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Global Carbon Capture and Storage Institute Regulatory Test Toolkit

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# Carbon Capture and Storage Regulatory Test Toolkit for Victoria, Australia Outcomes and Recommendations



**AECOM**

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# Carbon Capture and Storage Regulatory Test Toolkit for Victoria, Australia

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## Executive summary

The Global Carbon Capture and Storage (CCS) Institute Regulatory Test Toolkit (test toolkit) assists government agencies to work together with other stakeholders to test and improve the regulatory framework for CCS. The test toolkit has previously been successfully deployed in Scotland, Trinidad and Tobago, Romania and Malaysia.

CCS is a process where carbon dioxide (CO<sub>2</sub>) emissions are captured, compressed, transported and injected into storage, usually a deep geological formation; also referred to as geosequestration. It is mostly applicable to high emission industrial systems, such as coal-fired power stations and steel production plants. While CCS is a potentially viable option for significantly curbing CO<sub>2</sub> emissions, it crosses many regulatory boundaries and subsequently requires coordination of regulatory processes. As a result, testing a regulatory framework can help to minimise the time and cost risks associated with regulatory approvals for CCS projects.

The test toolkit was used by the Department of State Development, Business and Innovation (DSDBI) to assess if the existing regulatory framework could accommodate commercial-scale CCS projects in Victoria. It tested a hypothetical CCS project against the relevant Commonwealth and Victorian regulatory framework, current at the time of the test toolkit.

The test toolkit was used in Victoria, as the Gippsland Basin has the highest technical ranking of any storage basin and the largest storage potential of any east coast basin in Australia (CSTF, 2009). Victoria also has existing CCS-specific legislation and funding under the Australian CCS Flagships program for the CarbonNet Project (DRET, 2013a).

A key part of the test toolkit exercise was a workshop involving Australian and Victorian government agencies and other stakeholders. This test toolkit workshop focused on identifying key issues, and any gaps or overlaps with the existing regulatory framework.

Key inputs into the test toolkit workshop included:

- Mock Toolkit CCS Project – a hypothetical CCS Project
- Mock Toolkit CCS Project approval application – made on the referral form for the Victorian *Environment Effects Act 1978* for the hypothetical CCS Project
- mock approvals and permits register – a matrix of regulations, permits, approvals and licences that might apply to the hypothetical CCS project under the current regulatory framework.

While the focus of the workshop was primarily on Victoria, national and international developments were noted and best practice approaches were recognised. The Global CCS Institute, as a global entity and advocate with extensive international industrial membership and experience, contributed its depth of CCS understanding and networks to the test toolkit workshop.

The test toolkit workshop was held in August 2013 and this report provides a record of discussions. It does not document every comment made during the sessions but highlights the key issues and themes based on the interpretation of the workshop facilitators, report authors and the test toolkit Steering Committee.

This report has been prepared for an audience with some familiarity and interest in CCS and/or the regulatory framework for CCS.

Overall, the test toolkit workshop confirmed that the regulatory framework is generally fit for purpose for commercial-scale CCS deployment in Victoria.

The workshop recognised that, while the regulatory framework is complex, various components are applied successfully to other major multifaceted, non-CCS infrastructure projects. Common issues that emerged across the components of CCS included:

- the coordination and sequencing of assessment and approvals
- building regulatory capacity for addressing the specific technical issues associated with CCS deployment
- engaging with the community to build awareness and knowledge of CCS
- project proponents obtaining enough information to meet the standards required for regulatory approval.

Table 1 provides a list of the recommendations that could be adopted to enhance the capacity of the regulatory framework to accommodate CCS projects in Victoria. The recommendations are underpinned by the emerging

themes that were identified from the test toolkit workshop and are intended to provide a basis for further analysis and subsequent forums between agencies. To assist in this process the recommendations are categorised as follows:

- **needs gap** – knowledge and capacity gaps relevant to deployment of CCS in Victoria
- **relationships** – opportunities to coordinate interactions between stakeholders
- **refinement of processes** – opportunities to improve guidelines and standards that inform the regulatory framework
- **secondary guidance** – opportunities to develop and/or promote best practice approach for deployment of CCS.

In order to progress these recommendations a timeframe has been suggested to prompt actions in the short (one to three years) and medium (three to five years) terms. It has also been acknowledged that actions will either be project specific or require ongoing attention as CCS develops in Victoria. The implementation of the recommendations will be considered and coordinated by the Steering Committee.

**Table 1 Global CCS Institute Regulatory Test Toolkit recommendations**

No.	Recommendation description	Timeframe
<b>Needs Gap</b>		
1	Develop a strategy to increase the capacity within Australian and Victorian government regulatory agencies to respond to CCS projects.	Short term
2	Understanding emissions profiles of source and capture projects associated with CCS, including atmospheric emissions and airshed-implications, water consumption and waste generation.	Short term as part of regulatory reform – such as Victoria State Environment Protection Policy (Ambient Air Quality).
3	Coordinate analysis and modelling required to better understand project specific risks associated with controlled and uncontrolled release and dispersion from CO <sub>2</sub> pipelines.	Project specific
<b>Relationships</b>		
4	Leverage off regulatory reform in Commonwealth and Victorian statutory approvals processes to incorporate consideration of CCS.	Short – medium term as part of regulatory reform
5	Investigate opportunities to coordinate and sequence approvals for components of CCS chain.	Project specific
6	Develop programs to educate the community about CCS technology, particularly storage.	Ongoing
<b>Refinement of processes</b>		
7	Benchmark international standards for CO <sub>2</sub> pipeline design against the Australian Standard for pipelines (AS2885) to ensure best practice application in Australia.	Short term
8	Identify options for enabling cross-jurisdictional storage of CO <sub>2</sub> .	Short term
9	Consider international approaches to storage performance and assess relevance to Australia, including performance monitoring as a means to verify integrity.	Short term
10	Consider need to align approach to long term storage liability across jurisdictions taking into account international developments.	Short term

No.	Recommendation description	Timeframe
Secondary guidance		
11	Ensure CCS projects follow best practice for community engagement.	Project specific
12	Share and promote the outcomes of the test toolkit workshop and CCS framework in Victoria.	Short term
13	Investigate methods to quantify greenhouse gas emissions (GHG) from CCS projects for the purposes of National Greenhouse and Energy Reporting Scheme (NGERS).	Medium term

## Abbreviations and definitions

To assist the reader in understanding the content of this report, the following list of abbreviations and definitions has been prepared.

Term	Definition
airshed	geographic area that is being investigated or managed for air pollution control
CCUS	carbon capture, use and storage
CCS	carbon capture and storage
CEM	Clean Energy Ministerial
CO <sub>2</sub>	carbon dioxide
CO2CRC	Cooperative Research Centre for Greenhouse Gas Technologies
collector hub	location where a collector spur connects into the trunk pipeline of the network.
CSTF	Carbon Storage Taskforce – established under the National Low Emissions Coal Initiative to develop a NCMIP
CSIRO	Commonwealth Scientific and Industrial Research Organisation
distribution hub	location where the trunk pipeline is transferred to the storage formation.
DoI	Department of Industry (formerly Department of Resources, Energy and Tourism)
DSDBI	Department of State Development, Business and Innovation (formerly Department of Primary Industries)
EIA	environmental impact assessment
EOR	enhanced oil recovery
ERD	extended reach drill
geosequestration	injecting carbon dioxide directly into underground geological formations
GHG	greenhouse gas
HDD	horizontal directional drill
IEA	International Energy Agency
LNG	liquefied natural gas
MEF	Major Economies Forum
Mtpa	million tonnes per annum
NCMIP	National Carbon Mapping and Infrastructure Plan
NGERS	National Greenhouse and Energy Reporting Scheme
NH <sub>3</sub>	ammonia
NO <sub>x</sub>	nitrogen oxides are produced from the reaction of nitrogen and oxygen gases in the air during combustion
offshore transport	project components which convey CO <sub>2</sub> from the coast to the storage site
OHS	occupational health and safety
onshore transport	project components which convey CO <sub>2</sub> from source to the coast
source and capture	site where CO <sub>2</sub> is collected and processed
storage	site where CO <sub>2</sub> is injected and is permanently stored
transition hub	location that is to be used for metering CO <sub>2</sub> prior to injection and for ancillary monitoring and operational equipment
transport	action of transferring CO <sub>2</sub> from source and capture to storage

Term	Definition
UN	United Nations
USA	United States of America

## 1.0 Introduction

The Global Carbon Capture and Storage (CCS) Institute Regulatory Test Toolkit (test toolkit) assists government agencies to work together with other stakeholders to test and improve the regulatory framework for Carbon Capture and Storage (CCS). The test toolkit has previously been successfully deployed in Scotland, Trinidad and Tobago, Romania and Malaysia.

The test toolkit was used by the Victorian Department of State Development Business and Innovation (DSDBI) to assess whether the existing regulatory framework could accommodate commercial-scale CCS projects in Victoria, with storage in Commonwealth waters.

