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Valuation of “Start-Up” Oil and Gas and Mining Projects

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The unprecedented fluctuation in energy and precious and industrial metals prices in the last five years has been a significant catalyst for the flood of resource extraction-related international arbitration cases during that time. Of particular note are the current international arbitration cases filed involving sovereign governments expropriating declared commercially viable oil and gas and mining concessions from their consortium partners, and disputes between majority and minority shareholders or joint venture partners in the development of such concessions.

In the face of these dramatic price fluctuations, a number of countries with undeveloped oil and gas resources such as Venezuela, Argentina, Equatorial Guinea, Algeria, Angola, Ecuador, Kazakhstan, Russia and others, have sought to adjust the terms of production sharing agreements.¹ This has been accomplished in a number of ways including the imposed ‘additional profits taxes’ or ‘windfall profits taxes’ on profits above a certain level, nationalisation of the sector or type of business by increasing state participation or imposing further limitations or controls on private participation; and modifying the terms and conditions of the granting instruments.² A similar trend has occurred in the mining industry where the price of resources had increased substantially, and sovereign governments who had issued mining licences sought to renegotiate, rescind or reassign those licences, or similarly applied some form of a windfall profits tax.³

Recent international arbitrations related to the alleged expropriation of resource development investments by sovereigns as well as disputes between joint ventures partners over development of oil and gas and mining concessions have highlighted an intriguing valuation issue: what is the appropriate method to value start-up resource development companies or projects which have very little or no production history? A number of cases filed in the past couple of years fit this profile, including: *ConocoPhillips Company et al v Venezuela*,⁴ *Chinese Petroleum Company v Bolivian Republic of Venezuela*,⁵ and *Anadarko Algeria Company LLC (US) v Sonatrach (Algeria)*.^{6,7}

Resource development companies are particularly susceptible to expropriation or disputes between development partners in the early stages of production. This is because the cost and risks of exploration and development licences for concessions such as oil and gas or mining resources are largely ‘front-end loaded’. Once a project is declared commercially viable and the infrastructure is in place to produce the oil, gas or raw ore and transport it to market, the exploration risk has passed and most of the significant capital development costs have already been incurred, presenting an opportune time for a state government or licence holder to attempt to renegotiate the terms of previous agreements.

This article will seek to explore the proposition of valuing early stages resource development projects or entities for the purposes of awarding damages in an international arbitration case. We will consider the concept of fair market value, and examine appropriate valuation methodologies to compensate an injured party in the context of an international dispute. We will also provide some discussion of a select number of decisions of past arbitration cases and the valuation approaches that were endorsed therein.

It is a widely accepted principle that any award to a claimant should, as far as is possible, wipe out all the consequences of the illegal act and reestablish the situation which would, in all probability, have existed if that wrongful act had not been committed.⁸ The right to reparation is a well established concept in international arbitration having its roots in the well-known, oft-referenced case involving Chorzów Factory before the Permanent Court of International Justice (PCIJ), in which the court held: ‘it is a principle of international law that the breach of an engagement involves an obligation to make reparation in an adequate form.’⁹ It is within the tribunal’s discretion to determine the best way to reach this objective. Various measures of compensation have been awarded including: investment costs incurred, the amount of dividends that could have been received absent a wrongful act,¹⁰ variations of fair value which provide the benefit of hindsight to the injured party, and others. A full discussion of all of these approaches, however, is beyond the scope of this article.¹¹ In this article we will focus on the most widely accepted valuation approaches for determining damages in cases involving resource extraction.

‘Fair market value’ is arguably the most well-known standard of value and is commonly applied in judicial and regulatory matters. It is also the standard of value which is sought in most commercial and investment treaty arbitrations. The American Society of Appraisers defines fair market value as: ‘The price, expressed in terms of cash equivalents, at which property would change hands between a hypothetical willing and able buyer and a hypothetical willing and able seller, acting at arm’s length in an open and unrestricted market, when neither is under compulsion to buy or sell and when both have reasonable knowledge of the relevant facts.’¹²

In a number of international arbitration cases the standard of fair market has been rejected where no expropriation was found and damage was done to productive assets. However, there are also a number of non-expropriation cases where arbitral tribunals elected to use the concept of fair market value in determining economic damages.

