
Limit Applied to 1st 3 years	0.333333							
GS/Total WS Carry	60%	1997		1				
		1998	0.0	0.9516	0.0	0		
		1999	(2.7)	0.8611	(2.4)	-2.602130057		
		2000	(13.7)	0.7791	(10.6)	-11.76125527		
		2001	(2.3)	0.7050	(1.6)	-1.800292305		
Project Start ==>		2002	2.9	0.6379	1.8	2.012599782	11.8	2.9
		2003	4.5	0.5772	2.6	2.848526763	22.2	4.5
		2004	4.7	0.5223	2.5	2.739713229	23.6	4.7
		2005	6.6	0.4726	3.1	3.466271098	25.0	7.5
		2006	0.0	0.4276	0.0	0	25.7	15.5
		2007	0.0	0.3869	0.0	0		
		2008	0.0	0.3501	0.0	0		
		2009	0.0	0.3168	0.0	0		
		2010	0.0	0.2866	0.0	0		
		2011	0.0	0.2593	0.0	0		
		TOTAL	(0.0)		(4.6)	(5.1)		
1/1/98 PW10 Carry + Prod Payment		(12.3)						
10/1/98 PW10 Carry + Prod Payment		(13.2)						
1/1/99 PW		(13.6)						

Note: This is linked to a model that should be set to 27.5% working interest.

PRODUCTION

Disc Rate	10%

Project Start ==>

		1998 PW	PW10 01/01/1998	PW11 02/01/1999
1997	0.0	1		
1998	0.0	0.9516	0.0	0.0
1999	0.0	0.8611	0.0	0.0
2000	0.0	0.7791	0.0	0.0
2001	0.0	0.7050	0.0	0.0
2002	0.0	0.6379	0.0	0.0
2003	(7.0)	0.5772	(4.0)	(4.4)
2004	(7.0)	0.5223	(3.7)	(4.0)
2005		0.4726	0.0	0.0
2006		0.4276	0.0	0.0
2007		0.3869	0.0	0.0
2008		0.3501	0.0	0.0
2009		0.3168	0.0	0.0
2010		0.2866	0.0	0.0
2011		0.2593	0.0	0.0
TOTAL			(7.7)	(8.5)

APPENDIX 5

CFM MODULES (WORKSHEETS)

DESCRIPTION AND SAMPLE MODULES

The is divided into 2 section. One deals with the operating variables and the other is the financial variables section. Both sections although separate are integrated and interlinked with the help of macros. All modules (worksheets) of both sections are housed in one workbook using the EXCEL software. By having all modules in one workbook, linking relevant worksheets to obtain data from the input sheets, eliminates any risk of erroneous results. This workbook can be copied and then used on any PC supporting EXCEL, hence is very flexible, transparent and yet retains the aspect of accuracy. Below the various modules included in both sections of the CFM workbook is documented.

CFM – MODULES INCLUDED IN THE OPERATING VARIABLES SECTION

One aspect of the CFM is the Operating Variables. This section of the CFM includes operational components as individual modules (worksheets):

- Reserves / Volumes
- Pricing
- Revenues
- Cash Budgeting / Costs
- Capital Expenditures
- Working Capital
- Unlevered Cash Flow

All key inputs / variables used in the above operating modules are correlated. The entire model is interconnected, however only the main input links are shown in the flowchart.

Technical data comprises of final acceptance certificate, operational reliability certificate, completion month and year, initial yield, initial plant condensate to well head ratio, well head gas production, LNG conversion factor, sulphur yield, gas heating value and feed stock royalty. Final acceptance and operational reliability certificate is calculated based on the delay of the capital expenditures head with 6 months period.

Operating costs provides variables like Inflation rate and sensitivity, which are utilised to calculate the operating cost inflation factor for the scheduled period of cash budgeting.

A requirement in the Gulf Cooperation Council (GCC) countries, Royalty Charges comprises of the royalty on condensate sales and feedstock gas royalty.

Capital expenditures consist of delay, beginning period and cost overrun. Beginning period number is used to calculate the actual period based on the scheduled period. i.e. if the scheduled period is greater than or equal to the beginning period number (variable of the capital expenditures) then actual period will be the difference between scheduled period and delay else it will be zero.

Condensate decline rates for field and plant are provided per year. This is taken as the base value for calculating the linear decline curve of the field and plant condensate of the reserves / volume module.

All the modules in the Operating Variables section of the CFM are documented below.

RESERVES / VOLUMES

In this module, Reserves / volume of LNG, field condensate, plant condensate and sulphur are provided. LNG trains in operation is identified based on the actual period of the operating variables. Total LNG sales quantities for 1st buyer is calculated from actual period if its less than the schedule period of the sale agreement or else the lookup value from the scheduled period, year and month of the sale agreements.

Total LNG volumes of the 1st and the 2nd buyer is the product of LNG conversion factor of the technical data variable and the sales quantity of the respective buyer. Total well head gas production required for 1st and 2nd buyer is arrived from the W/head gas prod. to LNG volume ratio of the technical data variable and the total LNG volumes of the buyers. Production details of Field and plant condensate and sulphur recovery are provided from the technical data section in the operating variables module.

Reserves Module

LNG	YEAR	**1997**	**1997**
	MONTH	**6**	**12**
LNG Trains in Operation		0.00	0.00

Total LNG Sales Quantities (MMT FOB)			0.00	0.00
Total LNG Volumes (trillion Btu)			0.0	0.0
Total Wellhead Gas Production Required (scf/day)			0.0	0.0
Total Field Condensate Produced (MMbbl)			0.0	0.0
Total Plant Condensate Produced (MMbbl)			0.0	0.0
Total Sulphur Produced ('000 tons)			0.0	0.0

The various graphical and mathematical methods of forecasting future producing rates and productive lives with different types of production decline relationships have been presented. These are useful in predicting cash flows from producing properties. Ultimate recovery figures are also usually required in property valuations, and financial statements (55e).

In accordance with the definition adopted by the Society of Petroleum Engineers and the World Petroleum Congresses "Reserves are those quantities of petroleum which are anticipated to be commercially recovered from know accumulations from a given date forward. All reserve estimates involve some degree of uncertainty. The uncertainty depends chiefly on the amount of reliable geologic and engineering data available at the time of the estimate and the interpretation of these data. The relative degree of uncertainty may be conveyed by placing reserves into one of two principal classifications, either proved or unproved. Unproved reserves are less certain to be recovered than proved reserves and may be further sub-classified as probable and possible reserves to denote progressively increasing uncertainty in their recoverability." Methods for determining reserves can be broadly classified in two groups; i.e. those based upon reservoir rock and fluid properties and those determined from reservoir production performance.

Pore Volume Calculation of Reserves: In addition to the decline curve analysis, reserves can be determined from reservoir pore volume calculations. The volumetric, or oil-in-place estimation of oil reserves, consists primarily of determining the hydrocarbon-saturated pore volume of rock and applying a recovery factor based primarily upon engineering experience to determine the volume of recoverable stock tank barrels for liquid, or million standard cubic feet for gas. It is customary first to develop an estimate of acre/feet of gross rock volume containing the oil or gas. A porosity value for the productive formation is then derived from core data, neutron or electric logs. Connate, or interstitial water saturations are usually obtained from electric log or core analysis data.

PRICING

Details of reference crude prices based on Brent and Dubai base are calculated. If the Brent forecast is 1 then Purvin & Gertz (P&G) is taken as base case for pricing. LNG floor price for 1st and 2nd buyer is calculated from the first and second sale agreement price. LNG market price, field condensate price, plant condensate and sulphur price are also provided from the Alpha (CPI base) and Beta (transport) variables of the sale and purchase agreement.

Sulphur price is arrived at as:

Sulphur price = sulphur price (1996)*(1+ % per year) ^ (current year – 1996)

Where 1996 is the base start year.

Purvin & Gertz forecast comprises of Brent (MOD), Dubai (MOD), JCC (MOD), field condensate and plant condensate (MOD). These are calculated from the yearly ($1996) values and the escalation factor as below.

