House of Representatives' Science and Innovation Committee - Inquiry Into the Science and Application of Geosequestration

STANWELL CORPORATION LIMITED

Submissions of Stanwell Corporation Limited (ABN 37 078 848 674)

Stanwell Corporation Limited (**Stanwell**) makes the following submissions to the House of Representatives' Science and Innovation Committee (**Committee**) in relation to the inquiry into the 'Science and Application of Geosequestration' announced on 30 June 2006 (**Inquiry**).

1. Introductory comments

1.1 Overview of ZeroGen Project

1.2 ZeroGen Pty Ltd, currently a wholly owned subsidiary of Stanwell, is developing a leading edge geosequestration demonstration project, investigating the viability of integrating coal-based gasification and carbon capture and storage (**CCS**) to produce low emission baseload electricity (**ZeroGen Project**).

1.3 Stanwell is the primary service provider to the ZeroGen Project and is responsible for the management of the project. Stanwell is working in conjunction with external advisors and project participants, including Shell, MBA Petroleum Consultants and Upstream Petroleum.

1.4 ZeroGen technology will consolidate and strengthen Australia's strong economic growth, prosperity and high living standards in a carbon constrained world, which is currently underpinned by its access to low cost, reliable and secure baseload electricity derived from coal.

1.5 The ZeroGen Project will be a leading edge demonstration, combining both coal gasification and CCS in deep saline aquifers using commercial scale components. The technology demonstrated by ZeroGen is capable of providing baseload electricity with 'deep cuts' in CO_2 emissions, making it a key contributor to national and international efforts aimed at finding technological solutions to climate change. In particular, ZeroGen will derive a high hydrogen gas for use in gas turbine generators, integrated with the capture and safe storage of CO_2, presenting a step forward for clean coal technologies and the wider use of hydrogen.

1.6 Following concept studies in 2002 and 2004 and a range of expert peer reviews, a feasibility study is currently underway to investigate the economic, environmental, social, regulatory and technical considerations of this demonstration facility. A team of commercial, engineering, scientific and industry advisors have been assembled to undertake the feasibility study.

1.7 As part of the feasibility study, ZeroGen's CO_2 test well program is already underway. This test phase will involve drilling a number of wells up to two kilometres deep to test the viability of safely storing CO_2 in deep saline aquifers in Central Queensland. The results of this test well program will be one of the key initial outcomes of the ZeroGen Project and will be of high interest to stakeholders such as industry, Government and academia.

1.8 Key benefits of ZeroGen Project

1.9 ZeroGen will deliver significant economic and social benefits, such as:

(a) accelerating the commercial uptake of this clean coal technology by generating vital experience that will facilitate cost reductions. This is particularly critical if the Australian power generating industry is to deploy this technology;

(b) preserving the long-term commercial viability of Australia's coal industry and confirming coal as a viable energy supply option in a carbon constrained world. ZeroGen will assist in sustaining and enhancing Australia's coal exports, valued at $13.5 billion a year, and industry employment of approximately 24,000 workers, many of whom live in rural and regional communities;

(c) enhancing Australia's energy security and independence. With approximately 80,000 million tonnes of black and brown coal reserves, ZeroGen's demonstration of clean coal technologies will support Australia's energy requirements for many years;

(d) preserving the international competitive advantage of many of Australia's industries such as minerals and minerals processing. These industries are dependent on competitively priced, reliable baseload electricity and are valued at $18.9 billion;

(e) catalysing new investment and job creation opportunities in clean coal technologies;

(f) positioning Queensland and Australia as a world leader in clean coal technology research and development, which will be increasingly in demand in a carbon constrained world; and

(g) contributing to global efforts in achieving a widespread reduction of CO_2 emissions.

