

SUBMISSION 13

June 30, 2008

The Secretary
House of Representatives Primary Industries and Resources Committee
PO BOX 6021
PARLIAMENT HOUSE
CANBERRA ACT 2600

By email: pir.reps@aph.gov.au [*hard copy to follow*]

Dear Sir

Inquiry into the Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill 2008

Thank you for the opportunity to comment on the exposure draft. Our comprehensive examination of the Bill is provided as Attachment One.

Monash Energy is a joint development of Anglo American and Shell Gas and Power. We are the developer of a coal-to-liquids project in the Latrobe Valley, our primary goal is the production of an ultra-clean virtually zero-sulphur synthetic diesel (see Attachment Two Project Summary). Implementation of Carbon Capture and Storage (CCS) in order to reduce carbon dioxide (CO₂) emissions that would otherwise be generated in association with gasification of the coal is critical to our plans. We therefore welcome the recognition of CCS as a vital step in finding a way of maintaining affordable energy and economic growth in a carbon constrained world.

The proposed legislation has adopted useful processes from the regulation of the oil and gas industry; this should provide comfort to the community that CCS could be operated, monitored and closed in a safe and effective manner. We believe that well balanced legislation is necessary to facilitate the adoption of CCS. However in its processes for allocation of CCS acreage the proposed legislation makes timely adoption of CCS less likely, more costly and as a consequence puts a greater burden on the community in meeting any proposed CO₂ cap.

Monash Energy is uniquely positioned to comment on the Bill, as the joint developers have invested (if all work is considered) some A\$20 million over the two years to September 2008 in developing a clean coal project, including a significant allocation of those funds to investigating the storage potential of the Offshore Gippsland Basin and other potential injection sites. We are principally interested only in finding a solution for our own CO₂ storage needs. However as a unique pairing of an upstream oil and gas developer and a worldwide coal and metals mine developer we are also able to review the Bill from the perspective of a third party or CO₂ storage provider.

Our conclusion is that the Committee should recommend substantial changes to the Bill, principally on the grounds that it does not provide an appropriate level of 'legal certainty for access and property rights' for investment. These changes are detailed as recommendations in our Attachment One and we believe they can be adopted without unnecessarily delaying passage of this important legislation.

In Australia by far the largest source of CO₂ emissions is the coal-fired power generation sector. CCS is not likely to be their core business and so they will look to carbon storage services provided by a third party, either a new breed of entrepreneurial service provider, investing in the development of storage volumes and tolling CO₂ from power stations, or existing petroleum tenement holders that will (one way or another) use their incumbency to become the dominant players in this new 'market'.

In reviewing this Bill please bear in mind that the vast majority of commercially attractive potential storage capacity (high quality and close to the point sources of CO₂) is already covered by 'pre-commencement' petroleum titles; this is certainly the case in respect of the Offshore Gippsland Basin.

The Bill reflects a policy perspective that commercial agreements will be reached between parties for the provision of CO₂ storage services, either directly by petroleum extractors or indirectly by their grant of permission for GHG operations to occur in areas where the two types of title overlap (and they will overlap in virtually all cases of interest to Monash Energy). The Bill however puts in place substantial barriers to the formation of such agreements and gives no ability to the Minister to bring the parties together. The barriers include an unwarranted strengthening of the rights of petroleum tenement holders and an unreasonable standard of proof required for non-interference with these rights.

The rather hopeful expectations on the part of Government officials which accompanied release of the Bill seem to reflect a view that given an emissions trading scheme (ETS) and a CO₂ price, CO₂ storage could be an attractive business for a petroleum tenement holder. Please keep in mind that the dominant product from such tenements is in fact natural gas, which is held by few parties and competes with coal to provide energy to Australian consumers. As their economic interests are against facilitating CCS for third parties this may push out the timing for introduction of CCS past 2030 (if at all). Blithe expectations for the formation of 'commercial agreements' between incumbents and GHG injection applicants gloss over the reality that the commercial interests of the incumbent will go way beyond 'non-interference' with petroleum extraction.

Despite this clear economic imbalance, negotiations between parties seeking to sequester CO₂ and petroleum tenement holders in areas where CCS activities overlap require a level playing field. If there were truly a level playing field then parties seeking access may be prepared to commit the substantial amounts (\$50-\$100 million mentioned by the Government) as necessary to secure a GHG injection licence. However unless corrected the Bill does not provide a level playing field. It is more analogous to a playing field which is not only tilted, but littered with pits into which one can fall and never emerge, such as

- incumbent petroleum tenement holders, relying on proprietary information not subject to challenge by third parties, can influence the acreage release process to ensure that the most prospective regions for GHG storage are not even presented;
- if a company does secure a GHG assessment permit, the incumbent petroleum producer can assert the existence of a significant adverse impact on the petroleum operations and withhold consent for the operations proposed to prove up the site;
- the applicant, having spent the indicative \$50-\$100 million to identify a suitable system of deep saline aquifers, and looking as the next step to seek to obtain a Greenhouse Gas Injection Licence, may find that someone has determined that there is a low probability risk of a 'significant impact' on petroleum extraction (the Act expressly requiring the authorities to ignore that there is a low probability of such impact occurring), and that in the absence of agreement from the petroleum tenement holder that is the end of it;

- there is no capacity for review of the significance of the impact by third parties and the Minister cannot intervene to bring the relevant parties to the table, questions of scale, scope for preventative or remedial measures cannot be considered by the authorities;
- an applicant may have invested the near-Billions of dollars needed in order to begin operations, continues with the risk that if any new petroleum is found in the Greenhouse Gas Injection Licence area the Minister can suspend operations indefinitely and potentially cancel the licence, with the capital invested to that point written off.

The capacity of, and incentives for, incumbent petroleum tenement holders to meet their own interests by steering applicants into these proverbial pits is clear. Thus, the opportunity to capture and store CO₂ from coal-fired power stations, at least in offshore Victorian waters, is pushed out by decades. For the Latrobe Valley there are no other basins of comparable quality and potential storage volume.

We are concerned that this runs directly counter to the Government's declared intent to introduce an ETS with ambitious short-term CO₂ targets and by that means encourage a transition to a low emission economy (including near zero emissions power from coal). If CCS is made infeasible, then it is more likely that private sector investment in transitional clean coal technologies will slow rather than increase under an ETS. The opportunity to ensure immediately achievable 'least-cost abatement' is abandoned with the first act of climate change policy.

We can refer to any number of economic modelling exercises which show that (even with increases in natural gas utilisation) in the absence of low-emissions coal fired power in the base-load mix, the impact of an ETS driving deep cuts in emissions by 2050 is highly inimical to consumers and the economy generally.

Quite apart from the impact on the power sector and electricity consumers, indefinite deferral of CCS removes the historic opportunity for the low-cost Latrobe Valley lignite to form the basis of entirely new industry cluster based on coal to diesel and other coal conversion opportunities (see also Attachments Three and Four: Focus on Key Technologies and Building a Regional Infrastructure). An industry with the potential to trigger billions of dollars in investment and make a material difference to Australia's increasing balance of trade deficit in oil products would be stillborn. Certainly the Minister for Resources, Energy and Tourism see the connection between the two, telling *The Australian* on June 19 2008 that:

"the future of synthetic fuels is 'absolutely interrelated with the successful development of carbon capture and storage over the next five to 10 years'"

Thus if this Bill holds back the development of CCS (and we believe it does), then the development of Australia's synthetic fuel industry will also be held back.

