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5.4 Hydrocarbons and Mining Laws

5.4.1 Key Ideas:

(1) The building blocks of a legal framework for oil, gas or mining are laws, contracts, usually model form contracts, and implementing regulations. Often the laws are sector-specific, treating hydrocarbons and mining separately, but inter-meshing with other domestic laws dealing with tax, investment and environment matters, for example, and also any bilateral and multilateral treaties to which the state is party. It is crucial for all parties (and not only investors) that these legal instruments function as a coherent framework, with links where appropriate to other parts of the country's legal system, its enforcement agencies and taking account of any federal/provincial levels of government. The Source Book online version includes many examples of these instruments;

2) The host state for EI investment may and often will play not one or even two but three roles: as owner of the resource; as regulator of operations, and as operator by means of a national resource company. These roles will often overlap and may well conflict. In the event of disputes, the host state may also be the primary forum for hearing and adjudicating the issues;

(3) Capacity will play a crucial role in the operation of a regime. If little is available, the resulting constraints can be anticipated in the framework, at least in its early stages of operation. Legal frameworks can do so by including 'non-discretion' provisions that specify that the government 'shall' issue a license provided that the specified procedures are followed and criteria are met as defined in the law and regulations (these are the procedures and a criterion that generally relate to legal entity status, good standing, and financial and technical capacity). Such provisions help limit the need for 'discretion' by a government minister or other authority in granting licenses, promoting certainty and countering possible corruption. However, a sound framework will only be effective if there are well-functioning, accountable institutions with adequate resources to implement them;

(4) Any legal framework for hydrocarbons or mining will operate within a wider legal system in the host state that is shaped by civil law, common law, Islamic law or a hybrid;

(5) The legal framework for hydrocarbons or mining has to be consistent with the country's constitutional framework. Constitutions differ to the extent that they recognize and guarantee private property rights or prohibit private parties or foreigners from acquiring property rights in general and rights over extractives in particular. They will often differ in their approach to vesting authority to regulate specific matters in special agencies (e.g. environmental protection) or in the executive (e.g. taxation, foreign exchange) or the judiciary (review of government decisions; settlement of disputes). They may also differ in the way and the extent that they vest authority to grant rights in particular levels of government rather than the central authorities; and

(6) The legal framework has to be consistent with the country's international obligations. A wide variety of international hard and soft law rules and principles will impact upon the domestic laws of most EI producing countries. These range from the obligations on trade from membership of the World Trade Organization, and various free trade agreements, investment treaties and double taxation treaties, to soft law principles such as those concerning transparency (for example, EITI) and sustainable investment (such as the Equator Principles). This can impact upon the design of local content provisions, health, safety, insurance and environmental standards to be followed by investors in the host country.

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5.4.2 Issues to be Addressed

Typically, there are a wide range of issues that will be addressed in the legal framework whether it applies to hydrocarbons or mining. The same issues need to be addressed by the package of legislation and licenses or contracts. Differences between the two EI sectors tend to lie in the level of detail or comprehensiveness adopted in each legal instrument. As ideas about good practice develop, a mechanism needs to be in place to ensure that these rules can be adapted and updated. The principal issues that need to be addressed are the following:

- ownership of the natural resource;
- authority to allocate rights for the development of natural resources;
- establishment of a clear framework for the role of the competent bodies of government, for companies, and for civil society and local communities;
- identification of the authorities and procedures by which the government allocates mineral or petroleum rights along with the rights and obligations of both the license holder and the government;
- clear, transparent, competitive, and non-discretionary procedures for issuing exploration and production rights, including those issued by contracts, and

including the technical and financial qualifications needed to hold a mineral or petroleum right;