Brent (MOD) = Brent ($1996) / escalation factor, Where

Escalation factor = (1+ Annual escalation rate) ^ (current year – 1996)

Factors that determine the price of crude oil (54d) are in the order of importance:

- Market (supply/demand)
- Quality (refining cost and yield)
- Location (transportation)
- Reliability (production rate)
- Availability (reserves)

These factors are actively considered and incorporated in the design and working of the CFM. The first 3 items in the above list currently have the greatest effect on crude oil price, but from time to time the last two will also exert an influence. Supply/demand must include both crude oil and petroleum products made from it. Crude oil quality reflects the products that can be refined from a particular crude oil and the cost to the refiner to do so. Location will determine the transportation cost to move crude oil and/or petroleum products from the point of production/refining to the customer. Reliability is controlled by production rate and productive capacity, while availability refers to reserves. In addition, it can also be said that; productive capacity influences prices in the short term while reserves influence prices in the long term (54e).

REVENUES

Revenues of LNG, field condensate, plant condensate and sulphur are calculated as follows. LNG price is determined from the LNG floor price of the pricing module based on the criteria provided in the sale and purchase agreement as (1 =highest, 2 =floor & 3= market).

LNG revenue is the product of LNG volume (trillion btu) and price ($/btu). Field condensate revenue is the product of field condensate produced (MMbbl) and field condensate price ($/bbl). Plant condensate revenue is the product of plant condensate production and price. Sulphur revenue is the product of sulphur produced ('000tons) and price ($/ton).

Income portion of cash flows are also known as revenue. The Net Present Value (NPV) of a project is the difference between what the project costs and what it is worth. The best we can do in advance is estimate a project's NPV. We will not know its true market value, or what it is really worth, until the project is completed and the returns are collected (55f).

Another method of evaluating a proposed project is called the Internal Rate of Return (IRR). The IRR is the capital investment project's expected rate of return. If the cost of capital (required rate of return) equals the IRR (expected), the NPV would equal to zero. But because of the uncertainty connected with risky cash flows, the realised rate of return will almost surely be different from the IRR.

CASH BUDGETING / COSTS

Cash budgeting consists of the operating cost factors such as train one / train two operating costs and royalties. Train one and Train two operating costs include overhead and general, offshore and LNG plant. Total operating costs are provided at sensitivity 1.5% for the actual period with respect to the scheduled period. Actual period is calculated as follows.

If scheduled period is greater than/equal to the beginning period variable of the capital expenditure, then comparison is made over the delay variable. If the sum of delay and beginning period variable is greater than the scheduled period, then actual period is 0 else actual period will be the delay variable else the scheduled period is assigned as the actual period.

Costing Module

Scheduled Period				0	7	8
				YEAR	**1997**	**1997**
				MONTH	**6**	**12**
OPERATING COSTS						
TRAIN ONE ($1996)				**0.0**	**0.0**	**0.0**
TWO TRAIN TOTAL ($1996)				**0.0**	**0.0**	**0.0**
Total Operating Costs	Sensitivity	1.5%			0.0	0.0
ROYALTIES						
Gas Royalty Index (to LNG prices)					0.00	0.00
Feedstock Gas Royalty		$0.50	/MMBtu -1993		0.50	0.50
Feedstock Gas Volume (billion Btu/day)					0.0	0.0
Feedstock Gas Royalty					0.0	0.0
Field Condensate & Plant Condensate Revenues					0.0	0.0
Field Condensate & Plant Condensate Royalty @				9.0%	0.0	0.0
Total Royalties					0.0	0.0

Total operating costs is calculated from the trains in operation of the LNG plant production variable. If train 1 is under operation, then lookup values of the train 1 and train 2 is taken else the product of the operating cost inflation factor and the lookup value of the operating costs of the train 1 and train2 and sensitivity at 1.5%.

Royalties consists of the gas royalty index, feedstock gas royalty, field condensate and plant condensate royalties.

Gas royalty is arrived from the weighted average LNG price and the feed stock gas royalty variable provided in the variable module. Maximum value of the field stock gas royalty and product of itself is the feedstock gas royalty. Feed stock gas royalty is the product of feedstock gas royalty and feedstock gas volume. Total royalties is the sum of field condensate and plant condensate royalty and feedstock gas royalty.

These budgets are largely non-discretionary since the overall operation must continue if the firm is to stay in business. In reality they become forecasts. The expense portion is the precursor to the cash forecast, which may be key to many items during the capital budget preparation (84q).

Expense forecasting must include all items of cash outlay incorporating both direct and administrative costs for the budget period. The direct operating cost forecast, broken down by operation units, can also serve as an important supervisory control instrument. This amplifies the desirability of having the field operating people participate in its preparation.

Budgeting Expense: Most expense involves the maintenance of the organisation and its ongoing activities. Thus a logical place to start formulating the projects of these costs for the forthcoming budget year is from the accounting records of the past several years.

Fixed and variable costs should be differentiated. Office rents and the maintenance of lease roads, or docking facilities, represent fairly fixed or reasonably constant types of ongoing expenditures. On the other hand, there are a number of types of costs which vary directly with the number of wells being operated, the amount of oil being produced, or the number of personnel employed in a given organisation unit. These are designated as variable costs.

Time spend analysing those costs which will simply be repeats of the previous year, and those which will change due to some accomplished or predicted change during the budget period, is always a worthwhile exercise. Both types of costs must then be predicted for the budget period since this takes one of the very first allocations of budgeted cash.

A check of the current year's budget against the actual expenditures for the year to date is also worth undertaking in order to determine how closely the two sets of data correlate. If there is a significant discrepancy a study should be undertaken to ascertain the reason, so that the same deficiency is not repeated.

Cash Budgeting: A cash budget is a short term forecast that coincides with the budget period and includes all cash flow items for the entire organisation. It recognises income from all existing projects plus the projected income from those projects in the proposed budget and any projects carried forward from previous budgets. This budget should also include cash-in from financing or other non-operating sources. On the other side of the ledger, it includes projected expenses for all ongoing operations, any anticipated non-discretionary expenses, expenses associated with proposed and carry-forward projects and indirect or overhead expenditures. It must also include the portion of capital expenditures for all carry-forward projects and include all cash-in and cash-out items anticipated for the budget period. A negative annual cash flow would indicate the need for outside financing or call for a reduction of outlays. A positive cash flow may indicate that funds are available for payment of a dividend or for a dividend or for additional investment.

Economic Modeling: The generic term which is applied to the mathematical development of net cash flow streams on a cash basis, financial basis, or on an after tax approach is called economic modeling. A complete array of modeling techniques exists varying from simple arithmetic spreadsheets to complex systems of mathematical equations, such as linear programming or dynamic programming, involving relationships between several economic variables and constants. Some variables are explicit and some must be derived.

CAPITAL EXPENDITURES

Capital expenditures comprises of the drilling, offshore, onshore plant / receiving facilities and corporate capital of Train 1 and Train 2. Onshore capital encompasses of EPC contract / company items, heat exchanger, LNG tanks, compressors, site preparation, project cost true up. Sum of capital involved in the above gives the total onshore capital and expenses.

Offshore capital comprises of the platform and pipeline capital and expenses, which sums up to give the total offshore capital expenditure. The capital expenditures/budget or fixed asset-spending plan tends to be on a project-by-project basis. This is in contract to other types of expenditures. Capital expenditures in particular, have important financial implications for the firm, both on the balance sheet as well as the more immediate effects on cash flow. The capital expenditure basis process, which is described below is typical although each individual step may vary considerably from one organisation to another (84r).

Non-discretionary, or mandatory, items, which must be undertaken for various reasons are listed first for the allocation of available funds. These may reflect the impact of government regulations or the result of new corporate policy. Occasionally funds are budgeted for projects previously justified or under development. If funds were included in a previous justification, but not budgeted at that time, it may not be necessary to re-justify their expenditure when they are included in a subsequent budget. They might be carried in a "non-profitability" category along with the non-discretionary or mandatory items,. Most, but not all, capital budget items are discretionary in terms of financial outlay, or time of undertaking. A healthy organisation will generally have more capital improvement proposals than it has funds for personnel to handle. This calls for a selection, or culling, process in order to identify the economically most desirable projects. The projects are then ranked accordingly, and the available funds allocated to the top ranking projects. The rest are either rejected or deferred for reconsideration in a subsequent budget period. Some companies also include a "contingent not in budget" category for these projects. So if additional funds become available during the budget year they may be undertaken, or they may be substituted for approve projects that do not materialise.

Not all organisations employ the same technique in ranking investment opportunities. Ranking will reflect the organisations goals and strategy. Large organisations tend to rank investments with different emphasis than smaller companies. The immediate cash potions of the organisation also materially affects the way it looks at new investment opportunity, with the cash short organisation placing a greater emphasis on a rapid return. The volume and quality of investment opportunities available to an organisation obviously also has an impact upon how investments are perceived and ranked.

