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## **Introduction**

The Western Australian Government ("the Government") is committed to reducing greenhouse gas emissions through regulatory, fiscal and voluntary measures and efficiency improvements in all sectors of the economy. This commitment includes greenhouse gas emission reductions through the use of geosequestration, or carbon capture and storage (CCS). This commitment is reflected in policy and strategies including for example the State's Greenhouse Strategy and the consideration of CCS as an environmental offset in the Environmental Protection Authority's (EPA's) Guidance Statement No. 12 on minimising greenhouse gas emissions. The Government considers it is important that actions to mitigate greenhouse gas emissions are further developed to ensure Western Australia's contribution to national greenhouse gas abatement is strong.

The Government is supportive of CCS as a transition technology, used as part of a suite of greenhouse gas abatement measures, to address climate change. The Government has a keen interest in CCS and has been involved in international and national CCS initiatives. For the purpose of consistency with national and international discussions, the term carbon capture and storage (CCS) has been used in this submission. When referring to CCS in this submission, it is meant as synonymous with 'geosequestration' as defined in the terms of reference of this inquiry.

## **Background**

### Western Australia's Involvement

CCS is identified in the Government's Greenhouse Strategy ("the Strategy") published in September 2004 as a key measure to manage the State's carbon dioxide (CO<sub>2</sub>) emissions. The Strategy details actions to address climate change and greenhouse gas emissions management and assigns responsibility for these actions to specific government agencies. The Department of Industry and Resources ("DoIR") is responsible for investigations into CCS, including technical feasibility, regulatory and approval issues and encouraging industry development. The actions arising from the Strategy are monitored by the Minister for the Environment to ensure that the implementation of the actions is progressed in accordance with the Strategy schedules. In addition, through the environmental approvals process the EPA has the ability to request environmental offsets for significant residual impacts resulting from major projects, which can include CCS as an emissions abatement measure.

Western Australia has been involved in CCS discussions at national and international levels, including through membership of the Carbon Sequestration Leadership Forum (CSLF) and as chair of the Ministerial Council for Minerals and Petroleum Resources (MCMPR)

Regulatory Reference and Working Group that initiated the development of the *Australian Regulatory Guiding Principles for Carbon Dioxide Capture and Storage*. Western Australia acknowledges the importance of continued discussions between the States and Commonwealth governments on CCS, particularly regarding liability and risk issues and the development of regulatory regimes. Western Australia continues to provide input to consideration of these issues through membership on the MCMPR CCS Contact Officers Working Group.

Government's recent focus has been on developing policy and regulatory frameworks for CCS projects as well as developing a technical understanding of the sequestration process in order to ensure Western Australia has the expertise to regulate CCS projects. The Government is keen to promote Western Australia as a leader in CCS.

### The Gorgon Geosequestration Project

A major driver for the Western Australian Government's recent investigations into CCS is the Gorgon Joint Venture's proposed CCS project on Barrow Island. The Gorgon Joint Venture (GJV) is proposing to develop the Greater Gorgon gas fields, located in Commonwealth waters approximately 130km off the north-west coast of Western Australia. The development proposal includes a gas processing facility on Barrow Island comprising two 5 million tonne per annum LNG trains and carbon dioxide injection facilities. It is proposed that reservoir CO<sub>2</sub> will be injected into a saline aquifer 2km beneath Barrow Island. This CCS project would effectively reduce greenhouse gas emissions from the proposed LNG project by 40%, by sequestering 2.7 – 3.2 million tonnes of CO<sub>2</sub> per annum. This would be the first commercial application of CCS in Australia, and one of the largest CCS projects on a global scale. The project proponents adopted a greenhouse gas management strategy in 2003, which has guided the GJV in planning the development and continues to provide a framework for future decisions. Chevron, as operator of the GJV, is undertaking substantial research into the suitability of an aquifer beneath Barrow Island as the chosen site to safely reinject CO<sub>2</sub>. Legislation specific to Barrow Island (the *Barrow Island Act 2003*) will be used to authorise and regulate the proposed CCS project, if approved by Government. While the EPA has advised the Minister for the Environment that it considers the proposed LNG project is not environmentally acceptable, the Government is yet to make its final approval decision, which will also take into consideration the economic and social factors.