Assuming fair market value is the appropriate compensation being applied, the method or methods for assessing fair market value must be selected. There are three generally accepted methods of determining the fair market value of a business or a business opportunity as a going concern: the income approach, the market approach; and the asset or cost-based approaches.

Income approach

Under this approach the value of an asset or resource is determined based on the future economic benefits that it is expected to generate, taking into account the risks of achieving those economic benefits. The primary methodology under the income approach is the discounted cash flow (DCF) method. The DCF method involves estimating future after-tax discretionary cash flows, on a year-by-year basis, and discounting the cash flow estimates to their present value, as at the valuation date, using an appropriate risk-adjusted rate of return.

This method is highly dependent upon the reasonableness of

the forecasts employed. In valuing resource based businesses or assets, especially those with little to no historical financial results, it is very difficult to accurately forecast the future economic benefits. Thus, it is crucial that the valuator conducts an objective, detailed review of any forecasts or projections used in a DCF analysis to ensure they are reasonable and that the assumptions employed are appropriately supported.

Market approach

Under market-based methodologies, information from comparable transactions or other information from the marketplace is assessed to determine fair market value. For the results of this approach to be reliable, the market-based information must relate to comparable resource properties at comparable stages of development.

Historical transactions involving the subject property may provide the best information as to the fair market value of a given resource property, although the details surrounding any such transactions must be assessed to determine whether they met the definition of fair market value. That is, to provide an indication of value a past transaction must have been (at a minimum) between willing and informed arm's length parties. Further, since value is determined at a point in time, any changes in market conditions (ie, price changes of the underlying resource) or changes in the resource itself (in terms of its stage of development or the confidence in the quantity or quality of the underlying resources) must be considered before a historical transaction is applied or used as a primary valuation approach.

Asset or cost-based approaches

Generally, under asset-based valuation approaches, value is determined solely on the market value of the assets of the business entity, net of its liabilities, without consideration of its capacity to generate future earnings. Under a cost-based approach, the costs incurred to develop the asset or resources are assessed as a measure of the value of the asset or resource.

Of the three principal valuation approaches detailed above, the DCF methodology is the most widely adopted because it emanates directly from the fundamental financial principle that the value of a business (or an asset or resource) is equal to the future cash flows produced by that business or asset, discounted to a present value at an appropriate rate of return which reflects the risks of realising the estimated future cash flows. Relating back to the concept of restoring the injured party to the position that they would have enjoyed absent the wrongful act, Jones, Tyler and Deutsch indicate that, '[c]ompensation that fails to make up for the loss of those future cash flows is inadequate.'¹³ In fact, an annual survey conducted by the Society of Petroleum Evaluation Engineers reveals that 90 per cent of the respondents which were made of up of producers, consultants and bankers, use the DCF methodology in evaluating investment opportunities, though the approaches to applying a discount rate varied widely.¹⁴ Further, according to International Valuation Standards, '[t]he method most commonly used by businesses for investment decision-making with the Extractive Industries is net present value analysis/delayed cash flow analysis (NPV analysis/DCF analysis).'¹⁵

This is not to imply that other valuation methods should not be attempted or should be summarily discarded. A proper valuation should consider each of the principal valuation approaches, discarding them only if they are not relevant to the specific circumstances of the business being valued or if sufficient reliable information to perform them is not available. Divergent results from the application of two valuation methods in particular need to be re-examined and reconciled to determine the most accurate presentation of value. As Mark Kantor points out, '[v]aluation

methods are often complementary. If the valuations reached by two methodologies are widely inconsistent with each other, that can be a strong signal that something is awry. If several valuation methods produce consistent results, arbitrators can take greater comfort from the valuations.'¹⁶