The optimum ranking criteria for any organisation should lead to the selection of investments which are commensurate with the cost of capital from all sources, utilise all of the capital available, and support the continued operation of the organisation. An organisation will generally find that one, or more likely a combination, of commonly used criteria meets its particular needs in ranking investment opportunities. This may include Net Present Value (NPV), Discounted Rate on Investment (DROI), Internal Rate of Return (IRR) and Profit on Investment (POI). Once investment opportunities have been graded according to the criteria which best reflect the goals and strategies of the organisation, the selection process is undertaken.

WORKING CAPITAL

Working Capital consists of Current assets and current liabilities. Current asset consists of LNG receivable for 1st and 2nd buyer, field and plant condensate and LNG inventory and condensate inventory. LNG receivable of the buyers is the product of LNG revenue for 8 business days. i.e. LNG revenue x 8 / 251 *2.

Field condensate receivable and plant condensate receivable are calculated based on the total field and plant condensate production. i.e. Field Condensate Produced ('000 bbl/day) x 30 (cal. days) / (total field condensate x1000) x field condensate revenue. Plant Condensate Produced ('000 bbl/day) x 30 (cal. days) / (total plant condensate x1000) x field condensate revenue (from the revenue module).

LNG inventory for 1st and 2nd buyer is the product of the LNG revenue input from the revenue module and feed stock gas royalty from the cash budgets module for the respective buyer.

Condensate inventory is arrived from the total field condensate produced of the reserves/volume module and 100% of shipload at 450 '000 bbl/ship. Sum of LNG receivable, field and plant condensate, LNG inventory and condensate inventory results in the total current assets.

Current liabilities consist of gas feedstock royalty payable, condensate royalty payable, operating expenses payable, which are arrived from the cash budget module.

The difference between the current assets and current liabilities provides the working capital. Change in the working capital is the difference between the previous and current period's working capital.

In addition to the usual ratios, investors are increasingly looking to the figures of "Working Capital Provided by Continuing Operations," or sometimes merely "Changes in Working Capital", which is to be found in the company's financial statements as an important index of the firms fiscal health. This figure is a good indicator of whether the firm is generating enough cash to meet its payroll, conduct its operations, and service its debt. Another good indicator of fiscal health is the company's record of continuity in paying dividends to its shareholders (84s).

One measure of corporate fiscal efficiency that is immediately available from the balance sheet is the net working capital. This is merely the figure for current liabilities, subtracted from current assets and, represents the company funds retained for current operating expenses. Any marked change in the net working capital from one year to the next would certainly warrant further inquiry.

UNLEVERED CASHFLOW

Unlevered cash flow provides details of working capital and capital expenditures. Operating cash flow is the sum of revenues, operating costs, royalties, taxes and working capital, which are taken as inputs from the respective modules as indicated in the flow chat.

CFM – MODULES INCLUED IN THE FINANCIAL VARIABLES SECTION

The second aspect of the CFM is the Financial Variables. This section of the CFM includes financial components as individual modules:

- Financial Summary
- Equity/Bonds and Debentures
- Risk Management / Guarantee
- Cash Flow Waterfalls
- Taxation and Depreciation
- Income Statement
- Balance Sheet
- Cash Flow Summary

- Ratio Analysis
- Bank / ECA Facilities

A financial variable provides vital details like loan pricing matrix, bond financing, tax assumptions, ECA amortisation and other financial assumptions for the CFM financial modules.

Loan pricing purveys provides details of Commercial Interest Reference Rate (CIRR) and London Inter Bank Offering Rate (LIBOR) for the guarantee facilities like banks, US Exports and Imports (USEXIM), Exports credit guarantee department (ECGD) and Credit agencies of Italy (SACE).

A project's initial capitalisation table shows the financial condition of the project. The cash flow projects will indicate how profitable the project is expected to be, how much cash flow it is expected to generate, and how that cash flow will be allocated among the various providers of capital. These projects can also be used to predict how the project's financial condition is expected to change over the life of the project. Consequently, the initial capitalisation table can be used in conjunction with the information underlying the cash flow projects to prepare a set of projected financial statements – income statement, balance sheet and statement of cash flow – for each year in the project's life (55g).

The amount of debt a project can support depends on the amount of cash flow that is available to make debt service payments, the extend of supplemental credit support mechanisms, and the loan parameters – interest rate, the maturity date, the loan amortisation requirements, and the lender's coverage requirements.

Bond Financing : Average bond interest rate, Bond upfront fees are calculated. The Avg. bond interest rate is calculated based on the Tranche Amount and the interest rate for the respective Tranches. Years to Maturity and 1st Principal Repay for all the 3 Tranches are provided in years and months. Repayment Term is calculated based on the difference between final and first repayment. Principal payment is calculated based on the Repayment term. Details of Issuance, Completion month end and year details are also provided. First repayment is calculated from the Issuance period and the first principal repay. Final repayment is calculated from the Issuance period to years to Maturity.

Other Financing Variables : Details of percentage funded by equity, Final period cash flow by pre-completion, build up period reserve account (Required Balance, Debt Service Coverage Ratio (DSCR) Release criteria) and Dividend payment tests (Loan Life Coverage Ratio (LLCR) and DSCR test).

Tax Assumptions: Tax rate, Tax holiday, Depreciation, Asset details of the Trains.

ECA Amortisation: Month and year of Commitment date, First drawdown date, Number of principal payments, End of availability period, First repayment and Final Repayment are provided.

All the modules in the Financial Variables section of the CFM are documented below.

FINANCIAL SUMMARY

Use of funds: Capital expenditure comprises of onshore, offshore CAPEX, drilling costs, and venture costs. All the details are extracted from the Capital Expenditure module for the respective trains in operation. Finance fees and Interest during construction are calculated from the Bank-ECA facilities module. Total project cost is the sum of Finance fees, Interest during construction and Total capital expenditures. Total Funding of Reserves Pre-Completion is calculated from the unlevered cash. Thus the input values are from the operating modules.

Sources of Funds: Senior project debt consists of bank facilities, ECA guaranteed tranches, capital market debt. Withdrawal details are obtained from the Bond Funding module (macro hardwired). Shareholders commitments are taken from the Bank–ECA module. The Sum of all these give the total funding for project costs. Pre-Completion Cash flow is arrived from reversing the total funding of reserves pre-completion, which is calculated, based on the post completion values provided above.

Operating cash flow is arrived from the post completion and debt repayment period values provided above and operating cash flow value from the unlevered cash flow module. Income on reserve accounts is arrived from the post completion and Debt repayment period values provided above and total income on Reserves from the bond-funding module. Sum of the above provides the cash flow available for debt service.

Financial summary module takes the calculated / projected values from the other financial models.

Interest post completion is calculated from the Interest payment due from the Bank-ECA module and the Interest value for all Tranches provided in the Bond-Funding module. Bank/ECA Loan Principal Repayment and Bond Principal Repayment are derived from the Bank-ECA and Bond-funding modules respectively. Sum of the above Interest post completion and Loan and Principal repayment provides the Total Debt service.

Drawing from (repayment of) the Guarantee is arrived from the Risk Management module. Shareholder Infusion to Reserve Accounts at Completion is extracted from the Bond-Funding module. Withdrawal (deposit) from Operations and Maintenance O&M Account, Withdrawal (deposit) from Build Up Period Reserve Account and Withdrawal (deposit) from Debt Service Reserve Account are arrived from the O&M account, Build-up period reserve account and Debt service reserve account from the Bond-funding module.

Cash flow to borrower distribution amount is calculated from the Post completion, Debt payment period, Bank-ECA Debt out standing and sum of Cash flow available for Debt service, total debt service, Drawing from mobile guarantee and Total withdrawal from reserve accounts. Cash retained in borrower distribution account is arrived from the DSCR test of financial assumptions and cash flow available for debt service from the Ratio analysis module. Cash Paid Out from Borrower Distribution Account Balance is calculated from the Cash balance of the Balance sheet and LLCR / DSCR of the financial assumptions.

Distribution is the sum of cash flow to borrower distribution account, cash retained in borrower distribution account and cash paid out from borrower distribution account balance.

Summary Ratio Analysis: Annual DSCR is the Cash flow available for debt service / 12 months from the Ratio Analysis module. LLCR is the Loan life coverage ratio.