The test toolkit was used in Victoria, as the Gippsland Basin has the highest technical ranking of any storage basin and the largest storage potential of any east coast basin in Australia (CSTF, 2009). Victoria also has existing CCS-specific legislation and funding under the Australian CCS Flagships program for the CarbonNet Project (DRET, 2013a).

The test toolkit considered a hypothetical CCS project, against the relevant Commonwealth and Victorian regulatory framework, current as at the time of the test toolkit. By doing so, the test toolkit endeavoured to minimise cost, time and risks associated with CCS project applications and provide greater knowledge of the regulatory framework for CCS projects.

The purpose of the test toolkit exercise was to assess whether:

- the regulatory framework currently accommodates all main aspects of the CCS project cycle
- any gaps or overlaps exist in the regulatory process
- roles for regulators are clearly defined and regulators have adequate understanding of the key components of the CCS project cycle
- the regulatory framework is best practice
- the framework minimises the administrative time, and cost burden for government, industry, the applicant/proponents and regulators while providing community confidence (Global CCS Institute, 2011).

The forum for the test toolkit was a workshop attended by government agencies and relevant stakeholders.

The test toolkit exercise investigated legislation applicable to a hypothetical CCS project, and assessed regulatory requirements at each stage over the life of the project, from feasibility to decommissioning. The benefits of the analysis include:

- a better grasp of the regulatory framework and the roles of regulators
- greater clarity on regulatory requirements, such as licences and permits, information requirements, timescales for planning and approvals, regulators to be engaged and the expertise required
- identification of potential gaps and overlaps
- greater development of regulatory interest and involvement in the process (Global CCS Institute, 2011).

### 1.1 Toolkit preparation for Victoria

A Steering Committee was established comprising the Global CCS Institute, Australian Government Department of Industry (DoI) (formerly the Department of Resources Energy and Tourism) and the DSDBI (formerly the Department of Primary Industries). Items discussed included, the development of a hypothetical CCS project, namely the Mock CCS Toolkit Project, a mock approval application, a mock approvals and permits register, and the test toolkit workshop including, the roles of facilitators, agenda and workshop materials such as the worksheet and feedback forms.

Planning for the workshop commenced in February 2013 with a meeting of the test toolkit Steering Committee.

AECOM was engaged as the consultant to provide advice on the regulatory approvals and to prepare the Mock CCS Toolkit Project application, approvals and permits register, assist with preparing the test toolkit workshop materials and to prepare this outcomes and recommendations report.

Beatty Legal Pty Ltd was engaged to facilitate the test toolkit workshop and prepare the rules of engagement.

## 1.2 Purpose of this document

This report is a record of discussions undertaken at the test toolkit workshop. It does not document every comment made during the sessions but highlights the key issues and themes based on the interpretation of the workshop facilitators, report authors and the test toolkit Steering Committee.

This report has been prepared for an audience with some familiarity and interest in CCS and/or the regulatory framework for CCS.

Building on the test toolkit workshop input and preliminary synthesis, emerging themes are identified in this report. In addition, recommendations have been developed following the workshop that could be adopted to enhance the capacity of the regulatory framework to accommodate CCS projects in Victoria.

## 2.0 Introduction to CCS

CCS is a process where carbon dioxide (CO<sub>2</sub>) emissions are captured, compressed, transported and injected into storage, usually a deep geological formation; also referred to as geosequestration. It is mostly applicable to high emission industrial systems, such as coal-fired power stations and steel production plants. While CCS is a viable option for significantly curbing CO<sub>2</sub> emissions, it crosses many regulatory boundaries and subsequently requires coordination of existing regulatory framework. As a result, testing a regulatory framework can help to minimise the cost, time and risks associated with regulatory approvals for a CCS project.

This section provides a brief introduction to CCS, the rationale for CCS deployment, international and Australian legislative context, an overview of international and Australian CCS projects and key components of the CCS process. Further detail is provided in Appendix A.

### 2.1 Rationale for CCS

A substantial collection of scientific evidence now indicates that accelerated climate change is occurring due to anthropogenic activities. Furthermore, it indicates that without significant reductions in greenhouse gas (GHG) emissions, there is a strong possibility of devastating environmental impacts from climate change effects (NRC, 2010). Since the Industrial Revolution, CO<sub>2</sub> emissions from the burning of fossil fuels for energy have increased rapidly (Leggett, 2007), and as a result, there needs to be a concentrated focus on restricting CO<sub>2</sub> emissions from industrial activities.

According to the International Energy Agency (IEA), CCS is necessary to meet urgent climate change mitigation targets, as it provides an option to minimise carbon emissions for industrial and power sectors. Its large scale deployment could contribute about 20 per cent of the mitigation of CO<sub>2</sub> emissions globally (IEA, 2012).

Additionally, it is considered one of the few technologies which allow countries with large coal reserves, such as Australia, to use their vast reserves while helping to mitigate the GHG emissions that are generated. This is particularly important given the extent to which current economic activity is reliant on the combustion of fossil fuels and/or other industrial methods producing CO<sub>2</sub> emissions (KAPSARC, 2012).

#### 2.1.1 Regulatory and legislative context

CCS is a technology that covers various regulatory and legislative contexts, both internationally and in Australia. Various policy forums, legal and regulatory actions internationally have focused on accelerating large scale CCS deployment. CCS initiatives on an international scale include:

- Global CCS Institute - the Global CCS Institute was established in 2009 to accelerate the development of CCS globally through knowledge sharing activities, fact-based influential advice and advocacy to create favourable conditions to implement CCS. The Global CCS Institute supports the large scale deployment of CCS as a “vital, safe and clean technology” within a range of clean energy technologies required for the minimisation of GHG emissions. With 370 members from more than 40 countries the Global CCS Institute is one of the largest global centres of CCS expertise internationally (Global CCS Institute, 2009).
- Major Economies Forum (MEF) on Energy and Climate – the MEF was launched in 2009 to enable an open dialogue to occur between major developed and developing economies and help create the political leadership needed to accomplish an effective outcome at the annual United Nations (UN) climate negotiations. Furthermore, the MEF aims to progress “concrete initiatives and joint ventures” which increase the green energy supply and cut GHG emissions (MEF, 2009).
- Carbon Capture, Use and Storage (CCUS) Action Group, an initiative of the Clean Energy Ministerial (CEM) brings together energy ministers from leading clean energy technology countries. The purpose of this group is to act as an international forum which advocates programs and policies that develop clean energy technology, discusses best practice technologies and lessons learned and promotes the transition to a global clean energy economy (CEM, 2013).

In Australia, there has been a significant push through various programs, policies and legislation for the implementation of CCS technology, such as:

- the CCS Flagships program which was established under the previous Australian Government's Clean Energy Initiative in 2009 to support the construction of large scale integrated CCS projects in Australia. Two CCS demonstration projects have been awarded flagship status and funding – the Collie South West Hub in Western Australia (2011) and the CarbonNet Project Victoria (2012) (DRET, 2013a)

- the development of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)* (OPGGS Act) as primary Commonwealth legislation for CCS applicable within Commonwealth waters (the area beyond three nautical miles from the Territorial sea baseline).

Victoria is the only state in Australia with specific legislation in place regarding onshore and offshore GHG emission storage. In particular Victoria has:

- for onshore storage of GHG emissions, the *Greenhouse Gas Geological Sequestration Act 2008 (Vic)* (GGGS Act) which was formed to “facilitate and regulate the injection of greenhouse gas substances into underground geological formations” (GGGS Act, s.1).
- for offshore storage of GHG emissions the *Offshore Petroleum and Greenhouse Gas Storage Act 2010 (Vic)* (OPGGS Act) regulates the construction and operation of GHG infrastructure and pipelines in the Victorian offshore area.

### 2.1.2 Impediments to CCS

While there are large scale CCS projects in operation around the world which demonstrate the technology’s potential (see section 2.2), challenges remain to deployment on a broad scale. These include technical, financial and social considerations (Stigson et al., 2012 and IEA, 2013). The CEM’s fourth assessment report identifies three primary impediments to the deployment of CCS in industrial applications:

- remaining knowledge gaps around cost and technical performance
- the potential impacts of CCS on market competitiveness
- engagement and developing public understanding of CO<sub>2</sub> transport and storage (IEA, 2013).

According to the International Energy Agency (IEA, 2013), pollution control methods such as CCS require policy action for large scale deployment. This requires alignment and coordination between levels of government in order for CCS projects to succeed, as visible conflict is likely to erode public confidence. It is also necessary to consider public perception and community engagement to bring about a more coordinated and aligned vision (Ashworth et al., 2011).

