

**House of Representatives Standing Committee on
Science and Innovation**

Inquiry into Geo-sequestration Technology

Submission by

ExxonMobil™

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Contact Details

Rob Young

Senior Adviser - Issues and Government Relations

ExxonMobil Public Affairs

12 Riverside Quay, Southbank Vic 3006

GPO Box 400C, Melbourne, Vic 3001

+ 61 3 9270 3443 Telephone

Executive Summary

1. Managing the risks from increases in global greenhouse gas emissions are an important concern for ExxonMobil, industry and governments around the world.
2. Our view, on which there is a growing consensus, is that technology is the only long term solution to managing global emissions.
3. One technology option that could play a significant role in helping reduce CO₂ emissions from the use of fossil fuels is carbon capture and storage (CCS) or geosequestration.
4. However commercial-scale CCS is practiced today only in a few niche applications and pilot demonstration studies - one of the best-known of which is in the Sleipner Field in the North Sea 21, in which ExxonMobil shares ownership.
5. Before CCS can be widely deployed on a global scale, it must overcome important challenges which include:
 - improving the economics of CO₂ capture which remains expensive; and
 - dealing with CO₂ storage issues which present technical and regulatory issues associated with ensuring safe operations and the integrity of the site over the long term.
6. While recognising that there are challenges to be overcome, ExxonMobil continues to examine the commercial and technical viability of CCS globally and here in Australia. For example in Australia, we have :
 - worked collaboratively with the Co-operative Research Centre for Greenhouse Gas Technologies and Monash Energy on its feasibility study on the storage of coal emissions in the Gippsland Basin; and
 - Participated in the assessment of the commercial and technical viability of reinjecting CO₂ from Gorgon into the Dupuy reserve below Barrow Island (as part of the Gorgon LNG Project)
7. While there may be a sound scientific basis for considering the application of CCS technology in Australia, the technical and economic viability of the technology needs to be addressed according to the specific circumstances of any CCS project under consideration. Enthusiasm for the possibilities needs to be tempered by an acknowledgement that broad improvements in performance, cost and integrity of CCS systems and component technologies require further research.

Inquiry Terms of Reference

The House of Representatives Science and Innovation Committee announced an inquiry on 30 June 2006 into the potential management of greenhouse gases using the process of geosequestration or carbon capture and storage (CCS).

ExxonMobil is well placed to provide a submission on the potential for CCS technology drawing on both its international and Australian experiences. In doing so this submission focuses on:

- The role of technology in addressing global climate change policy
- our investments in technology R&D
- our global involvement in CCS initiatives
- our experience and learnings from Australian CCS initiatives; and
- regulatory issues associated with CCS projects

Background

ExxonMobil, through its affiliated companies Esso Australia and Mobil Oil Australia has been operating in Australia for over 100 years and is the largest integrated oil and gas company with a total investment of over A\$16 billion at hand.

ExxonMobil is a major producer of oil and gas and a marketer of petroleum products in Australia. Through our operations most notably in Bass Strait and Gippsland, we have produced over two-thirds of the country's cumulative oil production and almost one-third of gas production.

In our downstream business we have a network of 900 branded Mobil service stations and operate the Altona Refinery. In addition, ExxonMobil is seeking to become a major producer of gas in Papua New Guinea and in the Carnarvon Basin off Western Australia.

Globally, Exxon Mobil Corporation is the world's largest publicly quoted oil and gas company and the world's largest corporation in terms of market capitalisation. The company does business in some 200 countries world-wide and produces more than 4.5 million oil-equivalent barrels of energy resources every day from some 1600 fields.

ExxonMobil is also the world's largest non-government marketer of natural gas and in our global downstream business the company has interests in 50 refineries in 27 countries and over 45,000 service stations world-wide.

ExxonMobil and Technology R&D

ExxonMobil has been the industry leader in research and technology, with a history of invention, including 3-D seismic, digital reservoir simulation and industry ‘firsts’ in such areas as geologic interpretation and modelling, deepwater drilling, refining technology, chemicals and synthetic lubricants.

Today we invest over \$600 million per year in research and development, balancing our investment between technology extensions, which can be rapidly deployed to our existing operations, and breakthrough research in areas that can have a lasting impact on the company and the industry.