2. Scope of Stanwell's submissions

Stanwell's submissions focus on the following matters raised by the terms of reference for the Inquiry:

(a) some brief comments on scientific issues;

(b) the need for test and pilot projects (demonstration projects) to be conducted within Australia to demonstrate the potential of CCS technology for Australia;

(c) the economic issues associated with developing CCS technology in Australia and the need for greater certainty in long-term greenhouse policy and economic frameworks, including a carbon constraint that effectively values carbon emission reductions;

(d) the need to build technical expertise and capacity in CCS and CCS-related disciplines to support the future widespread uptake of CCS technology within Australia; and

(e) the need for Governments to ensure that the regulatory environment in Australia supports the conduct of demonstration projects and, if they are successful, the subsequent commercial uptake of CCS technology.

3. The science of geosequestration

3.1 The Cooperative Research Centre for Greenhouse Gas Technologies (**CO2CRC**) has a key role in developing the science and application of CCS technologies in Australia. Stanwell understands that CO2CRC will be making submissions to the present Inquiry on the science, application and environmental benefits of using CCS technologies in Australia.

3.2 Stanwell will not be making detailed comment in these submissions on the science underpinning geosequestration technology, or the potential environmental benefits that will flow from the uptake of CCS technology.

3.3 However, Stanwell does wish to make the following broad comments in relation to the scientific aspects of CCS:

(a) CCS technologies are at a developing stage and the science is still uncertain. During this phase, when the science is being developed, there are likely to be outcomes that were not expected. Governments need to accept that the current ability of science to precisely model or track the sequestered CO_2 is limited and subject to local geological conditions. Any proposed regulatory environment needs to acknowledge this and allow project proponents to assess and manage the risks without being too prescriptive.

(b) Small leakages of CO_2 may occur over the long term, even when the technology is mature, and this is still likely to be an acceptable solution for society. Regulation should take a risk-based approach.

4. Need for Australian demonstration projects

4.1 Geological sequestration of CO_2 is currently occurring in several other countries, for instance the Sleipner gas field project in the North Sea, the In Salah gas project in Algeria and the Weyburn enhanced oil recovery project in Canada.

4.2 CCS technologies are at a developing stage. There is a need to build the body of scientific and technical knowledge concerning CCS. The purpose of conducting CCS demonstration projects is to encourage 'learning by doing'. Demonstration projects will highlight where further work is required to enable the future widespread uptake of CCS technology.

4.3 Stanwell believes there is a clear need for CCS demonstration projects to be conducted in Australia to demonstrate the potential of CCS technology for Australia and international markets, at both technical and economic levels.

4.4 Australia should conduct its own demonstration projects (and not wait for the technology to be developed overseas) because:

(a) geosequestration potential is very site-specific and Australia has its own unique geology;

(b) Australia's energy supply is (and will continue to be) largely dependent on coal and other fossil fuels. Fossil fuels are also a major export earner for Australia;

(c) international geosequestration projects are developing slowly, with no projects yet financially committed that demonstrate a complete geosequestration solution for coal-based power stations. Australia has the opportunity to be a world leader, particularly with projects such as ZeroGen;

(d) CCS presents an opportunity for Australia to develop new technologies and expertise that can be sold to other countries;

(e) Government and community acceptance of technology is a local issue. Acceptance in other countries does not guarantee acceptance in Australia (for example, nuclear power); and

(f) Australia has internationally acclaimed expertise in geosequestration research and development that can be capitalised upon.

5. Development of economic frameworks

5.1 Threshold economic issues – policy uncertainty

5.2 The present level of regulatory uncertainty regarding the long-term direction of greenhouse and energy policy is influencing investment decisions, resource allocation and the overall efficiency of the energy market in Australia.

5.3 Total generation of electricity in Australia is projected to grow by 73% to 2030 (an average 2.1% a year), increasing from 237 TWh in 2003/04 to 409 TWh by 2029/30[1]. This will require significant investment in new generation capacity. In the absence of carbon constraints, conventional coal–fired power stations provide the lowest cost electricity and would likely make up the bulk of new generating capacity, significantly increasing Australia's greenhouse emissions.