The CCUS Action Group suggested several initiatives to help overcome the challenges of CCS deployment to the CEM in April 2011, such as:

- developing policies which focus on the financial gap and risks related with early mover CCS demonstration and deployment
- ascertaining applicable funding mechanisms which can support large scale CCS demonstration projects in developing nations
- sharing knowledge of the development of best practice CCS projects
- reviewing the key data gaps in understanding CO<sub>2</sub> storage, particularly with regard to exploration and capacity of potential storages (CEM, 2011).

Ashworth et al., (2011) advise the importance of engaging the public early with CCS projects. They discuss the importance of understanding the community, identifying the local benefits which the CCS project could bring and highlighting the importance of considering how the information is communicated e.g. using multiple information sources and a variety of forums for informal as well as formal engagement. In addition, Ashworth et al., (2011) recommend establishing and maintaining trust through transparent and frequent communication throughout the course of the project.

Some of the recommendations discussed above are being executed through global knowledge sharing forums such as the Global CCS Institute.

## 2.2 Potential development of CCS

There are numerous CCS development projects both internationally and in Australia. To minimise time, cost and risk, most CCS projects take a staged approach, where each component is developed over time.

### 2.2.1 International CCS projects

Internationally, there are around 65 large scale CCS projects underway, with most of them in planning stage (Global CCS Institute, 2013a). Figure 1 identifies the locations of large scale CCS projects worldwide and

indicates which industry and storage type CCS has been integrated. Worldwide, large scale CCS projects are located in the United States of America (USA), Europe and China and integrated predominately within the natural gas and power generation industries. In the USA, captured CO<sub>2</sub> is being employed for enhanced oil recovery (EOR) and in Europe CO<sub>2</sub> is predominately injected into deep saline formations. China currently includes a mixture of various storage options.

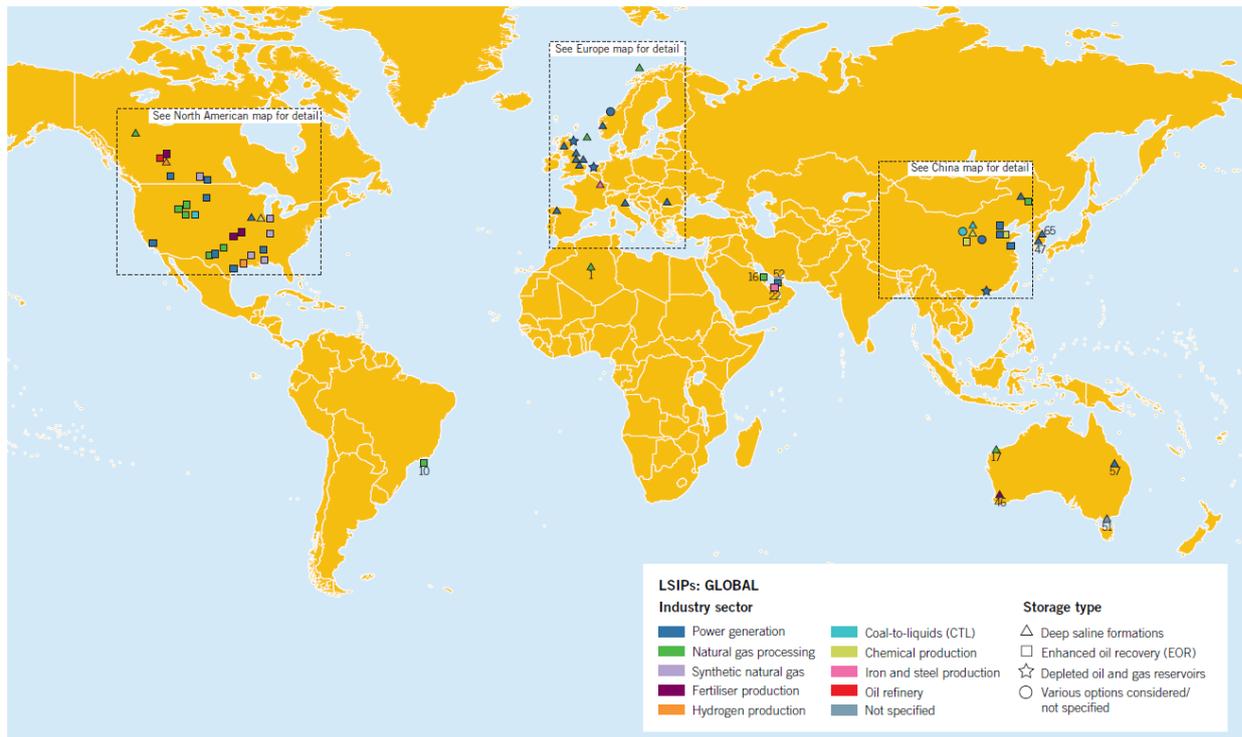


Figure 1 Location of large scale CCS projects around the world in planning, construction or operation (Global CCS Institute, 2013a)

### 2.2.2 Australian CCS projects

In Australia there are currently four (see Figure 1) CCS projects at various stages, either in feasibility, development or operation, namely the Gorgon Carbon Dioxide Injection Project and South West CO<sub>2</sub> Geosequestration Hub project in Western Australia, the Surat Basin CCS Project in Queensland and the CarbonNet Project in Victoria (Global CCS Institute, 2013a).

Other notable projects in Australia that are continuing research and development work to progress CCS include, the Callide Oxyfuel project that is to undergo an 18 - 24 month test period and the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) which is continuing geological storage research at its Otway project. Figure 2 presents the CCS projects existing in Australia (Global CCS Institute, 2013a).

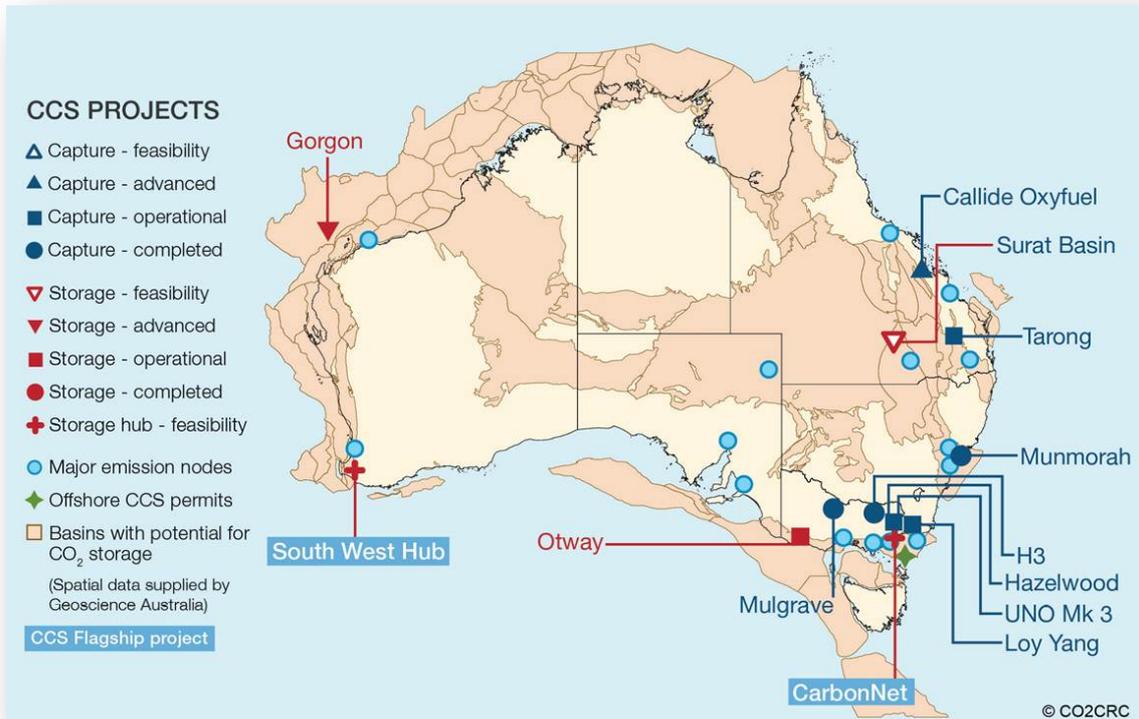


Figure 2 CCS Projects in Australia as of 2012 (CO2CRC, 2013)

### 2.3 Components of CCS

There are three primary components of CCS projects as follows:

- **source and capture** of the CO<sub>2</sub> emissions through the use of various separation processes
- **transport** of the CO<sub>2</sub> by-product from the capture hubs to the storage area
- **storage** of the CO<sub>2</sub> in a geological formation.

An example of the CCS process is shown in Figure 3.