- permissible contract types;
- assurance to a prospective license holder or contract signatory of security of tenure which includes issues relating to development rights, assignment rights, and retention rights;
- listing of the obligations of the mineral or petroleum right holder to explore, invest, and produce the mineral or petroleum or else relinquish the right so that it can be made available or assigned to another party ready to take on those obligations;
- reporting requirements of the license or right holder;
- conditions for voluntary relinquishment and termination for cause of the license or right;
- health, safety, and environmental (HSE) requirements related to the license or right;
- procedures for management of possible land-use conflicts between different claimants or users;
- dispute resolution procedures;
- establishment and implementation of an effective communications strategy;
- definition of the mandate and role of state-owned NRCs and minority state equity in mining, oil and gas companies (NRCs are addressed in **Chapter 6** below);
- grant of the right to construct and own infrastructure specific to petroleum or mining operations (for example, pipelines or rail routes); and
- the main principles of the fiscal regime.

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5.4.3 Operation of the Rules

The basic principle underlying any EI sector-specific legislation is that the government provides the investor with mineral or petroleum rights in exchange for the investor undertaking exploration or development work. The laws and regulations will need to specify the authorities and procedures by which a government allocates mineral or petroleum rights along with the rights and obligations of the license holder. A well-designed licensing system (see **Section 5.4** below) will provide a licensee with good assurance that whatever is found can be developed by the licensee and that what the licensee develops can be retained with an equitable sharing of both risks and benefits with the host government.

The legal regime will also provide the government with good assurance that licensees or contractors will undertake exploration or development work in a timely, technically, competent, environmentally responsible, and socially acceptable manner or be obliged to relinquish the mineral or petroleum right so that the land can be made available to another party for exploration and exploitation. Thus, the laws will need to clearly specify the mandate, authority, and responsibility of different agencies and ensure that overlaps and inconsistencies are avoided between different laws, particularly between EI sector laws and HSE regulations.

Most laws require a measure of interpretation for them to work; in turn that requires an understanding of what a rule means and what it was intended to achieve. A lack of trained staff to interpret laws will create uncertainty, confusion and poor decision-making.

In the event that omissions or ambiguities arise, one way to resolve them may be through supplementary agreements with individual operators or investors until such time as the needed amendments can be made to the laws or regulations. In countries like Norway and the UK, governments issue Guidance Notes on a regular basis to provide clarity on the operation of the laws. In the case of overlapping regulations between EI sector laws and environmental laws, for example, different departments of government may decide by written memorandum of understanding which regulation will be applied and by whom until such time as the regulations or legislation are clarified. Such a procedure can give clarity in the interim and allow activities to proceed. However, this is unlikely to meet with success unless there is extensive consultation with the local communities and any local NGOs.

Some extractives sectors have peculiarities. For that reason, laws governing oil, gas and mining are treated separately below. Taxation issues are treated in Chapter 6, but it may be noted that in most countries a separate hydrocarbons taxation law is adopted as the normal practice. Alternatively, a set of special provisions related to oil and gas issues is inserted in the General Tax Code.

5.4.4 Petroleum

Three distinct approaches to the design of hydrocarbons legislation can be identified:¹ (1) a comprehensive, highly detailed approach to legislation; (2) reliance

¹ This section follows closely the scheme set out in Chapter 3 of Duval, C., et al. (2009). *International Petroleum Exploration and Exploitation Agreements: Legal, Economic, and Policy Aspects* (2nd ed.). New York: Barrows, pp. 28-29. This study provides an excellent survey of key issues under these headings. The terms used by the authors

on individually legislated contracts or agreements; and (3) a hybrid approach, which combines less comprehensive, or framework, legislation with detailed regulations and flexible contract or agreement specificity.² Usually, laws relating to petroleum will be adopted separately from laws that address mining of other minerals. This can lead to the perception that there are significant differences between mining and hydrocarbon legislation. However, the similarities between the two sectors often out-number the differences.

Each of the three approaches below have one feature in common: they will normally provide for upstream (exploration and production) activities only, leaving downstream activities to be covered in a separate law. This could be a Gas Law (addressing phases of gas development after production, such as processing, transportation, storage and trading) or an Energy Law (addressing either or both gas phases post-production and/or electricity and other forms of energy). An exception to this (for oil and gas) is the Indonesian Law 22 of 2001 Concerning Oil and Gas which covers oil and gas upstream and downstream activities but in distinct chapters of the law and in separate regulations. This topic is discussed further in **Chapter 6**.