The Global Climate and Energy Project (GCEP):

In an effort to apply the combined resources of industry and academia to the challenge of identifying technologies that meet growing energy demand while dramatically reducing greenhouse gas emissions, we launched the Global Climate and Energy Project (GCEP) at Stanford University in 2002.

GCEP is a major long-term research program designed to accelerate development of commercially viable energy technologies that can lower GHG emissions on a worldwide scale. Current GCEP research areas include CO₂ sequestration, hydrogen, solar energy, biomass, advanced combustion and advanced materials. ExxonMobil provides \$100 million to Stanford University’s Global Climate and Energy Project – the largest-ever independent climate and energy research effort.

Geological CO₂ Storage Research Program at the University of Texas:

ExxonMobil is also a major supporter of the Geological CO₂ Storage Research Program at the University of Texas: which is examining the critical issue for geological storage – that being the potential for captured and stored CO₂ to escape from the host formation.

This project addresses a potentially game-changing approach to preventing escape, namely, sequestering the CO₂ in physical and chemical forms whose immobility is assured over geologic time. Harnessing extensive experience in subsurface flow and transport, the project is developing new concepts and technology, carrying out state-of-the-art simulations to evaluate the feasibility and reliability of subsurface storage schemes. The results will provide essential input for decisions by governments, industry and regulators on the role of storage in global environmental and energy policy.

Addressing Greenhouse Gas Emissions – A Global Issue

ExxonMobil recognizes that the risk of climate change and its potential impacts on society and ecosystems may prove to be significant. Our approach is to take sensible, economic actions now to improve efficiency and reduce emissions while pursuing research designed to better understand scientific issues and to achieve technology breakthroughs that could dramatically reduce future emissions.

Climate change is a global issue requiring governments to work towards global solutions. In this context an effective climate change policy should have clear objectives that:

- identify that economic progress is essential for environmental stewardship
- promote sensible, economic actions now to reduce emissions; and
- recognize that only technology can provide a long term solution to reducing emissions; and
- engages all countries

We believe that Australia's national greenhouse response has incorporated these principles and as a result has been one of the most comprehensive and effective in the world. The response of the Australian Government has recognized the energy intensive nature of Australian industry and the level of Australia's contribution to global emissions. In identifying these important factors the Australian Government's approach has been implemented to-date without significantly damaging the economy.

In particular the decision by the Australian Government to become a signatory to the Asia Pacific Partnership for Clean Development and Climate is an important step in the development and deployment of technology aimed at the main sources of emissions growth in the emerging Asia-Pacific region.

Increasing recognition of technology's vital role

As nations have begun to consider options for reducing GHG emissions, there is a growing consensus that technology is a fundamental solution to global emissions reduction. As noted, the recently announced Asia Pacific Partnership for Clean Development and Climate is one recent initiative that recognises the importance of promoting the use of clean, efficient technology.

The focus on technology development and deployment is supported by recognition that:

- The more widespread application of existing energy-efficient technologies could significantly reduce the growth in greenhouse gas emissions without damaging economic growth.
- New breakthrough technologies offer the possibility of substantial long-term reductions in emissions at lower costs than current technology options.
- Deployment and transfer of technology in those countries which will be the major sources of future emissions is critical to lowering the global emissions profile.

Technology Options for the Longer Term – Carbon Capture & Storage

Meeting future energy needs will require a diverse range of energy technologies. Looking to the long term, concern about energy security and rising greenhouse gas emissions has brought a number of new or enhanced technologies to the forefront of public discussion – most notably CCS.

Our own approach is based on the belief that technological breakthroughs, and not simply expanded scale, are key to unlocking the potential of alternative energy technologies. We closely analyze the potential of emerging technologies.

Based on these assessments, we determine our approach, and – if appropriate – a level of involvement consistent with our business needs and strengths. This may involve proprietary research, shared knowledge through participation in industry groups or the funding of external research in those areas where fundamental breakthroughs are needed for a technology to reach its potential.

Carbon Capture and Storage – Our Global Experience

CCS technology separates CO₂ from a gas stream, compresses it to reduce volume and transports it by pipeline to a storage site.

All of the important components of CCS systems are practiced commercially today at industrial scale by ExxonMobil. For example, ExxonMobil recovers CO₂ at LaBarge, Wyoming, which is used for enhanced oil recovery. As part of that activity, a gas stream including CO₂ is removed and geologically sequestered.