The financial affairs of the company are directed by and are the responsibility of an individual designated as its Chief Financial Officer. The organisation, which the CFO directs includes the company's treasury functions, accounting and investor relations. Although the Treasury Department, lead by the company's Treasurer, is normally one of the smaller units of the company, personnel wise, it handles all of the monies actually received by and disbursed by the firm.

A good part of the Treasurer's duties, including the prompt collection of funds due, and paying the account due, involves timing of the cash management function. An oil company's cash income stream is normally fairly steady over time as oil and gas production is paid for month by month. Major projects and the payment o f dividends require large disbursements at specific points in time. This necessitates accumulating funds in anticipation of these requirements, usually in the form of commercial paper.

Commercial paper comprises short-term obligations with maturities of 2 to 270 days issued by banks, major corporations and other borrowers to investor with temporary idle cash. Company Treasurers like the flexibility and security of this type of instrument, which is issued only by top-rated concerns and is nearly always backed by a bank line of credit.

Good management practice calls for the periodic production of operating cost statements for each organisation unit. The difficulty of most of these statements stems from, the inclusion of large portions of allocated costs outside the control of supervisor. The allocated costs at these levels may include such things as accrued, but untaken, vacation time and other accounting refinements which are of little help in the day to day management of the activity.

Accounting for the financial performance of the entire firm follows an infinite maze of rules and regulations. Many of these procedures are traditional, and many are legal requirements, in society's effort to protect the innocent investor in the company. Accounting is the method of keeping score in business.

The scores depicted on the company's financial reports do not represent the availability of real spendable dollars. In contrast to the company's cashbooks, or records, the financial books are based on accruals that keep track of transactions that create assets or liabilities.

At the corporate level a series of several scoreboards, known as financial statements, are used. These always include the balance sheet and the income statement as a minimum. Other additional financial statements are also provided depending upon the requirements of the host government and the preference and persuasion of the CFO of the company.

EQUITY / BONDS AND DEBENTURES

Trance details like equity/bond amount, Interest, principal payments and ending balance are provided. Equity/bond amount is calculated based on the issuance period and the current month / year and the trance amount of the financial assumptions. Interest percentage is also taken from the financial assumptions and ending balance. i.e. Interest = Ending balance / (- %age of Interest / 2)

Principal payments is arrived from the input of first repayment period and final repayment period with respect to the sum of equity/bond amount and the current financial year / month. Reserve account details like O&M, royalty and tax reserve, loan and guarantee facilities, loan reserve balance are arrived from the cash budgets and tax depreciation modules as per the financial section flowchart.

Equity/bonds and debentures are in effect formal IOU's (I Owe You) in which the borrower or "issuer" commits to repay the total amount borrowed on a fixed date (84t). The issuer also agrees to pay interest on the debt at a fixed rate, usually in semi-annual payments. In the language of the financial community the period of time that the money is held by the borrower is called the "term". The interest rate is called the "coupon" even though it is no longer the custom to actually attach coupons to the certificates, which would be clipped off and cashed as the means of collecting the interest due. The coupon rate varies with the degree of financial risk, which the borrowing carries, and with the general level of interest rates, at the time the bond is first issued. The total amount to be rapid on the maturity date is referred to as the "face value", "par value" or "principal amount".

An equity or bond's current yield is found by dividing its coupon (annual interest) rate by its trading price. For an equity/bond bought at par the current yield is its coupon rate. If the equity or bond is purchased at any other price, its yield will differ from the coupon rate. The price of an equity or bond and its yield always move in the opposite directions as shown below for a $1,000 bond paying $100 annual interest:

Equity/Bond Price at par : $\frac{\$\ 100}{\$1,000} = 10.00\%$

As Equity/bond price rises its yield declines: $\frac{\$\ 100}{\$1,100} = 9.09\%$

When the equity/bond price declines, its yield rises: $\frac{\$\ 100}{\$\ 900} = 11.11\%$

In addition to considerations of "current yield", the investor is interested in "yield to maturity".

Here again, at par the equity/bond's yield to maturity is its coupon rate. If it is purchased at a premium it must be recognised that a portion of the premium must be amortised as a deduction from the coupon rate each year to its maturity in determining its true yield. An equity/bond purchased at a discount, of course, has the opposite and more favorable effect. These calculations are important in pricing new issues since the potential investor will not be interested in buying the new bonds if older ones from the same company are available in the market at more favorable terms. The yield to maturity may be determined by calculating the internal rate of return (IRR) of the bond.

Bank/ECA Loan Debt Service Account is calculated based on the previous periods 3 months balance. The same for 6 months balance period is provided. 3 months average balance is arrived from the Total Debt Service (P + I) /2 of the Bank-ECA module, based on the post completion and debt payment period provided above for the period 1994 to 2023 of 6 months period. Equity/Bond Debt Service Account is derived from the pervious period of a 3 months and 6 months balance. Equity/Bond Debt service for 3 and 6 months is calculated based on the total Bond debt service for all the 3 Tranches.

Total Target Amounts: Target Bank/ECA Loan Reserve Balance is the Bank/ECA Loan Debt Service Account for 6 months period. Target Equity/Bond Reserve Balance is the Equity/Bond debit service reserve for a 6 months balance. Target O&M Reserve Balance is the O&M, Royalty and Tax Reserve for a 2 months balance. Sum of all the above will lead to Total Target Reserve Account Balances.

Funds Available from Pre-Completion Cash flow is derived from operating cash flow value of the unlevered cash module and Final Period Cash flow Pre-Completion of the financial assumptions module. Funds Available from Post-Completion Cash flow (a) is calculated from the Cash flow available for debt service and Total debt service of the financial assumptions module. The sum of the post and pre-completion cash flow provides the Total Reserve funding available.

Operations and Maintenance (O&M) Account: Details of beginning balance are provided for duration of 29 years from 1994 in 6 months period. Based on the beginning balance and the Target O&M reserve balance, the Deposit to account is arrived. Shareholder Infusion at Completion and Withdrawal from account is arrived from the difference between Beginning balance, Deposit to account and Target O&M reserve balance.

Ending balance is the sum of Beginning balance, Deposit to account, Shareholder Infusion at Completion and Withdrawal from account.

Build Up Period Reserve Account: Details of beginning balance are provided for 30 years duration from 1994 in 6 months period. Deposit to account is arrived from the Cash flow Available for Debt Service / Debt Service (12 months) of the Ratio Analysis module, DSCR Release Criteria (historic) and Required balance of the Financial Assumptions.

Shareholder infusion at completion is the difference of Required balance of Financial Assumptions module and the Beginning balance / Deposit to account of the Build up period reserve account. Based on Drawing from (repayment of) the Guarantee of the Financial summary, withdrawal excess funding and Beginning balance/Shareholder infusion at completion and Deposit to account of the above the Withdrawal from account is derived. The sum of the above provides the Ending balance.

Debt Service Reserve Account: Based on the above build up period reserve account and O&M Account, the beginning balance, deposit to account and shareholder infusion at completion are arrived.

Withdrawal - Excess Funding is the difference between beginning balance, deposit to account and Shareholder infusion at completion. Withdrawal - Debt service shortfalls arrived from the Cash flow available for Debt service, shareholder infusion to reserve accounts of the financial summary module.

Interest Income: O&M Account, Debt service reserve account, Debt service accounts and Build up period reserve accounts are calculated by their individual above details and the LIBOR of Loan pricing matrix of the Financial assumptions. The sum of the above gives the Total Income on Reserves.

Equity/Bond Proceeds Account: Beginning balance is the previous ending balance. Interest income is the product of LIBOR of Loan Pricing matrix and Beginning balance. Deposit is the Capital Markets debt of the financial summary. Ending balance is calculated from the above without withdrawal (Macro Hardwired). Withdrawal (calculated) is the smallest of the sum of Total project cost, Bank facilities and ECA guaranteed Tranches reduced from beginning balance.

RISK MANAGEMENT / GUARANTEE

Risk management does not reduce the probability of an adverse even nor does it eliminate those things, which may cause loss. However, this can reduce or eliminate the loss, which would be incurred when the adverse even occurs. It is like seat belts in an automobile. They will not prevent an accident or reduce the probability of one occurring, but if an accident does occur it may prevent or reduce injury to the person wearing the seat belt. Risk management like the seat belt, just being there is not enough, it must be used to have an effect. Risk management will then be defined as a pre-loss planning. It involves identifying all events, which may occur that would cause a loss and evaluating each potential loss. The potential loss must include cost of repair or replacement, legal costs, lost or deferred income and lost future income in the event that repair or replacement are not possible (16c).