In general, however, provided that an oil and gas or mineral property has been sufficiently evaluated such that reliable data is available relating to expected future costs and projections of production and revenue, the DCF method of valuation will provide the most accurate indication of the future value of the investment. Other valuation methods in this respect have both significant limitations and impediments in their application. Valuation methods based on an asset-based methodology for example, which derive value from the replacement values or even book values of assets, do not properly represent the anticipated value and risks that the investors are likely to experience from the investment. Historical investments in a resource property may have no resemblance in fact to the anticipated future cash flows that are projected from this property.

Looking to a market-based valuation method, on the other hand, would provide a reasonable indication of the fair market value of a resource-based investment such as in oil and gas or mining. The difficulty with this method however, is that finding a publicly available comparable sale or company which is truly comparable is notoriously difficult. Most often, a roughly comparable transaction can provide a sanity check, confirming that the values resulting from a discounted cash flow are reasonable, but again, the most accurate indication of future value, assuming realistic inputs is derived from the DCF method of valuation.

When dealing with mining properties valuers must be familiar with the valuation standards for mineral assets that have been promulgated by internationally recognised organisations. The principal standard setting bodies for mining resources include the Canadian Institute of Mining Metallurgy and Petroleum (CIM), the South African Mineral Assets Valuation Working Group (SAMVAL) and the Australian Institute of Mining and Metallurgy (AusIMM). The valuation codes of these organisations are the CIMVAL Standards and Guidelines,¹⁷ the SAMVAL Code¹⁸ and the VALMIN Code¹⁹ (Australia). Generally, there is conformity among these three major international mineral asset valuation codes. The three generally accepted valuation approaches for mineral properties in the SAMVAL, CIMVAL and VALMIN standards are the methods indicated above (ie, income approach, market approach and asset approach).

According to these valuation codes in the formal valuation of a mineral property the approach selected depends on the stage of development of that property. The four main categories of development under the CIMVAL code include:²⁰

- exploration properties involve a mineral asset that is being actively explored for mineral deposits but for which economic viability has not been demonstrated;
- mineral resource properties are mineral properties which contain a mineral resource that has not been demonstrated to be economically viable by a feasibility study or prefeasibility study;
- development properties are mineral properties that are being prepared for mineral production and for which economic feasibility has been demonstrated by a feasibility study or a prefeasibility study but which is not yet financed or under construction; and
- production properties are mineral properties with an operating mine, with or without a processing plant, which has been fully commissioned and is in production.

Under the CIMVAL and SAMVAL the primary approaches are

classified as to their appropriateness based on the above noted categories (ie, stage of development).²¹ The following table provides summary of the appropriate methodologies for the various stages of development of a mineral property per the CIMVAL standards:

Valuation Approach	Exploration Properties	Mineral Resource Properties	Development Properties	Production Properties
Income	No	In some cases	Yes	Yes
Market	Yes	Yes	Yes	Yes
Cost	Yes	In some cases	No	No

According to the CIMVAL, subject to the stage of development, the discounted cash flow methodology is ranked as a primary methodology, is very widely used and is generally accepted in Canada as the preferred method.²² According to the SAMVAL code the DCF method is identified as the most acceptable and most widely used approach for development properties, mining properties and economically viable dormant properties.²³

Therefore, as is the case with oil and gas properties that are determined to be commercially viable, mining resources at the 'development property' stage for which economic feasibility has been demonstrated, but production has not yet started, the DCF method is deemed appropriate by the major international mineral asset valuation codes.

