return to AMPLA 1999 Table of Contents

Filling Cavities: Storing Natural Gas Naturally

Thomas Kennedy*

SUMMARY

Re-injection of large volumes of natural gas into depleted cavities and reservoirs has been popular overseas for many years. Recent months have seen some exciting developments in underground gas storage in Australia.

Its "sudden" popularity in Australia is a reflection of the potential for storage to solve many of the challenges that face the creation of a truly dynamic and competitive gas market. It also addresses the critical issue of security of supply.

Until recently, Australia's petroleum laws inadequately dealt with the technical and commercial issues of underground gas storage. With a shift in emphasis to storage for market-making purposes, our law makers are grappling with the question of how to deal with the interesting legal issues that arise in underground gas storage.

This paper looks briefly at the commercial potential of underground gas storage and the legal issues it raises, contrasting the approaches of three States that are at varying stages of introducing storage-related legislation.

UNDERGROUND GAS STORAGE

In recent years the concept of storing natural gas in underground reservoirs has moved from the technical pages of gas industry journals to being a hot topic among governments, players in the evolving energy business and consumers. Re-injection of large volumes of gas into depleted cavities and reservoirs has been popular in the United States and Canada since the First World War,

* BSc, BComm (Melb), LLB (Hons), MBA (Griffith); Deacons Graham & James, Brisbane. With thanks to Peter Dighton, Partner, Deacons Graham & James for his comments.

and in Europe since the Second World War. So why the sudden popularity in Australia?

The simple answer is that gas storage may turn out to play a key role in competition policy reforms. It has the potential to stimulate competition in Australia's closely held gas markets, to encourage development of new sources and uses of gas, and to be a lynch-pin in creating a secure and sophisticated, geologically diverse integrated energy market.

Until recently, regulators and law-makers have turned a blind eye to the fact that our petroleum laws inadequately dealt with the technical and commercial issues of underground gas storage. Storage was largely perceived as an internal production issue for the gas industry to deal with. With the shift in emphasis to storage for market-making purposes, however, and with the added impetus of the fear of a political backlash from supply failure, the question for regulators has become not whether to regulate but exactly *how much*?

RUNNING ON (STORED) GAS: RECENT DEVELOPMENTS

Recent months have seen some exciting developments in underground gas storage in Australia:

- In November 1998, the Victorian Government passed its new *Petroleum Act*, introducing Australia's first true framework for development of an underground gas storage industry.[1]
- In December 1998 the South Australian Government released its draft Petroleum Bill, which includes a proposal to grant a right of access to depleted underground gas reservoirs for storage purposes,[2] and announced funding for an exploration project to determine the feasibility of underground gas storage close to Adelaide.[3]
- In January 1999 the Queensland Government released its discussion paper on review of the *Petroleum Act* 1923 and *Gas Act* 1965, with a significant part of the paper set aside to consider different options for regulation of underground gas storage.[4]

[1] *Petroleum Act* 1998 (Vic), assented to on 24 November 1998.

[2] Petroleum Bill 1998 (SA) released for public comment 21/12/98, available at www.mines.sa.gov.au/petrol/legislation.htm; See also comments of Bob Laws, Director Petroleum Group, PIRSA in "Upstream Gas — the South Australian Reform Agenda and New Developments" available at www.mines.sa.gov.au/petrol/legislation.htm.

[3] Part of the *Targeted Exploration Initiative South Australia (TEISA)*: www.mines.sa.gov.au/petrol/petroleum_projects.htm.

[4] DME Discussion Paper (Qld) available at www.dme.qld.gov.au.

- By June 1999, Texas Utilities Australia (TUA) had acquired the rights to own and operate Australia's first commercial underground gas storage facility to be run on a contracted capacity basis,[5] CMS Gas Transmission of Australia announced its commercial gas storage facility north of Perth in Western Australia was ready to take customers,[6] and Santos and the Oil Company of Australia announced the successful operation of their private gas storage facility near the critical Wallambilla interconnect on the Roma to Brisbane pipeline.[7]

In six short months the landscape of gas industry regulation and the law of underground gas storage in Australia had changed dramatically forever. Before then, gas players had pursued their storage projects without fanfare, generally free from regulatory scrutiny and despite the lack of any comprehensive legal regime. Several factors combined over recent years to change industry, government, and community perceptions of underground gas storage. These are explored in more detail below, followed by a brief analysis of the latest legislative developments in underground gas storage law.

Industry Perceptions: Why Store Gas Underground?

From a technical viewpoint, gas is extremely efficiently stored in the ground. Nature has created excellent storage reservoirs where gas can be contained for many thousands of years. Naturally pressurised and, sometimes, relatively pure natural gas usually occupies space in porous rock, minerals or sand trapped between layers of impermeable rock.[8] Given the cost of extraction, processing and transportation, gas would ideally not be produced until it is needed for consumption. The reality of how gas markets work, however, makes that virtually impossible.