5.4 However, coal-fired power plants are highly capital intensive, typically costing in excess of $1B with a life in excess of 30 years. Investing in such long lived assets is risky in the face of possible future carbon constraints that could render the plant uneconomic.

5.5 Deferral of investment in baseload power plants could be detrimental to the Australian economy by forcing up electricity prices and potentially resulting in a failure to ensure security of electricity supply.

5.6 Stanwell considers that the development CCS technologies and other clean coal technologies are vital to mitigate the future carbon risks for coal-fired power stations. CCS provides a means to continue to provide competitively priced baseload electricity in a carbon constrained world, maintaining international competitiveness of Australian businesses, while reducing Australia's greenhouse gas emissions.

[1] from ABARE

5.7 However, like investment in new power stations, the development of CCS technologies is an expensive, long-term investment.

5.8 Stanwell's own analysis indicates that capture and storage of CO_2 produced in electricity generation is not economically viable in Australia at this time.

5.9 Although proponents such as Stanwell, through ZeroGen, are attempting to develop CCS technology, it seems that the wider industry is waiting for a clear carbon constraint before it will spend time and money on developing clean coal technologies.

5.10 At the same time, it seems that Government is waiting for clean coal technologies to mature and demonstrate their cost competitiveness, prior to introducing carbon constraints. However, CCS will not mature and achieve lower costs without significant further investment. This creates a 'chicken and egg' situation, and one which is at odds with the need for immediate steps to reduce Australia's greenhouse gas emissions.

5.11 Stanwell acknowledges and encourages present Government funding schemes, such as the LETDF, which are available for CCS technological development. However, further incentives are required for industry to develop CCS technologies. Government could consider other methods of providing support for CCS projects, such as:

(a) providing taxation concessions;

(b) waiving the requirement for financial assurances or bonds to be provided by proponents of demonstration projects;

(c) allowing projects to access revenue from existing greenhouse gas reduction schemes, such as the NSW Greenhouse Gas Abatement Scheme and the Queensland 13% Gas Scheme (possibly in relation to the issue of the certificates under the relevant scheme for electricity generation utilising clean coal technologies or alternatively in relation to the issue of certificates for the injection and disposal of CO_2);

(d) developing appropriate economic frameworks constraining carbon emissions to provide greater financial incentives for industry to develop and use CCS technology, including linkages with overseas markets.

5.12 Industry enthusiasm for CCS will depend on a firm commitment from Government to provide these incentives and economic frameworks.

5.13 Comparison with oil and gas industry model

5.14 The need for greater financial incentives from Government is apparent when comparing CCS activities to standard oil and gas activities.

5.15 Although CCS activities are similar to standard oil and gas activities in many respects, there is a fundamental difference between the current financial incentives for CCS and the risk/reward model that applies to the oil and gas industry. Currently, oil and gas companies are willing to take commercial risks on exploration activities because they can earn substantial revenues from the oil and gas reserves if they are successful in their exploration.

5.16 However, unlike the oil and gas model, there is currently no revenue able to be earned by project proponents from undertaking CCS activities. Consequently, there is not a sufficient financial incentive for the private sector to consider using CCS technologies, even if demonstration CCS projects are funded with Government assistance and prove successful.

5.17 Need for Government to manage liability for demonstration projects

5.18 Concerns about potential legal liabilities provide another significant barrier to industry being willing to undertake projects to develop CCS technologies. These potential liabilities, even if small and likely to be dormant for many years, are not compensated for by an adequate revenue stream, particularly for demonstration projects. For industry, the CCS risk/reward ratio is not sufficient.

5.19 Stanwell believes Government should play a role in managing the potential legal liabilities of project proponents, particularly for demonstration projects. This could be achieved in a variety of ways. For example, Government could assume the responsibility (and liability) for injected CO_2 in relation to demonstration projects, or Government could legislate to limit the liability of project proponents.