### Special Report into Carbon Dioxide Sequestration

The Intergovernmental Panel on Climate Change released a special report into carbon dioxide sequestration in September 2005. This comprehensive review assesses the current state of knowledge surrounding carbon capture and storage in terms of technical, scientific, environmental, societal and economic factors. The report can be viewed at <http://www.ipcc.ch/index.html>. The study found that adopting CCS in conjunction with other mitigation options could significantly reduce the costs of greenhouse gas stabilisation and increase the flexibility in achieving these reductions. The report discusses some CCS issues of interest to this inquiry in detail including the science underpinning the technology, the maturity of current research, risks and benefits, regulatory regimes, gaps in knowledge and market applications at a global scale.

Areas identified in the report as requiring further work include:

- Technologies for capture and storage;
- Geographical relationship between sources and storage opportunities;

- Geological storage capacity and effectiveness;
- Impacts of ocean storage;
- Legal and regulatory issues;
- Global contribution of CCS to mitigating climate change.

## **The science underpinning geosequestration technology**

### Key Issues

Research in Western Australia has been focussed on areas that have knowledge gaps and warrant further inquiry. Injection of gas into geological formations is already practised in the WA petroleum industry and the knowledge of these processes has been further refined for application to the proposed Gorgon CCS project. Key issues relating to the establishment of technically sound CCS projects include the effectiveness of the geological formation in storing CO<sub>2</sub> including seal integrity and trapping mechanisms, leakage risk and mitigation, and monitoring, as discussed below.

### Injection

In WA onshore and offshore petroleum industry, the re-injection of unused natural gas (methane) produced in association with oil into producing or depleted reservoirs is a well understood practice. A number of current production proposals in WA incorporate integrated gas re-injection systems. These have the benefit of significantly reducing greenhouse emissions that would usually result from flaring the gas, in addition to assisting in oil recovery. Depleted reservoirs can also be used for temporary storage of natural gas. For example, the depleted Mondarra field has recently been developed into a gas-storage facility to service the WA natural gas industry.

Furthermore, the injection of gas into partially depleted petroleum reservoirs is well documented as an enhanced oil recovery (EOR) technique within the petroleum industry. For example, a feasibility study on the strategic development of the Barrow Island petroleum resources using EOR methods including CO<sub>2</sub> injection has already started by the Western Australian Energy Research Alliance (WA ERA) and Chevron Australia. Also, DoIR is proposing to outsource a WA EOR feasibility study of Barrow Island. The principles behind EOR are similar to CO<sub>2</sub> sequestration, but it differs in the fact that the stored gas may eventually be used for a variety of purposes (e.g. CO<sub>2</sub> supply to industry).

### Geological Storage Effectiveness

While there is substantial knowledge of CO<sub>2</sub> injection, there is less known about the long term storage of large volumes of CO<sub>2</sub> in depleted reservoirs and saline aquifers. The key scientific issues are the effects of CO<sub>2</sub> storage on the reservoir or aquifer's characteristics, the increased pressure on the seal's integrity and leakage into adjoining reservoirs or aquifers and the atmosphere.

Minimising the risk of leakage is strongly dependent on appropriate site selection which requires rigorous testing of potential CCS site suitability including depth, geology and physical and chemical trapping mechanisms. There are some knowledge gaps in the science underpinning CCS that have been identified and need to be addressed. Each CCS project will have its own particular issues due to the site specific nature of effective CO<sub>2</sub> trapping.

Other suggested research includes the acidification of aquifers and the consequent effect on the aquifer integrity.

### Monitoring

Techniques which could be used for monitoring injected CO<sub>2</sub> – such as seismic surveys, tracers, downhole sensing (wireline logging, pressure and flow tests), well monitoring, formation geochemistry monitoring and shallow groundwater monitoring – are commonly used in the petroleum industry. Western Australia is therefore fortunate that these techniques, which are suitable to the North West Shelf petroleum activities, are readily available for its CCS projects. Each site, however, will still require extensive development.