On the supply side, gas extraction is not a predictable and instantaneous process. Raw gas flows up bore holes at varying pressures depending on an enormous range of geophysical factors that, despite over 100 years of scientific endeavour, combine to make

[5] Western Underground Gas Storage Pty Ltd (WUGS) was purchased from the Victorian Government in November 1998 and since then has acquired the State's interests in eight depleted reservoirs in the Port Campbell area of Western Victoria: "Underground Gas Storage Project Will Ease Supply Strain During Victoria's Winter Demand Peaks" (1998) 33(1) *Petroleum Gazette* 35; and "Going Underground to Secure Victoria's Gas Supply" (media release), Eastern Energy, 16 April 1999.

[6] "WA's Mondarra Opens The Way For Natural Gas Storage Facility" (1999) *Australian Gas Journal* 26 (June).

[7] "Oil Company of Australia Develops Gas Storage Facility at Newstead" (1999) *Australian Gas Journal* 28 (June).

[8] See Appendix for a more detailed analysis of types of underground gas storage.

accurate prediction difficult.[9] Gas must also usually be processed before it is ready for sale,[10] making supply far from instantaneous.

On the demand side, gas usage fluctuates weekly, daily, even hourly (following industrial and domestic consumption patterns), and of course is seasonal (gas consumption — directly in winter and indirectly through electricity generation in summer and winter — being temperature-sensitive).

Producers and suppliers of gas have tended to rely on sufficient inventory of pressurised gas in pipelines (linepack) to balance the lag in supply against erratic demand patterns and deliver instantaneous supplies. However, pipelines are expensive to build and maintain particularly if you want to build one larger than requirements for storage. Above ground they are unsightly and below ground they are expensive to maintain.

It was the United States and Canadian pipeline industry that first began to exploit the commercial potential of underground gas storage as an alternative, on-demand supply buffer early on this century.[11] Until then, gas storage had been used only as part of the oil production process, it being good oil field practice to re-inject surplus gas in order to maintain pressure in reservoirs, forcing oil to the surface.[12]

Technically, the principle of commercial storage is simple: When gas demand is low, processed gas (sales gas), or less frequently raw gas, is re-injected into either the reservoir from where it came or another reservoir suitable for storage, preferably as close to the market as possible. When demand is high, pipeline pressure can then be maintained by tapping into the stored gas, supplemented by linepack. This means that instead of building pipelines large enough to move sufficient gas from production fields to processing and marketing facilities to cater for maximum (peak) load demand variations, smaller pipelines can be built to transport a constant volume of gas at constant pressure when it is cheapest to do so. Storing the gas as near as possible to downstream processing or marketing facilities and end users allows it to be efficiently extracted,

[9] The quantity, location, independent and interdependent permeability of subterranean material, natural and human-assisted fluctuations in water table pressure, even the number, type and depth of wells tapped into a reservoir all contribute to make prediction of production flows extremely difficult. See for example, S G Keleman, "Sales Gas and Ethane Storage Projects — Moomba Field, Lower Daralingie Beds (1986) 26(1) *APEA Journal* 405.

[10] Generally involving removal of the two major impurities, carbon dioxide and water, as well as other field-specific contaminants such as sulfides and nitrates.

[11] D Anderson, "Report of the Commission of Inquiry into Fraser Valley Petroleum Exploration", Province of British Columbia, January 1991 at 34-35.

[12] Until relatively recently, gas was thought to have little commercial value and was regarded by oil producers as a nuisance.

when needed.[13]

Storage can only work, however, where there is a difference between peak and off-peak costs for the industry and a pricing differential exists for consumers. Getting a storage industry started in Australia, where there was no real spot market for gas, no extensive pipeline transmission network and an industry characterised by long term take or pay sales contracts, was always going to require more than technical innovation.[14]

Government Perceptions: Midwifing the Australian Gas Market

The United States gas market is characterised by huge demand, vast reserves of readily-accessible gas and intense competition, all allowing the creation and maintenance of a strong spot and derivative market. Australia on the other hand lacks those same drivers. Without them there was little incentive to develop underground gas storage other than for production efficiency purposes. This changed in recent years, however, with the trend towards industry deregulation, privatisation of government utility monopolies, and the subsequent distancing of governments from guaranteeing security of supply and regulatory responsibility.[15] Gas became politically attractive as a relatively clean (that is, green) fuel and with the realisation that known reserves in south and eastern Australia would be sufficient for only 10 years came the need to stimulate industry investment and the search for alternative sources of energy.[16]

The resultant reforms have — to a greater or lesser extent, depending on political motivation — been remarkable. These include introduction of a comprehensive, national third party access regime for pipelines, establishment of innovative, pro-competitive and flexible regulatory regimes and market mechanisms for the gas and pipeline industries, and the unbundling of public and private

[13] Liquefied natural gas (LNG) is sometimes used to provide immediate gas supplies to supplement pipeline supplies during short-term extreme demand peaks: eg, the 12,000 tonne storage facility at Dandenong outside of Melbourne. However, the cost of LNG storage (between four and 10 times the cost of underground storage) makes it far less attractive than underground gas storage: J R Fishe, and R A Nelson, "Building Your Own Underground Gas Storage Project: From Leasing to Open Season Under FERC Order Number 636", 40 *Rocky Mountains Mineral Law Institute* Ch 19 at 19-12.