5.20 If and when CCS technologies develop to a stage where they generate a revenue stream in their own right, then Government could transition to a model where CCS proponents assume greater responsibility/liability in relation to injected CO_2.

5.21 Possible development of a 'CO_2 solution' industry

5.22 CCS may provide an emissions reduction solution for the power generation industry, the natural gas production industry and other industries that produce emissions from stationary sources. Transport sector emissions might also be reduced by CCS, if hydrogen becomes widely used as a transport fuel (for example, via fuel cells).

5.23 As CCS technologies develop in Australia, we may see the concurrent development of a 'CO_2 solution' industry, where CCS activities are carried out by specialist CCS operators.

5.24 There is likely to be a role for specialist operators of CO_2 sequestration fields who are capable of taking CO_2 from multiple sources.

5.25 The potential role and responsibilities of this 'CO_2 solution' industry will be shaped by the regulatory environment applicable to CCS activities (discussed in more detail later).

5.26 Government may wish to consider encouraging the development of this 'CO_2 solution' industry as a possible outcome of the Inquiry. There may be a role for Government in supporting specialist sequestration field operators. It is also likely that there will be a need for Government support in the building of a CO_2 infrastructure system (i.e. the development of common user infrastructure to connect CO_2 emission/capture sources to geosequestration sites).

6. Need to build technical expertise and capacity in CCS and CCS-related disciplines

6.1 The expertise for the utilisation of geosequestration technologies is drawn largely from adaptation of conventional oil and gas industry technology and techniques. With the oil, gas and resources sectors currently experiencing boom times, this further exacerbates the cost and resourcing pressures facing proponents of demonstration CCS projects.

6.2 Whether or not there is the concurrent development of a 'CO_2 solution' industry, some long-term Government support of training and education programs would be warranted to address this skill shortage.

6.3 This Government support should be justified, given that Australia has the opportunity to be a world leader in this field.

7. Need for a supportive regulatory environment

7.1 Threshold jurisdictional considerations

7.2 There is currently no legislative regime anywhere in Australia which facilitates the transportation and long-term storage of CO_2 for the purpose of mitigating greenhouse gases, although some States do have legislation which may support aspects of CCS.

7.3 Each Australian State, Territory and Commonwealth Government has sovereignty and law making powers in respect of its own jurisdiction (subject to their respective constitutions).

7.4 Geological reservoirs that are suitable for storage of CO_2 may occur onshore or offshore and they may cross boundaries between Australian States or between State waters and Commonwealth waters. Similarly, if CCS technologies are to be deployed in Australia on a large scale, there will need to be large-scale CO_2 pipeline infrastructure that will likely cross jurisdictional boundaries.

7.5 This raises a fundamental question as to how best to regulate CCS, given the differing jurisdictions in which it will occur.

7.6 Stanwell submits that, in considering a CCS regulatory regime, Government should seek to balance:

(a) industry preference for uniform regulation to provide certainty, efficiency and least cost compliance; with

(b) a least cost approach to regulation making, which may suggest the augmentation of existing State and Commonwealth legislation and administrative bodies, rather than enactment of entirely new CCS legislation and administrative bodies.

7.7 An interim regulatory regime to facilitate demonstration projects

7.8 In order to encourage CCS demonstration projects, Stanwell believes Government should establish an interim regulatory regime which is flexible, rather than prescriptive. If the initial standards are too prescriptive, then project proponents will not undertake projects for fear of being unable to meet the standards.

7.9 A flexible interim regulatory regime would allow for the science and application of geosequestration to develop and be shaped by experience from CCS demonstration projects. Appropriate and realistic technical standards and regulations could then be developed, based on the outcomes of CCS demonstration projects.

7.10 This interim regulatory regime would provide a bridge between the development phase of CCS technology and the longer-term uptake of CCS by industry in a commercial/market-based framework.