### Gorgon Feasibility Appraisal Studies

Chevron Australia, in order to meet the Government's requirements, is undertaking substantial scientific research into CCS on Barrow Island. As a means of fully understanding the sequestration process and the associated risks, DoIR and Chevron agreed to regularly review the technical work for "due diligence" purposes. The Government, through DoIR, engaged independent consultants to appraise the feasibility of the GJV's proposal to sequester reservoir CO<sub>2</sub> on Barrow Island. This has comprised three phases:

- The Phase I appraisal was completed in June 2003 and concluded, based on the information available at the time, that the proposed injection project was technically feasible and that the risks could be managed. This information assisted Cabinet in its decision to grant the GJV in-principle access to Barrow Island with the execution of the Barrow Island Act and State Agreement in 2003.
- The Phase II appraisal, completed in November 2004, looked at the proposal in more detail. It consisted of a technical review of the GJV's Phase II assessment of potential injection sites on the island and modelling the long term injection process at the preferred injection location.
- Phase III of the study has been commissioned to Innovative Carbon Technologies Pty Ltd (ICTPL), and the study team comprises technical experts from organisations worldwide. The Phase III study will monitor the GJV's ongoing investigations in the project. The key objectives of the Phase III study are to review, assess and verify GJV's effectiveness of the following plans:
  - The data well program to evaluate the injectivity and safety requirements of an effective injection program in the Dupuy Formation;
  - The monitoring program for detecting any migration of the CO<sub>2</sub> plume away from the injection site over the life of the project;
  - The remediation well program to ensure that existing wells that have been drilled near the proposed injection site have been properly secured as to pose no leak hazard of CO<sub>2</sub>.

The outcomes of Phase III will assist the Barrow Island Act Minister in his assessment of GJV's application to inject reservoir CO<sub>2</sub> on Barrow Island, which is required under the *Barrow Island Act 2003*.

## **The potential environmental and economic benefits and risks of such geosequestration technology**

### Environmental Benefits and Risks

The Government supports CCS as part of a suite of abatement measures including energy efficiency and renewable energy technologies. CCS applications in the energy sector have the potential to store large quantities of CO<sub>2</sub> in a safe manner and in doing so provide a means of managing and reducing the irreversible impacts of greenhouse gas emissions to the atmosphere. It may also be used as a transition technology for Australia's greenhouse gas management from fossil fuels to cleaner energy sources such as large scale renewable energy and hydrogen technologies. Use of CCS would assist in enabling the continued use of fossil fuel resources and existing industrial infrastructure through for example, the potential for CCS projects to draw and capture emissions from clusters of significant point sources of emissions, such as existing heavy industrial areas. It should be noted however that under current circumstances the cost of establishing CCS projects is likely to preclude its use for smaller or more diffuse sources of emissions.

Australia is a signatory to various international agreements, and has obligations and responsibilities to support new technologies that would assist in the abatement of greenhouse gases. Also, Australia may be held liable under international law for violation of its international obligations under both customary international law and treaty law, if significant environmental impacts were to result from a CCS operation. Particularly, the United Nations Convention on the Law of the Sea 1982 (UNCLOS) and the United Nations Framework Climate Change Convention 1992 (UNFCCC) should be regarded.

CCS for the purpose of avoiding CO<sub>2</sub> emissions into the atmosphere is a new application of existing petroleum technology and thus there are associated risks and uncertainties that must be identified and minimised. Site specific research is required prior to project commencement and stringent monitoring plans must be in place for projects to receive approval. There is currently work underway to apply the MCMPR Regulatory Principles for CCS in the development of a suitable regulatory framework to assist in encouraging investment in CCS projects. It will be important that proposals for establishment of CCS projects are encouraged, and that constructive guidance is provided to project proponents regarding the technical and environmental assessments that will be required to demonstrate project suitability. The provision of funding to assist in research and development through appropriate technology development or industry assistance grants programs may also assist in encouraging the establishment of CCS projects in Australia.