CEPMLP Design Option 1: Detailed Content Approach

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This approach fixes, in a particular law and enabling regulations, all or most of the provisions that are required for the conduct of petroleum operations. These detailed instruments, enacted by the legislature, mandate standard content for licences and contracts usually in the regulations, which can be easily and if necessary, often amended, although some specific terms may be left for negotiation or competitive tenders. This ‘codified’ approach is often supplemented by highly detailed guidance notes which provide an official interpretation of key provisions and issues. It is the preferred approach in almost all Organization for Economic Cooperation and Development (OECD) states, from Canada and Australia to Norway and the United States, many of which have extensive legislative experience of these regimes.

There are also a number of Latin American states that have adopted this approach. Its supporters claim it has several advantages: (1) it assures equal treatment for all EI sector participants or licensees; (2) it focuses negotiations on a few key variables and limits opportunities for arbitrary or discretionary behaviour; (3) it ensures full knowledge and transparency regarding the licensing regime; (4) it enhances

are however, slightly different: fixed content, agreement and flexible systems are the three categories used there.

² It should be noted that rules contained in a basic constitution are likely to override any of the above in the event of conflict.

protection against corrupt practices whereby resource rights are obtained for bribes; (5) it mitigates the disadvantages of asymmetry of information and capability between often inexperienced officials of small governments and highly experienced and skilled resource company negotiators; and (6) it also avoids scarce government capacity being tied up in intensive negotiations on individual projects.

The main disadvantage of this approach lies in its inflexibility. Any adjustments require changes to primary legislation, which may be difficult, or at least slow, to achieve.³ Nonetheless, there appears to be a preference for states to adopt this detailed legislative approach in the mining sector,⁴ while the petroleum sector tends to adopt a framework approach to legislation albeit with a higher degree of reliance on a model contract to supplement the legislative framework.⁵

Design Option 2: Individually Legislated Agreements

Under this approach, the most important terms are contained in individually negotiated agreements between the state or its agent and investors which are given the force of law by legislative ratification. This has been the approach taken in developing states where there the existing law was too general or where there was no overall petroleum code in place at a time of growing investor interest, and where waiting for the preparation and passage of comprehensive legislation is deemed to be costly in terms of delayed investment and development. A model agreement may still be used to facilitate negotiations. Since such an agreement is consensual in character, is subject to negotiation, and has the force of law, it reduces the chances of unilateral intervention by the state and can create a stable and predictable framework for the private party.

This approach also gives maximum flexibility to government authorities to negotiate terms with investors. This is perceived by some as an advantage but by others as a serious drawback. At its worst, it may facilitate corruption. At a minimum, it can complicate sector management by creating a patchwork or multiplicity of legal regimes. This is due to the fact that once terms have been agreed and legislated they

³ Date-Bah, S., and Rahim, M. (1987). Promoting Petroleum Exploration and Development: Issue for Government Action. In: Khan, K. (ed.). *Petroleum Resources and Development: Economic, Legal, and Policy Issues for Developing Countries*. London: Belhaven Press, p. 94.

⁴ Williams, J. (2005). Legal Reform in Mining: Past, Present and Future. In: Bastida, E., Warden-Fernandez, J., and Waelde, T. (eds.). *International and Comparative Mineral Law and Policy*. The Hague: Kluwer International, pp. 37-71.

⁵ Onorato, W. (1995). *Legislative Frameworks used to Foster Petroleum Development*, World Bank Policy Research Working Paper No. 1420. Washington, D.C.: World Bank Publications.

become fixed, subject to any provisions they may contain regarding stability of terms.