7.11 To minimise the cost of regulation, an interim regime could be managed by way of augmentation of existing State and Commonwealth legislation, such as petroleum and mining legislation.

7.12 Development of 'commercial phase' regulatory regime

7.13 If geosequestration proves viable and moves into a 'commercial phase', the regulatory regime for this phase could also be managed by way of augmentation of existing State and Commonwealth legislation.

7.14 However, the need for national and international consistency of regulation is much more important in a longer-term, commercial phase regime so as to:

(a) encourage widespread investment in geosequestration and reduce regulatory compliance and administration costs;

(b) maximise the opportunities for participation and recognition of CCS activities conducted in Australia under any national and/or international carbon credit/emission trading schemes; and

(c) facilitate the keeping of a national record and monitoring program for geosequestration over the longer term (possibly hundreds of years), containing specific details of geosequestration activities – i.e. where, when, how much, by whom, etc.

7.15 To regulate geosequestration in the longer term, it would be preferable for State and Commonwealth Governments to jointly develop a set of uniform regulations (or principles) for geosequestration which would then be adopted by each State and the Commonwealth to apply in their respective jurisdictions.

7.16 This legislative approach has previously been successfully applied by participating States in relation to the National Electricity Law and the National Third Party Access Code for natural gas pipelines.

7.17 This issue has been considered to some extent by the Ministerial Council on Mineral & Petroleum Resources (through COAG). The MCMPR has published a set of Australian Regulatory Guiding Principles for Carbon Dioxide Capture and Geological Storage. Stanwell has previously made a submission to MCMPR during the consultation phase for the development of the Regulatory Guiding Principles.

7.18 Even in a longer-term geosequestration regime, some flexibility should be retained, particularly in terms of technical and operating standards for CCS activities. For instance, the chemical composition of the CO_2 and other greenhouse gases that will be able to be stored in geological formations should take into account the varying industrial sources of greenhouse gas emissions (for example, coal-fired electricity generation using a range of different coal specifications and combustion technologies, CO_2 from CSM and oil shale production, etc).

8. More detailed comments on regulatory issues

8.1 Set out in the Appendix to these submissions are more detailed comments on issues that need to be considered in developing a regulatory regime for CCS activities.

Appendix – Issues for consideration in developing a CCS regulatory regime

1. Access and property rights

1.1 Certainty of access to sites

1.2 A proponent wanting to undertake geosequestration on a particular parcel of land would need to gain a legal right to access and use that land, for example, by buying the land or entering into a lease or licence with the owner of the land. While this approach to land access may be workable while geosequestration is in an experimental phase, it is unlikely to support large-scale commercial development of geosequestration. There needs to be a more certain method for gaining access to suitable geosequestration sites.

1.3 A method of providing a uniform way to facilitate geosequestration over all types of land, both onshore and offshore, might be to create a special form of statutory 'geosequestration licences'. Current mining and petroleum production legislation applicable to State and Commonwealth jurisdictions may provide a useful model for statutory licences dealing with geosequestration activities. Such licences could be granted for a defined area or volume and a fixed period of time.

1.4 Competition between differing land uses

1.5 A regulatory regime would also need to regulate the priority of use of an actual or potential geosequestration site between prospective users of the site for geosequestration purposes and persons who may seek (and who may already have made application) to use the site for other purposes such as mineral or petroleum exploration. By way of example, the *Petroleum Gas (Production and Safety) Act 2004* (Qld) provides a regime for determining the priority amongst competing coal and natural gas resource development applications in respect of an underlying parcel of land. A similar regime could be adapted to provide a hierarchy to prioritise geosequestration activities in relation to other competing resource development applications.

1.6 Where a suitable geosequestration site is located in onshore land, the person who 'owns' that land (either freehold or under a crown lease) will likely expect compensation for the use of the land to conduct geosequestration. The regulatory regime should provide a mechanism for compensating landowners and resolving any disputes between the proponent of the geosequestration project and the landowner. Existing petroleum and mining legislation in Australia again provides models for landowner compensation arrangements.