There are a number of environmental implications that arise from CCS that need to be addressed such as the potential impacts of stored CO<sub>2</sub> on the aquifers and potential impacts from leakage on the surrounding environment. Though the likelihood of CO<sub>2</sub> leakage is very low, especially at the surface, the potential impacts must still be considered. Leakage during injection or as a result of ineffectual reservoir containment could affect subterranean fauna populations. Subterranean fauna, including stygofauna and troglifauna, are common in Western Australia and can be found in sedimentary formations, including those at Barrow Island. Many taxa have restricted distribution and a local catastrophic impact could lead to extinction of local species. Site specific research is required to ensure that impacts to subterranean fauna are minimised, primarily by properly siting CCS projects and effective containment of CO<sub>2</sub> during the life of the project. Site selection is important to ensure that

stable geological environments are chosen, with low risk of disturbance such as earthquakes. Effective monitoring of CO<sub>2</sub> plume movement during injection and in the long-term would identify any deviation from modelled behaviour and potential pathways through which CO<sub>2</sub> could reach the surface. Mitigation measures would then be taken to ensure that the plume is contained.

### Liability Issues

The potential for leakage from CCS projects raises the issue of liability. It is standard practice in the resources industry that once a regulator has accepted that closure criteria for a project have been met and the site is relinquished by the operator, the liability for impacts resulting from the lawful use of the land can in part rest with the regulator. It would be assumed that a similar situation would apply for CCS projects, that is, that closure criteria would be developed and there would be a point at which the regulator must accept some of the liability for the for the stored CO<sub>2</sub>. Given that the sequestered CO<sub>2</sub> could be stored for perpetuity, the potential liability for the stored gas will also be indefinite. There are several factors that further complicate this issue:

1. In the event that a carbon trading system is adopted and in the event that there is leakage of CO<sub>2</sub> after the CCS operator has received payment for the sequestration, achieved the required closure criteria and relinquished the site it is possible that there may be some liability not only for any impacts of the leaking CO<sub>2</sub>, but also potentially for the cost of the release of the CO<sub>2</sub>.
2. There are also cross jurisdictional issues that arise when considering CCS projects. This issue has been encountered with the Gorgon Joint Venture project where the gas for the proposed gas processing facility will be extracted from Commonwealth waters, however the proposed site for the CCS is within the State waters. This raises the issue of who should be responsible for the liability that will be attached to the stored CO<sub>2</sub> when the royalties from the gas extraction that produce the CO<sub>2</sub> will accrue to the Commonwealth government. It is likely that similar inter-jurisdictional issues will arise in the future where the benefits and costs from the production of the CO<sub>2</sub> and its storage accrue in different jurisdictions. There is a potential for these issues to occur at State-State, State-Commonwealth, and also potentially at international levels.

### Economic Benefits and Risks

The establishment of operations for the storage of carbon dioxide emissions would be of benefit in the event that carbon trading schemes are adopted in Australia. The absence of a carbon trading system in Australia results in the lack of a price signal to encourage the establishment of CCS projects. While there is ongoing work between the States to consider potential emissions trading systems it is also important to note that even in the absence of a price signal there are already a number of proposals for the establishment of CCS projects. These projects are being encouraged through existing environmental approvals processes and cooperative research programs. Environmental offset systems such as those in place in Western Australia can assist in encouraging investment in projects that incorporate CCS. An increasing investment pressure for sound corporate governance is also a driver for investment in improved greenhouse gas emissions management.

It is quite clear that in these stages of developing CCS in WA and elsewhere in Australia, the economic risks and issues of liability are still being addressed. Other issues such as the effect of CO<sub>2</sub> in reservoir/aquifer environments require further investigation. It is important that economic and environmental risks relating to CCS are further considered by the

Commonwealth and State governments but this should not prevent consideration of CCS projects.

As stated above, the Government considers CCS as only one of a suite of greenhouse gas abatement measures. While geosequestration should continue to be developed, it is important that the development of other greenhouse gas abatement measures, such as low emission fuels, are also progressed. While the Government appreciates the amount of public and private investment in CCS research and development to assist in reducing the greenhouse gas emissions from fossil fuels, it is concerned that funding provided for research and development of alternative fuel has not been advanced. Such alternative fuels must be developed to ensure security of energy supply for domestic and industrial purposes throughout Australia.