In the CFM Risk Management/Guarantee module, LNG Volume is provided from the reserves/volumes module. LNG market price is from the pricing module. Price guarantee is arrived from the LNG price for the period through 2009-2014 of the operating variables. LNG revenue differential is the difference between LNG price guarantee and LNG market price based on the LNG volume. Debt service shortfall is the difference between cash flow available for debt service and total debt service of the financial summary module.

LNG revenue differential is arrived as follows. LNG rev. differential = MAXA (price guarantee-LNG market price) x LNG volume. MAXA returns the maximum value in the list of arguments provided.

Risk Management Module

YEAR	1999	1999	2000	2000
MONTH	6	12	6	12
LNG Volume - KGC (trillion btu)	0.0	30.6	76.5	91.8
LNG Market Price – KGC		2.90	2.92	2.92
Price Guarantee		1.90	1.90	1.90
LNG Revenue Differential	0.0	0.0	0.0	0.0
Debt Service Shortfall	0.0	0.0	0.0	0.0
Subordinated Loan				
Beginning Balance	0.0	0.0	0.0	0.0
Drawdown	0.0	0.0	0.0	0.0
Repayment	0.0	0.0	0.0	0.0
Ending Balance	0.0	0.0	0.0	0.0
Beginning Balance	0.0	0.0	0.0	0.0
Current Interest on Principal	0.0	0.0	0.0	0.0
Interest Repayment	0.0	0.0	0.0	0.0
Ending Balance	0.0	0.0	0.0	0.0

Beginning balance is arrived from the previous ending balance. Drawdown is the minimum of the values of Exposure capital of the operating assumptions module and the LNG revenue differential, Debit service shortfall. The inputs from the financial summary and the bond-funding module provide the repayment loan. These input links are shown in the CFM flowchart.

CASHFLOW WATERFALL

Cash flow waterfall provides details of operating cash flow, additions and deductions, which are taken as input from unlevered cash flow module, bond funding and risk management / guarantee module. The module provides and explains the Cash flow. Total revenue, operating costs, Royalty, Taxes and working capital are extracted from the unlevered cash flow module. The sum of the above provides the Operating cash flow.

Additions: Interest Income on Reserve Accounts, Withdrawal from O&M Account, Withdrawal from BUPRA are provided from the Bond funding module. Withdrawal from Debt Service Reserve Account is the difference between withdrawal excess funding and withdrawal –Debt service short fall. Drawdown from guarantee is the principal drawdown from the Risk management Module. Drawdown from Cash Balance is the Cash Paid Out from Borrower Distribution Account Balance of the financial summary module. Sum of all the above is the Total additions.

Deductions: Debt service, Deposit to O&M account, Deposit to BUPRA, Deposit to Debt service reserve account, Interest on guarantee, Principal on guarantee, Deposit to cash balance and Dividends details are provided from their respective modules.

TAXATION AND DEPRECIATION

Earning Before Interest, Tax, Depreciation and Amortisation (EBITDA) is derived from the taxation module. Interest expense is from the interest post completion from the financial summary module. Interest income is taken from the bond funding. Sum of the above with EBITDA and depreciation is the taxable income. Tax expenses are calculated based on the operating and financial assumptions.

Depreciation comprises of total capital expenditure from the Capital Expenditure module, financial fees and IDC is the sum of finance fees and interest during construction of the financial summary module. Depreciable assets are calculated based on the Taxation assumptions made on assets included in the financial assumptions as per the links given in the CFM flowchart.

Total depreciation asset is the sum of Total capital expenditure and Finance fees and IDC. Net Depreciable assets, is the difference in sum of Total Depreciation assets and Depreciation and previous period's net Depreciable assets.

Tax calculations will vary considerably from country to country, and even from project to project. Details of the calculations, particularly with regard to depreciation, will have to be provided from expert sources and reflected in the model as they become available. Careful consideration is required in order to distinguish between essential data and inappropriate detail when trying to incorporate such information into the model. It is, for example, not usually appropriate to break out the costs of one or two staff vehicles in order to calculate capital allowances for them on a different basis to the other costs. When selecting the level of detail to be reflected in the model, consideration should be given to the likely effect of any simplifying assumptions on the tax calculations, and the extend to which the tax values critically affect the project.

Given the above, a general layout can usually be assumed for tax calculations, and can certainly be used in a feasibility model if no useful tax information is initially available. The basic data for which assumptions are required are:

- The tax rate as a percentage.
- The basis for depreciation / capital allowances
  - Straight line or declining balance;
  - Periods of depreciation or percentage per annum;
  - Assignment of capital costs between different depreciation bases
- The basis for timing of payment of calculated tax.

Tax depreciation or capital allowances can often prove the most complex part of the tax calculation. Information must be obtained giving appropriate estimates of the division of capital costs between different depreciation categories, and what categories are to be included in the model. Depreciation is generally calculated on one of two bases – straight line or declining balance. Straight-line depreciation is the depreciation of a value in equal annual amounts over a specified period. Declining balance depreciation is calculated as an annual value equal to a given percentage of the remaining un-depreciated costs, for a specified or an unlimited period.

When first setting up the depreciation calculations, if the actual depreciation basis is unknown, and time is limited, declining balance depreciation is easier to model. If time is not critical, then include both methods as options to be selected for each of, say, two categories of depreciation. A table can then be included in the data that lists all elements of construction costs, plus ongoing maintenance and capitalised interest and fees, and specifies the percentage of each item included in each depreciation category. Each category should allow input of the period over which straight line depreciation (if selected) will apply and the percentage to be used for the alternative, declining balance calculation, should that be selected. Selection between them can be made for each category by means of a switch in the data.

Allowing determination of the period over which straight line depreciation is to be made, as an input data item, requires some care if costs are not all depreciable from a single period. This is often the case, with ongoing maintenance and refurbishment costs needing to be depreciated, or with depreciation commencing before all capital expenditure has been made.

INCOME STATEMENT

The income statement is the second of the principal financial statements. While the balance sheet shows the assets, and how they are financed as of a particular date, the income statement indicates the amount of profit the company made during the year; how much was paid out to shareholders as dividends; and how much retained for the growth of the business (55h).

The income statement shows four different types of profit. These are: Gross Profit; Operating Profit; Profit Before Tax and Net Profit After Tax. It is this latter figure that is often referred to as "the bottom line". Net Income is the company's profit for the reporting period. All of the adjustments previously described are included in arriving at the Net Income. This figure represents the funds that are available for dividends to the shareholders or for reinvestment in the business. If "Cash Dividends" exceed Net Income, then the end of year balance will be less than that at the beginning of the year.

The after tax profit for the period, usually one fiscal year ending with the date of the balance sheet, is comprised of the revenues earned, expenses incurred, the gains, losses and net income or net loss for the period. All of this information is detailed in the Income Statement, which is sometimes referred to as the Profit and Loss Statement or merely as the Earnings Report.

The monetary amounts shown in the financial statements must confirm to certain account practices. The International Accounts Standards Committee with representation from over 70 countries seeks to coordinate and unify these procedures. In the US, the procedures must be acceptable to such authorities as the Financial Accounting Standards Board (FASB), the Securities and Exchange Commission (SEC) and the Internal Revenue Service (IRS). In the IK, the Accounting Standards Committee (ASC) with its Statements of Standard Accounting Practice (SSAP) serves similar function. There are counterpart organisations in the other countries. Each of these bodies has its own rules. These do not generally vary a great deal from one another as to the basics, but they can certainly differ in the specifics – and accounting has to be specific.

A frequent source of these differences stems from an observation that, accounting theory is not static. This means that changes in one country, while they may be fully acceptable to the next country, are not always implemented at the same time. There is also the frequent case that each country, like to be a little different, if for no other reason than to draw attention to its independence.

In the CFM, the income statement module includes revenue details like LNG revenue, field and plant condensate and sulphur revenue that are taken from the Revenues module. Total operating costs like field and plant operating costs and royalty payments are provided from the cash budget costs module. EBIT is the difference between EBITDA and depreciation, which is from the tax depreciation module.

Profit / Loss to retained earnings are calculated from Pre-tax profit and post-tax profit, which are derived from the bond funding and tax depreciation modules respectively as per the links in the CFM flowchart.