Design Option 3: Hybrid Approach

Under a hybrid approach, which is now common in states with sectors to develop, legislation typically takes the form of a relatively brief enabling law, sometimes called a ‘framework law.’ Such a framework is used to confirm policy choices and covers key concepts and topics but refrains from going into detail and leaves room for further definition by governmental authorities through secondary regulations and individual contracts. States as diverse as Namibia, Cote D’Ivoire and Timor Leste have preferred systems where the government has the power to enact detailed rules and regulations but also has sufficient discretion to make adjustments of some terms on an individual basis. The less detailed legislative content under this option is designed to minimize the need for later amendments in the primary law. While this benefit is often considered to be a significant factor in states where the legislative process is typically lengthy, or where such legislation represents a delicate compromise of diverse interests, it can also prove challenging to reconstitute in an amendment process.

Negotiating discretion under this hybrid approach can be, and usually is, limited by the issuance of model licenses or contracts. This can be important in reducing the burden on government bodies with limited resources at their disposal. At the same time, the enabling legislation allows governmental authorities to respond quickly to new needs as they arise by adjusting model contracts for new awards and amending regulations: a process that will be carried out primarily at the ministerial level rather than legislative action. The main advantage of this approach is that “it predetermines in a legislative form all those issues in respect of which the government requires a minimum standard or which can be realistically, as it were, pre-negotiated.”⁶

Assessment of Options

The choice of approach to legislative design will depend on state context and take into account legal, cultural, political, social, and economic factors as well as the level

⁶ Date-Bah and Rahim, *supra* n. 16, p. 96.

of investor interest in development of the sector. At greater or lesser levels of detail, all three of the above approaches will seek to reflect the overarching policies noted in **Section 4.1** above and in particular will include reference to the topics listed in **Section 4.3** below. Effectiveness will depend very much on the fit with context rather than any formal advantage one approach may have over another.

In all cases, a key consideration is that sector legislation is harmonized with other relevant legislation, including not only fiscal and environmental legislation but also other legal texts applicable to economic activity, such as foreign investment laws, labour laws and the general tax code.

5.4.5 Gas

A Gas Law usually refers to legislation that covers the activities *beyond* the field delivery point along the gas supply chain, such as transmission pipeline networks, distribution and supply to end-consumers. It is very unusual to adopt a law specifically for gas *exploration and production*. The reasons for this are explained by Dr Leleuch:

“...both oil and/or natural gas may be discovered from exploration activities and therefore the rights granted to the State and the explorers concern both products. Oil and natural gas consist respectively in the liquid and gaseous forms of petroleum or hydrocarbons generated in underground formations. Moreover, the search for and exploitation of oil and gas require techniques and methods relatively similar”⁷.

Example: The scope of the Cameroon Gas Code 2002 provides an illustration of the objectives and content of a gas law in a developing country designed to encourage the development of the domestic gas industry. Section 1 states:

“This law... shall govern the downstream gas sector comprising transportation, distribution, processing, storage, import, export, and marketing of natural gas within the national territory.

Except as otherwise provided, this law shall exclude the following:

- Prospecting, exploration, exploitation, transportation, storage and processing activities of liquid or gaseous hydrocarbons as

⁷ H Leleuch, *Good Practice Note on (Upstream) Natural Gas: A Guidance Note to complement the EI Source Book* (2012). The list of special provisions for gas in a Petroleum Law is based on this Note and much of this text follows the content of this EISB commissioned paper.

governed by Law no. 99/13 of 22 December 1999 to institute the Petroleum Code;...”

Under Section 2: “The purport of this law is to promote the development of the downstream gas sector in Cameroon. As such, it is aimed at:

- Putting in place a legal framework conducive to the development of gas resources;
- Setting up an attractive environment for private national and foreign investors in the gas sector;
- Laying down principles governing regulation of the sector”.