[14] Observations of the Australian Competition Tribunal in the *AGL Cooper Basin* case are apposite. See in particular pp 45 and 46, *Re: AGL Cooper Basin Natural Gas Supply Arrangements: Application for a Review of a Determination of the ACCC*, ACT, 14 October 1997.

[15] Beginning in February 1994, as part of the Council of Australian Government's (CoAG) National Competition Policy reforms, the Commonwealth, States and Territory governments made a commitment to achieve free and fair trade in natural gas.

[16] Laws, op cit n 2, at 2.

utilities and services.[17] The most recent effect of all this has been the emergence (in line with recent global trends) of horizontal integration in the energy market.

In the emerging competitive environment, the ability to store large volumes of rapidly-accessible gas for commercial purposes clearly generates an attractive range of potential benefits:

- For producers, it can assist with gas flow management and transportation charge reduction.
- For pipeline owners, it can aid gas balancing, enabling optimal flow and pressure maintenance and avoiding under-utilisation of capacity and duplication of facilities.
- For tenure holders and storage facility operators (private or government), it creates a new market for storage services (capacity reservation and user charges), with varying tariffs depending on load requirements.
- For gas users, it can mean a choice of suppliers, greater security of supply, and in a deregulated market it allows for peak price shaving and minimising of exposure to high transmission costs between production and usage centres during peak periods.
- For gas traders, it will allow gas balancing, self-regulation of gas flows and hedging of contracts and can provide emergency supply reserves.
- For regulators, it will assist with the creation of a more competitive and realistic primary and secondary market for gas, allowing unbundling of service providers and eventually forming a key component of a truly competitive gas market.[18]

One other significant benefit of underground gas storage is that it can assist with development of alternative sources of gas where they may have otherwise been uneconomical. In Queensland, for example, underground gas storage is likely to be of particular benefit in commercialising low deliverability fields and diversifying sources

[17] Most notably, South Australia's proposed co-regulatory regime: see Laws, op cit n 2, and Victoria's achievements in establishing the "Victorian Gas Market". This includes establishing VENCorp to regulate the wholesale market for gas and facilitate trading arrangements, the unbundling of gas transmission, distribution and retailing operations (*Gas Industry Act* 1994), introduction of a licensing system along similar lines to electricity industry reforms (*Gas Industry (Further Amendment) Act* 1997) and providing an independent system operator with authority for making Market and System Operation Rules (MSO Rules) relating to gas market regulation, participant conduct and system security.

[18] The example is being set in the United States, where US Federal Energy Regulatory Commission (FERC) O 636 (issued 8 April 1992) is intended to develop secondary markets in released firm capacity, short-term gas sales and transportation services, and allows for gas futures trading: www.ferc.fed.us/news1/rules/pages/orders636.htm.

of supply.[19] Coal seam methane production (CSM) is an emerging industry that has the most potential to benefit from the development of storage facilities by assisting with proving up reserves and overcoming perceived supply guarantee problems, making CSM projects even more bankable than is the case at present.[20]

Having recognised the potential for underground gas storage to play a significant role in developing active gas markets, the question for governments shifted from whether to regulate, to how it should be done. Creating a market from a regulated, tariff-based system dominated by long-term gas supply contracts involves the complex task of forecasting peak and off-peak differentials, valuing unbundled systems and pricing the premium which industry, governments and consumers were prepared to pay for reliability.[21] These issues, as well as the question of whether underground gas storage facilities should be subject to open access principles dominated preparations for creation of the Victorian Gas Market over several years.[22]

GRAPPLING WITH THE LEGAL ISSUES IN UNDERGROUND GAS STORAGE

In Australia, each State (except Tasmania) and the Northern Territory, as well as the Commonwealth, has specific petroleum legislation.[23] In recognition of good oil-field practices, these generally acknowledge that the re-injection of gas into producing reservoirs is part of the production process. Only the Western Australian[24] and Victorian[25] statutes actually *permit* underground gas storage. The rest

[19] DME Discussion Paper, op cit n 4.

[20] "Queuing Up for Coal Seam Methane" (unauthored) (April, 1999) *The Miner* 15-17; see also the submission of Transfield Pty Ltd to the ACCC on Allgas Energy Ltd's application for Interim Authorisation No A90691 (C1999/83 ACCC public registers at www.accc.gov.au). Note that CSM drainage raises a number of legal problems not unlike those posed by underground gas storage. See for example P C McGinley, "Legal Problems Relating to Ownership of Gas Found in Coal Deposits" (1978) 80 *West Virginia Law Review* 369 at 377-378.