It is clear that applying the DCF valuation method to a start-up enterprise with little or no historical performance data is a challenging exercise and the results are only as reliable as the underlying data and assumptions. This is because the base year of a discounted cash flow is often derived from the considered combination of past performance and expectations of how the future will impact and influence the future cash flows. Some view DCF analyses based on companies with little to no historical performance data to be 'open to legitimate skepticism'.²⁴ This is due to the fact that historical financials demonstrate what has been accomplished by a particular entity given the constraints of industry, business model, local geographical conditions, etc. A past record of historical profitability is often regarded as the best evidence that a company or investment is capable of generating a profit.

The preference for a proven track record has been clearly demonstrated, where historical performance has often been considered to be critical evidence that the projections on which a DCF analysis is based are reasonable. Tribunals have developed a concept of 'going concern', not only in the traditional accounting sense of a business which will continue to operate as a business (as opposed to having its assets liquidated on a piecemeal basis), but to mean additionally an entity that has several years of historical profitability.

As noted in the *Metalclad v Mexico*²⁵ decision:

...[w]here the enterprise has not operated for a sufficiently long time to establish a performance record or where it has failed to make a profit, future profits cannot be used to determine going concern or fair market value. In *Sola Tiles, Inc. v. Iran* (1987) (14 Iran-U.S.C. T.R. 224, 240-42; 83 I.L.R. 460, 480-81), the Iran-U.S. Claims Tribunal pointed to the importance in relation to a company's value of "its business reputation and the relationship it has established with its suppliers and customers". Similarly, in *Asian Agricultural Products v. Sri Lanka* (4 ICSID Reports 246 (1990) at 292), another ICSID Tribunal observed, in dealing with the comparable problem of the assessment of the value of good will, that its ascertainment "requires the prior presence on the market for at least two or three years, which is the minimum period needed in order to establish continuing business connections".

The focus is thus to ensure that projections of future performance have been established with 'reasonable certainty'.²⁶

It should also be noted that there are a significant number of cases where the DCF method of valuation has been rejected by arbitral Tribunals as speculative and uncertain based on the fact that the businesses being valued were start up operations. In the majority of these cases however, additional circumstances existed which caused the DCF calculation to be more speculative in the view of the Tribunals. Although we have not attempted to provide an exhaustive list of cases in this area herein, one such example is provided with the ICSID case²⁷ *Siag v The Arab Republic of Egypt* which involved the expropriation of a hotel or resort property by the government of Egypt. In this particular case, as the investment was in a very early stage in that the hotel had not yet been constructed, all of the inputs needed to be estimated, and were subject to a significant amount of debate between the parties. The tribunal accepted the idea that the venture would eventually be a very profitable one 'with no hesitation', therein rejecting the adoption of the book value of the investment as an appropriate measure of compensation.²⁸ The tribunal found significant the admission made by the claimants expert that the future cash flows can be calculated with a 'higher degree of certainty' for companies which have a proven track record of profitability, finding '[p]oints such as those just mentioned tend to reinforce the wisdom in the established reluctance of tribunals such as this one to utilise DCF analyses for 'young' businesses lacking a long track record of established trading'.²⁹ The tribunal chose instead to apply a comparable sales approach based on an analysis of the sale of comparable properties, with several adjustments based on the specific circumstances of the case.

Another example where the DCF valuation was rejected occurred with the ICSID case *PSEG v Turkey*³⁰ which was decided in January of 2007. In this case the DCF methodology was rejected by the tribunal in favour of repayment of the amounts invested by PSEG. PSEG, a US company, was granted an authorisation to conduct a feasibility study into the construction of a coal-fired power plant and an adjacent coal mine in the Turkish province of Konya. Although construction on PSEG's proposed coal mine and power plant never commenced, the company spent millions of dollars on an initial feasibility study, follow-up studies and several rounds of negotiations with government agencies. The tribunal rejected damages based on projected future cash flows on the basis that there was no established record of profits and performance.³¹ It should be noted that in this case there were other circumstances which also affected the evaluation of the future cash flows of the company including the fact that the contract was subject to 'adjustment mechanisms and other possible variations' which made it difficult to assess potential future profits.³²

In *Metalclad v Mexico*, Metalclad had purchased a Mexican company for the purposes of constructing and operating a landfill in La Pedrera, Mexico. Metalclad had commenced construction prior to the disputed acts but had not completed construction and had not commenced operations. The tribunal found that a DCF analysis would be inappropriate as '... the landfill was never operative and any award based on future profits would be wholly speculative'.³³ Rather, the tribunal opted to base compensation on Metalclad's actual investment in the project.