From our work to date we are increasingly confident that safe and secure storage can be demonstrated to the satisfaction of the broader community, and also that technical solutions can be found which allow for co-existence of continuing petroleum extraction as well as GHG injection operations (see Attachment Five: Technical Summary, for further information). The chances of achieving this hoped-for scenario will be greatly increased if the Committee recommends and the Government and Parliament accept amendments to this Bill which:

- mandate greater transparency in the acreage release process, and in the provision of information about potential GHG storage areas generally;
- give the Minister scope to resolve apparent deadlocks between incumbent petroleum tenement holders and potential GHG injectors, having regard to the public interest;
- ensure that rights to inject field gas CO₂ currently held by petroleum tenement holders are not inadvertently extended to provide a 'back-door' route to them locking up potential GHG storage areas;
- better define the tests of 'significant impact' and 'public interest' in the Bill rather than await subordinate legislation, given that these are critical to whether or not the Act can meet the test of investment certainty (the lack of real consultation during the Bill's development gives us no confidence that there will be a chance for meaningful input during the subordinate legislation process, which is even further removed from public and Parliamentary scrutiny);
- address the confusions arising from the attempt to redefine 'risk' as it applies to 'significant impact' (proposed S15F) which in its ordinary meaning both the magnitude of that impact and the probability of it occurring (see for example AS/NZ4360). Deliberately setting aside the element of probability will be confusing and possibly deleterious to the Bill's objectives;
- create greater flexibility for the Minister in respect of renewals and re-applications, given the difficulty of a proponent navigating a path to a successful project.

Attachment One provides a context and rationale for each of these proposed amendments.

We are entirely supportive of attention being given to the risks to production and the rights of other users such as the existing tenement holders. As a resource development project owned by resource companies with strong sustainable development principles, we respect the rights of the community, the fishing industry and the protection of existing rights to explore for and extract petroleum. We also believe that we all benefit from balanced legislation. We encourage the Committee and the Government in reviewing this draft legislation to address the imbalances in the current draft and recognise the risk of making CCS notionally legal but putting in place impediments in to its commercial adoption in the next two to three decades.

I would be pleased to make verbal submission to the committee, and can be reached on 03 9868 7804.

Yours sincerely



Roger Bounds
Project Director

**MONASH ENERGY
SUBMISSION**

**IN THE MATTER OF THE OFFSHORE PETROLEUM
AMENDMENT (GREENHOUSE GAS STORAGE) BILL 2008 (BILL)
AND
THE PARLIAMENT OF THE COMMONWEALTH OF
AUSTRALIA,
HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON
PRIMARY INDUSTRIES AND RESOURCES, REFERENCE FOR
REVIEW OF THE BILL**

SUBMISSION OF MONASH ENERGY PTY LIMITED

EXECUTIVE SUMMARY

Measures of success of the Bill

1. Monash Energy believes that the success of the Bill in establishing a sound regime for transportation, injection and storage in geological formations of certain greenhouse gases should be measured against the following fundamental deliverables:
 - (a) The grant of a greenhouse gas Assessment Permit, Holding Lease, Injection Licence and other related titles (greenhouse gas titles) should provide legal certainty to underpin investment;
 - (b) The procedure and tests for release of acreage and subsequent intermediate steps leading to the grant of the various greenhouse gas titles should:
 - (i) provide balanced treatment that is transparent; and
 - (ii) provide that the Minister retains final decision making responsibility especially where there may be competing incumbent interests;
 - (c) The holder of a greenhouse gas Assessment Permit which seeks approval to conduct key greenhouse gas operations, declaration of an identified greenhouse gas storage formation or grant of a Holding Lease or Injection Licence should be able to know, at the outset, the case it must answer for the achievement of each stage with a reasonable degree of clarity and particularity.

2. There are a number of geological, technical and commercial factors that will dictate whether the development of offshore greenhouse gas storage can be made viable. These factors include:
 - (a) the geological likelihood that potential storage areas will be proximate to existing petroleum tenements. Thus, access to acreage in these areas is essential to move greenhouse gas storage from the present embryonic stage towards the creation of a successful injection and storage process;
 - (b) sound technical achievability of a proposed injection and storage operation is the basis for operating in a location with proximity to an over/underlying petroleum accumulation;
 - (c) the technical expectation for greenhouse gas storage of gasses derived from an associated industrial activity is that injection is not expected to take place into presently producing petroleum reservoirs. Rather injection and storage can be expected to take place into non petroleum producing saline aquifers lying beneath the regional seal;
 - (d) the commercial importance of having access to potential offshore storage acreage closest to the source of greenhouse gas so as to minimise capital investment and operating costs.
3. The importance of initial acreage release is therefore vital.
4. The extent to which the operation of the Bill is able to be responsive to the above factors will also be a measure of its success or otherwise in implementing a successful greenhouse gas storage regime.

Shortcomings of the Bill

5. Based on the above, the Bill succeeds in establishing an overall general regulatory framework for a greenhouse gas injection and storage regime. However there are substantial and serious defects in the Bill. These defects impinge on the legal certainty of greenhouse gas titles and create a lack of transparency in the process for release of acreage and the process of decision making in managing competing activities and interests. It follows from this that there are significant areas where the Bill fails to respond to concerns of greenhouse gas proponents seeking a balanced and transparent regime. If left unaddressed, the fulfilment of greenhouse gas mitigation through the process of offshore greenhouse gas storage may be compromised. In the above matters, the Bill does not meet a number of important criteria set out in the Standing Committee's Terms of Reference.
6. The following summarises Monash Energy's comment on a number of important aspects of the Bill. Each of these (a-h) is then discussed in detail in the body of the submission.
 - (a) **Public interest:** It is essential that the public interest be defined with clarity in the Bill itself to enable a better assessment of the operation of the Bill. The public interest test should also have expanded application such as being a consideration in the exercise of Ministerial discretion;
 - (b) **Scope and guidance for Ministerial discretion:** Ministerial discretion has been substantially expanded under the Bill into key areas that determine rights between competing parties. A mechanism to provide advice to the Minister that will assist in the exercise of discretion needs to be provided;
 - (c) **Acreage release:** The acreage release process does not afford adequate stakeholder consultation during the deliberations that lead to a decision to release or withhold acreage. To redress this lack of transparency, consultation with stakeholders during the assessment stage should be enabled;

(d) ***Ranking competing work bids for GHG assessment permit:***

To ensure balance between a competing incumbent petroleum title holder and a greenhouse gas assessment permit aspirant, recognition needs to be given to a greenhouse gas permit aspirant who may have access to a greenhouse gas stream for injection. Also, in comparing competing work bids, the Bill needs to be amended to avoid the opportunity for the petroleum title holder to be unfairly advantaged;

(e) ***Approval of key greenhouse gas operations:*** The operation of S.249AF fails to provide a reasonable balance between competing interests. The section effectively gives to the incumbent petroleum title holder a power of veto and does not empower the Minister to exercise his or her discretion in a way that restores a balance. A significant adverse impact, ill defined, can be argued as existing on low probability grounds and so prevent the granting of approval until the incumbent agrees in writing. The result is that the Bill, which does not provide a deadlock breaking mechanism, leaves the greenhouse gas assessment permit holder without any ability to move forward. The Bill should be amended to allow the Minister to apply a public interest test to grant approval for the conduct of key greenhouse gas operations notwithstanding that agreement in writing of the pre existing petroleum title holder may not have been obtained;

(f) ***Significant risk of a significant adverse impact:*** These terms are ill defined yet they are essential to understanding the operation of the Bill. An important issue is the definition of ‘significant risk’ which has the effect of defining an impact as significant even where the probability is low;

(g) **Greenhouse gas injection licence:** The process for assessing the significant adverse impact test and the consequences are not dissimilar to that for seeking approval for conduct of key greenhouse gas operations. The potential for the pre existing petroleum title holder to have a de facto power of veto through its refusal to provide agreement in writing should be removed by requiring the Minister to have regard to the public interest;

(h) **Post closure liability:** The failure to transfer post closure liability to the Commonwealth is an impost on embryonic greenhouse gas storage activities. Recognition by DRET that risk effectively ends up with the Commonwealth in the longer term should be recognised in the Bill through the formal transfer of risk post closure.

Background note re existing petroleum titles

7. This submission, unless otherwise indicated, has confined comment to the interaction between existing petroleum titles (and future production licences) with greenhouse gas storage processes. Monash Energy's view is that future post commencement petroleum titles are not likely in a time frame relevant to its present development strategy based on the Gippsland Basin.

CONTEXT

Standing Committee of the House of Representatives

8. The Standing Committee has been given terms of reference which are to ascertain whether the Bill:
 - (a) Establishes legal certainty for access and property rights for the injection and long term storage of greenhouse gas/substances (GHG) in offshore Commonwealth waters;

- (b) Provides a regulatory regime which will enable management of GHG injection and storage activities in a manner which responds to community and industry concerns;
 - (c) Provides a predictable and transparent system to manage the interaction between GHG injection and storage operators with pre existing and co-existing rights including, but not limited to, those of petroleum and fishing operators, should these come into conflict;
 - (d) Promotes certainty for investment in injection and storage activities; and
 - (e) Establishes a framework that provides a model that could be established a national basis.
9. The Standing Committee will be reporting it's finding to the House of Representatives on 29 July 2008.