There are other reasons why it is hard to specify precise rules for gas in the way that is typically done for oil:

- Firstly, there is a need to identify a specific market for the gas discovery in order to work out how commercial it is. Usually, such markets will be regional; for example, an obvious market for the sale of gas from fields in either Mozambique or Namibia would be South Africa.;
- Secondly, in the absence of an international dollar denominated price as in oil, gas has to be priced according to a basket of alternatives that reflect the market it is to be sold into. The resulting formula is usually complex, and needs to be negotiated in each case;
- Thirdly, the cost of infrastructure for gas commercialization is very high, whether in terms of transportation and distribution pipeline networks or installations for its liquefaction and specialized tankers for its transport. Finance for such long-term fixed investments on a large scale is unlikely to be forthcoming from lenders, unless there is an assurance of long-term markets and contracts. This has implications for the kind of gas sales contract that is adopted by the parties; and
- Finally, the lead time for development of a gas field is usually quite long: the contract provisions (or the petroleum law or both) will normally allow for a much longer period to discuss commercialization of a gas deposit rather than oil; they usually require the parties to discuss how to proceed and give them a generous amount of time to conclude their discussions on the technical and financial aspects of the discovery.

Given these conditions, the common practice is to have provisions inserted into a hydrocarbons law that address specific features of natural gas development and extraction. *Sub-optimal practice would be to treat gas as oil and omit specific provisions encouraging gas activities.* In particular, customized provisions should provide for incentives to encourage the development of new projects and uses, and

to compensate for the higher cost and lower value of natural gas relative to oil. As Onorato notes in a policy research paper on legal frameworks:

“Enlightened modern Petroleum Laws have specially-tailored gas development and commercialization provisions to encourage positive action on gas discoveries”⁸.

These special provisions will typically be variants of the following:

- Ownership of gas in the ground belongs to the state, as with oil;
- Associated gas will be distinguished from non-associated gas⁹;
- Licensing procedures are adapted so as to permit longer times for appraisal and for production than for oil, with the right to authorize a specific retention license for assessing the viability of a gas discovery and finding buyers for the gas;
- Joint development and production of gas discoveries is mandatory between several licensees when such an approach makes gas projects viable which would otherwise be non-commercial;
- Gas flaring is prohibited except in strictly defined circumstances;
- Statement of the priorities for gas uses: between domestic and export uses and for gas re-injection in oil reservoirs; establishment of national gas reserves if required and conditions for gas exports.
- Specific fiscal incentives for gas promotion need to be defined as well as the principles for gas pricing, including the entry point into the mid-/downstream facilities and the valuation point for tax purposes;
- Specific provisions for unconventional gas;
- Transparency issues such as publishing government revenues and related agreements on oil and gas; and
- If gas export revenues are expected to be large, the law may provide for the establishment of a sovereign wealth fund (see **Chapter 8**).

Examples: *Australia* was one of the first countries to use the concept of a retention lease to allow the holder of rights to a gas discovery to benefit from a longer exploration and appraisal phase. *Vietnam* allows a retention period of up to 7 years. *Australia* also encouraged the joint development of gas projects combining the resources and infrastructure of third parties so as to jointly develop or complete an access agreement for the use of facilities or technology to provide an acceptable rate of return. *Angola* forbids gas flaring except for short periods of time when this is required for testing purposes and other operating reasons. *Indonesia's* Oil and Gas

⁸ W Onorato (1995), *Legislative Frameworks used to Foster Petroleum Development*, Policy Research Working Paper 1420, The World Bank, Washington D.C.

⁹ Associated gas will usually mean gas that it produced in association with oil but in a project that is primarily focused on oil production. Non-associated gas usually refers to gas in fields or reservoirs that contain mostly gas reserves, even if associated liquids such as condensate are present as well.

Law of 2001 sets out a priority for domestic gas uses over gas exports, and introduced a domestic market supply obligation.

Sub-optimal practice would include: absence of regulations to limit flaring of gas or giving a priority to gas exports in highly populated countries with potentially limited gas resources.

* * *

It is unusual for a Petroleum Law to include the activities of transportation, commercialization and utilization. This is typically provided for in a separate law, discussed in **Chapter 6**. Indonesia is one of the very few countries to adopt a law that covers both upstream and downstream sets of activities in a single law, the Oil and Gas Law of 2001.