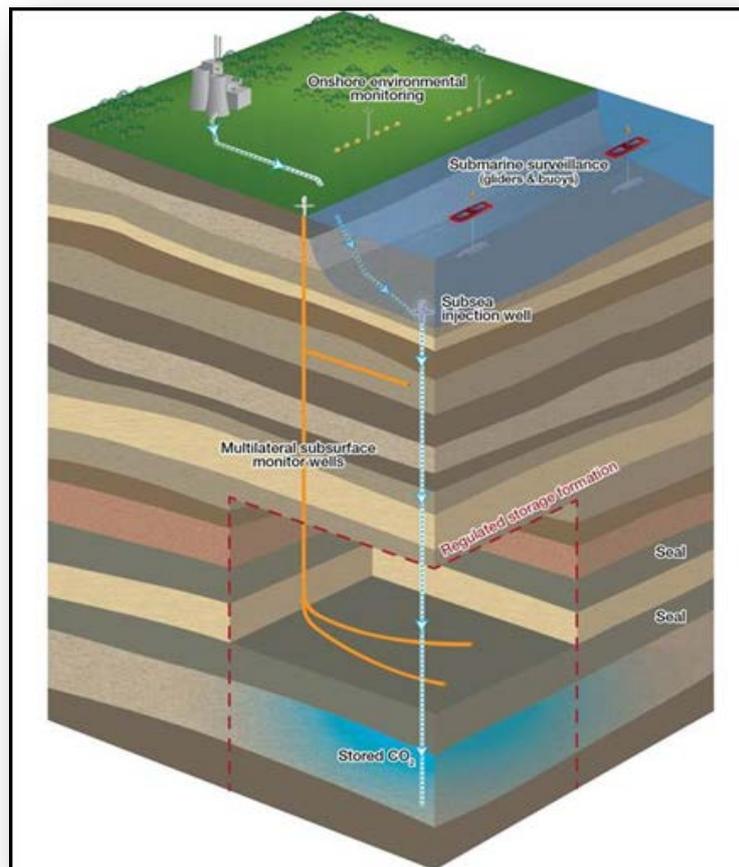


Figure 3 The CCS Process (CO2CRC n.d.)

### 2.3.1 Source and capture

Capture of CO<sub>2</sub> at the source is the first step in the CCS process and can occur through a variety of technology options depending on the type of industrial activity. It can be (and has been) sourced from any large scale high CO<sub>2</sub> emitting industrial processes ranging from coal-fired power generation to cement and steel manufacturing and gas processing. Depending on the source, and capture technology, CO<sub>2</sub> may contain traces of other gaseous by products such as nitrogen or sulphur (Global CCS Institute, 2013b).

### 2.3.2 Transport

There are a number of key considerations around transporting CO<sub>2</sub>, particularly with regards to the extent of transport infrastructure and investment needed to deploy CCS on a large scale (Global CCS Institute, 2013c). In Gale and Davison (2004) key considerations for the transport of CO<sub>2</sub>, include safety in pipeline design such as actions to prevent corrosion, the ability to develop the infrastructure on a large scale and economic considerations required for integrating networks of CO<sub>2</sub> sources to individual storage sites.

### 2.3.3 Storage

A CO<sub>2</sub> storage site will typically consist of a layer of porous, permeable rock – into which the CO<sub>2</sub> will be injected in a condensed, liquid-like state – overlaid by a layer of impermeable, non-porous rock, which acts as a seal and contains the stored CO<sub>2</sub> within the porous layer (IPCC, 2005). This is similar to how oil and gas have remained naturally trapped for millions of years and in many cases depleted oil and gas reservoirs serve as suitable CO<sub>2</sub> storage sites.

Storage site exploration and selection is a complex and comprehensive process. In Australia, the Carbon Storage Taskforce (CSTF) was established by the then Australian Government to identify the storage potential of geological formations around Australia (DRET, 2013b). From these studies, the CSTF produced a National Carbon Mapping and Infrastructure Plan (NCMIP), which ranked sites of geological storage potential around Australia. The Gippsland Basin in Victoria has the highest technical ranking of any storage basin and the largest storage potential of any east coast basin in Australia (CSTF, 2009).

## 3.0 CCS regulatory test toolkit methodology

The test toolkit was deployed by DSDBI to determine whether the existing Commonwealth and Victorian regulatory framework, can accommodate commercial-scale CCS deployment in Victoria.

The key mechanism to undertake this process was through a workshop involving government agencies and regulators as well as other stakeholders such as research organisations. There was no involvement from industry at the workshop in order to focus discussions on the role of regulators within the regulatory framework of CCS.

Key components of the test toolkit exercise discussed in further detail in the following sections are the:

- Mock Toolkit CCS Project description
- Mock Toolkit CCS Project application
- mock approvals and permits register
- test toolkit workshop.

### 3.1 Mock Toolkit CCS Project description

A hypothetical project, namely the Mock Toolkit CCS Project provided a hypothetical scenario to test an approvals application under the relevant Commonwealth and Victorian regulatory framework. The Mock Toolkit CCS Project includes the capture of CO<sub>2</sub> emissions generated in Victoria's Latrobe Valley and storage in the Gippsland Basin (at least 800 m below the seafloor in Commonwealth waters). The Mock Toolkit CCS Project also includes a variation of CO<sub>2</sub> storage below Victorian waters.

The Mock Toolkit CCS Project involves the following components (Refer to Figure 4 for a schematic of the Mock Toolkit CCS Project):

- **source and capture project** – the source is the origin of the CO<sub>2</sub>. In this hypothetical scenario, the source is assumed to be an existing coal-fired power station in the Latrobe Valley (not any specific existing power station). The CO<sub>2</sub> capture will use post-combustion technology resulting in supercritical fluid at approximately 30°C that is >95% CO<sub>2</sub>, with other substances likely to include traces of hydrogen sulphide (H<sub>2</sub>S) and nitrogen oxide (NO<sub>x</sub>).
- **onshore transport** – involves the following components:
  - **collector hub and spur** – the collector hub and spur will connect the source and capture project to the trunk pipeline. The collector hub will be on existing industrial land and will comprise fittings and valves to allow interconnection. The collector spur will be a pipeline on a new easement and will be designed and operated in accordance with the Australian Standard for pipelines (AS2885)
  - **trunk pipeline** – an underground pipeline will transport CO<sub>2</sub> from the Latrobe Valley to the distribution hub located on the coastline. The trunk pipeline will be designed and operated in accordance with AS 2885 and will occupy a new easement which will traverse Crown land (including land under Native Title) and freehold land. The trunk pipeline corridor will also require waterways crossings
  - **distribution hub** – the distribution hub will be located on coastal land owned by the Mock Toolkit CCS Project with a footprint of approximately 20 m x 10 m. The site will be equipped with a compressor, enclosed pump station and have an existing power line available
- **offshore transport** – offshore transport from the distribution hub will consist of a shoreline crossing via an Horizontal Directional Drill (HDD) well to a trenched seabed pipeline which extends to an offshore drill rig with a single injector well and platform. The offshore drill rig will be established in Commonwealth waters as part of the testing and appraisal of the storage formation. For the variant storage below Victorian waters, CO<sub>2</sub> is transferred via an Extended Reach Drill (ERD) well only
- **storage formation** – the storage formation will be located offshore in the Gippsland Basin (at least 800 m below the seafloor in Commonwealth waters). This formation does not overlap with existing petroleum tenements. A variant storage in Victorian waters is also considered.

### 3.2 Mock Toolkit CCS Project application

An illustrative application for a Mock Toolkit CCS Project was developed encompassing carbon source and capture, transport and storage components based on the Mock Toolkit CCS Project description. The mock application was used to test the current regulatory framework and to consider and address any potential risks

ahead of any live CCS projects. The mock application was prepared in conjunction with a mock approvals and permits register (described in 3.3), which provides the relevant statutory requirements for each component of the Mock Toolkit CCS Project.

The mock application was made on the referral form template for the Victorian *Environment Effects Act 1978*. This referral form is used by other major projects in Victoria and so considers the breadth of potentially relevant regulatory issues and is familiar to the regulators.

The mock application included:

- a project description of the Mock Toolkit CCS Project that provides a brief outline of the project and discussion of alternatives, exclusions and implementation
- a description of the proposed project area, including existing environment, land availability and controls, and required approvals
- details of a preliminary assessment of potential environmental effects, including native vegetation, flora and fauna, water environments, landscape and soils, social environments including European and Aboriginal cultural heritage, energy wastes and GHG emissions
- proposed environmental management, program of future investigations and community and stakeholder consultation.

The Mock Toolkit CCS Project is entirely hypothetical. Participants involved in the workshop did so independently of any actual CCS project in which they may be involved, using the interactive test toolkit workshop to make comments on the CCS regulatory framework.