[21] See generally, papers from the 8th Annual National Power Conference, September 1997, Melbourne and "Energy '97", August 1997, Melbourne. As to a reliability premium, the tragic events at Esso's Longford plant which left Melbourne without gas supplies for two weeks in winter 1998 would have fundamentally shifted the reliability premium in the Victorian Gas Market, as well as further afield.

[22] Geoff Swier, former Deputy Projects Leader of the Energy Projects Division, Department of Treasury & Finance, Victoria, interviewed for this paper.

[23] *Petroleum (Onshore) Act* 1991 (NSW); *Petroleum Act* 1923 (Qld); *Petroleum Act* 1940 (SA); *Petroleum Act* 1998 (Vic); *Petroleum Act* 1967 (WA); *Petroleum Act* 1984 (NT); *Petroleum (Submerged Lands) Act* 1967 (Cth) governing exploration petroleum resources of submerged lands beyond the outer limits of each State's (and the Northern Territory's) territorial seas. In Tasmania, onshore petroleum is regulated by the general mining legislation.

[24] Section 67, *Petroleum Act* 1967 (WA).

[25] Sections 8 & 46, *Petroleum Act* 1998 (Vic).

simply include re-injected gas in the definition of "petroleum"[26] or make no mention of it at all.[27] All refer to storage only in passing when dealing, for example, with royalty payments.

To date, the lack of any comprehensive legislative regime has presented no difficulties as gas has mostly been stored by the holder of a petroleum production licence or lease in reservoirs covered by the lease itself. It was simply always assumed and came to be accepted (by industry and governments alike) that some storage may occur as an adjunct to the mining, extraction, recovery and disposal of petroleum, as authorised by the leases.

With the shift in emphasis from production-motivated storage to storage for commercial purposes, however, governments and regulators are now faced with a dilemma. On the one hand they must ensure the law is comprehensive and sophisticated enough to deal with the latest technical and commercial developments in underground gas storage, delivering the necessary level of safety, environmental and consumer protection measures. On the other hand, the reforms are primarily motivated by deregulation — the need to remove regulatory barriers to encourage the growth of an open and sophisticated market for producers, suppliers and users of gas. This is the paradox of deregulation.

Legislative Reform: Key Legal Issues to Tackle

Having decided to support and encourage commercial underground gas storage, the next step for market and law reformers was to look at the legal impediments to creation of storage projects.

The key legal issues facing a project participant can be broadly classified into four areas:

(a) ownership of re-injected gas;
(b) approvals and authorisations (covering such issues as tenures and operating licenses, third party access and payment of royalties);
(c) interaction with surface rights holders; and
(d) interaction with other laws.

Each throws up a multitude of sub-issues and permutations and combinations of legal scenarios (a project lawyer's dream) depending on such things as the nature of the gas to be stored, the nature of the storage facility itself, the applicable legislative regime and finally, the common law.

[26] Section 2, *Petroleum Act* 1923 (Qld); s 3, *Petroleum (Onshore) Act* 1991 (NSW); s 5(1), *Petroleum Act* 1984 (NT); and s 5, *Petroleum (Submerged Lands) Act* 1967 (Cth).
[27] *Petroleum Act* 1940 (SA) — the only mention is in s 63 which deals with storage of gas in tanks and pipes.

Only the first two areas, however, are what could be called "fundamental", such that without some legal infrastructure to deal with them, projects may not proceed. It should therefore come as no surprise that, motivated by a desire to shift regulatory responsibility away from government to innovative and flexible market makers, the Victorian and South Australian governments have elected to address the first two only in their introduction of storage-specific legislation. Both legislatures are creating what in effect is a legal "skeleton" around which a body of law and industry practice will be encouraged to grow.

Ownership

Ownership is perhaps the issue most easily resolved. In Victoria, petroleum is stated to be the property of the Crown unless it came to be on or below the surface with "human assistance".[28] This makes it perfectly clear that re-injected gas remains the property of the gas owner.

In contrast, every other State and the Northern Territory purports to retain ownership in re-injected gas, with varying degrees of clarity.[29] Whereas the re-vesting of ownership of gas in the Crown was not inappropriate in the case of production-motivated storage, it has the potential to cause great difficulties in the case of a contracted facility, where the owner of gas effectively "loses" ownership upon storage.

When applied to a typical storage scenario — for example, the commingling of re-injected sales gas with raw gas (which belongs to the Crown) — it becomes clear that the Victorian model provides the most desirable outcome. It allows the parties themselves to resolve questions of ownership by contract, with little or no interference from the Crown. Each gas owner simply retains rights to its quantity of gas of a certain specification. It is left to agreements between the parties to resolve conflicts of ownership (for example, when re-processing or balancing is required, disproportionate withdrawal occurs, dealing with input and output timing, supply of "cushion" gas, purchase of back-up supplies, etc).

[28] Section 13, *Petroleum Act* 1998 (Vic).