BALANCE SHEET

By tradition the balance sheet is divided into two sides. On the left hand side the assets of the firm are listed, and subdivided into several major groupings. On the right hand side the company's liabilities are listed, i.e., what the firm is obligated, or is obligated, or will be obligated to pay. Below the liabilities section is a statement of the stockholders equity, i.e. paid up common shares plus retained earnings and surplus. The equity figure, in effect, lists the amount the stockholders would share, or "split up" if the company were liquidated at full market value on the balance sheet date. The left and right sides of the balance sheet always total to exactly the same figure, i.e., the assets must equal the sum of the liabilities plus the shareholders equity, the basic accounting equation (84u).

There are two important facts that should be recognised with regard to a company's balance sheet. First, the asset values shown, is what was actually paid for the listed assets, when they were acquired less accumulated Depletion, Depreciation and Amortisation (DD&A), unless the DD&A is listed separately. If the assets were acquired a long time in the past they probably bear little relationship to current or replacement value due to inflation. Secondly, any change that is made to the balance sheet must flow through the income statement. This means that any accounting changes that affect the balance sheet will also affect profit on the income statement. Any revelation of assets, such as inventory or marketable securities will also affect profit.

The left hand side of the balance sheet would typically have the Assets listed in. A company's list of assets reflects how the enterprise has used monies made available to it. The assets page is nominally divided into Current assets and Fixed assets. Current Assets include cash in the bank, and other liquid assets that will be turned into cash in the normal course of business within on year of the balance sheet date. Fixed Assets are the major assets of the company which are not intended for sale and which are used in the conduct of the company's business.

The right hand side of the balance sheet would traditionally have the Liabilities and the Net Worth of the project or company. The liabilities indicate what money has been made available to the enterprise and its source. Liabilities can also be further divided into Current Liabilities and Long-Term Liabilities. Current Liabilities are those financial obligations, which are due within one year. Current assets and current liabilities are related to some degree since the current assets represent the source from which payments are made to satisfy the current debts. Long-Term debts are categorised as a Long-Term Liabilities.

On the right hand side of the balance sheet, following liabilities, it would also show the Net Worth or Shareholder's Equity, which represents the total equity interest that all of the shareholders as a group own in the corporation. The category is also variously known as owner's equity, proprietorship, capital and net worth. The company's net worth is determined after subtracting all liabilities, although it must be remember that the assets are recorded at their initial, or original cost rather than at their current replacement value. Also in the case of oil and gas exploration and producing companies there is no direct recognition on the balance sheet of the often very substantial value of the firm's underground reserves, which have been found through its own exploratory effort.

Net worth can be further divided to Common Stock, Preferred Stock and Retained Earnings. Most public companies issue a certain amount of equity in shares. This is known as its authorised capital. A company may not need its entire authorisation initially. The amount actually issued to stockholders is known as the issued capital. This may equal but not exceed the total authorised by the current shareholders. Basically the category of the firm's common stock, or contributed capital represents the shareholder's ownership of the company.

A secondary form of oil company financing is known as Preferred Stock. These usually non-voting, certificates represent contributions of capital to the company with a commitment that dividends will first be paid to the owners of the preferred shares before any dividends are paid to the company's common share owners.

Retained Earnings, which is sometimes designated as "Earned Surplus", is the accumulation of the firm's earnings that have been reinvested in the company and not paid out as dividends. It is properly included as part of the shareholder's equity or Net Worth of the project.

In the CFM balance sheet module, cash balance is the difference between cash retained in borrower distribution account and cash paid out from borrower distribution account balance.

Reserve accounts, bond proceeds amount is from the bond-funding module. Net working capital and Net fixed assets are from the Working capital and the Tax depreciation module respectively.

Accrued tax is from the tax depreciation module. Bank ECA loans, bonds, subordinated loans are from the bank ECA and bond-funding module respectively.

Shareholders Equity details like paid-in capital is the sum of shareholders commitment of the financial summary module and previous period paid-in capital. Retained earnings is the input from the Income statement module. Income statement module is the major data provider of the balance sheet derivation.

CASH FLOW SUMMARY

Cash flow summary consists of the cash flow from operations, cash flow from investment and cash flow from financing.

After-tax profit and change in deferred taxes are from the income statement and Tax depreciation model. Change in working capital, change to cash balance and depreciation are from the working capital, balance sheet and the Income statement module. Cash flow from investment input of the cash flow summary is from the financial assumptions and capital expenditure module.

Total cash flow is the sum of increase (repayment) of debt, decrease (increase) in reserve accounts and decrease (increase) in bond proceeds account, new equity subscribed and dividends paid, which are taken as input from the financial summary, bond funding and risk management / guarantee modules.

The cash flow summary is a key report for project finance purposes and can give a very full picture of a particular scenario being presented. The details of rows included in the cash flow summary will vary from deal to deal, reflecting the nature of the project – for example the industry type, and the figures of particular concern for the project at a given time.

In addition, the content of the cash flow summary will depend upon who is preparing the model and who will ultimately see the printed results. Detailed equity returns, for example, may well be considered confidential if the model is being prepared by the investors for presentation to banks or as part of a bid. Similarly, banking advisers may not wish to provide details of assumed fee amounts when presenting model output to potential lenders, with whom fees will be a matter of negotiation.

The total cash flow summary statement would include cash flow from Operations, Investment and Financing. Typical cash flow from Operations would be the sum of After Tax Profit, Change in Deferred Taxes, Change in Working Capital, Change to Cash Balances, and Depreciation. Cash flow from Investments would be Capitalised Finance Fees, Capitalised Interest During Construction, and Other Capital Expenditures. Cash flow from Financing is the total of Increase (Repayment) of Debt to Banks, ECA's, Bonds or Company Loans, Decrease (Increase) in Reserve Accounts, Decrease (Increase) in Bond Proceeds Account, New Equity Subscribed, and finally Dividends Paid.

RATIO ANALYSIS

Ratio analysis comprises of main groupings like operating ratios, financial ratios and Loan Life Coverage Ratio (LLCR).

Percentage increase in revenues is calculated from the total revenues of the revenue module. EBITDA margin and EBIT margin are calculated from the Income statement module. Pre-tax profit margins and after tax profit margin are calculated from Pre-Tax profit, after tax profit and total revenues of the income statement. Operating module is the source of main input to operating ratios.

Cash flow available for debt service / interest is calculated from the cash flow available for debt service of financial summary and working capital of the unlevered cash flow module. EBITDA / interest is calculated from EBITDA of income statement and interest post-completion of financial summary. Cash flow available for debt service / debt service (6 months period) is arrived from the total debt service, Cash flow available for debt service and working capital of unlevered cash flow. EBITDA / debt service is calculated from the EBITDA of the Income statement and Total adept service of Financial summary module. Financial modules are a main source of income for the financial ratios of the ratio analysis module.

Loan Life Coverage Ratio is calculated from comprises of the cash flow from completion, NPV of cash flow, debt service reserve accounts, bond amortisation, bank/ECA loans and bond principal.

Cash flow from completion to final maturity of debt is calculated based on the details provided in the operating variables module. Debt service reserve accounts is the sum of target bank/ECA loan reserve balance and target bond reserve balance. Bond amortisation during bank/ECA facilities is the principal from the bond-funding module. Bank/ECA loan balance is calculated from the Bank-ECA module.

The primary cash flow tool in project finance is ratio analysis (13f). These are as follows:

- Annual Cover Ratios includes Interest Cover, Principal Cover and Debt Service.
- PV Cover Ratios includes Loan Life and Project Life.
- Overall Ratios includes Debt:equity and Residual Cover.

The numerator is first established as Available Cash Flow (ACF) before debt service. An easy way to do this is to take total uses from total sources (net cash flow) and add back Principal and Interest (P&I). The best practice is to evaluate the net cash flow after all other cash requirements or available surpluses (not reserves) are counted. The ACF is then divided by principal, interest, or debt service payments in that year to determine the respective annual cover ratio.

There is a proliferation in definitions of ACF. There may be (deliberate) inclusions and exclusions such as replacement CAPEX, reserves, bonus accounts, interest on surplus funds, residual value, abandonment/site rehabilitation costs, working capital charges, provisions, or sinking funds, each of which affects the annual cash flow or availability of funds for servicing debt.