PUBLIC INTEREST

10. The definition of what constitutes the 'public interest' and how it is to be applied should be provided for in the Bill proper and should not be placed in subordinate legislation as envisaged by DRET. Given the policy decision not to provide an objects clause, the work to be done by a public interest test will be pivotal in guiding Ministerial decision making for achieving a balance between development and management of natural resources and mitigation of greenhouse gas emissions through storage, particularly in respect of certain post commencement petroleum titles.
11. The importance of a public interest test and how it is defined should have the force of Parliamentary approval so that the Minister, in the exercise of discretion, can be guided by the clear will and intent of Parliament. In addition, there is scope to expand the application of a public interest test under the Bill to inform the Minister in the exercise of a number of the Minister's discretionary powers.

Recommendation

12. A clear definition of what constitutes public interest is required and should be inserted into the Bill, not subordinate legislation or guidelines. Consistent with the need to achieve proper balance, the Bill should provide that, when considering the public interest, the Minister should have regard to the public's interest in the development and management of offshore natural resources and the public's interest in achieving mitigation of greenhouse gas emissions through cost effective development and management of offshore storage. This definition recognises that the public interest is twofold.

SCOPE OF MINISTERIAL DISCRETION – INADEQUACY OF BASIS FOR EXERCISE

13. The Commonwealth petroleum legislation has traditionally vested significant discretionary power in the Joint Authority and ultimately in the relevant Commonwealth Minister. Apart from work bid competition between parties to secure an exploration permit, the exercise of this discretion does not generally involve other parties. However, the introduction of the greenhouse gas storage regime contemplated by the Bill significantly expands upon the scope of discretion. The expanded areas of discretion are in sensitive areas of decision making which involve interaction between petroleum activities and greenhouse gas activities which involve rights and interests of competing parties.
14. The exercise of discretion by the Responsible Commonwealth Minister (Minister) under the Bill is partly guided by having regard to the public interest, but this is only for limited purposes. The Bill fails to provide clarity on what the Minister might have regard to in the exercise of his or her wide discretionary powers. This could be achieved in a number of ways, including the provision of specified criteria and broadening the application a public interest test. The Bill also fails to provide any mechanism to which the Minister could have reference so as to assist the exercise of that discretion.

15. The following are some areas in which the Minister may exercise (or should be able to exercise) discretion on significant matters that impact on interests and rights between competing parties.
- (a) manner in which the Public Interest test is applied;
 - (b) making an assessment of what constitutes acreage that is appropriate for release for work bid for a greenhouse gas assessment permit;
 - (c) making an assessment for deciding the grant of approval to conduct key greenhouse operations;
 - (d) deciding the ‘most deserving’ party where there is competition between parties for the grant of a greenhouse gas assessment permit;
 - (e) determining what constitutes a significant risk of a significant adverse impact;
 - (f) considering circumstances that may give rise to, and assessing the impact on, petroleum titles (present or future) of greenhouse gas operations leading to suspension or cancellation of rights;
 - (g) manner in which the ‘national interest’ (not defined) is to be interpreted and applied to justify indefinite suspension of certain petroleum or greenhouse gas titles (S.229 of the OPA and S.249KC of the Bill).

Recommendation

16. With the expansion of Ministerial discretion under the Bill into areas that affect the rights of parties *inter se* such as those listed, the Bill must provide a mechanism that will enable the Minister to be able to receive advice to assist in the exercise of that discretion. There are various mechanisms employed in other legislative areas concerned with commercial and technical matters where the Minister may have regard to advice, such as under the Commonwealth Trade Practices Act 1974 concerning declaration and access to services. The exercise of Ministerial discretion should be clarified and a mechanism established under the Bill where the Minister may have access to advice in the areas which call for the exercise of his or her discretion.

ADMINISTRATION OF GREENHOUSE GAS TITLES BY RESPONSIBLE COMMONWEALTH MINISTER

17. The mechanism under the OPA for considering the grant of petroleum titles and the exercise of associated discretion is exercised by the Joint Authority. This structure in respect of petroleum titles has a known record and facilitates cooperation between the Commonwealth and the relevant State or Territory.
18. The proposed mechanism in respect of greenhouse gas titles is for powers and discretion to be exercised by the Responsible Commonwealth Minister. It is presently expected that prospective acreage for greenhouse gas injection and storage will be in locations proximate to and/or under/overlying existing petroleum titles. Monash Energy is concerned about the potential for complexity in decision making that may arise from the division of powers and discretion between a Joint Authority, in respect of petroleum titles, and the Responsible Commonwealth Minister, in respect of greenhouse gas titles. The division is an unnecessary complication that can only derogate from smooth decision making and a level of predictability, being one of the desired outcomes noted in the Standing Committee's Terms of Reference.

Recommendation

19. Designate the Joint Authority as the responsible decision making and administration body in respect of both petroleum titles under the OPA and greenhouse gas titles under the Bill.

ACREAGE RELEASE

Basis for non release of GHG acreage and stakeholder consultation

20. The process and criteria for assessment and determination of acreage release is not disclosed in the Bill itself. In this regard it follows the OPA model. The Bill only makes reference to the release of acreage, in a manner similar to the OPA, at S.249AJ (work bid method) and S.249AP (cash bid method). Both sections describe that the release is announced by publication of the block(s) in the Government Gazette.
21. Without the provision of further detail, no proper assessment can be made on the nature and operation of the acreage release process. Yet the early stage of acreage release is pivotal. The only guidance is provided by the Department of Resources Energy and Tourism (DRET) on its web site which copies the presentation made by it around Australia (Melbourne on 29 May 2008) (DRET presentation). The DRET presentation, at slides #15 and #16, provides a brief overview of acreage release considerations. These appear to be similar to the OPA considerations and concern matters such as prospectivity and geological formation. There are also some greenhouse gas storage considerations such as source/sink matching and regard to be had to ‘activities compatible with other resource usage (esp. petroleum)’.

22. It is this latter consideration that highlights the difficulties that can flow from the paradigm that arises where greenhouse gas storage processes are put in the parlance of managing petroleum acreage release and the issue of petroleum titles. From the outset, greenhouse gas storage considerations, even at the stage of acreage release, are not assessed on an unfettered basis. Instead, the starting point appears to be to consider greenhouse gas acreage release in the context of its impact on other resources ‘especially petroleum’ (slide #16). This is not to deny the reality that where potential greenhouse gas storage acreage overlies petroleum tenements, there is a need to consider interactions. However, by using the processes that have been employed for the OPA model, this consideration takes place between Governmental agencies and Departments in a manner that lacks transparency (slide #15) and consultation. Only the call for nomination of acreage itself involves industry consultation. After that, the assessment, comprehensive compilation of information and package release takes place in a manner where the basis for rejecting certain potential acreage for release is not known to interested parties. It takes place in a manner where an interested greenhouse gas storage party is not given an opportunity to put alternative evidence that may assist in the proper consideration of any impact on other resources such as petroleum. For a practical example of the shortcomings of the acreage release procedure, refer to Example A in paragraph 28.
23. What may work well for considering the releasing of exploration acreage under the OPA, where there is a congruence amongst all stakeholder to have prospective acreage released, does not necessarily deliver similar outcomes for considering acreage release for potential greenhouse gas storage where there is a pre-existing petroleum title. This is because different interplays are at work. Acreage release for potential petroleum exploration has in mind an eventual discovery and the conduct of a commercially profitable operation. The commercial drivers are present to ensure acreage release, with the main concern being transparent, fair and competitive allocation of that acreage once released. The acreage is generally not subject to uses which compete with the exploration for and, upon discovery, recovery of hydrocarbons.