However commercial-scale CCS is practiced today only in a few niche applications and pilot demonstration studies. One of the best-known and longest-running CCS projects is in the Sleipner Field in the North Sea 21 – in which ExxonMobil shares ownership. Before CCS can be widely deployed on a global scale, it must overcome important challenges.

These include:

- CO₂ capture from large combustion facilities remains expensive.
- CO₂ storage presents technical and regulatory issues associated with ensuring safe operations and the integrity of the site over the long term.

Recognizing these challenges, ExxonMobil believes that CCS represents an important option to address global CO₂ emissions globally. That is why we have conducted research relevant to CCS for many years and have supported external research and other activities to understand scientific, economic, technical and policy aspects of carbon capture and storage.

In addition to the CCS studies as part of GCEP, ExxonMobil has supported the IEA's Greenhouse Gas R&D Program and the Geological CO₂ Storage Research Program at the University of Texas. The research that we conduct and support is aimed at improving the performance, lowering the cost and assuring the integrity of CCS systems and their component technologies.

Carbon Capture and Storage – Our Australian Experience

In Australia, ExxonMobil has worked collaboratively with the Co-operative Research Centre for Greenhouse Gas Technologies on its feasibility study for the storage of coal emissions in the Gippsland Basin. We are also examining the commercial and technical viability of CCS as a part of the development scope of the Gorgon LNG Project.

ExxonMobil is pleased to provide the Committee with our key learning's and observations to date from this work.

Latrobe Valley CO₂ Storage Assessment Project (LVCSA)

On 5 July 2004, the Minister for Transport and Regional Services approved funding from the Sustainable Regions Program to Australian Power and Energy Limited (now Monash Energy – A subsidiary of Anglo Coal) for the Latrobe Valley CO₂ Storage Assessment Project (LVCSA). This project developed into one of the largest front end study of a CCS project in the world.

The LVCSA provides a medium to high-level technical and economic characterization of the volume and cost potential for secure geosequestration of CO₂ produced by the utilization of Latrobe Valley brown coal. It identifies key issues and challenges for implementation and provides a reference framework for the engagement of stakeholders, including the identification of items that will require further focused verification studies.

ExxonMobil was an advisory partner in the study and provided technical input on the Gippsland basin, in particular its suitability for carbon storage. In participating ExxonMobil also provided input on the potential risk of re-injection into operational oil and gas reservoirs.

The results of the LVCSA were preliminary in nature and included:

- Broad definition of the capacity of the Gippsland sedimentary basin to provide a high integrity storage site for CO₂ sourced from the Latrobe Valley over the long term.
- Scoping of the costs of providing transportation, injection and monitoring verification of CO₂ from the Latrobe Valley from commencement through until around 2050.

- Initial evaluation of the potential synergies and identification of issues associated with implementing the CO₂ storage project while oil and gas operations continue through to ultimate field depletion.
- Initial definition of an optimum CO₂ storage infrastructure roll-out plan including preferred injection locations.
- Definition of the specific uncertainties associated with implementation and specification of the work necessary to ensure that these are mitigated to the extent necessary.
- Collaboration during the assessment between Monash Energy, the CO₂CRC, the Federal and Victorian Governments and, ideally, key oil and gas producers operating in the area of prospective CO₂ storage.
- A framework for engagement with community stakeholders.

ExxonMobil is broadly supportive of these preliminary findings but would highlight to the Committee a number of issues that make a definitive assessment of the viability of CCS in Gippsland premature:

Risks to Existing Petroleum Production

While Gippsland has potential as a candidate project for a future CCS initiative in the long term, it must be recognized that the re-injection of CO₂ into operational oil and gas fields presents significant risk and integrity issues to personnel, production and infrastructure.

These risks in our view may not be manageable from either a technical or cost perspective. It is also worth noting that the report is overly optimistic in its assessment that there may be depleted reservoirs available in the Gippsland Basin as early as 2015. ExxonMobil's assessment is that the 2025+ timeframe is a more realistic assessment, and even this remains uncertain as technology development continues to extend the life of the fields.