The PV ratios discount the annual ACF by the interest rate and then divide that sum by the total amount of the project financing. The PV ratio to the end of the loan is called the Loan Life Ration (LLR) and until the end of the project/pro forma, the Project Life Ration (PLR). Originally popularised in North sea petroleum projects, this ratio is now required even for long term projects where cash flow profile is distinctly different from petroleum and the PV seriously diminishes the value of cash flow beyond say 10 years out.

For the overall ratios, most project financiers count the future funding only in the debt:equity ratio. Sunk-equity may or may not be counted.

BANK / ECA FACILITIES

The major banking institutions of the world are an important source of funds to the oil and gas industry. Bank loans tend to be more flexible, but are generally costly than other forms of financing. A frequent first use of new long-term debt in the industry is to pay off the more expensive short-term bank loans that have not been amortised out of current earnings (84v). Unsecured short-term bank loans by definition are payable in one year or less. Such loans are typically of several different types.

Line of Credit. This is usually an informal agreement between the bank and its customer. The specified amount is intended as a ceiling of the credit available at any one time, and is based on the bank's assessment of the credit worthiness of the borrower. There is no legal obligation on the part of the bank to actually extend the promised credit.

Revolving Credit Agreement. This involves an actual legal commitment on the part of the bank. A fee, normally a fraction of a percent, is usually charged on the unused portion of the total credit. The portion drawn down is also subject to the agreed interest charges.

Transaction Loan. This type of loan is undertaken when a firm has need of funds for a specific purpose or project. The principal determinant of the loan and its terms is the bank's evaluation of the cash flows, which the project is expected to generate.

Dedicated COI Payment. Dedicated Cash Operation Income (COI) payment loan is the most common type of borrowing, particularly to the independent sector of the oil and gas industry. This type of arrangement is also known as a production payments interest (PPI). The dedicated COI payment loan is repaid from a "dedicated" portion of the COI. Since income from a producing property varies on a monthly basis, the total periodic payment also varies, and there is not set time period under which the loan must be repaid. Normally, the dedicated portion is a percentage of the COI, after a retainer has been taken out. Interest is paid first from the dedicated monies then the remaining funds are used to repay the principle. If the dedicated monies are not sufficient to pay the interest charges, then the remaining amount of interest is compounded.

Export Credit Agencies (ECAs) exist to foster the foreign investment and export of goods and services of their nation's companies (55i). Most offer a substantial portion of funding as long term and fixed rate. Sometimes they will take the long maturities (after the banks have been repaid).

However, ECAs have only focused on project financing as a discrete business function since around 1994, and the majority, proceed with great caution. ECAs follow the Berne Union, which establishes rates for the main currencies and terms. For large project financings, two or three may participate as complementary financiers with parallel facilities. ECAs can also provide project financing through banks or directly to the buyer via guarantees to the buyer's bankers. As government agencies, ECAs require longer to analyse, approve and document a transaction.

Bank Facilities: Margin is calculated based on the Post-completion and number of periods post completion. Interest rate is the sum of Margin and LIBOR.

Bank facility details like Loan Amount, Percentage of Cap Ex Drawdowns, Bank upfront fee, Bank commitment fee, ECA commitment fee, ECA premium, First

Drawdown year and month and Number of principal payment details are provided. Amortisation is arrived from the maximum outstanding loan balance. Interest payments due, is calculated from the Interest rate and beginning balance. Based on the 1st Drawdown and the current, the product of Loan Amount and Bank upfront fee the Bank upfront fees due is calculated.

Based on the current period and Commitment date and month, the sum of product of ECA premium1 and Loan Amount and product of ECA Premium2 and Drawdown for Capital expenditures, the ECA premium due is calculated. Based on the Post commitment date and post completion and the Loan amount and ECA commitment fee, the Commitment fees due is calculated.

The difference between sum of Total Drawdown / Principal repayments and Sum of interest payment due, Bank upfront fees due, ECA premium due, Commitment fees due and other fees costs due provides the all-in cost. Based on Principal Repayments, Loan amount and Period (for weighted average life), the Weighted Average Life (from Completion) is calculated.

In CFM module, Bank Facilities, US Export and Import (USEXIM) guarantee facility, Exports Credit Guarantee Department (ECGD) guarantee facility and SACE (Export Credit Agencies of Italy) guarantee facilities are calculated and explained.

Details like LIBOR, margin and interest rate are taken from the financial assumptions module. Loan amount (actual) is the sum of total drawdowns. All other details like bank commitment fee, ECA commitment fee and ECA premium is from the financial assumptions. Based on these details, interest payment due, bank upfront fee due, ECA premium due, commitment fees due, other fees / costs due are calculated.

Ending balance comprises of beginning balance, drawdown for capital expenditures, drawdown for financing costs, drawdown of uncovered ECA financing costs and undrawn due to maximum loan amount. The above details are provided for all the four guarantee facilities. The cumulative of all the four facilities are also explained. Thus operating assumptions, financial assumptions and bond funding modules serve as a main data source for analysing the ECA-Bank facilities.

SAMPLES MODULES OF THE CFM

OPERATING VARIABLES

TECHNICAL DATA

Final Acceptance Certificate:	Train 1	
	Train 2	
Operational Reliability Certificate:		
Completion Month (end of month)		
Completion Year		
Initial Stabilised Field Cond. to Wellhead Gas Ratio		0 bbl/MMscf
Initial Plant Condensate to Wellhead Gas Ratio		0 bbl/MMscf
W/head Gas Prod. to LNG Volume Ratio (FOB Basis)		0 MMscf/bn Btu
LNG Conversion Factor		0 MMBtu/ton
Sulphur Yield (tons/MMscf wellhead gas)		0
Gas Heating Value at Plant Inlet		0 Btu/scf
Percentage of Wellhead Stream Exempt from Feedstock Royalty (Fuel, Losses & Inerts)		%

OPERATING COSTS (1995 $ Millions) See Costs page

Inflation Rate	0 %	Sensitivity	0%

PRICING

Brent Forecast	0	if "2" or "3" then	Brent Price	$
JCC Forecast	0	if "3" then	Ratio JCC/Brent	
Dubai Forecast	0	if "3" then	Constant Ratio Dubai/Brent	
Field Condensate Forecast	0	if "3" then	Constant Ratio Field Cond./Dubai	
Plant Condensate Forecast	0	if "3" then	Constant Ratio Plant Cond./Dubai	

(1=P&G Base Case, 2=P&G Ratios, 3=Constant Ratios)

Annual Escalation Rate 0%

Sulphur Price (1996) $0.0 /ton plus 0% per year

LNG Price Guarantee

Price		*Thru*		
			Exposure Cap ($M)	0.0
0	$/MMBtu			
0	$/MMBtu		Interest Rate	0%

First Sale and Purchase Agreement

LNG Price Scenario (1=Highest,2=Floor,3=Market) 3

Scheduled Period	11	12	13	14	15	16	17	18	19	20

ROYALTY CHARGES

Royalty on Condensate Sales	0%	
Feedstock Gas Royalty (minimum)	$0	per MMBtu
L (1993) / L (1995)	0	
P (1995)	0	

CAPITAL EXPENDITURES (see CapEx page)

Delay (number of 6 month periods)	0
Beginning period number	0
Cost Overrun (in excess of contingency)	
Train 1	0.0
Train 2	0.0

CONDENSATE DECLINE RATES (see Volumes page)

	Field	Plant	
Linear Decline Rate	0.0%	0.0%	per year
Hardwired (YES or NO)	YES	YES	

Scheduled Year	1999	1999	2000	2000	2001	2001	2002	2002	2003	2003
Scheduled Month	6	12	6	12	6	12	6	12	6	12
1st Buyer Adjusted Annual Cont. Quantity	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00

LNG Floor Price (1993)			*LNG Market Price*				Escalation
	$0.00	$/MMBtu	Oil weighting	0.00	"Alpha" (CPI base)	0.00	0.0%
plus	0.0%	per year	CPI weighting	0.00	"Beta" (Transport)	0.00	0.0%
until	0		Boiloff Percentage	0.0%			

Second Sale and Purchase Agreement **LNG Price Scenario (1=Highest,2=Floor,3=Market)**

Scheduled Period	11	12	13	14	15	16	17	18	19	20
Scheduled Year	1999	1999	2000	2000	2001	2001	2002	2002	2003	2003
Scheduled Month	6	12	6	12	6	12	6	12	6	12
2nd Buyer Adj. Annual Contract Quantity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

