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## **Introduction: An overview of the financial issues in the energy industry**

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**Abstract:** This special issue of the *International Journal of Global Energy Issues* discusses some models, concepts and cases related to the financial issues in the energy industry. The special issue itself is the brainchild of some oil and gas finance practitioners. It is based on their recognition of the importance of financing and investment decisions in the energy sector and their far-reaching implications not only for the energy industry but also for all other industries using energy products as their feedstock and fuel. This special issue presents the contributions of many academicians and practitioners. The specific topics include the financial and technical feasibility of a power plant, asset valuation and strategy, financial optimisation using real options approach in the refining industry, application of portfolio theory and optimisation in the oil and gas industry using the semivariance measure of risk, petroleum fiscal regimes in developing jurisdictions (Alaska and Angola), the impact of financial volume on strategy, risk management and incentives design, and finally, mergers and acquisitions in the electric utilities of Latin America.

**Keywords:** energy finance; asset pricing models; real options; mergers and acquisitions; asset valuation; financial optimisation; petroleum fiscal regimes; portfolio theory; risk management; financial feasibility; refining; electric utilities.

**Biographical notes:** Dr. Musa Essayyad is the Saudi British Bank Chair Professor of Finance at the King Fahd University of Petroleum and Minerals. He received his MA and PhD in Finance from the University of Alabama, USA. He teaches graduate courses in Investment Management, International Finance and Corporate Finance. His research interests are asset valuation, portfolio diversification and applications of financial theory to the oil and gas industry. He serves as editor, co-editor, associate editor and guest editor for some scholarly journals.

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This special issue contains eight papers on contemporary financial issues in the oil and gas industry. They discuss the financial and technical feasibility of a power plant, asset valuation and strategy, application of portfolio theory and optimisation, petroleum fiscal regimes in developing jurisdictions, the impact of financial volume on strategy, financial optimisation in the refining industry, risk management and incentives design, and finally, mergers and acquisitions in the electric utilities of Latin America.

In their paper ‘Techno-economic evaluation of revamping of coal-fired power plants in India’, Dutta *et al.* argue that owing to chronic power shortages and scarcity of capital, many countries, including India, have resorted to the revamping of old power plants, as opposed to building new ones, since new power projects go through long environmental assessments and approval processes. Moreover, many thermal power plants can benefit from additional capacity through upgrades of existing equipment. Such upgrades can be done in a relatively short time at a much lower cost. India, like many other countries around the world, has identified several thousand megawatts of thermal capacity for revamping and modernisation prior to 2012. The majority of these boilers use PC-fired technology and were designed for coal with an ash content of between 25% and 35%.

The three co-authors examine a number of technological options for revamping and modernisation of the Panki coal-fired power plant located in Kanpur, India. The technical analysis is supplemented with detailed financial analysis to present a comprehensive techno-economic evaluation of revamping a coal-fired power plant. The financial analysis indicates that the CFB revamping option gives the highest return on investment compared with alternatives. Moreover, to demonstrate the technical soundness and viability of the special design used in this revamping, a sub-scale CFB boiler has been designed and built at another power plant.

On asset valuation and strategy, Emhjellen *et al.* point out in their article, ‘The choice of strategic core – the impact of financial volume’, that recent trends among major oil companies and independents have been corporate consolidation through mergers and acquisitions and focus on key strategic core areas. The announced goals have been to achieve synergy, reduce costs and concentrate on areas with maximum expected value creation. They also point out that according to IRR evaluation, the absolute size of the discounted after-tax cash flow – often referred to as financial volume or materiality – is not considered integral for the decision of whether or not to invest. If a project’s IRR is higher than the required rate of return, the project will be implemented. This seems to be at deviance with investment patterns in the oil industry, where there seems to be a clear preference for projects with a high financial volume. A small project can be unattractive even if it gives an expected high IRR.

Furthermore, Professors Emhjellen *et al.* provide a model that endogenously determines the optimal number of projects to implement in an optimal number of areas. They show that the decision of whether or not to invest in a project cannot be seen in isolation but must be linked with portfolio optimisation and the strategic core of the firm. Accounting for excess opportunity costs and monitoring costs, they demonstrate how financial volume, *i.e.*, materiality, is decisive for companies’ investment allocation decisions and how implementing marginally profitable projects in low-tax areas may be part of an optimal solution.

In another paper on asset valuation, Fiorenzani applies real options to the refining industry. He points out that the real options approach has gained stature in valuation, especially in liberalised and competitive markets such as the oil and gas markets. His paper shows how the real options approach can be a useful tool for both risk management decisions and financial optimisation problem. “Refineries are black boxes, which can be used for the transformation of crude oil into more refined hydrocarbon products. These black boxes are characterised by operational flexibilities and constraints, which should be optimally managed in order to maximise the refiner’s economic goals. Stochastic dynamic programming represents the right mathematical instrument employed to solve the decision-making problem in such an economic environment”.