Having reviewed a few examples of the instances where the DCF valuation method has been rejected based on the lack of historical profits data, it should be noted that there is also considerable support for applying a DCF valuation under these circumstances, and particularly in the case of a resource development company. Aswath Damodaran, noted valuation expert and professor

of finance at the Stern School of management at the New York University, proposes that traditional valuation methodology can be applied to start-up companies if careful consideration is taken to providing reasonable inputs: 'while it is understandable that analysts, when confronted with the myriad of uncertainties associated with valuing young companies, look for shortcuts, there is no reason why young companies cannot be valued systematically.'³⁴

Particularly with regard to the valuation of oil and gas and mining investments however, the concerns related to the lack of historical profits data may be less relevant. Several experts have suggested that the lack of historical production data should not preclude the application of the DCF method.³⁵ There are a number of reasons for this. First, oil and gas and mining concessions that are starting up operations typically cannot be classified as new businesses in the traditional sense of the term 'start-up business'. They are generally new projects that are run by large and experienced multinational organisations (and consortiums of such entities) which have many years of profitable operations behind them.

Second, these organisations are very sophisticated in defining and evaluating the existing resources and reserves and accurately estimating the various costs and time required to extract the oil and gas or mineral resources in an efficient manner.

The estimation of hydrocarbon reserves is an especially important part of the equation for oil and gas companies as reserves are the one of the primary drivers of value for any oil and gas development venture. As per the Society of Petroleum Engineers, only those quantities of oil and gas anticipated to be economically recoverable from discovered resources should be classified as reserves.³⁶ Additionally, there is an expectation that hydrocarbon deposits reserves will be developed and placed on production within a reasonable timeframe.³⁷ Reserves can be classified into three types: 'proven', 'probable' and 'possible'.³⁸ While 'proven' reserves are the most reliable estimation of recoverable reserves, it is also considered to be the most conservative estimate.³⁹ Further, 'proven plus probable' reserves (P50 reserves) are considered 'best estimate (realistic)' estimations of total reserves.⁴⁰ Further, many companies refer to 'proven plus probable' reserves (P50 reserves) as being the more useful estimate upon which to base investment decisions.⁴¹

Similarly, mineral resources are classified from lowest to highest level of geoscientific knowledge and confidence as either 'inferred', 'indicated' or 'measured'. Once various factors such as mining,

metallurgical, economic, marketing, legal, environmental, social and governmental are appropriately considered mineral resources may be converted to 'proved mineral reserves' or 'probable mineral reserves'.⁴²

When a property has been declared commercially viable with estimated proven and probable reserves, the risks with regard to the existence of these reserves are significantly reduced. A significant portion of development capital costs have likely already been incurred as well. Additionally, remaining capital costs and anticipated operating costs can be calculated with an acceptable degree of precision by the resource developers, based on past experience and geological and engineering analyses.

Fourth, and perhaps most importantly, a well developed international market exists for these products which will absorb the project's entire production immediately.⁴³

Finally, frequently a significant portion of the infrastructure, capital and operating costs incurred as well as substantially all revenues received will be denominated in US dollars which serves to reduce a project's exposure to currency risk.

Contrast this with the start-up of a non-resource related commercial entity, for example a new software application company. During the start up phase, the costs, timing and resources required to develop and market the software cannot be estimated with an acceptable degree of precision. Furthermore, the market itself may not be established so that the price and volume of sales are unknown, making revenue forecasts very speculative. The value of such an entity would depend heavily on the technical attributes of the software product and the experience of the business owners and the relationships they have with established industry participants.