1.7 *Third party access considerations*

1.8 A regulatory regime for geosequestration would need to provide a mechanism for determining priority between parties competing for access to geosequestration site and facilities (including CO_2 transportation pipelines). The National Third Party Access Code for gas pipelines provides an example of how a mandatory third party access scheme, with approved access arrangements, might be used to provide access to geosequestration sites and associated facilities, including pipelines.

1.9 However, unless geosequestration is being undertaken on a large scale, the use of a separate access regime as detailed as the National Third Party Access Code for gas pipelines may not be warranted. An alternative approach would be to provide for a simpler access regime in the legislation governing geosequestration activities. The third party access regime for underground gas storage reservoirs in the *Petroleum and Gas (Production and Safety) Act 2004* (Qld) might be a useful model.

1.10 More generally, the issue of third party access to geosequestration storage sites should not delay the development of demonstration projects in the interim period. Third party access issues would only seem to be relevant once there is a large-scale uptake of geosequestration activities and competing interests for access to limited transportation and storage facilities.

1.11 Multiple site user issues

1.12 Several different parties may have an interest in the one injection and storage site, including the 'owner' for the time being of the land in which the pore space is located (which could be held by freehold, leasehold or Crown leasehold, or as unallocated Crown land), the person who has produced CO_2 and wishes to inject it into the pore space, and the person who will construct the injection plant and equipment and carry out the injection activities.

1.13 Regulation should allow for differing ownership (or rights of use) of each of:

(a) the CO_2 gas (both prior to and after injection);

(b) the pipelines and associated facilities used for CO_2 transportation;

(c) the pore space or geological formation into which the gas is injected; and

(d) the plant and equipment used to inject the CO_2.

1.14 Reasons for expressly regulating for separate ownership include:

(a) unless legislation provides otherwise, ownership of gas which is injected into a pore space in land may pass to the owner of the land (i.e. either the holder of the freehold estate or the Crown) as a result of the common law doctrine of fixtures. Similarly, ownership of compression and injection plant and equipment constructed on land may pass to the owner of the land unless legislation provides otherwise. Existing petroleum legislation in Australia provides a model for regulating for separate ownership of plant and equipment and storage gas, that would otherwise constitute fixtures at common law;

(b) persons spending money on construction of injection plant and equipment will want the ability to finance their geosequestration activities by granting the usual securities to financiers, to depreciate that plant and equipment and to take the benefit of other taxation advantages. Recognising their legal ownership of the plant and equipment would facilitate this;

(c) it would assist in establishing third party access arrangements in relation to the pore spaces and transportation and injection plant/equipment (as discussed above);

(d) it may be necessary or desirable to remove the CO_2 from the pore space at a future time (for example, because of problems with the storage facility or because there is a commercial use for the CO_2). Providing for separate ownership of the gas would facilitate this.

1.15 Specification for 'storage gas'

1.16 In relation to the chemical composition of the CO_2 'storage gas' to be sequested, and the quantity of gas allowed to be stored in any particular reservoir, Stanwell considers that such matters would be best dealt with under the licensing regime to be applied to the regulation of the individual geosequestration sites and site operators, rather than stipulated in any over-arching legislation. In this regard, the following matters should be taken into account:

(a) the specifications for the 'storage gas' to be injected into a reservoir should be sufficiently broad to take account of the varying emission sources of CO_2 and the range of combustion and capture/compression technologies in use that will produce 'storage gas' of varying chemical specifications. A prescriptive definition of 'storage gas' within narrow chemical parameters may inhibit the widespread use of geosequestration as a greenhouse gas abatement mechanism. Adequate industry consultation with the likely operators of the sources of emissions of 'storage gas' and broad and adaptable regulation should prevent this situation from arising; and

(b) the 'storage gas' specifications for any pilot project that is undertaken under an interim geosequestration regulatory regime should (for similar reasons) be as broadly defined and permissible as possible, in order to allow flexibility and encourage a prospective geosequestration proponent to undertake that pilot project. The initial pilot projects will provide assistance for the refinement of the geosequestration regulatory guidelines in general, including in relation to the issue of 'storage gas' specifications.