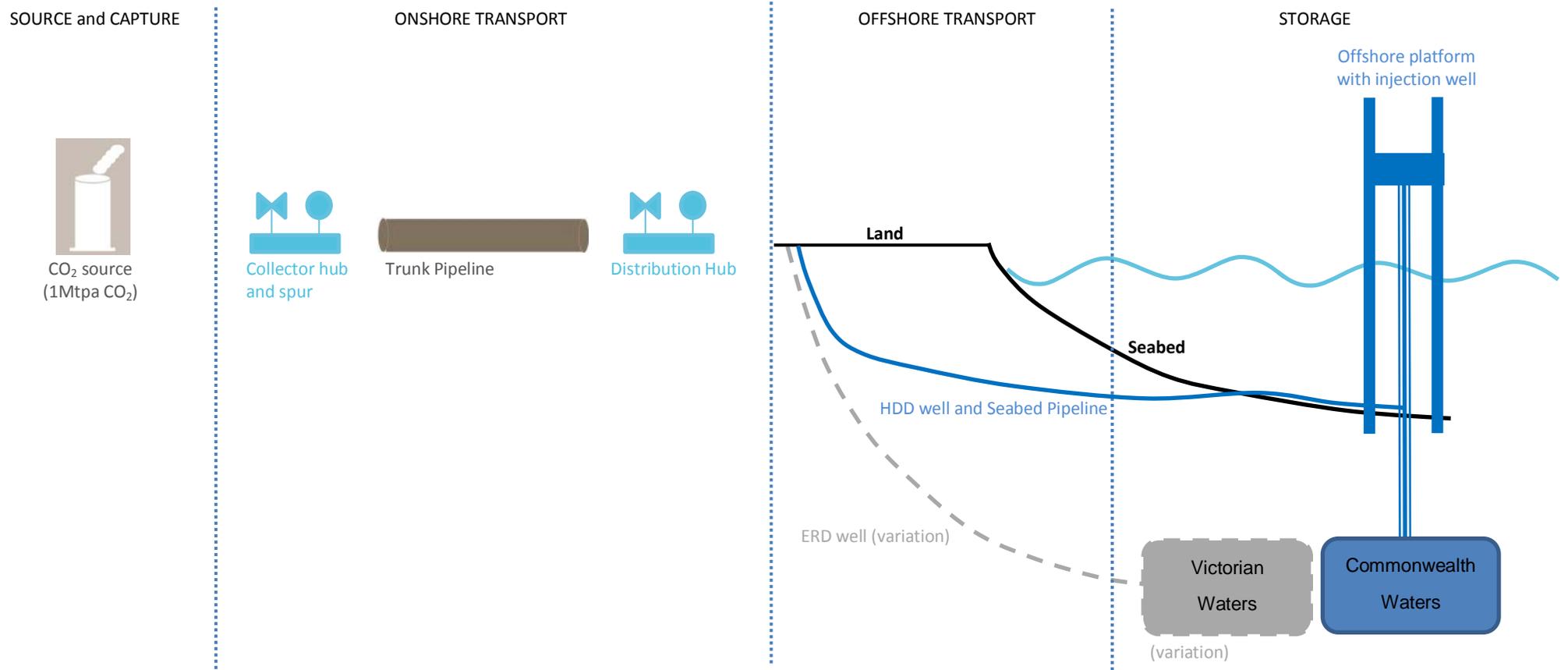


Figure 4 Mock Toolkit CCS Project – Project components

### 3.3 Mock approvals and permits register

A mock approvals and permits register was developed to present the matrix of regulations, permits, approvals licences and certificates that may apply to a potential CCS project under both the Commonwealth and Victorian legal and regulatory framework.

The mock approvals and permits register includes relevant statutory requirements for each component of the Mock Toolkit CCS Project, including:

- whole of project
- source and capture
- onshore transport – collector hub and spur, trunk pipeline and distribution hub
- offshore transport – via an HDD well and seafloor pipeline within Victorian and Commonwealth waters to storage formation
- storage formation wholly within Commonwealth waters.

A summary of these requirements is presented in Figure 5. A full list of the relevant licences and permits is presented in Appendix B.

The approvals and permits register also includes relevant statutory requirements for two potential variations to the Mock Toolkit CCS Project, being:

- offshore transport via an ERD well to a storage formation wholly under Victorian waters
- storage formation wholly under Victorian waters.

For each relevant approval and permit, the register identifies the name of the approval, the associated legislation, granting authority and work needed to complete submission, as well as providing a brief description and consideration of timing, relevance to the Mock Toolkit CCS Project and staging (construction, operation and decommissioning).

The mock approvals and permits register focuses on statutory approvals and so does not include land access and tenure requirements. Through June and July 2013 the draft approvals and permits register was reviewed by the Steering Committee. The register was provided to the workshop participants for review and preparation prior to the workshop.

The mock approvals and permits register provides a concise summary of Commonwealth and Victorian laws that apply under the existing regulatory framework however it should be considered as a 'living' document and will need to be further refined by examining a real project.

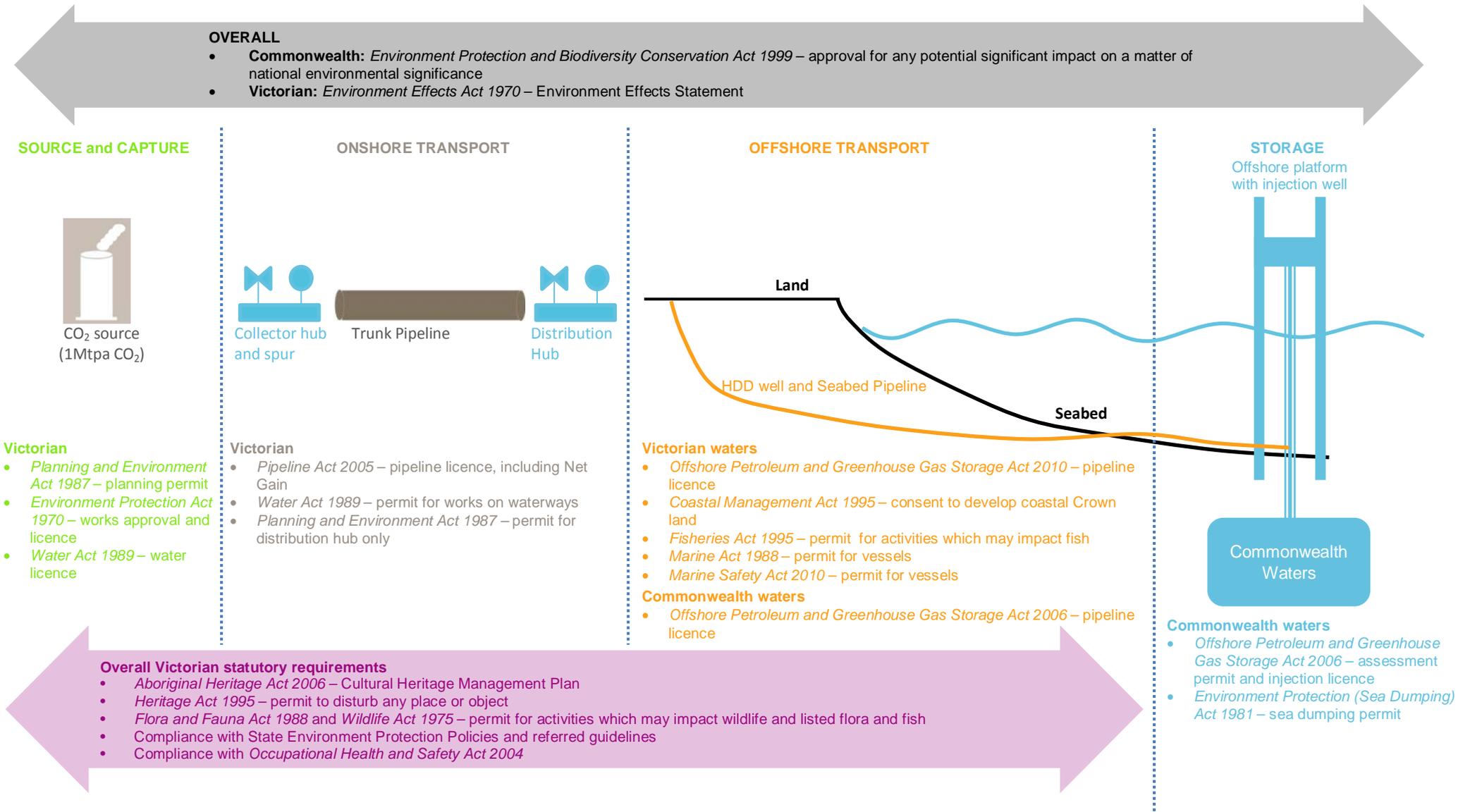


Figure 5 Mock Toolkit CCS Project – Key Commonwealth and Victorian statutory requirements

### 3.4 Test toolkit workshop

The CCS test toolkit workshop was held to assess the Victorian CCS regulatory framework and to actively involve the key stakeholders including government stakeholders. The interactive test toolkit workshop provided the opportunity for stakeholders to assess the current regulatory framework and to identify and address any potential regulatory risks ahead of any live CCS project. The test toolkit workshop sought to:

- test assumptions and beliefs regarding the current regulatory framework
- increase regulators' understanding of CCS
- highlight uncertainties and regulatory gaps
- identify risks in the regulatory regime to a CCS project by assessing the Mock CCS Toolkit Project application
- identify opportunities to streamline regulation
- consider and report any constraints where there is missing or incomplete information
- highlight areas where there are regulatory gaps or overlaps for amendment or development
- provide confidence to agencies, that the regulatory regime is generally fit for purpose, has been tested and provides a clear route to the safe storage of CO<sub>2</sub>.