[29] D Howard, "Underground Gas Storage — Legal and Regulatory Requirements in Australia" (1999) *APPEA Journal* 663; and R M Willcocks, "Underground Gas Storage in Australia" (1988) 6(2) *Journal of Energy & Natural Resources Law* 77. Both authors identify critical flaws in each State's legislation that leaves it impossible to be certain as to ownership rights. South Australia's Petroleum Bill 1999 leaves questions despite its bald, plain English style, and the Queensland DME's Discussion Paper (op cit n 4) does not deal with the question of ownership of stored gas, the issue being left to the general principle that gas occurring underground is the property of the Crown.

Another interesting scenario is what happens to stored gas on termination of a storage lease or licence. Regardless of the question of ownership of the gas, the Crown must provide specific legislation if it is to have any stored gas re-conveyed (if possession had remained with the tenure-holder or gas owner on re-injection). The Queensland DME proposes that ownership of all petroleum and the facility reverts to the Crown.[30] Neither the South Australian draft Bill nor the Victorian Act deals with the issue, presumably because both expect that the question of ownership of re-injected gas is not in doubt.[31]

Approvals and authorisations

Authority to own and operate a commercial storage facility

In all States and Territories (except Victoria), the relevant petroleum legislation merely acknowledges that re-injection may take place. Only in limited circumstances is the Minister specifically empowered to authorise it (for example, for waste management purposes).[32] Underground gas storage for *commercial* purposes is otherwise not specifically authorised. It is generally assumed that withdrawal of gas as part of a production process is consistent with the relevant production authority,[33] but it is unlikely that the authority extends to the re-injection and storage of gas as part of a commercial facility.[34]

This principle is also particularly relevant where a storage reservoir is located on Crown land. In that case, the Crown will own the porous rock and sand in which gas is typically stored (the "reservoir" and cavities which will contain the gas). By authorising commercial storage, the Crown is effectively granting an interest in that land. If the relevant Act does not authorise the operation of a commercial facility as part of a grant of production lease, the Minister is possibly not empowered to approve the use of Crown land for that purpose.[35]

Applying the principle to freehold, a disaffected landowner may be able to challenge a Minister's authority to permit (or decision to not prevent) underground gas storage, and may commence

[30] This is a little surprising given that nowhere in the discussion paper does it actually state that re-injected gas or the reservoir were not the Crown's: DME Discussion Paper, op cit n 4, at 38.
[31] A fair conclusion in the case of Victoria, but this is by no means made obvious in the SA Bill. See s 5(1) and the definition of petroleum in s 4 , Petroleum Bill 1999.
[32] For example, s 76, *Petroleum (Onshore) Act* 1991 (NSW).
[33] These generally grant an exclusive right to mine, extract, recover, remove and dispose of petroleum (s 44, *Petroleum Act* 1923 (Qld)); see also the case law on the taxation definition of "mining" in Willcocks, op cit n 29, at 86.
[34] Willcocks, op cit n 29, at 90-91.
[35] *Cudgen Rutile (No 2) Pty Ltd v Chalk* [1975] AC 520 at 533.

proceedings against a tenure-holder to prevent surface access or seek compensation for unauthorised interference. Clearly, specific legislation authorising commercial storage is required.

The proposed South Australian legislation provides for this, and more. As with the Victorian Act it specifically empowers the Minister to authorise commercial underground gas storage.[36] It goes a step further, however, by also stating that underground reservoirs themselves are the property of the State.[37] This suggests that the porous contents of all natural reservoirs — mineral or otherwise — is vested in the Crown, perhaps extending the original ambit of the Crown's reservation of mineral rights and in final analysis amounting to the impairment of a pre-existing legal right of a private landowner.[38]

The same principle may even apply to artificial caverns, or abandoned reservoirs, as the definition of natural reservoir includes one which has been artificially modified.[39] Whereas these were the property of the landowner they would now appear to be permanently vested in the Crown.

Queensland's Department of Mines and Energy (DME) proposes to issue special purpose "Commercial Storage Leases" (CSLs), perhaps in addition to also allowing storage of gas as part of existing production tenures.[40] If introduced, it will be one of the most comprehensive underground gas storage regimes in the world. The detail will come at a price, however. Creating a special purpose storage lease opens up a Pandora's box of issues that the DME will have to address.

For example, if a CSL will allow recovery of raw gas (as part of the "cushion"),[41] how much will be allowed? Presumably not much if the CSL is intended to be for the sole purpose of storing and retrieving injected gas. As some commingling and diffusion is unavoidable (and may even lead to loss of sales gas entirely,[42] who will own the raw gas and intermediate gas, and in what proportions or order of priority? Will overlapping tenures be allowed (for example, storage exploration rights over production leases), and if so, how will ownership of raw gas and sales gas be distinguished where there is commingling between two reservoirs?