2. Long-term responsibilities

2.1 Stanwell believes that the long-term responsibility for a geosequestration site should be accepted/assumed by a responsible Government authority.

2.2 For demonstration projects, Stanwell believes Government should assume responsibility for the injected CO_2 immediately after it is injected, though the project proponent would be responsible for conducting monitoring for an agreed period of years to track the CO_2 plume.

2.3 For commercial phase projects, Stanwell believes that Government should assume responsibility for a geosequestration site following its 'closure' (i.e. when the reservoir has been injected with its limit of storage gas, rehabilitated in accordance with the regulatory regime and the regulator is satisfied that the residual risks of leakage and liability are acceptably low[2]). The Government would then be responsible for managing the site and liable for the future risk of the site itself.

2.4 Potential storage sites may occur in both off-shore and on-shore locations. For on-shore locations, the liability regime would need to take into account the interests of the 'owner' of the underlying land tenure (which could be held by freehold, Crown leasehold or unallocated Crown land). Any regulatory regime would need to:

(a) deal with liability and compensation issues associated with the risk of damage to, or diminished use of, the underlying and surrounding land;

(b) specifically address the transfer (or perhaps extinguishment) of any liability owed by a project proponent to the owner of the underlying and surrounding land, as at the time of site closure (i.e. at the time of transfer of risk and liability to a Government authority); and

(c) address the potential for the owner of the underlying or surrounding land to be liable to other persons for damage/injury caused by the long-term effect of geosequestration activities (for example, by providing a statutory limitation on, or exclusion of, the liability of the land owner).

2.5 For commercial phase projects, Stanwell accepts that it would be appropriate for a project proponent to be required to provide a bond or other financial assurance to Government in relation to the conduct of geosequestration activities up until the time of site closure. Stanwell does not believe that it is appropriate or commercially practicable (and may in fact prove to be a disincentive) for proponents to be required to provide financial assurance for the period following site closure.

3. Environmental issues

3.1 A regulatory requirement that CCS activities be based on 'best practice' may be impractical for the injection and storage aspects of geosequestration. 'Best practice' procedures and standards for geosequestration activities are yet to be established. The concept of 'best practice' would be acceptable as a longer-term goal, but is unlikely to be a useful standard for geosequestration activities until many years into the future.

3.2 Stanwell appreciates that there are competing environmental priorities to be considered in developing a regulatory regime for the conduct of geosequestration activities. These competing environmental priorities are (fundamentally):

(a) minimising greenhouse gas emissions that are understood to be contributing to climate change; and

(b) minimising environmental harm caused by geosequestration of CO_2.

3.3 Stanwell considers that imposing a 'too rigorous' regulatory regime for geosequestration will inhibit the timely development of the technology and potentially expose the community to the accepted environmental hazards of rising atmospheric CO_2 levels and the consequential climate change. While the potential environmental risks of geosequestration are uncertain and very site-specific, the potential climate change risks are much greater. If society waits for more certainty in relation to any site-specific environmental issues associated with geosequestration activities, it may be too late for geosequestration to have an impact on climate change.

3.4 Provided that a pilot project does not pose direct risks to the health and safety of people or the surrounding environment (and these appear to be low/manageable risks), Stanwell considers that the inherent risk of geosequestration leakage should not, of itself, preclude the decision to allow a pilot project to proceed under an interim regulatory regime. The atmosphere would already bear the risk of the relevant CO_2 emissions even if the pilot project did not proceed. Rather than posing an environmental risk, Stanwell considers that the greater risk arising from geosequestration

[2] Of course, one of the issues to be determined in the development of a regulatory regime is the 'acceptable' low level of risk of leakage and liability that would be required to exist before the government geosequestration authority would assume responsibility for a storage site following its closure.

projects is an economic risk, in that the costs (including capture, injection and ongoing monitoring) could prove significantly higher than expected, without appropriate support from Government and industry.