Each workshop participant was asked to answer four questions in relation to the approval of CCS projects in Victoria:

- What are the regulatory and institutional overlaps/gaps?
- How can the regulatory process be streamlined/improved?
- Where should institutional capacity be strengthened?
- Where is there a need for additional information?

Participants were asked to record their response on worksheets (refer to Appendix D).

#### 3.4.1 Workshop methodology

The one-day test toolkit workshop was held in Melbourne. In the weeks leading up to the test toolkit workshop, participants were provided the Mock CCS Toolkit Project approval application, and the approvals and mock permit register to review. A supplementary report presenting an introduction to CCS (attached in Appendix A) was also provided to the workshop participants. Presenters were briefed, outlining their role at the workshop and suggestions about the scope of their presentations. Workshop presenters were also introduced to the workshop approach including the application of the Chatham House rule, outlined below:

*When a meeting or part thereof, is held under the Chatham House rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant may be revealed.*

Under this approach open discussion and an exploration of issues and options among participants was undertaken that ensured confidentiality of the source comment. There was no media and group feedback was compiled in this report, unless consented to, any comments remain anonymous.

#### 3.4.2 Agenda

At the commencement, the participants were introduced to the global context of CCS and then introduced to the Mock CCS Toolkit Project.

The workshop was led by two facilitators and was divided into four sessions:

- three working sessions corresponding to the three components of the CCS chain: source and capture, transport and storage
- one session to explore cross cutting issues that may be relevant in Victoria, on matters including environmental and planning, community and monitoring and reporting.

Each of the component sessions were prefaced with a technical expert providing an overview of the proposed technology and a presentation by a regulator, introducing permitting issues relevant to the component and encompassed; planning, construction, operation and decommissioning.

Following the presentations for each session, participants were asked in groups to address four questions (see Section 3.4) in relation to the approvals of CCS projects in Victoria, the outcome of which was then presented to the wider workshop group.

The agenda is provided in Appendix C.

### 3.4.3 Workshop participants

There were over 40 participants at the test toolkit workshop, with the organisations represented listed in Table 2.

**Table 2 CCS Regulatory Test Toolkit workshop participants**

Organisation	Government
Australian Maritime Safety Authority (AMSA)	Australian Government
Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC)	Not applicable
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Not applicable
Department of Environment and Primary Industries (DEPI)	Victorian Government
Department of Health (DoH)	Victorian Government
Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education	Australian Government
Department of Justice (DoJ)	Victorian Government
Department of Mining and Petroleum Western Australia	Western Australian Government
Department of Industry (DoI) (formerly Department of Resources, Energy and Tourism (DRET))	Australian Government
Department of State Development, Business and Innovation (DSDBI)	Victorian Government
Department of State Development, Business and Innovation (DSDBI) - Earth Resources Regulation Victoria	Victorian Government
Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)	Australian Government
Department of Transport, Planning and Local Infrastructure (DTPLI)	Victorian Government
Energy Safe Victoria	Victorian Government
Environment Protection Authority (EPA) Victoria	Victorian Government
Geoscience Australia	Australian Government
Geological Survey of Victoria	Victorian Government
Gippsland Water	Victorian Government
Global CCS Institute	Not applicable
Latrobe City Council	Local Government
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	Australian Government
National Offshore Petroleum Titles Administrator (NOPTA)	Australian Government
Parks Victoria	Victorian Government
Southern Rural Water	Victorian Government
Wellington Shire Council	Local Government
WorkSafe	Victorian Government

#### 3.4.4 Key feedback from the workshop

Participants of the workshop generally welcomed the opportunity to review the regulatory framework for CCS in Victoria. Overall the approach was considered a successful method for open discussion particularly given that all key regulatory stakeholders were in attendance.

Workshop participants were given the opportunity to provide feedback after the event via an online survey. The quantitative results in response to the survey questions are provided in Appendix E.

Approximately 50 per cent of workshop participants responded to the survey. A summary of the feedback from participants who responded to the survey is provided below:

- approximately 70 per cent of the participants who responded to the survey felt that the workshop was successful in helping to increase regulators' understanding of the regulatory and permitting approvals pathways for a potential Victorian CCS project.
- over 60 per cent of the participants who responded to the survey felt the workshop was successful in identifying issues, gaps and overlaps in the regulatory framework for CCS
- over 70 per cent of the participants who responded to the survey considered the chance to work together as regulators to identify issues, was the most useful part of the workshop, followed by the opportunity to learn more about CCS
- overall the format of the workshop was considered effective and productive in the delivery and level of material and was considerate to the diverse background and experience of the participants.

Participants were also asked to provide any additional comments to those made on the day and how the workshop could have been improved. The participants felt that:

- they would like to hear from industry
- they would like future opportunities to fully explore each component of CCS i.e. capture, transport and storage
- more interaction across participants would have prompted more discussion and allowed better sharing of agency specific issues
- more information on international experience and cross cutting issues relating to the carbon market would have been beneficial
- a follow up workshop(s) could be held to discuss outcomes.

### 3.5 Report

Following the CCS workshop, this report was developed to describe the deployment of the CCS Regulatory Test Toolkit for Victoria and to identify lessons learnt and provide recommendations.

This report draws upon the information provided by the workshop participants through the worksheet and feedback forms. Participants were advised at the start of the workshop that they were expected to fill in the worksheet forms for each of the sessions. The worksheet form is attached in Appendix D. Feedback from the workshop was undertaken on an online survey.

## 4.0 Test toolkit workshop outcomes

The test toolkit workshop focused on identifying key issues and any gaps or overlaps with the existing regulatory framework. The key issues and suggestions that emerged from the facilitated discussion are summarised below, without attribution to any specific organisation or individual.

Overall the test toolkit workshop confirmed that the regulatory framework is generally fit for purpose for CCS deployment in Victoria. However there are opportunities for streamlining or clarification of the process. The test toolkit workshop recognised that the regulatory framework is complex although it was acknowledged that various components are applied successfully to other major multifaceted, non-CCS infrastructure projects.

Issues identified that were common to all components of CCS included:

- the coordination and sequencing of assessment and approvals
- building regulatory capacity for addressing the specific technical issues associated with CCS deployment
- engaging with the community to build awareness and knowledge of CCS
- project proponents obtaining enough information to meet the standards required for regulatory approval.

The following sections provide an overview of each session by presenting a brief overview of the presentations, a summary of the key issues discussed and a synthesis of the emerging themes particular to CCS.

### 4.1 Source and capture

The technical and regulatory overview presentations focussed on the well-developed technical expertise that exist for the deployment of source and capture projects and the various technologies available. Key issues that were identified which require further consideration to demonstrate feasibility for deployment and regulatory approval of source and capture projects are:

- demonstration of the capture efficiency and performance standard to achieve optimal CO<sub>2</sub> capture
- the regulatory acceptance of the changed emissions profile
- the production of wastes that are subsequently released into the environment as a result of the process.

It was acknowledged that in Victoria CO<sub>2</sub> is currently classified as a 'waste' and not a 'pollutant', and therefore requires that best practice be applied to minimise CO<sub>2</sub> emissions to the environment. In Victoria, source and capture projects are typically regulated through an EPA Works Approval and Licence that requires the proponent to demonstrate that the relevant health and environmental criteria for all emissions to land, water and air are met. As part of this process, input is sought from the Victorian Department of Health and relevant local council.

#### 4.1.1 Key issues discussed

The test toolkit workshop source and capture session facilitated discussions that reflected the range of concerns and points of view of each participant. It included discussions on issues generally associated with complex major projects however attention focussed on those specific to CCS. The key issues, gaps and opportunities that were suggested from the source and capture session are summarised below.

The key issues relating to source and capture that were discussed included:

- the change in emissions to air
- the change in use of water and wastewater quality
- the change to existing operations with the retrofitting of existing power plants and impacts to the existing local amenity such as noise
- the Occupational Health and Safety (OHS) of industry employees of the new source and capture facility including the handling of different chemicals
- the level of existing skill and the training potentially required for the new source and capture technology for the current and emerging workforce
- the public perception of the capture of CO<sub>2</sub> and managing the concerns of the community
- the existing knowledge and expertise in the regulatory system to evaluate source and capture projects through the approvals process.

The gaps and overlaps that were raised during the discussion included:

- the Victorian and local government approvals process involving works approvals and planning
- the overlaps of the reporting of emissions to Australian and Victorian Governments.