[36] Section 33, Petroleum Bill 1999 (SA); s 8, *Petroleum Act* 1998 (Vic).
[37] Section 4 ("regulated resource") and s 5, Petroleum Bill 1999 (SA).
[38] *Wade v NSW Rutile Mining Co Ltd* (1969) 121 CLR 177.
[39] Section 4 ("natural reservoir"), Petroleum Bill 1999 (SA).
[40] See DME Discussion Paper, op cit n 4, at 29-39.
[41] Ibid, p 39.
[42] As part of its testing of depleted reservoirs in the Moomba field, Santos Ltd injected sales gas of 3 per cent CO_2 into Moomba wells 45 and 46. After shut-in, Moomba 45 immediately produced gas of 16 per cent CO_2 (raw gas quality) and, after 1 day of withdrawing sales gas, Moomba 46 produced gas of 8 per cent CO_2: Keleman, op cit n 9, at 415-415.

Three final issues on authorities and approvals are worth noting. The first is that in Victoria[43] and Queensland, the area of the relevant storage tenure is reservoir-specific, whereas in South Australia[44] they will be limited to twice the provable size or 100 square kilometres, whichever is less. Reservoir-specific reservations (allowing for a reasonable buffer) are probably a healthy means of promoting competition and encouraging the commercialisation of resources.

The second observation is that storage operators can expect their facilities, which will generally cost tens of millions of dollars to construct, to be economically useful for decades — one of the great advantages of having nature as chief project engineer. In Victoria the term of production licenses are not fixed by legislation,[45] in South Australia they are proposed to last 21 years,[46] and in Queensland up to 10 years in the case of a special-purpose storage lease or 21 if authorised as part of a petroleum lease.[47] There seems little point in putting a finite time limit on a storage facility. Surely it is a matter for the market to determine when a storage facility has outlived its purpose (subject to overriding safety and environmental constraints). Imposing a time limit will only encourage premium pricing and distort the valuation of storage services.

The second issue is to do with operator standards and responsibility. This is a critical issue in any petroleum venture, and gas storage is no different. The Victorian Act requires a Storage Development Plan to be lodged and approved by the Minister before operations can commence.[48] In the proposed South Australian regime, submission of a work program is not compulsory, but where requested by the regulator must be lodged, approved and complied with.[49] In the proposed Queensland regime, the Minister must be satisfied that the applicant has bona fide plans for commercial storage and that the proposed plan of operations is to an acceptable standard before a CSL will be granted.[50]

Special exploration tenures

In all jurisdictions, an exploration tenure would obviously authorise exploration for depleted reservoirs. However, the Queensland DME proposes that exploration tenures will specifically confer on the holder the right to explore for underground reservoirs

[43] Section 58, *Petroleum Act* 1998 (Vic).
[44] Section 36, Petroleum Bill 1999 (SA).
[45] Section 59, *Petroleum Act* 1998 (Vic).
[46] Section 39, Petroleum Bill 1999 (SA).
[47] DME Discussion Paper, op cit n 4, at 38.
[48] Part 5, Div 7, from s 68, and s 147, *Petroleum Act* 1998 (Vic).
[49] Section 37, Petroleum Bill 1999 (SA).
[50] DME Discussion Paper, op cit n 4, at 36.

for gas storage.[51] The South Australian Petroleum Bill 1999 will permit the same.[52]

This makes sense as testing will involve a different scale of activity and perhaps analysis by atypical techniques (for example, in the case of exploration of acquifers or artificial caverns). Of concern, however, is the Queensland DME's questioning of whether it is feasible to allow exploration for storage reservoirs on existing production leases (that is, allow overlapping tenures where they have different purposes).[53] This is potentially possible under the Victorian regime, though not actually sanctioned.[54] Provided there is no impact on a lease-holder's title, it may have the benefit of freeing up depleted reservoirs for storage.

Third party access

The question of overlapping tenures leads to the question of access, and whether a third party can acquire access to a depleted reservoir within a production lease-holder's tenement. The Victorian Act[55] and South Australian Bill[56] allow the Minister to excise unused reservoirs for underground gas storage purposes where a commercial use agreement cannot be reached. The Queensland DME is considering the same.[57] This issue is a fascinating one, and highlights both the need for specific legislation in this area and the pro-competitive motivation behind the legislation.

It is likely that open access principles will eventually apply to underground gas storage facilities as part of government competition policy reforms. So far neither the Victorian nor the South Australian regimes codify comprehensive third party access rights, however, it is inevitable that we will one day see storage tariffs and service rates, rules regulating the interaction between transport (pipelines) and storage of gas, perhaps even the unbundling of storage from transport. In the United States the principal owners and operators of underground storage facilities are interstate pipeline owners, local distribution companies, intrastate pipeline owners and independent storage providers. Already we are seeing a move in this direction, with Texas Utilities Australia in Victoria acquiring the Port Campbell storage facility, Eastern Energy Ltd, gas distributor Westar and retailer Kinetic Energy Pty Ltd.