### **The skill base in Australia to advance the science of geosequestration technology**

Western Australia has an extensive skill base in oil and gas operations, particularly due to the abundant resources in the Carnarvon Basin off the North West coast, as well as in the Perth and Browse Basins, onshore and offshore. The similarities between technologies used in petroleum operations and CCS projects mean that Western Australia is well placed to become a global centre for excellence in CCS research and development. Western Australia has a well established and sound regulatory regime for petroleum operations that can be applied to CCS projects and has considerable technical and regulatory expertise relevant to CCS in both the private sector and government.

The GJV are proposing Australia's first commercial CCS project, which is also the largest worldwide, with the project design undertaken in Perth. The development of the CCS project has involved a wide range of expertise within Australia. This includes experts in the Commonwealth and WA government agencies, the Cooperative Research Centre for Greenhouse Gas Technologies (CO<sub>2</sub>CRC), tertiary research institutions and on occasion experts from overseas. There is now a strong group of experts in CCS technologies and regulation in Australia, particularly in Western Australia and Victoria. This expertise includes the exploration for suitable CCS sites, development of these sites, their monitoring and verification and the development of legislation and regulating frameworks. Although some of these stages are in their infancy, it is at the world's best levels and standards. It is important that Australia develops this set of expertise to ensure Australia's lead position in CCS technology and regulation.

## Regulatory and approval issues governing geosequestration technology and trials

### Greenhouse Strategy

The WA State Greenhouse Strategy, published in 2004, acknowledges the need to ensure the State has appropriate policy and regulatory frameworks in place to make decisions about future CCS proposals. Table 1 below summarises the relevant action items arising from the Greenhouse Strategy.

No.	Action	Agency
3.2.1	The Western Australian Government should develop and communicate clear policies relating to key technical issues associated with geosequestration prior to approving specific proposals.	DoIR
3.2.2	The Western Australian Government will establish an effective regulatory regime for geosequestration, including new suitable specific legislation and regulations if necessary, to manage CO <sub>2</sub> handling, injection and storage prior to approving specific proposals.	DoIR
3.2.3	The Western Australian Government will develop its view as to how liability for carbon sequestration operations should be addressed and communicate this view to industry, the public and to other governments.	DoIR
3.2.4	The Western Australian Government will develop and implement a public information program about geosequestration.	DoIR

Table 1: Summary of Action Items in the WA Greenhouse Strategy Specific to CCS

This set of actions reflects the Government's recognition of CCS as an applied greenhouse gas abatement measure and importantly of the need to govern the development of this technology. Also important is the need to enhance the community's awareness of CCS, the current issues and its value to Western Australia. The Government will progress the development of technology and regulation to ensure CCS is a viable greenhouse gas abatement measure in Western Australia.

As stated above, the project approvals process has accommodated CCS as a possible greenhouse gas abatement option. The EPA in its Guidance Statement N<sup>o</sup> 12 *Minimising Greenhouse Gases* and its Position Statement N<sup>o</sup> 9 *Environmental Offsets* provides advice on how the Authority expects project proponents to address greenhouse emissions management, including how CCS can be used as an abatement measure. It is important to note that CCS is only one of several greenhouse gas abatement measures that the Authority considers in its deliberations on approval of proposed projects. While the Authority will consider CCS, it is also aware that important regulatory controls of the CCS process are being developed and that extensive trials to prove the integrity of the CCS process will be required.

The Government's commitment to greenhouse gas abatement and efforts such as the EPA's consideration of CCS as an abatement measure reflect the need for the development of regulatory and approvals processes to ensure CCS is viable. A key issue that is to be addressed in the approvals process is the longevity of the CCS process. This means that although there may be sound knowledge and regulatory actions for the injection phase, it is important that sound knowledge and regulation is applied for the post closure phase, which can extend decades and centuries into the future.



## Greenhouse Gas Accounting

Greenhouse gas accounting is a national issue in which Western Australia is inextricably bound. The WA Greenhouse Strategy has set actions for the development of a WA Greenhouse Inventory which requires mandatory reporting. The development of the inventory is progressing. The Government is mindful of the Council of Australian Government's (COAG) decision of 14 July 2006 regarding greenhouse reporting and has agency representation on COAG committees addressing the reporting process.