The opportunities suggested for consideration included:

- consideration of the *Public Health and Wellbeing Act 2008* as it relates to the public health and wellbeing of Victorians
- for regulatory bodies to approach all components of CCS holistically from the source to storage for an integrated approach to regulatory approval
- consideration of engaging the public early on in the planning process
- creating and maintaining regulatory expertise in the area of CCS.

#### 4.1.2 Emerging themes

Emerging themes considered specific to CCS that were discussed, in particular to the source and capture (S&C) of CO<sub>2</sub> are:

<b>S&amp;C1</b>	Where the approval process for the source and capture component share common regulations (such as emissions to air) potential overlap with the transport and storage components exist. This provides an opportunity to coordinate this regulatory process with other CCS components.
<b>S&amp;C2</b>	The technical knowledge of regulators in relation to source and capture facilities requires further development and could be enhanced by: <ul style="list-style-type: none"> <li>- encouraging regulators to gain further knowledge or by the formation or extension from existing expert CCS groups to assist regulators. A technical group that already exists is the CCS Working Group</li> <li>- encouraging CCS project proponents to engage regulators early on in project development by sharing knowledge amongst the relevant CCS industry stakeholders both nationally and internationally.</li> </ul>
<b>S&amp;C3</b>	The importance of engaging and educating the community about any proposed source and capture project and its place in the overall CCS project early in project development is considered crucial. Opportunity exists to build on existing programs of the Global CCS Institute, CO2CRC and CSIRO.
<b>S&amp;C4</b>	Process emissions from the capture of CO <sub>2</sub> from power plants requires greater understanding of source and capture projects, especially in relation to the following: <ul style="list-style-type: none"> <li>- changes in the profile of atmospheric emissions, and how these changes are reflected within the existing context of the local airshed</li> <li>- change in water consumption</li> <li>- change in wastewater quality as a result of by-products generated from the CO<sub>2</sub> capture process.</li> </ul>

## 4.2 Transport

The technical and regulatory setting relating to transport of CO<sub>2</sub> by onshore and offshore pipelines were acknowledged as well established in the current Commonwealth and Victorian regulatory framework. Specifically, current practices are prescribed within the Australian Standard for pipelines (AS2885) which considers the risks around pipeline construction, operations and decommissioning.

It was acknowledged that government agencies responsible for licencing and approval of pipelines are the DSDBI (onshore pipelines and offshore pipelines within Victorian waters) and the National Offshore Petroleum Titles Administrator (NOPTA) (offshore pipelines within Commonwealth waters). However unique issues relating to CCS projects that require attention are:

- the level of experience of transporting CO<sub>2</sub> is currently limited in Australia, while acknowledging the extensive experience overseas
- the engineering challenges associated with pipeline design, concerning the need to customise the design and materials for the various impurities present and the liquid and gaseous nature of CO<sub>2</sub>
- community health and safety risks associated with CO<sub>2</sub> releases (controlled or uncontrolled) and the roles of Energy Safe Victoria (ESV) and National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in relation to these issues.

Acknowledging the emergence of CCS projects worldwide, the International Organisation for Standardisation (ISO) has set up a technical committee namely; the ISO/TC 265 - Carbon dioxide capture, transportation, and geological storage. There are sixteen participating countries including Australia, and the scope of the committee is to standardise the design, construction, operation, environmental planning and management, risk management, quantification, monitoring and verification, and related activities in the field of CO<sub>2</sub> capture, transportation, and geological storage (ISO, 2013).

Research to better understand the engineering challenges and risks associated with CO<sub>2</sub> transport is being addressed by the Energy Pipelines Cooperative Research Centre (EPCRC). The EPCRC is an organisation that supports the Australian energy pipeline industry through research programs which investigate the efficient use of materials, extend the safe operating life of new and existing pipelines, support advancement of the design, construction and the public safety and security of energy pipelines (EPCRC, 2013). For example current research from the EPCRC relating to future energy pipelines carrying energy fluids such as CO<sub>2</sub>, aims to assist industry with anticipating the planning and design of the next generation of new and reused pipelines for the transportation of energy and combustion products. This study is expected to be publically available in 2015 and will support the revision of industry standards such as the Australian Standard for pipelines (AS2885), specifically Appendix BB.

#### **4.2.1 Key issues discussed**

The test toolkit workshop transport session facilitated discussions that reflected the range of concerns and points of view from participants. It included discussions on issues generally associated with complex major projects however attention focussed on those specific to CCS. The key issues, gaps and opportunities that were suggested from the transport session are summarised below.

The key issues relating to CO<sub>2</sub> transport that were discussed included:

- risk of CO<sub>2</sub> leakage and its environment and safety perception
- limited understanding of the composition of CO<sub>2</sub> from a CCS project and its leakage behaviour and the accounting of fugitive emissions
- limited knowledge of CO<sub>2</sub> and its properties by regulators in Australia especially within the marine environment
- construction impacts, including ancillary infrastructure such as compressors and their impacts to the environment e.g. on native vegetation
- engaging and negotiating land access and acquisition of easements especially with regards to Native Title
- notifications of planning approval requirements
- acknowledgement that the Australian Standard for pipelines (AS2885) continues to develop, particularly in relation to knowledge of and requirements for CO<sub>2</sub> pipelines
- the necessity for asset and safety management plans for CO<sub>2</sub> transport infrastructure, including an emergency response plan and decommissioning
- competency of workforce to construct and operate and the potential training required
- the interface between Commonwealth and Victorian regulatory jurisdictions from both on land and at sea.

The gaps and overlaps that were raised during the discussion included:

- the limited experience and knowledge relating to the monitoring and measuring of CO<sub>2</sub>, especially offshore
- the overlap of Commonwealth and Victorian regulatory interests on land and at sea
- limited knowledge and experience of CO<sub>2</sub> leakage behaviour.

The opportunities suggested for consideration included:

- early on in project development undertake pipeline assessment to identify land use issues to determine what is viable and the intended land use and development post CCS installation
- conduct risk assessment for loss of containment in transport
- integration of powers between Commonwealth and Victorian regulatory jurisdictions from land to sea.

#### 4.2.2 Emerging themes

It was acknowledged during the test toolkit workshop discussions that there are many established high pressure pipelines both in Victoria and Australia, such as those of the oil and gas industry which are designed and operated in accordance with the requirements of the AS2885. However, themes considered specific to CCS, in particular to the transport (T) of CO<sub>2</sub> were:

<b>T1</b>	That there are multiple regulators with an interest in regulation of pipelines and opportunities exist to streamline approvals processes, such as by generating common documentation.
<b>T2</b>	Further consideration and engagement with regulators on the application of Australian Standard for pipelines (AS2885) to CO <sub>2</sub> pipelines, particularly what constitutes best practice.
<b>T3</b>	That the transport of high pressure CO <sub>2</sub> via pipeline presents health, safety and environmental risks related to exposure from controlled and uncontrolled release. It was recognised that further work is required to: <ul style="list-style-type: none"> <li>- understand the release and dispersion of CO<sub>2</sub></li> <li>- investigate the implications of improved industry wide competency of managing the unique characteristics of CO<sub>2</sub> during normal operation and emergency preparedness and response</li> <li>- build understanding of potential risks associated with impurities which need to be further analysed against the relevant air quality standards.</li> </ul>

### 4.3 Storage

An overview of the natural properties of underground geological sites that enable CO<sub>2</sub> to be stored underground and CO<sub>2</sub> injection mechanics was presented. This included an explanation of several trapping mechanisms that prevent the CO<sub>2</sub> from migrating from the storage formation. One of the most important mechanisms highlighted was the presence of an impermeable rock layer, or caprock, which seals the formation. The methods and theories applied to geological investigations for CO<sub>2</sub> storage are similar to those in the long established oil and gas industry such as properties that enable fluids to flow through geology. It was also recognised that although the regulatory framework for injection and storage of CO<sub>2</sub> offshore are relatively new, that there are established regulators for the area beneath both Commonwealth and Victorian waters.

The long-term liability for stored CO<sub>2</sub> was also discussed, particularly the differences between Commonwealth and Victorian legislation; where the Commonwealth legislation allows for the transfer of liability to the Commonwealth following a minimum of fifteen years after the authorised closure of the storage site.

#### 4.3.1 Key issues discussed

The test toolkit workshop storage session facilitated discussions that reflected the range of concerns and points of view of each participant. It included discussions on issues generally associated with major projects, especially those related to the oil and gas extractive industry; however attention focussed on those specific to CCS. The key issues, gaps and opportunities that were suggested from the storage session discussion are summarised below.

The key issues relating to storage that were discussed included:

- the safety and security of storage, interpretation of geology and understanding the sideways migration
- definition of storage and the licencing and property rights for the storage formation
- competing resources, property rights and boundary issues with the oil and gas industry
- Commonwealth and Victorian jurisdictional interests

- public awareness and education of CO<sub>2</sub> storage
- impacts to existing offshore industries including shipping
- the long term liability arrangement of storage between CCS proponent and government
- the possibility of a carbon price on leakage of CO<sub>2</sub> and the effects on the proponent.