24. On the other hand, greenhouse gas storage could not be generally envisaged as a stand alone commercially profitable operation but rather a cost to be borne as part of and integral to an industrial endeavour, such as power generation. In addition, it is generally acknowledged that prospective greenhouse gas storage formations will tend to be found in the same areas as where there are existing petroleum recovery operations. From the outset, the more probable situation for considering release or prospective greenhouse gas storage acreage will involve a need to consider the interaction of different usages. This difference highlights the need for DRET and the other responsible Government agencies to receive and consider greenhouse gas stakeholder input *during the assessment stage* for release of greenhouse gas acreage for reasons that have not been pertinent to the acreage release process under the OPA related to exploration for hydrocarbons.
25. Monash Energy submits that, during the acreage release stage, stakeholder consultation is of great importance in ensuring that an assessment is conducted in a transparent open manner with the best available information brought to bear. If this is not provided for, the original information before DRET (which generally will have been derived from petroleum operations) can operate to the effect that, unless there is ‘no objection’ from an incumbent existing petroleum title holder, acreage may not be properly considered for greenhouse gas assessment release. The real potential exists under the procedure outlined in the Bill that little acreage will be released where there is the prospect of an over/underlying petroleum accumulation, thereby ruling out the most prospective areas for viable greenhouse gas storage.
26. The Bill in this regard does not meet the Standing Committee’s terms of reference for a regulatory regime which adequately responds to community and industry concerns, or which provides a predictable and transparent system to manage the interaction between GHG injection and storage operators with pre-existing and co-existing rights.

Recommendation for acreage release procedure

27. The Bill should be amended to make provision such that, in determining appropriate acreage for release, the Minister shall have regard to matters put before the Minister by interested stakeholders during the assessment stage. A provision to enable stakeholders to have input during the assessment stage could be amplified in regulations.
28. **Example ‘A’**

*A prospective greenhouse gas storage formation proximate to or under/overlying an accumulation of hydrocarbons, the subject of a pre commencement petroleum production licence. The hydrocarbons contained within the licence are very small or substantially depleted with reduced or little commerciality having regard to then existing recovery technology and ruling oil prices. A relevant consideration for determining acreage release (not prescribed in the Bill or foreshadowed for coverage by regulation but as described in the DRET presentation (slide #16) is a consideration of “activities compatible with other resource usage (esp. petroleum)”. The assessment of suitability for release of the acreage is conducted by DRET, Geoscience Australia and other Government agencies without stakeholder input. On the limited information, DRET forms the view that GHG operations under/overlying the production licence is an activity that may be regarded as **incompatible with petroleum operations**. The process of consideration by the Government agencies as to why prospective greenhouse gas acreage may be regarded as an activity incompatible, especially in respect of petroleum operations, is closed to stakeholders. The acreage is simply not released.*

GREENHOUSE GAS ASSESSMENT PERMIT

Ranking of multiple work bid applications - assessment criteria

29. Where there are competing parties for a work bid greenhouse gas assessment permit, S.249AL (2) provides that the greenhouse gas assessment permit will be awarded to whichever applicant is the “most deserving”. In determining the most deserving applicant, the Minister is to have regard to criteria to be made publicly available by the Minister. According to the Readers’ Guide [3.24], the assessment criteria proposed is to be similar to those used in respect of petroleum.
30. Without further detail of the assessment criteria, it is difficult to comment on the workability of the process. However, there is little comfort that the work bid approach will be appropriately adapted to account for the peculiarities of greenhouse gas in contrast to a work bid for a petroleum exploration title. As discussed in paragraph 23, there are different interplays at work that distinguish greenhouse gas storage considerations compared to petroleum exploration. The work bid approach, unless properly adapted to recognise the different drivers for greenhouse gas storage, risks placing the emphasis on criteria, such as the level of expenditure, which can lead to wasteful activities, activities which may even replicate existing knowledge. This concern is exacerbated in S.249AL (6) which, to separate two “equally deserving” applicants, stipulates the provision of proposals for additional work and expenditure.
31. Monash Energy is concerned to see that the criteria should include recognition of matters peculiar to greenhouse gas, such as a party that has or is reasonably likely to have an identified greenhouse gas stream available for injection into a greenhouse gas storage formation. Monash Energy submits that such a party should be accorded priority over competing parties that base their work bid solely on levels of expenditure, which might otherwise encourage acquisition of acreage on a speculative basis. A similar issue exists in respect of cash bidding which is discussed below.

32. Another concern that arises from the use of the work bid approach may be an unintended consequence. There is the potential for an incumbent petroleum operator who is competing with a new greenhouse gas assessment permit applicant to be at significant advantage in delivering its work bid. Planned activities or even completed operational activities, such as well data/drilling and acquisition of seismic, associated with petroleum activities conducted under the petroleum licence could also be used, at no or little additional real cost, to support the application for a greenhouse gas assessment permit. This would put the new greenhouse gas assessment permit applicant at a distinct disadvantage. It is important that this imbalance be addressed so that competing parties are competing on an equal footing.

Recommendations for the operation of work bid criteria

33. The Bill should be amended to expressly acknowledge that, in having regard to the work bid criteria to be made publicly available pursuant to S.249AL (3), the Minister shall have particular regard to a party that has or is reasonably likely to have an identified greenhouse gas stream available for injection into a greenhouse gas storage formation.
34. Secondly, where there is competition between an incumbent petroleum licence holder and a new greenhouse gas assessment permit applicant, the Bill should recognise that the comparison of work bid should not be based solely on the level of expenditure, with the Minister to have regard to matters such as the most deserving technical proposal, sources of the CO₂ stream and onshore project expenditure.

No renewal of Assessment Permit

35. The term of the greenhouse gas assessment permit is 6 years. However, the right to renew a greenhouse gas assessment permit in a manner similar to that afforded to an exploration permit under the OPA is prohibited for a greenhouse gas assessment permit (Readers' Guide [3.22]). This distinction is odd. A greenhouse gas assessment permit holder needs to implement the work programme which would have been approved at the time of being granted the acreage. To implement such a programme for exploration the greenhouse gas assessment permit holder is required to obtain approval to conduct key greenhouse gas operations, before any actual exploration operations can be conducted. If the greenhouse gas assessment permit title needed to be renewed for valid reasons, reasons akin to those for renewal of a petroleum exploration permit, it is difficult to see any policy basis for not allowing renewal.

Recommendation for renewal of Assessment Permit

36. Provision in S.249AH (1) be made for the renewal of a greenhouse gas assessment permit for a further period of 6 years.

Duration of Assessment Permit

37. In determining the date from which time should run in respect of the 6 year duration of a greenhouse gas assessment permit, Section 249 AH(1)(a) states that times runs from the date the greenhouse gas assessment permit is granted. Monash Energy submits that considerable time may need to be expended in obtaining Ministerial approval to conduct key greenhouse gas operations (refer below). The importance of giving flexibility to the commencement time from which the period runs is particularly important where no renewal is permitted beyond the 6 year period.

Recommendation on period of duration

38. S.249AH (1) be amended such that time should run from the date of approval for the conduct of key greenhouse gas operations.

Cash bidding

39. Cash bidding is unsuitable for greenhouse gas storage exploration. This is particularly so where an aspiring greenhouse gas storage aspirant has access to an available greenhouse gas stream. Cash bidding can encourage speculation or hoarding which is inconsistent with the underlying objective for establishing a greenhouse gas regulatory regime, one of facilitating least cost carbon abatement in Australia. Simply because cash bidding has been retained in respect of petroleum exploration permits is not reason enough to provide a similar process for greenhouse gas assessment permits.

Recommendation for cash bid procedure

40. Amend the Bill to remove the cash bid alternative.

APPROVAL OF ‘KEY GREENHOUSE GAS OPERATIONS’

41. The second step that is required before a meaningful right to conduct greenhouse gas storage exploration can be embarked upon, is the need to obtain from the Minister, under S.249AF, approval to conduct “key greenhouse gas operations” as defined in S.44. The requirement to meet this second step has the effect of preventing any substantive ability to conduct meaningful exploration under a greenhouse gas assessment permit. This two step process is not applicable to existing pre commencement petroleum titles but does apply in respect of post commencement petroleum titles.
42. A greenhouse gas assessment permit affords very little in terms of property rights. In fact, S.249AF (13) expressly states, ‘for the avoidance of doubt’, that there is no entitlement to be given approval to conduct key greenhouse gas operations simply because one is the holder of a greenhouse gas assessment permit.