4. Project approvals

4.1 Any CCS regulatory regime should include a process for Government approval of proposed geosequestration injection sites. Again, this process should not be too prescriptive during the initial period or it will discourage proponents from undertaking demonstration projects.

4.2 Stanwell suggests regulatory approvals should be site-specific, flexible and risk-based (i.e. they should allow CCS activities to be undertaken by project proponents at a given site, provided that they meet 'manageable' or 'acceptable' levels of risk and uncertainty for that site, rather than prescribing restrictive compliance standards which may not be appropriate to demonstration projects and which may prevent their proper development).

5. Monitoring and verification

5.1 Stanwell recognises that the procedures and standards for measurement, monitoring and reporting of the quantity and composition of captured emissions associated with capture and storage of CO_2 would be an important part of any regulatory regime.

5.2 However, Stanwell submits that the need to develop detailed procedures and standards for monitoring and verification should not delay the development of demonstration projects in the interim period.

5.3 Demonstration projects will endeavour to use existing practices from the oil and gas industry where appropriate. However, because these techniques were developed for different fluids and geologies, they may not be directly applicable to CCS and should not be made mandatory. It is anticipated that demonstration projects will be instrumental in developing the techniques and standards for the CCS industry. It would be appropriate to require a lesser and more flexible degree of compliance for monitoring and verification of demonstration projects to allow industry and Government to jointly develop long-term monitoring and verification standards and procedures that are appropriate to CCS.

5.4 In particular:

(a) one of the issues that the conduct of demonstration projects will help to provide greater clarity of is the migratory behaviour of injected CO_2 over time. This may require Governments, regulators and CCS proponents to start to think of CO_2 injection reservoirs in broader terms than simply the structure into which the CO_2 was injected, as the CO_2 may migrate over the long periods of time required for the CO_2 to be sequestered. A regulatory regime would need to recognise that the proponent's injection activities may have impacts beyond the boundaries of any tenement upon which those injection activities took place;

(b) for low permeability geological structures, it may not be possible to effectively monitor the CO_2 plume using existing oil and gas industry monitoring techniques. Consequently more experimentation and testing is required to further develop those monitoring techniques;

(c) small leakages of CO_2 may occur over the long term, even when the technology is mature, and this is still likely to be an acceptable solution for society. Regulation should take a risk-based approach.

5.5 The procedures and standards adopted for a longer-term commercial phase regulatory regime should be developed and applied on a consistent national basis.

5.6 Ideally, they should also be consistent with procedures and standards that are being developed internationally. It is increasingly likely that Australia will enter into international agreements or programs aimed at managing climate change and greenhouse gas emissions (whether these take the form of bilateral agreements or international treaties such as the *Kyoto Protocol*). To be able to maximise its opportunities under these agreements (such as participating in carbon trading), Australia should seek to adopt internationally recognised procedures and standards.

5.7 Stanwell believes an independent Government authority (rather than the owner/operator of a storage site) should be responsible for carrying out the long-term monitoring and verification of geosequestration activities on the site, following site closure.

5.8 An alternative approach would be to require industry to self-regulate the monitoring and verification of geosequestration activities by requiring the establishment of an industry-funded body to undertake those activities and report to Government within defined parameters.

6. Financial issues

6.1 Stanwell believes that regulatory measures should not inhibit the uptake of geosequestration as a viable form of CO_2 emission abatement.

6.2 Stanwell believes that the cost of regulation (at least under any interim regulatory regime) should be borne by the wider community, rather than borne by the industry sector participating in geosequestration.