Technical Issues Requiring Further Work

It should be stressed that different potential CO₂ storage sites have different physical characteristics. As such each must be considered on an individual basis and technical conclusions pertaining to one field may not be applicable to another. In the case of Gippsland the following issues were identified by ExxonMobil during the LCVSA study:

- *Migration uncertainties* - Studies to date offer a "coarse" and overly optimistic perspective on possible migration path for CO₂ injected up to 500 metres below existing productive horizons given the unknown characteristics of vertical migration conduits.

- *Risks of CO2 leakage to seafloor* - Exploration and production wells which are to be permanently abandoned (in compliance with PSL Act) are for existing reservoir fluids, not injected CO2. Therefore the ability of abandoned wells to contain CO2 within the sub-surface reservoir zones, or viability of remediation, has not yet been adequately established. The ability of the geological sub-strata to also contain CO2 within reservoir sections also requires further investigation in light of naturally occurring gas escape features having been identified on the Gippsland Basin oil fields.
- *Integrity implications for safety* of ExxonMobil personnel and existing production facilities in the event of earlier-than-predicted CO2 arrival. The facilities were designed for existing fluids and would require large investment for re-build to ensure the safety of operators and the integrity of production facilities is assured.
- ExxonMobil facilities not appropriate for CO2 injection hubs- Gippsland Basin Production facilities are designed to optimally handle hydrocarbon production, not the injection of CO2
- Gippsland fields have limited potential for CO2 injection to be utilized as a secondary recovery enabler due to the nature of the fields' geology and geometries.

In summary the LCVSA project was by definition a preliminary assessment of the risks and uncertainties of a major infrastructure investment. While the study shows that there is a sound technical basis for the Gippsland basin to be considered as a potential CO2 storage site further ongoing analysis is required before the commercial and technical viability of any CCS project in Gippsland can be determined. A full copy of the report is publicly available at www.co2crc.com.au

Gorgon LNG Project and CCS

The Gorgon LNG Project is a proposed development to exploit the significant natural gas reserves present in the Gorgon and Jansz fields off the north-west coast of Western Australia. The project is being pursued by three leading international energy companies – ExxonMobil, Chevron and Shell. ExxonMobil is a 25% shareholder in the project and is the operator of the Jansz field.

As part of the project proposal the Gorgon proponents are considering the technical and commercial viability of separating CO2 from the Gorgon gas field and injecting it into formations which are about 2500 metres beneath Barrow Island (BWI). These formations are overlain by regional geological seals which are expected to be effective in preventing the upwards movement of CO2 into oil producing reservoirs or to the surface. The Gorgon CCS proposal represents the largest single investment contemplated purely for the management of greenhouse gas emissions. The geo-sequestration of CO2 provides no financial benefit to the proponents of the Project, and represents a significant and costly step beyond best practice for greenhouse gas management associated with LNG projects and any major project in Australia.

ExxonMobil is committed to examining the Gorgon CCS initiative and as such we have supported and funded past technical studies the current drilling and testing program as part of the project's studies into CO₂ injection at Barrow Island. The Gorgon Project is currently receiving technical data from this drilling program. Once a complete data transfer has been received ExxonMobil as part of the Gorgon JV will undertake further assessment of the viability of the proposed initiative.

The CCS project is however also subject to environmental approval by the WA Government as one element of the overall required environmental approval process. The detail of the Gorgon Project's CCS proposal is outlined in Chapter 13 of the Environmental Impact Statement and Environmental Review and Management Program which is available publicly at www.gorgon.com.au.

Regulating Carbon Capture and Storage

ExxonMobil notes that the process of considering the appropriate legislative and regulatory framework for CCS projects has been initiated by Governments through the Ministerial Council for Resources. In this context the Department of Industry, Tourism and Resources has released an initial discussion paper setting out key issues and potential frameworks. The initiative is to be commended as it is an attempt to develop a 'fit for purpose' and consistent regulatory framework across all Australian jurisdictions.

ExxonMobil is generally supportive of the high level principles outlined in the Government's discussion paper. In particular we strongly support the stated intention of the paper that any CCS framework developed should not remove the existing property rights of petroleum producers. However our principle reservations at this stage remain around the lack of detail so far provided in the discussion paper and as a result we are concerned about the translation of broad policy principles into a practical working model.

ExxonMobil remains committed to work with government through the consultation process to ensure a workable CCS regulatory model considers all potential impacts.