43. A greenhouse gas assessment permit holder will obtain approval for the conduct of key greenhouse gas operations where the Minister is satisfied that there is no significant risk that any of the key greenhouse operations will have a significant adverse impact on petroleum exploration operations or petroleum recovery operations being carried out under existing pre commencement petroleum titles, post commencement production licence or future titles that derive from pre commencement titles (relevant petroleum title). If there is no significant risk, then no approval of the above class of petroleum title holders is required. The expressions 'significant risk' and 'no significant adverse impact' are, respectively, poorly defined and not defined at all.
44. Pursuant to S.249AF (11) and (12), if the Minister is satisfied that there is a significant risk of a significant adverse impact, the Minister must not approve the grant of a right to conduct key greenhouse gas operations unless the consent in writing has been obtained from the relevant petroleum title holder. Under Ss. (4) and (5) the Minister is to have regard to the terms of any written agreement. Notwithstanding this, the effect of not having consent in writing from the relevant petroleum title holder is that the relevant petroleum title holder has a *de facto* power of veto. This is the end of the process. There is no alternative procedure or provision for some form of deadlock breaking mechanism.
45. To the extent that the Minister or DRET may give assurances that greater definition will be ascribed to the vital operative terms 'significant risk' and 'no significant adverse impact' through future regulations, Monash Energy at this point can have no comfort that such regulation could or would reverse the clear burden of proof which has the effect of failing to deliver a fair, equal and transparent assessment process.
46. The issue is not whether the Minister may be acting fairly and reasonably in the exercise of his/her discretion. However, it is not clear that original evidence or information would be available to the Minister in making the assessment of significant risk that was not substantially supplied by an incumbent petroleum title holder.

47. The scheme of the Ministerial approval process favours incumbent petroleum title holders by allowing them to claim a significant risk, which by definition could even be of low probability. The incumbent has information to hand. The aspiring greenhouse gas storage explorer has little information. Notwithstanding this serious information asymmetry, the burden of proof falls to the one who has least opportunity of adequately stating its case.
48. In granting Ministerial approval for key greenhouse operations based on an agreement in writing, the Minister is to also have regard to the terms of such agreement and the “public interest”. However, the point is that once a significant adverse impact has been asserted, the effect is that the greenhouse gas assessment permit holder must treat with the incumbent petroleum title holder in order to obtain its agreement in writing. The Minister’s withdrawal from the arena combined with the incumbent’s possession of greater information concerning the very issue at stake creates a serious negotiating power imbalance leaving the incumbent as the gatekeeper.
49. The absolute requirement for approval in writing is a serious flaw in the Bill’s scheme. Adapting Example A from paragraph 28, at the application for approval to conduct key greenhouse gas operations stage, the relevant petroleum title holder could effectively veto the ability of a party to obtain the right to conduct key greenhouse operations, even though, in the example given, it must be in the greater public interest to support the delineation of a suitable storage area that may over/underlie the petroleum tenement for the mitigation of release of greenhouse gases into the atmosphere.

Recommendation re approval process

50. The designated Minister should, in respect of the relevant petroleum titles, have final responsibility for deciding and granting approval for the conduct of key greenhouse gas operations where a deadlock or absence of agreement exists between the competing interests. A well defined and overarching public interest requirement would be one means to achieving this end. This should be embedded in the Bill by making the requirement for agreement in writing with a pre existing petroleum title holder under S.249AF (12) subject to an exception ‘unless otherwise determined by the Minister to be in the public interest.’

SIGNIFICANT IMPACT – NO SIGNIFICANT ADVERSE IMPACT

51. It has already been observed above that the expressions ‘significant risk’ (S.6 and S.15F) and ‘no significant adverse impact’ are, respectively, poorly defined and not defined at all. The adverse impact test is applied for approval to carry on key greenhouse gas operations and approval for an injection and storage licence and relate to having no significant adverse impact on pre existing petroleum titles or a production licence (whenever issued). The test is a central feature of the greenhouse gas legislative regime.
52. Significant risk has been ‘defined’ in S.15F as being applicable where a particular operation will have a ‘large adverse impact’ on other operations. It is not clear if this ‘large’ adverse impact is intended to be the same as a ‘significant’ adverse impact otherwise employed in the Bill or whether the use of ‘large’ was unintended. Where there is the risk of a large adverse impact, a significant risk arises, even if the probability of the large adverse impact is low.
53. Again referring to Example A, where the probability of a significant adverse impact occurring would be low, in the context of the exemplar petroleum operation, it seems strange that even in such a situation the Minister would refuse approval for conduct of key greenhouse operations or the issue of a greenhouse injection licence.

Recommendation

54. It is essential that the impact test be better defined. Consideration should be given to reducing the potentially harsh effect of defining an impact as a significant even where the probability is low.

GREENHOUSE GAS INJECTION LICENCE

55. An injection licence authorises injection and storage in block(s) within an identified greenhouse gas storage formation, as declared, which is wholly situated in the 'licence area' being in accordance with the conditions attached at the time of the declaration of the identified greenhouse gas storage formation (and as may be modified from time to time).
56. The licence area is defined in S.6, in relation to a greenhouse gas injection licence, as the area constituted by the block(s) that are the subject of the greenhouse gas injection licence. Conditions attached to the grant of a greenhouse gas injection licence include the fundamental suitability determinants and the spatial extent associated with the declaration of the storage formation [S.249AU (10), (11) and (12)]. As conditions, these are attached to the licence by S.249CH (7) and (8) and include as conditions the matters set out in S.249CE (3) (essentially the fundamental suitability determinants).
57. The matters to which the Minister is to have regard in assessing the grant of greenhouse gas injection licence are the significant risk and significant adverse impact tests, applied in a similar manner as the process concerning an application for approval to conduct key greenhouse gas operations.
58. From Monash Energy's point of view, an assessment of the Bill's success or otherwise in establishing a regime for transportation, injection and storage in geological formations of certain greenhouse gases is driven by the fundamental deliverables described in paragraph 1 of this submission.

59. DRET and Geoscience Australia have consistently recognised throughout the long gestation period leading up to the issuing of the Bill that the most pertinent geology likely to reveal potential greenhouse gas storage formations lie in the areas where there are existing petroleum operations. By definition, the existing petroleum operations take place and are subject to existing petroleum titles issued under the OPA, which are defined under the Bill as pre commencement petroleum titles. DRET and Geoscience Australia acknowledge that it is how greenhouse gas titles interact and how such titles may be granted in areas proximate to or overlying these pre commencement petroleum titles that is of central importance. DRET has stated that, as a consequence, pre commencement petroleum titles have been afforded special protection.
60. To buttress this special protection, existing or future pre commencement petroleum title holders and any existing petroleum production licence holders must, in circumstances where a significant adverse impact is found, provide their agreement in writing before any identified greenhouse gas storage formation held by a greenhouse gas assessment permit holder can be considered for a grant of a greenhouse gas injection licence. However, for other titles (such as post commencement exploration permit or retention lease or future production licence from the same block(s) as an existing permit or lease), agreement in writing of the title holder is not mandated. The grant of a greenhouse gas injection licence for post commencement titles is considered on the basis of a public interest test.
61. Monash Energy agrees with DRET and Geoscience Australia that it is how greenhouse gas titles may be granted in areas proximate to or overlying pre commencement petroleum titles that is of central importance and will dictate how workable or otherwise will be the greenhouse gas injection and storage scheme under the Bill.

62. In like manner to Monash Energy's earlier comments (paragraphs 41- 49) regarding the requirement to obtain agreement in writing in respect of seeking approval for the conduct of key greenhouse gas operations, the same requirement, in respect of relevant petroleum titles [S.249CI(d) and (e)] for obtaining a greenhouse gas injection licence, is significantly flawed.
63. The same problem exists concerning lack of definition and precision of the core terms 'significant risk' and 'significant adverse impact'. Whatever definition and meaning those terms eventually come to have, the party seeking a greenhouse gas injection licence is effectively charged with the burden of proving and convincing an incumbent petroleum title holder that greenhouse gas operations will not have a significant adverse impact on its overlying acreage. In Example A at paragraph 28, a reluctant petroleum title holder, without the threat of any Ministerial or other intervention, can set the hurdle of being satisfied at a very high or unreasonable level.