On the application of portfolio theory and optimisation in the oil and gas industry, Sira believes that the semi-variance is a suitable risk measure to use since it can be applied consistently to a wide range of uncertainty profiles, generating a more complete measure of downside risk, especially in the oil and gas industry, particularly in the exploration and production activities. According to Dr. Sira, semi-variance is the suitable choice when it comes to the appropriate selection of valuation methodology and optimal project execution strategies. The author demonstrates the significant differences in portfolio optimisation outcomes as a result of using variance and semi-variance as alternative measures of risk. He shows that the use of semi-variance leads to more robust and intuitive results with regard to the selection of portfolios on a risk-and-return basis. Though the analysis is applied to the oil and gas industry, the results have broad implications with regard to the choice of a risk measure when utilising the portfolio optimisation approach within the more general context of real projects. The proper selection of a risk measure can lead to significant improvements in the quality of decisions with regard to capital allocation.

This special issue also contains two papers on petroleum fiscal regimes. The two papers discuss cases in two developing jurisdictions: one in Alaska, and the other one in Angola. In the first paper, entitled 'Economic development through state ownership of oil and gas: evaluating Alaska's royalty-in-kind programme', Berman argues that governments in remote resource-rich regions can stimulate economic development by giving away their natural resources to sponsors of projects that promise attractive economic benefits. However, Dr. Berman points out that such governments cannot simply dissipate the potential rent from their resources without losing a principal revenue source. The greatest potential for conflict between these two objectives occurs in oil-producing states, because the economic rents – and associated revenues – from oil are so large. Based on his long first-hand experience in Alaska, Professor Berman takes a retrospective look at the State of Alaska's policies and programmes regarding the disposition of oil and gas resources, focusing on the evolution of the royalty-in-kind program. He discusses how the State of Alaska has approached the tradeoff between revenue and development through the administration of its royalty-in-kind programme. He examines the relative success of different programmes in achieving objectives of import substitution and value-added export relative to the cost in foregone revenue. The analysis leads to general conclusions about programmes of this type, along with specific insights as the state prepares to embark on the biggest test yet related to the disposition of North Slope natural gas. Following the analysis of outcomes, Dr. Berman evaluates the programme to try to explain the pattern of successes and failures, and analyses their implications for likely future royalty disposals. He concludes with broader lessons for economic development policy for Alaska, other remote regions, and for developing areas with petroleum resources.

In the second fiscal regime paper by Kaiser, he uses the deepwater Girassol field development in Angola as a case study to develop an analytic framework to quantify the influence of private and market uncertainty on the economic and system measures associated with Production Sharing Contracts (PSC). Unlike the traditional approach, which presents the impact of changes in system parameters in a series of graphs or tables that depict the present value, rate of return, or take as a function of one or more variables under various scenarios, a more general and concise approach to fiscal system analysis is developed in this paper using a meta-modelling procedure and regression techniques.

Relationships are derived that specify how the present value, rate of return, and take statistics vary as a function of the system parameters. Based on the deepwater Girassol field development in Angola case, the objectives of the oil company and host government are briefly summarised, the licensing and negotiation process involved in exploration and development is formalised, the cash flow analysis of a generic PSC is developed, and the economic and system measures associated with a PSC are defined.

On risk management, Aven *et al.* point out in their paper entitled ‘Risk management and incentives’, that efficient risk management protects the company against significant losses, reducing the effective demand for equity capital. In other words, risk management creates virtual equity capital. Portfolio theory indicates that risk management should take place at the group level. Hedging at the project level or in the individual business areas will lead to suboptimal results. But enterprises are not concerned only with portfolio hedging. Management by incentives is also an important concern. The efficiency of a profit centre will always depend on its management’s being able to influence factors that are crucial to the unit’s financial results. Price hedging could be one such factor. In the wider perspective, this constitutes part of the balancing between centralisation and decentralisation. Economic literature has only to a very limited extent addressed this balancing in respect of risk management. This article covers important elements of risk management and incentive design. It goes on to discuss the balancing of overall risk management at the group level and incentive design in profit centres and corporate units. Throughout the article, the oil industry serves as a case.

Finally, in Raineri’s paper on global corporate governance and takeovers in electric utilities in Latin America – ‘Global corporate governance and takeovers in electric utilities: the case of ENERSIS, ENDESA and DUKE Energy’ – he takes up the case of ENERSIS, ENDESA and Duke Energy to present intriguing strategies used by different players, and shows how the friendly takeover ended with a hostile takeover with tangled transactions that impacted stock prices and returns. The case has had implications for the landscape of Latin American electric utilities.

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