LNG Floor Price (1993)			*LNG Market Price*				Escalation
	$0.00	$/MMBtu	Oil weighting	0.000	"Alpha" (CPI base)	0.00	0.0%
plus	0.0%	per year	CPI weighting	0.000	"Beta" (Transport)	0.00	0.0%
until	0		Boiloff Percentage	0.00%			

RESERVES / VOLUMES

Scheduled Period		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Actual Period		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
LNG	**YEAR**		**1994**	**1994**	**1995**	**1995**	**1996**	**1996**	**1997**	**1997**	**1998**	**1998**	**1999**	**1999**	**2000**	**2000**
	MONTH		**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**
LNG Trains in Operation			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total LNG Sales Quantities (MMT FOB)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1st Buyer													0.00	0.00	0.00	0.00
2nd Buyer													0.00	0.00	0.00	0.00
Total LNG Volumes (trillion Btu)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1st Buyer			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2nd Buyer			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Wellhead Gas Production Required (scf/day)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1st Buyer			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2nd Buyer			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIELD CONDENSATE																

Hardwired Decline Curve	ON	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Linear Decline Curve	OFF	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.0%	99.0%
Field Condensate Produced ('000 bbl/day)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
@ 0 bbl/MMscf of gas															
Total Field Condensate Produced (MMbbl)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PLANT CONDENSATE															
Hardwired Decline Curve	ON	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Linear Decline Curve	OFF	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.0%	99.0%
Plant Condensate Produced ('000 bbl/day)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
@ 0 bbl/MMscf of gas															
Total Plant Condensate Produced (MMbbl)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SULPHUR															
Sulphur Recovery (tons/day)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
@ 0tons/MMscf															
Total Sulphur Produced ('000 tons)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0

PRICING

		Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14
		YEAR	**1994**	**1994**	**1995**	**1995**	**1996**	**1996**	**1997**	**1997**	**1998**	**1998**	**1999**	**1999**	**2000**	**2000**
		MONTH	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**
REFERENCE CRUDE PRICES																
Brent ($/bbl)		**Purvin & Gertz**					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dubai Base ($/bbl)		**Purvin & Gertz**					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
LNG FLOOR PRICE ($/MMBtu)	1st Buyer						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2nd Buyer						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LNG MARKET PRICE																
JCC ($/bbl)		**Purvin & Gertz**					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beta Adjustment ($/MMbtu)	1st Buyer						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2nd Buyer						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LNG MARKET PRICE ($/MMBtu)	1st Buyer						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2nd Buyer						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FIELD CONDENSATE PRICE ($/bbl)		**Purvin & Gertz**					0.00	0.00	0.00	0.00	0.00	0.00	19.05	19.05	19.18	19.18

PLANT CONDENSATE PRICE ($/bbl)	**Purvin & Gertz**			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SULPHUR PRICE ($/ton)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PURVIN & GERTZ FORECAST (a)													
Brent ($)				**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Dubai ($)				**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
JCC ($)										**0.00**	**0.00**	**0.00**	**0.00**
Field Condensate ($)										**0.00**	**0.00**	**0.00**	**0.00**
Plant Condensate ($)										**0.00**	**0.00**	**0.00**	**0.00**
Escalation Factor				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brent (MOD)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dubai (MOD)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JCC (MOD)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Field Condensate (MOD)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plant Condensate (MOD)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dubai/Brent ($)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JCC/Brent ($)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Field Condensate/Dubai ($)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plant Condensate/Dubai ($)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(a) As of .

FINANCIAL SUMMARY

(US$ millions)

			1994	1994	1995	1995	1996	1996	1997	1997
YEAR			**1994**	**1994**	**1995**	**1995**	**1996**	**1996**	**1997**	**1997**
MONTH			**6**	**12**	**6**	**12**	**6**	**12**	**6**	**12**
1 = Completion			0	0	0	0	0	0	0	0
1 = Post-Completion			0	0	0	0	0	0	0	0
1 = Debt Repayment Period			0	0	0	0	0	0	0	0
1 = Bank/ECA Debt Outstanding			0	0	0	0	0	0	0	0
USES OF FUNDS	**TOTAL**									
Capital Expenditures										
- Onshore Capex	0	0%	0	0	0	0	0	0	0	0
- Offshore Capex	0	0%	0	0	0	0	0	0	0	0
- Drilling Costs	0	0%	0	0	0	0	0	0	0	0
- Venture Costs	0	0%	0	0	0	0	0	0	0	0
Total	0	0%	0	0	0	0	0	0	0	0
Finance Fees	0	0%	0	0	0	0	0	0	0	0
Interest During Construction	0	0%	0	0	0	0	0	0	0	0
Total Project Cost	0	0%	0	0	0	0	0	0	0	0
Total Funding of Reserves Pre-Completion	0	0%	0	0	0	0	0	0	0	0
Total Uses of Funds	0	0%	0	0	0	0	0	0	0	0
SOURCES OF FUNDS	**TOTAL**									
Senior Project Debt										
- Bank Facilities	0	0%	0	0	0	0	0	0	0	0
- ECA Guaranteed Tranches	0	0%	0	0	0	0	0	0	0	0
- Capital Markets Debt	0	0%	0	0	0	0	0	0	0	0
Total	0	0%	0	0	0	0	0	0	0	0
Withdrawl (Deposit) from Bond Proceeds Account			0.0	0.0	0.0	0.0	0.0	0	0	0
Shareholders Commitments	0	0%	0	0	0	0	0	0	0	0
Total Funding for Project Costs	0	0%	0	0	0	0	0	0	0	0
Pre-Completion Cashflow	0	0%	0	0	0	0	0	0	0	0
Total Sources of Funds	0	0%	0	0	0	0	0	0	0	0
NET CASHFLOW POST-COMPLETION										

Operating Cashflow					
Income on Reserve Accounts		-	-	-	-
Cashflow Available for Debt Service					
Interest Post-Completion					
Bank/ECA Loan Principal Repayment					
Bond Principal Repayment		-	-	-	-
Total Debt Service					
Drawing from (repayment of) Mobil Guarantee		0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
Shareholder Infusion to Reserve Accounts at Completion					
Withdrawl (deposit) from O&M Account					
Withdrawl (deposit) from Build Up Period Reserve Account					
Withdrawl (deposit) from Debt Service Reserve Account					
Funding from pre-completion cashflow		-	-	-	-
Total withdrawl (deposit) from Reserve Accounts					
		-	-	-	-
Cashflow to Borrower Distribution Account					
		-	-	-	-
Cash Retained in Borrower Distribution Account					
Cash Paid Out from Borrower Distribution Account Balance		-	-	-	-
		-	-	-	-
Distributions					
SUMMARY RATIO ANALYSIS					
Annual DSCR					
Average Annual DSCR	0				
Minimum Annual DSCR	0				
12 month Projected DSCR at Scheduled Completion	0				
LLCR					
Minimum LLCR at Completion	0				

RISK MANAGEMENT / GUARANTEE
(US$ millions)

12-1

YEAR	1994	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999	1999	2000	2000	2001	2001	2002	2002
MONTH	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
LNG Volume - KGC (trillion btu)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0
LNG Market Price - KGC												0	0	0	0	0	0	0
Price Guarantee												0	0	0	0	0	0	0
LNG Revenue Differential	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Debt Service Shortfall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<u>Subordinated Loan</u>																		
Principal:																		
Beginning Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drawdown	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ending Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest:																		
Beginning Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current Interest on Principal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ending Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

BALANCE SHEET

(US$ millions)

YEAR MONTH	1994 6	1994 12	1995 6	1995 12	1996 6	1996 12	1997 6	1997 12	1998 6	1998 12	1999 6	1999 12	2000 6	2000 12	2001 6	2001 12	2002 6	2002 12
ASSETS																		
Cash Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reserve Accounts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bond Proceeds Account	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Working Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Fixed Assets	0.0	0.0	0.0	0.0	0.0	0.0	00.0	0.0	0.0	0.0	0.0	0.0	00.0	0.0	0.0	0.0	0.0	0.0
Total Assets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIABILITIES																		
Accrued Taxes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current Portion of Long-Term Debt																		
Bank/ECA Loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bonds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subordinated Loan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long-Term Debt																		
Bank/ECA Loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bonds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHAREHOLDERS' EQUITY																		
Paid-in Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Retained Earnings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Equity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Liabilities and Shareholders' Equity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Debt/Paid-in Capital + Debt						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Balance check	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*