Given the above noted attributes of oil and gas and mining projects, there is a strong argument that provided a project has reached the point of economic viability (or with an acceptable degree of certainty would have reached this point absent the wrongful act), and provided the costs and revenues can be estimated with a reasonable degree of certainty, a DCF may be performed which would yield a reasonable determination of value. The remaining risks such as price risk, country risk (ie, political risk, disruption risk, etc), and any other risks specific to the region would have to be taken into account as well, as would also be the case for an entity with a proven track record.

At the time of this writing, to our knowledge the DCF



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approach has not yet been applied to value oil and gas and mining projects in the beginning stages of production in the context of international arbitration, for which public information is available. Considering the factors specific to resource development companies which make projections of expenses and production possible with 'reasonable certainty' after a property has been declared commercially viable, coupled with the fact that the DCF method is widely viewed as providing the most accurate valuation of the future cash flows of such properties, the application of the DCF approach may well be tested in the near future in currently pending international arbitrations.

Notes

- 1 'Expropriation, Nationalisation and Risk Management' Scot W Anderson; Cite some cases (*CPC v Venezuela*, *Conoco Phillips v Venezuela*, *Exxon Mobil v Venezuela*, *Murphy v Ecuador*, *others*).
- 2 'The New Latin American Oil and Gas Scene: Taking the High Road or the Low Road?' Elisabeth Eljuri And Carlos E Maduro – Macleod Dixon – Caracas, January 2009. www.whoswholegal.com/news/features/article/12774/the-new-latin-american-oil-gas-scene-taking-high-road-low-road.
- 3 *Sergei Paushok, CJSC Golden East Company, CJSC Vostokneftegaz Company v The Government of Mongolia Order on Interim Measures*, 2 September 2008, and 'Arbitrators in UNCITRAL BIT arbitration order Mongolia to refrain from collecting windfall tax from Russian mining company while case is heard; funds to be put in escrow instead of remitted to government' *Investment Arbitration Reporter*, Volume 1, No. 11, 1 October 2008.
- 4 *ConocoPhillips Company (US), Petrozuata BV (Netherlands) and ConocoPhillips Gulf of Paria BV (Netherlands) v Bolivarian Republic of Venezuela*, ICSID case No. ARB/07/30.
- 5 *Chinese Petroleum Company v Bolivian Republic of Venezuela*.
- 6 *Anadarko Algeria Company LLC (US) v Sonatrach (Algeria)*.
- 7 Arbitration Scorecard 2009: A listing of investment treaty arbitrations active in 2007-2008 in which at least \$100 million was in controversy. Expanded for the Web. Focus Europe, American Lawyer Luke Eric Peterson, 1 July 2009; 'Venezuela faces Taiwanese claim at ICSID,' *Global Arbitration Review*, Sebastian Perry, 4 June 2010; *ConocoPhillips 2006 Annual Report* p47; 'Algeria: Anadarko looking for first oil from El Merk in late 2011' www.energy-pedia.com/article.aspx?articleid=136329; *Anadarko Petroleum Annual Report 2009* p12-13.
- 8 *Metalclad Corporation v The United Mexican States*. ICSID Case No. ARB(AF)/97/1.
- 9 Case Concerning the Factory at Chorzów Jurisdiction, Judgment No. 8, 1927, PCIJ, Series A, no. 17, p29.
- 10 *LG&E Energy Corp, LG&E Capital Corp, LG&E International Inc v Argentine Republic*. ICSID Case No. ARB/02/1