Recommendation re approval process

64. The designated Minister should, in respect of the relevant petroleum titles, have final responsibility for deciding and granting approval of a greenhouse gas injection licence where a deadlock or absence of agreement exists between competing interests. The Minister should be required to have regard to the public interest in the same way that he or she is required to do in respect of post commencement petroleum titles. This additional requirement does not derogate from the rights of pre existing petroleum title holders. However, it does provide for greater transparency and balance in the consideration of the grant of injection licences.

Site plan

65. Under the OPA, a petroleum title holder can obtain a production licence without having to lodge a full project development plan or field development plan (PDP). It is difficult and somewhat inequitable for a greenhouse gas assessment permit holder, having approval to conduct key greenhouse gas operations, to have to provide definitive and full plans prior to having obtained the security of an injection licence. The site plan requirement being limited to a draft may go part way towards alleviating this sensitivity. However, there is no definition or expression that clarifies what a draft site plan should consist of with the result that little comfort can be taken.

Recommendation re site plan requirement

66. The Bill should clarify that only the provision of a draft site plan should be required for the application and grant of a greenhouse gas injection licence. A definition of 'draft site plan' should be provided that reflects, in a manner appropriate for greenhouse gas considerations, a level of detail not greater than is presently required for a draft PDP under the OPA.

Cancellation of greenhouse gas injection licence

67. Under S.249CZC (1)(h) and (i), the Minister may suspend indefinitely or cancel a greenhouse gas injection licence, even one of long standing, where a petroleum accumulation has been subsequently discovered under a pre commencement petroleum title. As drafted, the section illustrates the preference which is given to pre commencement petroleum title holders. The exercise of the discretion to suspend or cancel the greenhouse gas injection licence is a serious impediment rendering the injection title meaningless and presenting an unacceptable risk where many millions of dollars could be expected to have been invested establishing the injection and storage project. Item (a) of the Standing Committee's terms of reference concerning legal certainty for access and property rights is not met.

Summary criticism of Bill's scheme for grant of an injection licence

68. Judged against the Monash Energy deliverables referred to in the Executive Summary, the effective operation of the scheme for granting an injection licence overlying relevant pre commencement petroleum titles:
- (a) fails to provide balanced treatment that is reasonable in circumstances where regard needs to be paid to incumbent interests;
 - (b) by mandating agreement in writing from the incumbent but not otherwise providing a deadlock breaking mechanism, fails to place responsibility with the Minister and thereby compromises the public's interest in having an effective scheme enabling the mitigation of greenhouse gas emissions;
 - (c) fails to give the greenhouse gas storage aspirant the necessary certainty to underpin large investment in each stage up to application for grant of an injection licence, where unreviewable rejection of such application lies in the hands of an interested third party;
 - (d) fails to provide balanced treatment, legal or investment certainty in circumstances where the Minister may suspend or cancel a greenhouse gas injection licence, even one of long standing, where a petroleum accumulation has been subsequently discovered under a pre commencement petroleum title.

INJECTION LICENCE FOR A PETROLEUM PRODUCTION LICENSEE

69. The Readers' Guide at paragraph 6.22 invites comment on the scope of S.249CQ and S.249CR concerning circumstances in which a petroleum production licensee should be able to obtain an injection licence on a non competitive basis over block(s) in the production licence area. An ancillary question is asked about whether there should be any restriction on the sourcing by that petroleum production licensee of the greenhouse gas for injection.
70. It is clear from sub section 249CR (c) that the greenhouse gas substance to be injected is to be obtained as a by product of petroleum recovery operations carried on under the production licence. However, it is reasonable to envisage that a petroleum production licensee may wish, for operational and commercial efficiency reasons, to collect greenhouse gas substances from other proximate production licences and bring them to a centralised collection point for injection into a single formation. From a commercial point of view this would appear to make sense and, as such, would not appear to present a particular concern to greenhouse gas proponents generally.
71. However, the position would become a concern if the petroleum production licence holder sought to expand S.249CR (c) rights to a right of injection and storage of greenhouse gas substances on either on a commercial basis from other parties or from a separate industrial venture of the licensee which is not integral to its petroleum recovery operations under its production licence.
72. Protection against abusing the rights afforded by S.249CR (c) by a petroleum title holder exists given that the Minister has a discretion not to grant a S.249CQ licence. Monash Energy could accept a sensible interpretation of the rights of a production licence holder in the manner indicated in paragraph 70. However, to safeguard against exploitation of this right, the Bill should be amended to provide that the Minister must have regard to the extent to which the source of the greenhouse gas substances are derived from operations integral to the licence holder's petroleum production operations and the proximity of the same.

LIABILITY POST CLOSURE

73. The Bill is generally silent on who bears liability for injected CO₂. The DRET presentation at slide #29 states that, post closure, the common law liability lies where it falls. Further it states that the Commonwealth does not “take over liability” but notes that “longer term the risk will pass to the community when or if project participants cease to exist”. The reality of the passage of longer term liability to the Commonwealth is in fact recognised in the Regulatory Impact Statement made to the Bill (RIS) at page 27.
74. The DRET presentation and the RIS acknowledgement highlight a fundamental point that, for liability over the longer term, only the Commonwealth is properly placed to underwrite such liability. This suggests that it would be appropriate for there to be a formal process and point at which such longer term liability passes to the Commonwealth.
75. There is also an economic aspect that supports the transfer of longer term liability to the Commonwealth. The viability of greenhouse gas injection and storage is at an embryonic stage. The placement of longer term liability with the Commonwealth should be considered in the context of the public’s interest in the mitigation of greenhouse gas through offshore storage.

Recommendation

76. Upon compliance with the site closing provisions contained at S.249CZE to S.249CZM, any future liability should be transferred to the Commonwealth.
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The Challenge

Official forecasts of a sixty per cent increase in world primary energy demand over the next thirty years highlight the challenge of reducing man-made greenhouse gas emissions. They add to the concerns of those worried by the prospect of adverse climate change.

For an energy-intensive and energy exporting nation like Australia, the shift to a carbon-constrained world could impact economic growth and export potential.

Along with renewables, fossil fuels will inevitably be one of the sources of additional energy, so new and more efficient utilisation technologies are vital to achieving a goal of near-zero emissions to the atmosphere.

Our Response

Monash Energy is helping meet this challenge by applying to brown coal (lignite) advanced drying and gasification technologies which enable production of low emission power and hydrocarbon products such as an ultra-clean, virtually zero-sulphur synthetic diesel.

The fundamental mission of the Monash Energy project is to design and build a world-scale coal to liquids (CTL) plant. It would provide an alternative source of diesel and other fuels in Australia enhancing energy security and reducing the forecast trade deficit in oil.

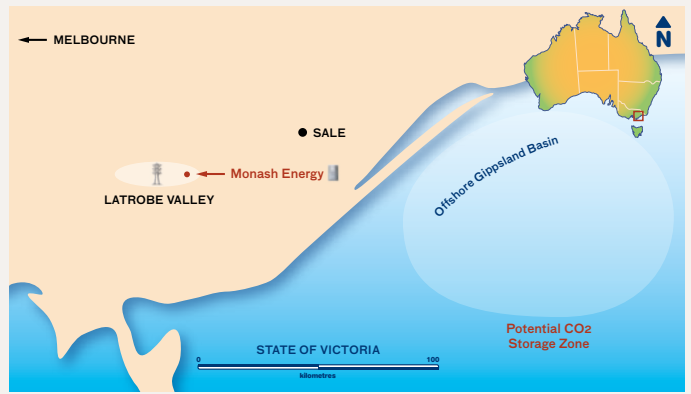
Critically, the technologies chosen enable separation of a concentrated stream of greenhouse gas for transport to injection wells for secure storage deep underground in geological formations.

Location and Ownership

The brown coal fuel source and proposed processing facilities are located in the resource rich Latrobe Valley, 160km to the east of Melbourne, Australia. The principal area being examined for CO₂ injection and storage is the offshore Gippsland Basin.