5.4.6 Mining Laws

At the most basic level a mining law should be simple and clear to understand. The challenge for many countries is that because mining is often an old activity, perhaps with a history of hundreds of years, as in many Latin American countries, existing laws often date from a pre-modern period. In Africa they might date from colonial times. It was only in the 1990s that many Latin American countries undertook major reforms of their old laws on mining. In regional terms such legal reform often proceeds in waves: in Latin America in the 1990s, in Africa in the 2010s. This need to grapple with a historical legacy is in contrast to the hydrocarbons industry in many parts of the world, which tends to have a more recent history, not least due to its shift into offshore areas.

The kind of benefits which investors look for in a mining law include clear and transparent processes, security of tenure, the freedom to transfer their rights and freedom to operate and market their output on commercial terms. The laws are usually complemented by provisions in investment or tax legislation that “provide reasonable freedom to dispose of foreign exchange earnings, primarily profit-based taxation on internationally competitive terms, and stability of those terms by contract for a reasonable period of time”¹⁰. Of all of these, security of tenure – the guaranteed right of an exploration right holder to mine the ore that the holder has discovered – is particularly important. If the exploration licence holder needs to

¹⁰ K Naito, F Remy and J Williams, *Review of Legal and Fiscal Frameworks for Exploration and Mining* (World Bank Group Mining Department/Mining Journal Books, 2001), iii (study based on a survey of the legal framework in various countries, completed by government officials).

obtain governmental approval of its feasibility study and mine development plan as a condition for the grant of a mining right, it is at risk of not obtaining a right to mine an ore that it has discovered. This acts as a strong disincentive to investment¹¹.

If the law takes a framework character rather than being highly detailed, it can permit flexibility in project-specific or site-specific agreements. These can include agreements for community programs, targets for local employment, or agreements on value-added or government equity in a specific project.

Lessons for the successful reform of mining laws were generated by several Latin American countries in the 1990s. Among the key principles of mining law reform identified from that period were: (1) ease of access to areas on a 'first come, first served' or some other non-discretionary basis (but with a review of the applicant's financial and technical qualifications); (2) an open mining cadastre and title registry; (3) free transferability of mining titles; (4) simple financial maintenance requirements, and (5) minimal royalty obligations. These have been found to be essential elements for the attraction of foreign investment. However, learning from the experience of others can be hampered by a lack of understanding of how knowledge is to be applied in a particular setting. Attempts at regional and bilateral harmonization of mining regulatory regimes have developed to compensate for this. Examples of the former are: the African Mining Legislation Atlas, an online platform about legislation in Africa's mining sector, and the directive adopted by the Economic Community of West African States (ECOWAS) in 2009, setting out the issues that a national mining law should address¹². The directive's impact is likely to be limited by the diversity of circumstances that it encounters among the 15 member states. An example of the latter is the mining and geology cooperation agreement between Angola and Congo of 2013 which promotes the exchange of geological data, the harmonization of tax frameworks in areas such as diamond mining, and establishes training and assistance programs¹³.

Environmental aspects of mining laws are particularly important so it is necessary to identify whether environmental regulations are integrated into the mining law and whether they are attached to the title of mineral rights or are imposed as conditions of operation. The kind of provisions where such considerations will be particularly important will be those relating to environmental and social impacts and mine closure and land reclamation. However, *a key principle is prevention, rather than just pollution control and mitigation of impacts*. Provisions on community consultation,

¹¹ This was evident among the 'transition' countries examined in a World Bank Group Mining Department report, 'The Potential for Mining Investment in Transition Economy Countries of East and Central Asia (A Clark, K Naito, N Stevens, P van der Veen, J Williams, Mining Journal Books, 2003).

¹² The ECOWAS Directive on the Harmonization of Guiding Principles and Policies in the Mining Sector. ECOWAS is a group of 15 West African states.

¹³ Congo ratification was made through Decree No. 2013-430 of 13 August 2013.

publication of information and community development could also be enshrined in the law and developed in detail in regulations, noting the role of international standards in guiding the latter and filling in any gaps.