- 11 In an editorial in *Petroleum World* entitled 'Venezuelan oil assets expropriation, compensation and arbitration', authors Andrew B Derman and Emily A Miskel assert the following: 'The history of international law shows that the remedy for nationalization of investor property has consistently been full compensation based on market value. Prior to World War II, the standard of full compensation for expropriation was almost unquestioned in customary international law. In one study of 60 international claims Tribunals ruling on damages to foreign investors from 1840 to 1940, none of the arbitral panels held that the appropriate measure of compensation was less than the full value of the property taken, and many specifically affirmed the rule of full compensation. While the determination of full compensation associated an expropriation may be subject to debate, an arbitrary rule that book value or something other than fair market value is not the standard under international law. Full compensation has been held to mean prompt, adequate, and effective compensation in the amount of the full market value of an investment as a going concern.'
- 12 ASA Business Valuation Standards (Business Valuation Committee American Society of Appraisers, Herndon, VA, 2009), American Society of Appraisers p27.
- 13 'Accounting for Uncertainty in Discounted Cash Flow Valuation of Upstream Oil and Gas Investments', William H Knoll III, Scott T Jones, Timothy J Tyler, Richard D Deutsch, p6.
- 14 *Ibid*, p27.
- 15 *International Valuation Standards*, (8th Edition), section 5.3.3.
- 16 *Valuation for Arbitration: Compensation Standards Valuation Methods and Expert Evidence*, Mark Kantor, p27.
- 17 Source: Standards and Guidelines for Valuation of Mineral Properties from the Canadian Institute of Mining, Metallurgy and Petroleum on Valuation of Mineral Properties, February 2003.
- 18 Source: South African Code for the Valuation of Mineral Assets (the SAMVAL Code) prepared by the South African Mineral Assets Valuation Working Group dated August 2006.
- 19 Source: Code for the Valuation and Technical Assessment of Mineral and Petroleum Assets and Securities for Independent Expert Reports, The VALMIN Code, 2005 Edition.
- 20 Source: Standards and Guidelines for Valuation of Mineral Properties, Special Committee of the Canadian Institute of Mining, Metallurgy, and Petroleum on Valuation of Mineral Properties (CIMVAL). February 2003.
- 21 The VALMIN Code does not specify acceptable approaches.
- 22 Standards and Guidelines for Valuation of Mineral Properties, Special Committee of the Canadian Institute of Mining, Metallurgy, and Petroleum on Valuation of Mineral Properties (CIMVAL). February 2003, Table 2, p22.
- 23 South African Code for the Valuation of Mineral Assets (The SAMVAL Code), effective August 2006, p25.
- 24 'Accounting for Uncertainty in Discounted Cash Flow Valuation of Upstream Oil and Gas Investments' William H Knoll, III, Scott T Jones, Timothy J Tyler & Richard D Deutsch, p7.
- 25 *Metalclad Corporation v The United Mexican States*, ICSID Case No. ARB(AF)/97/1, paragraph 120.
- 26 Valuation for Arbitration: Compensation Standards Valuation Methods and Expert Evidence." Mark Kantor, p. 79.
- 27 *Waguih Elie George Siag and Clorinda Vecchi v Arab Republic of Egypt*, ICSID case No. ARB/05/15.
- 28 Award in matter *Waguih Elie George Siag and Clorinda Vecchi v The Arab Republic of Egypt*, ICSID Case No. ARB/05/15, June 1, 2009, p148.
- 29 *Ibid*, p159.
- 30 *PSEG Global Inc and Konya Ilgin Elektrik Uretim ve Ticaret Limited Sirketi v The Republic of Turkey*, ICSID case No. ARB/02/5.
- 31 Case summary *PSEG Global Inc et al v Republic of Turkey* prepared in the course of research for S Ripinsky with K Williams, *Damages in International Investment Law* (BIICL, 2008), p2.
- 32 *Ibid* p7.
- 33 *Metalclad Corporation v The United Mexican States*, ICSID Case No. ARB(AF)/97/1.
- 34 'The Dark Side of Valuation: Valuing Young, Distressed and Complex Businesses 2nd Edition.' Damodaran, Aswath, FT Press; 2nd edition (27 July 2009), p225.
- 35 See 'Accounting for Uncertainty in Discounted Cash Flow Valuation of Upstream Oil and Gas Investments' William H Knoll, III, Scott T Jones, Timothy J Tyler, Richard D Deutsch, p8 note 13; and 'Key Damage Compensation Issues in Oil and Gas International Arbitration' Manuela Abdalla p550.
- 36 'Petroleum Resources Management System', sponsored by Society of Petroleum Engineers (SPE), American Association of Petroleum Geologists (AAPG), World Petroleum Council (WPC), Society of