This Basin contains an extensive system of deep saline aquifers which offer the potential for safe and secure storage of CO₂ more than two kilometres underground. Careful injection site selection can and must ensure that CCS is compatible with continuing oil and gas production. The oil and gas fields, once depleted, are potential storage volumes within the overall aquifer system.

Monash Energy is a joint development of Shell Gas and Power and Anglo American plc, pursuant to a Clean Coal Energy Alliance between the two companies.



Carbon Capture and Storage (CCS)

The process of Carbon Capture and Storage ('CCS'), also known as geosequestration, has been identified as the critical step which enables the world to cope with increases in energy demand while achieving deep cuts in greenhouse gas emissions.

Critically for the competitiveness of Australian industry, it enables development of a new generation of near-zero emissions power stations.

Australia and Monash Energy are at the forefront of moving CCS to reality.

Monash Energy is working with State and Federal Government agencies to ensure the technical, environmental and commercial aspects of CCS are investigated and demonstrated, and appropriate regulatory structures established.



Current Status

In the two years from September 2006, when they signed a Joint Development Agreement, the two owners will have invested almost A\$20 million in proving up the concept and developing the project. Currently the project is undertaking technical and commercial studies to identify the appropriate pathway to establish a CTL plant, including the requirements for first demonstrating key technologies.

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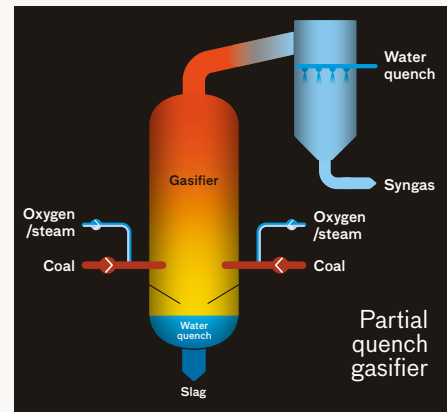
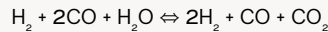
Monash Energy is a collaboration of Shell and Anglo American to jointly develop a clean coal to liquids project in Australia's Latrobe Valley, utilising the latest low-emissions technologies. Three of the key process steps are explained in this Fact Sheet.

Technology Focus #1: Gasification

In the Shell Coal Gasification Process, coal is transported via pressurised nitrogen gas (N₂) and CO₂ into a gasifier operating at 1400-1600°C. Partial combustion occurs in an atmosphere of pure oxygen, together with steam created within the process. At these temperatures, approximately 75% of the ash in the coal melts and runs down the wall to the bottom of the gasifier, for later quench and removal. The coal combusts with the oxygen and the steam to produce synthesis gas ('syngas'), which is a mixture of hydrogen gas (H₂) and carbon monoxide. By reacting the syngas with

water (steam) in a 'shift' reaction, the proportion of H₂ can be increased, which makes it ideal for GTL conversion but creates CO₂. It is this CO₂ which is the focus of capture techniques at Monash Energy.

Shift Reaction:

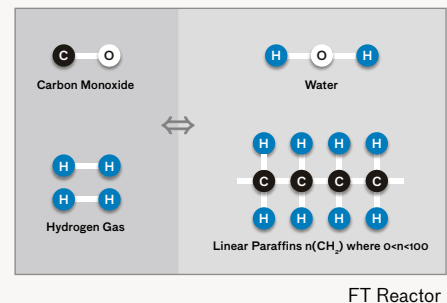
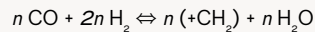


Technology Focus #2: Gas to Liquids (GTL)

In a GTL plant natural gas is first partially combusted with pure oxygen to produce synthesis gas (syngas), a mixture of hydrogen and carbon monoxide. The key process step, named Fischer-Tropsch conversion after its inventors, involves conversion of syngas into long-chain hydrocarbon molecules. Shell's proprietary GTL process, also known as Shell Middle Distillate Synthesis (SMDS), involves syngas being fed through small tubes tightly packed with a catalyst. As the Hydrogen and Carbon Monoxide molecules

of the syngas pass over the catalyst they join to form hydrocarbon chains and water, producing a pure paraffinic wax which can be 'refined' or 'cracked' (as crude oil is) to produce fuels and other hydrocarbon products. Thousands of such tubes are bound in an FT Reactor. GTL is a mature process – adaptation for coal to liquids will require a focus on ensuring the purity of the syngas.

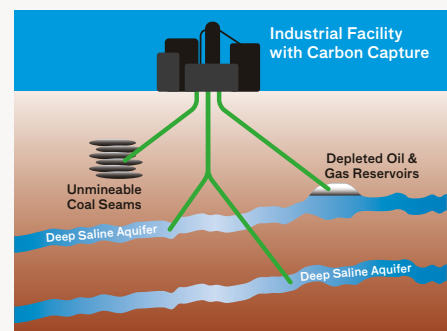
FT Chemistry:



Technology Focus #3: Carbon Capture and Storage or 'CCS'

Also known as geosequestration, CCS is the generic phrase for the process by which carbon dioxide is captured, compressed into a fluid state, and transported via pipeline for long-term storage deep underground. In general terms suitable sites for storage include depleted oil and gas fields, deep saline aquifers, and unmineable coal seams, although some 85% of the world's storage potential is said to be in deep saline aquifers.

In the Gippsland Basin – most of which lies off-shore – there is an extensive system of deep saline aquifers which offer the potential for safe and secure storage of CO₂ more than two kilometres underground. A regional seal or 'cap' rock will prevent leakage to the atmosphere. Careful injection site selection can and must ensure that CCS is compatible with continuing oil and gas production. The oil and gas fields, once depleted, are potential storage volumes within the overall aquifer system.



Building a Regional Infrastructure

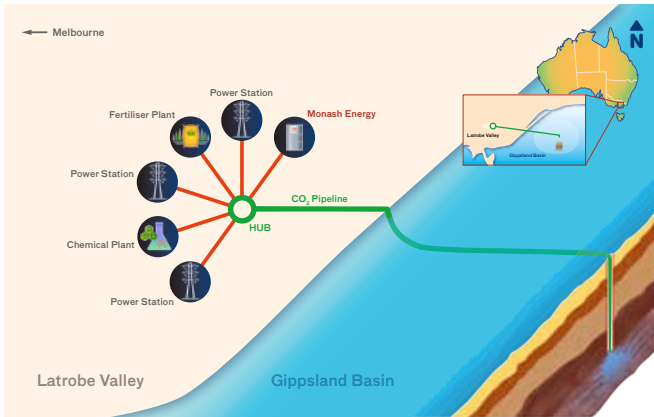


Fig 1: The 'Hub' concept

'As a centrepiece among methods for reducing greenhouse gases, carbon capture and storage could help secure the long-term viability and prosperity of the Latrobe Valley community and economy.'

Hon Peter Batchelor MP, Victorian Minister for Energy and Resources, 2007

The development of clean coal conversion technologies creates scope for an energy and resource processing hub in the Latrobe Valley (as shown in Figure 1 at left).

The abundant coal resource is the foundation of this vision, as syngas – the product of coal gasification – can be used to produce a wide array of products. These include the transport fuel that Monash Energy would produce, as well as chemicals, fertiliser, chemical feedstocks and near zero emissions electricity. The flexibility of coal gasification is shown in Figure 2 at right.

The Latrobe Valley's proximity to high-quality, high-volume potential storage in the offshore Gippsland Basin is the key to the viability of the hub concept. Captured CO₂ from multiple sources could be compressed and use shared pipelines, lowering the unit cost of transport, injection and storage.