[51] Ibid, p 31.
[52] Section 20, Petroleum Bill 1999 (SA).
[53] DME Discussion Paper, op cit n 4, at 31.
[54] Section 25 only states that exploration permits must not overlap: *Petroleum Act* 1998 (Vic).
[55] Division 8, s 73, *Petroleum Act* 1998 (Vic).
[56] Section 72, Petroleum Bill 1999 (SA).
[57] DME Discussion Paper, op cit n 4, at 34 and Appendix 2.

Royalties

Two major royalty issues arise when dealing with underground gas storage: avoiding double-royalty, and dealing with the timing of payments.

Most legislation in Australia exempts the payment of royalty on re-injected gas. Only the Victorian Act, however, makes it clear that royalty is not payable on petroleum in respect of which royalty has already been paid.[58] This means that where gas is transported from another field, or from interstate or offshore, the storer will have to be careful to ensure royalty is not paid twice.

As to timing, even though the various Acts make it clear royalties are not paid on reinjected gas, they do not make it clear when those royalties are to be paid once gas is re-injected. In theory, the liability to pay arose when the gas was first extracted, and if stored in a commercial facility, the liability may remain on foot.

Interaction with surface rights holders

Surface rights are essential for operation of a commercial storage facility. Underground gas storage will usually require injection and recovery wells, monitoring wells, gas processing facilities, compressor stations, a gas gathering and interconnection system, and other ancillary facilities.

The Victorian legislation does not make any special allowance for surface access requirements in respect of underground gas storage. None of the legislation needs to, as it is generally governed by existing surface access principles, including payment of reasonable compensation for interference.

Native title will be a significant issue for an underground storage operator as well drilling may be fairly widespread and frequent (for measurement purposes). In addition, the need for additional facilities may mean the project footprint is greater than for a typical natural gas well and gas gathering system. The Victorian Act states that the Commonwealth's *Native Title Act* 1993 will apply unless the relevant parties have agreed otherwise.

In contrast, the South Australian Government placed before Parliament last December 1998 a Bill to introduce a right-to-negotiate process into the current *Petroleum Act*. Whereas the Commonwealth *Native Title Act* requires native title issues to be resolved before a licence can be granted, the South Australian proposal provides for licenses to be issued up front and for the licensee to then be

[58] Section 155(e), *Petroleum Act* 1998 (Vic).

responsible for negotiating with the native title claimants. It also provides for conjunctive agreements and umbrella authorisations.[59] The proposals do not appear in the draft Petroleum Bill 1999. The Queensland DME also proposes to attempt to deal comprehensively with native title in the proposed petroleum legislation.[60]

Interaction with other laws

There are a multitude of other laws that the storage operator must be aware of when developing a storage project. These may include:

- laws prohibiting interference with water resources and providing for environmental management, including waste and contamination issues;
- reporting requirements (to the relevant State department and stock exchange);
- laws dealing with interference in other tenures, the movement of stored gas across reservoir boundaries, leeching and seepage of gas and the question of trespass and nuisance; and
- the taxation implications of storage.[61]

None of these are dealt with to a significant extent in the Victorian Act. Environmental issues receive substantial elaboration in the proposed South Australian legislation[62] and Queensland Discussion Paper,[63] but neither of these deal with issues specific to underground gas storage.

These and many other general legal issues fall to be dealt with as part of a project's overall legal risk management. Over time these will come to be the flesh that fills out the legislative skeleton that is, at present, the law of underground gas storage in Australia.

CONCLUSION

Underground gas storage in Australia has to date been treated as a production management issue. More recently the commercial,

[59] See D Mutton, "The State of Plays in SA", Speech to PESA lunch, 27 May 1999, pp 4-5, available at www.sa.gov.au/petrol.htm.
[60] DME Discussion Paper, op cit n 4, at 70.
[61] Note that Ruling TR 2190 (10 September 1985) made it clear that stored gas is not trading stock for ATO purposes (as it must usually be re-processed, and there is no guarantee of recovery). It was premised on the principle that all re-injected gas vests in the Crown. As this is no longer the case in Victoria, and may be in doubt in other Sates (except South Australia, perhaps), there must be some doubt about the application of that ruling.
[62] Part 12, s 88, Petroleum Bill 1999 (SA).
[63] DME Discussion Paper, op cit n 4, at 73 and Appendix 4.

engineering and legal focus has shifted to seeing gas storage as a vital part of Australia's future energy industry, essential for development of a viable gas market and guaranteeing security of supply.

Only a few key legal hurdles must be overcome to get an underground gas storage project off the ground. The Victorian Government's new *Petroleum Act* is a good example of all that is needed: a minimalist yet effective approach to stimulating industry growth, technical innovation and competition. The rest is predominantly a matter of contract, as it ought to be in a free market.

APPENDIX

Technical Issues and Project Status of Underground Gas Storage in Australia

There are a number of different methods for underground gas storage. Howard provides a useful overview of the characteristics of the three main types of storage reservoirs: "depleted" reservoirs, aquifer storage and artificial caverns.[64]

Depleted Reservoirs

Depleted reservoirs are the most common form of underground gas storage. By 1997 at least 410 underground storage facilities were in operation in the United States and 85 per cent were using depleted gas reservoirs. Reservoirs have several major advantages over other types of storage. Most notably, because the geology of the reservoir, its porosity and rates of petroleum recovery will already be known, the exploration and development costs of a storage project will have already been paid for by the earlier gas producer.