In this vein, the intrusive character of mining may require provisions in the law expressly limiting its scope. The kind of areas that may be excluded include national and local parks, nature reserves, and areas close to communities. In the Philippines Mining Law of 1995, for example, ancestral lands are excluded unless consent is obtained from the local cultural community, as well as military or government reserves, cemeteries, infrastructure and public or private buildings. Such exclusions should be made explicit before any rights are awarded so that it does not affect any pre-existing title. In Ghana the mining law permits the Minister to reserve land that “is not subject of a mineral right”. If rights have already been rewarded, it is still possible to ‘grandfather’ them in, and allow such mining to continue.

5.4.7 Unconventional Oil and Gas

Very few laws on oil and gas make distinctions between conventional and unconventional sources (including shale gas, tight gas and coal-bed methane). However, the economics and the techniques used are different. The growing interest of governments and private investors in awarding and acquiring exclusive rights to explore for and produce unconventional sources of gas and oil has begun to change this, and to encourage provisions that deal with each category of unconventional gas and oil relative to their conventional counterparts¹⁴. In Argentina an amendment was made to the Federal Hydrocarbons Law in 2014, introducing a new type of concession contract for unconventional exploitation, with a 35-year term, and unlimited 10-year extensions. In the UK the existing regime for licensing has been adapted to include certain new conditions, but in terms of structure it remains the same as for conventional sources. Since operations are located on-land, important environmental and social considerations need to be assessed prior to the development of policies and legal frameworks. Indeed, comparisons may be made with the challenges typically arising in the mining rather than the conventional hydrocarbons industry. In all cases, transparency is of particular importance in order to promote a positive community response to a new (and controversial) industry, as well as to attract foreign investment.

¹⁴ For an overview of the early years of the industry in its US setting, see Susan L Sakmar, ‘The Global Shale Gas Initiative: Will the United States be the Role Model for the Development of Shale Gas around the World?’ University of San Francisco School of Law Research Paper No 2011-27 (<http://ssrn.com/abstract=1927593>).

However, any policy and legal framework will have to take into account several specific features of unconventional gas and oil, such as the following:

- *Operational considerations:* the higher density of wells and on-land base for exploration, appraisal, development and production operations, leads to a greater demand for land access authorizations and operational permits. A well for shale gas will typically run vertically down to the shale layer for a kilometer and a half and then extend horizontally, possibly for as much as two miles, going under the land of many owners potentially;
- *Environment and social regulation:* the potential impact and perceived risks on the surface land, air quality and underground water resources mean that regulation is required. In practice, the risks of groundwater contamination from the fracking process itself are likely to be less common than those arising from improperly managed sludge and fracking pits, and improperly disposed fracking fluids; such fluids typically contain methane, ethane and volatile organic compounds, which may be hazardous to health if not contained and disposed of during fracking operations. Air emission pollution may also arise from inadvertent venting of substances into the atmosphere affecting the quality of air in the surrounding area;
- *Fiscal incentives:* these are required when the cost of unconventional operations is substantially higher than for conventional ones. This could mean reduced royalty rates, a tax credit or more favourable schemes for cost recovery and profit gas split. This approach is less justified if there is an additional profits tax or a profit sharing scheme in place, since in that event the economic criterion on which it is typically based will allow for an automatic integration of the economic differences between conventional and unconventional gas; and
- *Licensing systems:* adjustments would need to be made to provisions on exploration and appraisal periods, work commitments, the definition of an unconventional gas field and submission of development plans. Where rights have already been awarded for conventional petroleum or coal exploration and production in a given area, new rules may allow the award of separate rights for unconventional resources. In Indonesia, for example, regulations give a priority access to holders of existing rights if they wish to seek rights over unconventional resources. The PSC for coal bed methane has a term of 30 years including an initial exploration term of 6 years, which may be extended by 4 years for assessing the viability of a commercial CBM project.