Petroleum Evaluation Engineers (SPEE), 2007, Table 1, p24.

37 Ibid.

38 Ibid, pp28-29.

Proven reserves are defined as oil and gas "reasonably certain" to be producible using current technology at current prices, under current commercial agreed terms and arrangements with local government. Proven reserves are also known as 1P reserves or P90 reserves indicating that they have a 90 per cent certainty of being produced. Proved reserves are those reserves that can be estimated with a high degree of certainty to be recoverable. It is likely that the actual remaining quantities recovered will exceed the estimated proved reserves.

Probable reserves are defined as oil and gas "reasonably probable" of being produced using current or likely technology at current prices, with current commercial terms and government consent. Probable are 2P reserves or "proven plus probable, or also can be referred to this as P50 or having a 50 per cent certainty of being produced. Probable reserves are those additional reserves that are less certain to be recovered than proved reserves. The P50 designation indicates that it is equally likely that the actual remaining quantities recovered will be greater or less than the sum of the estimated proved plus probable reserves.

Possible reserves are reserves that have been classified as "having a chance of being developed under favorable circumstances" These are also referred to as P10 reserves which means having a 10 per cent certainty of being produced. - This is also known in the industry as 3P or Proven plus probable plus possible. Possible reserves are those additional reserves that are less certain to be recovered than probable reserves. It is unlikely that the actual remaining quantities recovered will exceed the sum of the estimated proved plus probable plus possible reserves.

39 'Definitions of Oil and Gas Resources and Reserves' The Companion Policy to National Instrument 51-101 Standards of Disclosure for Oil and Gas Activities sets out, in Part 2 of Appendix 1, the reserves definitions derived from Section 5 of Volume 1 of the Canadian Oil and Gas Evaluation Handbook (COGEH).

40 'Definitions of Oil and Gas Resources and Reserves' The Companion Policy to National Instrument 51-101 Standards of Disclosure for Oil and Gas Activities sets out, in Part 2 of Appendix 1, the reserves definitions derived from Section 5 of Volume 1 of the Canadian Oil and Gas Evaluation Handbook (COGEH).

41 'Oil and Gas Reserves: Communication with the Financial Sector,' Rob Arnott, Sustainable Development Programme, Oxford Institute for Energy Studies October, 2004, p7.

42 2007 SAMREC Code for Reporting of Exploration Results, Mineral Resources, and Mineral Reserves.

43 The future price of the resource, is one of the most significant, yet difficult variables in a DCF calculation to predict with reasonable certainty into the future. However, this issue is faced equally by start-up entities as with well established entities.



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Laura Hardin is a managing director in FTI's economic consulting, international arbitration practice, and is based in Houston, Texas. Laura specialises in providing litigation support, business valuation and forensic accounting services on a variety of different engagements. These have included damage analysis for international arbitration disputes on both investment treaty and commercial matters, breach of contract, purchase price disputes, libel and slander litigation, and patent disputes. She has managed international arbitration cases brought before ICC, ICDR, LCIA, SCC, ICSID and ad hoc tribunals, involving the valuation and calculation of alleged damages suffered for disputes in a variety of industries including energy and mining, aviation, manufacturing, and financial services. Laura holds a BA with Honors from Wesleyan University, and an MBA from George Washington University.



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