It is of concern to the Government that there is not an adequate framework for accounting for CCS within the Kyoto Protocol's Marrakech Accords. The Government is establishing a WA Greenhouse Gas Inventory and will need to develop adequate monitoring and accounting arrangements for CCS to ensure that CCS activities can be adequately recognised in greenhouse reduction policy measures. This is particularly important in the event that Australia enters into a National Emissions Trading Scheme. In any event it is important that Australia plays a lead role through the UNFCCC in the development of appropriate accounting methods and rules that deal with CCS particularly issues of physical leakage from all stages of the process.

In respect of this concern, the Government would support the Commonwealth in its position on the UNFCCC committees to address this issue towards including CCS as a greenhouse abatement measure within the Marrakech Accords. This should also be raised by Australia in other international fora such as the Asia-Pacific Partnership on Clean Development and Climate (AP6).

## Current Status and Amendments to Legislation

The potential of existing WA legislation to accommodate CCS has recently been reviewed to ensure consistency with potential project requirements and current Commonwealth regulatory directions. Currently, the only legislation in WA that can authorise CCS is the *Barrow Island Act 2003* (BIA). The BIA, however, is specific to Barrow Island and cannot authorise CCS elsewhere in the State.

Under section 13 of the BIA, a person must seek the BIA Minister's approval to dispose of the CO<sub>2</sub> by injection into a subsurface reservoir beneath Barrow Island. In addition, Schedule 1 to the BIA, the Gorgon State Agreement (*Gorgon Gas Processing and Infrastructure Agreement*), requires the proponents to submit a CO<sub>2</sub> disposal proposal and a Closure Plan Proposal which addresses the long term management of the injected CO<sub>2</sub>. The proposed Gorgon CCS project is to be regulated via conditions set on the BIA approval and through the State Agreement proposals approval, to ensure the activity is regulated in line with existing relevant petroleum industry legislative requirements.

For the injection activities, drilling and geophysical surveys, the GJV will be required to comply with relevant existing petroleum legislation requirements, i.e. the *Petroleum Act 1967* and Onshore Schedule. The BIA has amended the *Petroleum Pipelines Act 1969* to allow for the transport of CO<sub>2</sub> by pipeline on Barrow Island. The capture of CO<sub>2</sub> during gas processing on Barrow Island will be authorised and regulated under the State Agreement plant proposals and the Major Hazards Facility regulations for the plant.

To authorise the transport and injection of CO<sub>2</sub> elsewhere in the State, amendments to existing legislation or new legislation would be required. These may amendments include:

- Amendments to the *Petroleum Act 1967* are currently being investigated to allow for CCS onshore in WA and some areas of internal waters, by including CO<sub>2</sub> as a naturally occurring gas associated with hydrocarbons in its definition. The *WA Petroleum Act* enables the storage of hydrocarbons in naturally occurring underground reservoirs by way of purpose specific agreements with the Minister. Any party can make application for such a project. Other existing provisions within the *Petroleum Act* (e.g. Special Prospecting Authorities and Access Authorities) could also be utilised;
- Similar amendments to the *Petroleum Pipelines Act 1969* would also be required for State projects;
- The *WA Petroleum (Submerged Lands) Act 1982*, for other areas of internal waters, may need to be amended to mirror upcoming changes to the Commonwealth legislation (Under the *Offshore Petroleum Act 2006*).

The WA government is committed to progressing the definition of appropriate approval and regulatory mechanisms in order to aid development of CCS proposals in the State and ensure regulatory certainty is achieved.

### **How to best position Australian industry to capture possible market applications**

Australia has an excellent potential for CCS project development as there are many geologically stable areas that may be suitable sites. CCS has applications in the petroleum industry, especially LNG projects, where CO<sub>2</sub> is stripped from the gas stream as part of the normal liquefaction process. CO<sub>2</sub> can also be captured from stationary power sources such as coal-fired power stations. There is also potential to develop multi-user CCS sites to store CO<sub>2</sub> captured from various sources in industrial areas, e.g. Kwinana industrial area, south of Perth.