Depleted reservoirs are characterised by the human-assisted removal of naturally occurring gas. The reservoirs can range from oil and gas fields to coal seam methane beds that have been tapped, where gas can be re-injected to fill the cavities in the fractured or cavitated coal.

Some recoverable and unrecoverable gas remains in all reservoirs. That gas is usually referred to as "cushion" gas, and is needed to build the pressure base that will operate a reservoir. As much as half to three quarters of the reservoir's capacity may be required as cushion gas. The remainder will be cycled in and out and is referred

[64] D Howard, "Underground Gas Storage — Legal and Regulatory Requirements in Australia" (1999) *APPEA Journal* 663.

to as "working" gas or "cycle" gas. There is always going to be a certain amount of mixing or "commingling" of cushion gas (with higher CO_2 or other contaminant content if it was raw natural gas) with processed working gas (sales gas, ready for market). This can lead to serious contamination problems and the need to reprocess the withdrawn gas if the reservoir and storage operations are not properly managed.

Different characteristics of depleted reservoirs can determine the best utilisation of the facility. As Howard points out, a small reservoir with good drainage characteristic may be best utilised for short period, high-rate gas supply, to satisfy a peak demand. A large reservoir with more limited drainage may be best suited for longer periods of supply at a lower rate.

Aquifer Storage

In the case of aquifer storage, gas is injected into an existing aquifer, displacing the naturally occurring water. The water (and any raw or injected cushion gas — which need not be natural gas) acts as the pressuriser to enable recovery of injected gas. The three greatest obstacles to use of aquifer storage are development cost (that is, cost of locating and testing the capacity and sealing qualities of the aquifer), the need for a downstream de-watering (and processing) facility, and the risk of environmental contamination or leeching.

The location of suitable aquifers closer to capital cities in Australia than any depleted gas reservoirs may make this type of storage project attractive, however.

Artificial Caverns

In the case of both reservoirs and aquifers, the storage involves taking advantage of the porous nature of materials in which the gas or water was originally stored. The other type of storage involves use of artificial or naturally occurring underground space. Abandoned coal mines and coal shafts, rock caverns and salt caverns have all been used as gas storage facilities in the United States, Canada and Europe.

Reservoir Storage in Australia: State of Plays

Reservoir storage is the only type of storage so far employed in Australia on any commercial scale. Gas storage began in Australia

with offshore storage in depleted Bass Strait reservoirs.[65] In New South Wales, over several years AGL explored a number of sites for gas storage close to major NSW markets in the Sydney Basin area. At different times consideration has also been given to use of disused coal mines near Newcastle, a depleted coal shaft in the Sydney Metropolitan area and aquifer beds close to Sydney.[66]

The Western Australian and Northern Territory governments have both conducted feasibility studies into development of storage facilities, partially to overcome the high costs and inefficiencies created by the remote location of their gas reserves.

The Santos-owned Moomba field in South Australia has been used since 1980 as Australia's first successful on-shore facility. It suffered early setbacks as Santos grappled with the lack of information about the geophysical details of its fields and the relative novelty of the science in Australia. Santos and OCA[67] have also been using a depleted reservoir at Newstead in the Western Surat basin in Southwest Queensland, about 50 km south of Roma and the Wallumbilla pipeline interconnect. Both projects are located near processing plants, which allows for re-processing of withdrawn gas (where necessary) to bring it back up to sales quality.

Recent months have seen two very exciting new underground gas storage projects take shape in Australia. Both independent commercial storage sites, they reflect the maturing of gas markets. The first is at Port Campbell in Victoria's South West, where the Victorian Government's recent sale of the Otway Basin's Iona reservoir to Texas Utilities Australia gives the company a right to build, own and operate an underground gas storage facility. The site is a depleted reservoir which the government had acquired an option to purchase, along with seven other reservoirs in the Port Campbell area.

The second project utilises Western Australia's Mondarra field, 350 km north of Perth. CMS Gas Transmission Australia (CMS GTA) has recently completed preparation for use of the depleted reservoir for underground gas storage. The company will be offering its field as a storage facility to provide true peaking services rather than cyclical storage, working on a 120-day injection cycle and 40-day withdrawal cycle, twice each year.[68]

[65] Gas has been stored offshore from time to time in a partially depleted reservoir in the Barracouta field since 1971.
[66] R M Willcocks, "Underground Gas Storage in Australia" (1988) 6(2) *Journal of Energy & Natural Resources Law* 77 at 156.
[67] Oil Company of Australia Ltd.
[68] "WA's Mondarra Opens The Way For Natural Gas Storage Facility" (1999) *Australian Gas Journal* 26 (June).

return to AMPLA 1999 Table of Contents