Power produced from syngas in this configuration is known as Integrated Gasification Combined Cycle (IGCC) and is

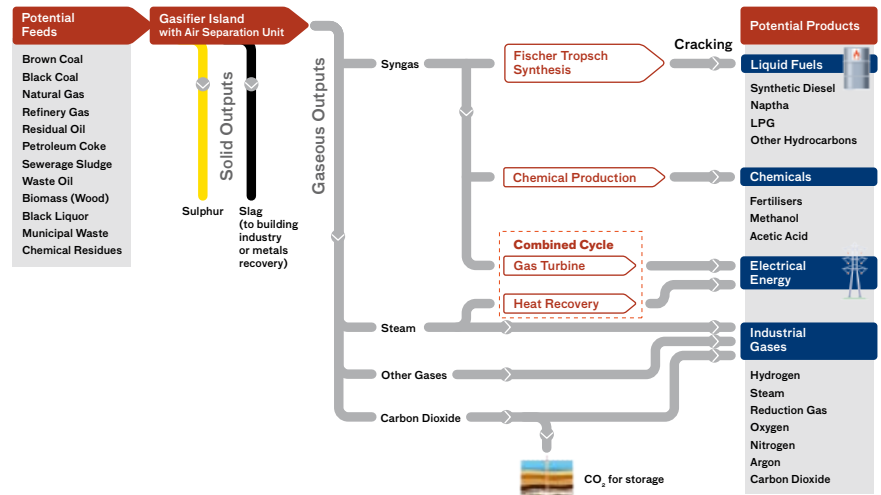


Fig 2: Feedstock options and product options from gasification (generic)

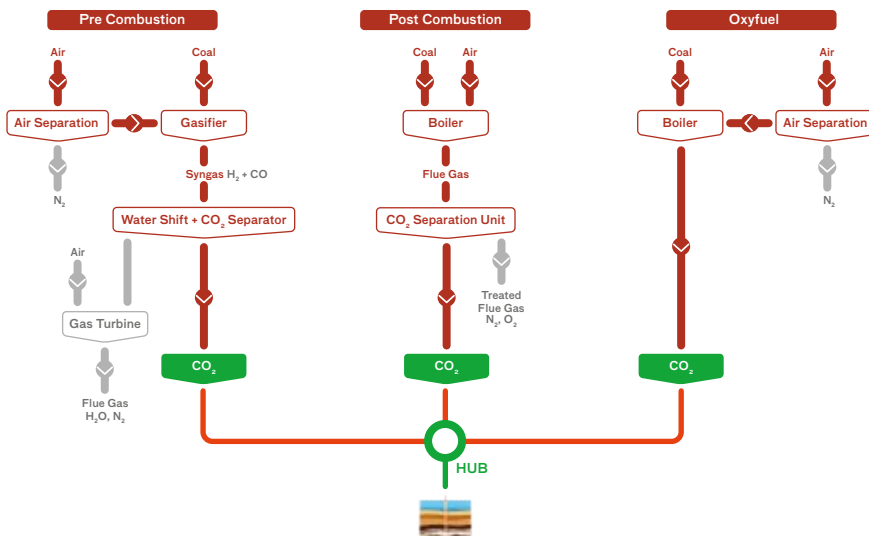


Fig 3: Three principal pathways for establishing a near-zero emissions power station

an example of the configuration known as 'pre-combustion' capture of the CO₂. There is also a great deal of research and development underway globally, and in the Latrobe Valley, to develop 'post-combustion capture' (PCC) of CO₂, which would enable retrofit of the existing power stations with CCS.

A third configuration, the 'Oxyfuel' power station, is also post-combustion but the separation of the CO₂ is easier because the exhaust stream (after clean-up) is pure CO₂ rather than a mixture of CO₂ and nitrogen.

PCC and Oxyfuel power stations provide an additional pathway for developments in the Latrobe Valley that can make use of a regional CO₂ collection and transport hub. This is shown in Figure 3 at left.

Monash Energy welcomes regulatory developments which enable safe, secure and cost effective CCS, an important technique for reducing GHG emissions.

The key to safe and secure storage of GHG's is appropriate site selection and monitoring. The primary factors that define an appropriate storage site are its capacity (size & quality) and the integrity of the overlying cap rock (seal). Appraisal, evaluation and modelling techniques to assess these properties have been developed and are routinely applied in the oil and gas industry. The process of injecting and monitoring fluids in the subsurface is also well understood.

Operational activities required for GHG injection are identical to those in oil and gas developments, which in many cases involve injection of fluids (including CO₂). Therefore, existing operating procedures and regulations will enable safe and secure GHG operations.

A number of GHG storage projects are now operating, with perhaps the best example being the Sleipner geosequestration project in Norway. This project has safely injected approximately 1 mtpa of CO₂ into a saline aquifer for over 10 years, and has collected comprehensive monitoring and verification data, particularly time-lapse 3D seismic data which clearly shows the location of the CO₂ plume over time.

Oil and gas accumulations are excellent examples of long term underground storage, having been securely trapped for many millions of years. As a result, the characteristics that define attractive storage locations are very similar to those that are required for oil and gas accumulations. However, it is a misconception that storage must be in the depleted oil and gas fields. Within a geologic formation which lies beneath a regional seal, hydrocarbons usually fill only a small proportion of the porous rock, with saline aquifers occupying the majority of the space. These saline aquifers have potential for much greater GHG storage capacity, and offer storage mechanisms that are more permanent (residual trapping and dissolution). Figure 1 is a stylised diagram indicated the principal options for storage of

greenhouse gas, making a distinction between injection into deep saline aquifers and depleted or depleting oil and gas fields.

The Gippsland basin, offshore Victoria is an example where coexistence of CCS and petroleum development should be possible. A large areal extent and over 1000m of reservoir strata and aquifer beneath the hydrocarbon fields allows for GHG injection well below and laterally distant from the fields and provides for long migration paths and significant trapping without impacting hydrocarbon deposits. Figure 2 (below) which shows a 3D image of the Gippsland Basin regional seal with the oil and gas fields indicated in red, shows the relative extent (vertically and laterally) of the basin vis a vis those fields. Intuitively, one can see the scope for injection options which do not directly interfere with oil and gas productions.

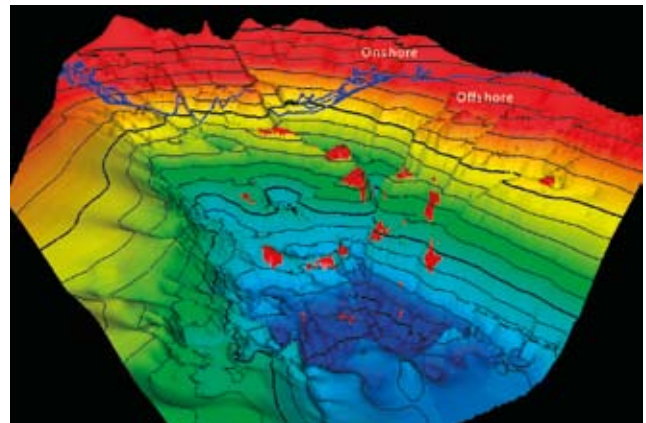


Fig 2: 3D image of Offshore Gippsland Basin (colour indicates depth)

Modelling techniques from the oil and gas industry can be used to determine the likely plume migration path and select the most appropriate injection locations which avoid and/or delay beyond any reasonable period interaction with oil and gas deposits. Appraisal of potential injection sites, together with detailed modelling will provide the necessary confidence prior to commencing injection, whilst a comprehensive monitoring and verification (M&V) program will ensure compliance during and after injection.

In the event that the storage activity does not behave as planned, there are many pro-active and re-active remediation options available. For example, wells could be strategically positioned to inject or produce water from the aquifer in order to change the pressure distribution, and therefore the CO₂ plume migration path.

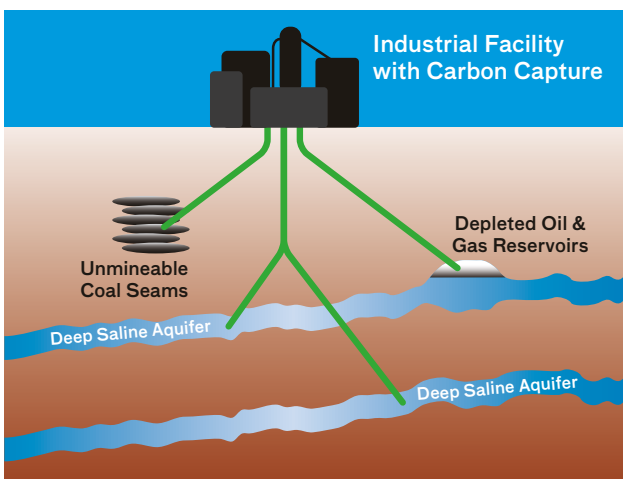


Fig 1: Principal options for GHG storage