Uncomplicated and well understood regulatory regimes and approvals systems are necessary to attract investment. Any new legislation for CCS should be simplified and where possible, in keeping with the *Australian Regulatory Guiding Principles for Carbon Dioxide Capture and Storage*, existing legislation should be used. In the absence of formal legislation worldwide that addresses CCS, Australia, with its current leading edge knowledge on CCS technology and regulation, is in a strong position to market this expertise in other countries. It also means that there is greater certainty about CCS, which may be seen as attractive to overseas investors.

There is also a need to ensure that there are adequate public information programs on CCS technologies and projects. The WA Government, through DoIR and the Department of Premier and Cabinet, hosted a public workshop on carbon sequestration in November 2004 and covered a variety of issues surrounding organic and geosequestration. The workshop was well attended by government, industry and members of the public. It is anticipated that the regulatory framework for CCS will include requirements for consultation on project proposals; however these consultations would be assisted by implementing strategies to educate and inform the public on CCS at a broad level in the first instance. Developing a knowledge base and providing information to the public and key stakeholder groups will assist in limiting the potential for unnecessary public concern to result in project delays and would assist in enabling constructive input from stakeholders on project proposals.

## Summary

CCS has the potential to reduce global carbon dioxide emissions significantly as a mid-term solution to climate change by safely storing large quantities of CO<sub>2</sub> in stable geological formations far beneath the earth's surface. The Western Australian Government supports the use of CCS as part of a suite of abatement solutions including energy efficiency programs and development of renewable energy systems. CCS has value as a transition technology from current fossil fuel usage to cleaner energy sources.

The Government's focus has been on developing sound a sound regulatory framework and technical knowledge for CCS projects in order to properly assess the Gorgon Joint Venture's CCS proposal on Barrow Island. There is potential to develop other CCS projects in WA and nationally, including other stand-alone projects and multi-user systems. Legislation in WA regarding CCS projects is specific to Barrow Island, and will be used to authorise and regulate the proposed Gorgon CCS project, should Government give its approval for the project to proceed. Continued discussions within and between Governments are required to further develop the regulatory framework for CCS and resolve issues such as long-term liability and emissions trading schemes. The Government is looking forward having close involvement in these issues through various working groups and discussions.

Technical research in WA has focussed on Barrow Island as a potential storage site. Substantial site-specific investigations must be completed due to the variables involved in successfully trapping CO<sub>2</sub>. Some gaps in knowledge and uncertainty remain and require further investigations, chiefly the effectiveness of containing CO<sub>2</sub> within an aquifer, plume monitoring and mitigation in the unlikely case of leakage from the target reservoir. Though further investigations are required, particularly on a case-by-case basis, further development of CCS proposals in Australia should not be precluded.

Australia is signatory to various international agreements on climate change issues, such as AP6, and it has the responsibility to support technologies such as CCS in an effort to lessen Australia's greenhouse gas emissions. It is noted, however, that CCS is only one of a range of options for greenhouse gas abatement that requires further research and investigation.

There are a number of CCS proposals currently in development in Australia, encouraged by existing cooperative research programs and environmental approval processes. State and Commonwealth governments can encourage investment by achieving more certainty in the regulatory process and providing support, for example in the form of research grants, offsets and other incentives to develop CCS projects. It is important that Australia continues research to remain a world leader in developing CCS technologies and to further develop local expertise in this emerging industry. Through current private and publicly funded research Australia has developed a broad skill base, particularly through the petroleum industry, in which many of the techniques and experience is sourced. Western Australia in particular is well placed to become a global centre of excellence in CCS technology, with the development of the Gorgon CCS project and many years of experience in gas extraction and re-injection in the petroleum industry. Potential CCS projects exist in WA, as a result of substantial gas reserves off the north-west coast of WA, the coal industry, and the siting of dedicated industrial areas.

The Government supports the continued development of CCS in Australia and further research into the technical feasibility and regulatory aspects of future industry. The

Government also supports continued discussions between the State and Commonwealth governments to apply an uncomplicated approach to CCS regulation. Open and transparent consultation and information programs will be necessary to increase public knowledge regarding the use of CCS as a greenhouse gas abatement measure. Technical, policy and regulatory issues are currently being addressed at international, national and state levels in order to reduce uncertainty and associated risks. Further work and support by government will be necessary to continue to utilise CCS as an appropriate tool for addressing climate change.



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