The gaps and overlaps that were raised during the discussion included:

- confidence of governments in assuming liability for long term storage and the degree of evidence required and conditions to be imposed before liability transfer is effected
- robustness of data required to monitor storage integrity and details such as acceptable distance of monitoring from injection well
- management of regulatory risks across jurisdictions, including roles and responsibilities
- interpretation and ambiguity of current legislation and the absence of secondary guidance
- regulation for storage formations that cross jurisdictional boundaries.

The opportunities suggested for consideration included:

- improved clarity in legislation relating to the definition of storage (particularly in relation to licencing and property rights) and the interpretation and demonstration of long term storage integrity
- an alternative to licencing as a mechanism for regulating storage
- integration of environment plans between Commonwealth and Victorian jurisdictions
- cultivation of social confidence around CO<sub>2</sub> storage.

#### 4.3.2 Emerging themes

Whilst there is a current regime to regulate offshore CO<sub>2</sub> storage, the following was identified as requiring further consideration for the storage (S) for CO<sub>2</sub>:

S1	Education to build understanding of storage formations and their ability to contain CO <sub>2</sub> .
S2	Opportunity to enable regulations for storage formations that straddle Commonwealth waters, regulated under the Commonwealth <i>Offshore Petroleum and Greenhouse Gas Storage Act 2006</i> (OPGGS Act 2006) and those in Victorian waters, regulated under the Victorian <i>Offshore Petroleum and Greenhouse Gas Storage Act 2010</i> (OPGGS Act 2010).
S3	Opportunity for coordinating regulations for storage formations that straddle the Victorian onshore ( <i>Greenhouse Gas Geological Sequestration Act 2008</i> ) and offshore Victorian OPGGS Act 2010.
S4	Monitoring programs and reporting to verify the performance of storage formations and demonstration of long term storage integrity.
S5	Monitoring and reporting under the <i>National Greenhouse and Energy Reporting Act 2007</i> for possible emissions from CCS projects.
S6	Streamlining of environmental and GHG legislation for example OPGGS Act 2006 and the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act 1999).

## 4.4 Cross cutting issues

Matters which are considered to affect all components of CCS were discussed in the cross cutting issues session. Cross cutting issues relevant to Victoria were explored through facilitated discussions on the following topics:

- **environmental and planning** – mechanisms for a CCS project to obtain statutory environmental approval. The focus of this matter was the approval process under the Victorian *Environment Effects Act 1978*. Issues raised from this discussion included the following:
  - although the total footprint of a CCS project may trigger approvals processes under the Act, development of an individual component may not trigger the Act
  - the onus is on the proponent to submit a referral for the Minister for Planning's decision
  - pre-referral engagement of government agencies by the proponent is recommended.
- **community** – related issues associated with CCS were discussed with emphasis on the fundamental importance of the CCS industry engaging with the community. This matter is likely to have two components. The first is the need for general education on the benefits of CCS technology to the community. The second is project specific consultation with stakeholders.
- **monitoring and reporting** – the Victorian Otway Project was discussed as an example to demonstrate the practicality of monitoring CCS projects. In particular the storage component was monitored for pressure, plume size and water quality to demonstrate storage certainty and compliance with regulations.

### 4.4.1 Key issues discussed

The test toolkit workshop cross cutting session facilitated discussions that reflected the range of concerns and points of view from participants. It included discussions on issues generally associated with major projects. The key issues, gaps and opportunities that were suggested from the cross cutting session discussion are summarised below.

The key issues that were raised during the cross cutting session included:

- the critical importance of community perception and acceptance
- quantifying the effects of catastrophic failure
- the level of technical and regulatory expertise
- understanding safety risks of CO<sub>2</sub>
- the reliance on willingness of Australian and Victorian Governments' to coordinate and work together
- the technical and regulatory compliance requirements to define long term storage.

The gaps and overlaps that were raised during the discussion included:

- the possibility of remediation required for CCS projects
- the limited understanding of permit requirements
- the limited CCS expertise within regulators to share regulatory experience
- community confidence in regulators
- engagement of trusted expertise or independent verification for regulators.

The opportunities suggested for consideration included:

- the potential for eco-tourism of CCS projects
- organising the sequencing of CCS project approvals by generating tools to help navigate through the process
- a nominated lead agency to run operations
- sharing knowledge across agencies using knowledge hubs within government departments and agencies.

#### 4.4.2 Emerging themes

The following key issues emerged from the cross cutting (CC) workshop discussions:

<b>CC1</b>	If an EES is to be the primary CCS planning and environment assessment process it would have to be aligned with a range of Commonwealth and Victorian statutory approvals (refer to Appendix B for the Mock Approvals and Permits Register). Opportunities may exist within current and future Commonwealth and Victorian regulatory reform processes to achieve improved coordination.
<b>CC2</b>	Community education is important to the success of CCS projects, ensuring that people feel safe and are aware of the benefits of CCS projects to the environment and economy.

## 5.0 Recommendations

The test toolkit workshop provided a forum for Australian and Victorian Government regulators to identify the key issues, gaps and overlaps, and opportunities relating to improving the regulation of CCS projects in Victoria.

The workshop confirmed that the existing regulatory framework is generally fit for purpose for CCS deployment in Victoria. However, it also identified opportunities to reduce the complexity of regulation for deploying CCS projects in Victoria.

Table 3 contains recommendations that could be adopted to enhance the capacity of the regulatory framework to accommodate CCS projects in Victoria. The recommendations are underpinned by the emerging themes that were identified from the test toolkit workshop and are intended to provide a basis for further analysis and subsequent forums between agencies. To assist in this process the recommendations are categorised as follows:

- **needs gap** – knowledge and capacity gaps relevant to deployment of CCS in Victoria
- **relationships** – opportunities to coordinate interactions between stakeholders
- **refinement of processes** – opportunities to improve guidelines and standards that inform the regulatory framework
- **secondary guidance** – opportunities to develop and/or promote best practice approach for deployment of CCS.

In order to set priorities in relation to these recommendations a timeframe has been indicated for each, being:

- short term is defined as one to three years
- medium term as three to five years
- project specific – actions that will either be project specific or require ongoing attention as CCS develops in Victoria and more widely across Australia
- regulatory reform – to be undertaken in conjunction with regulatory reform
- ongoing – actions underway that require continuing development.

The implementation of these recommendations will be considered and coordinated by the Steering Committee.

**Table 3 Global CCS Institute Regulatory Test Toolkit recommendations**

No.	Recommendation description	Rationale	Timeframe
<b>Needs Gap</b>			
1	Develop a strategy to increase the capacity within Australian and Victorian Government regulatory agencies to respond to CCS projects.	Responds to emerging theme S&C2.	Short term
2	Understanding emissions profiles of source and capture projects associated with CCS, including atmospheric emissions and airshed-implications, water consumption and waste generation.	Responds to emerging theme S&C4.	Short term as part of regulatory reform – such as Victoria State Environment Protection Policy (Ambient Air Quality).
3	Coordinate analysis and modelling required to better understand project specific risks associated with controlled and uncontrolled release and dispersion from CO2 pipelines.	Responds to emerging theme T3.	Project specific
<b>Relationships</b>			
4	Leverage off regulatory reform in Commonwealth and Victorian statutory approvals processes to incorporate consideration of CCS.	Responds to emerging themes S&C1 and CC1.	Short-medium term as part of regulatory reform
5	Investigate opportunities to coordinate and sequence approvals for components of CCS chain.	Responds to emerging themes T1 and S6.	Project specific

No.	Recommendation description	Rationale	Timeframe
6	Develop programs to educate the community about CCS technology, particularly storage.	Responds to emerging themes S&C3 and S1.	Ongoing
<b>Refinement of processes</b>			
7	Benchmark international standards for CO <sub>2</sub> pipeline design against the Australian Standard for pipelines (AS2885) to ensure best practice application in Australia.	Responds to emerging theme T2.	Short term
8	Identify options for enabling cross-jurisdictional storage of CO <sub>2</sub> .	Responds to emerging themes S2 and S3.	Short term
9	Consider international approaches to storage performance and assess relevance to Australia, including performance monitoring as a means to verify integrity.	Responds to emerging theme S4. Consistent with the intent of the national measurement, monitoring and verification framework (Parsons Brinkerhoff 2012).	Short term
10	Consider need to align approach to long term storage liability across jurisdictions taking into account international developments.	Responds to emerging theme S4.	Short term
<b>Secondary guidance</b>			
11	Ensure CCS projects follow best practice for community engagement.	Responds to emerging theme CC2.	Project specific
12	Share and promote the outcomes of the test toolkit workshop and CCS framework in Victoria.	Responds to emerging theme S&C2.	Short term
13	Investigate methods to quantify greenhouse gas emissions (GHG) from CCS projects for the purposes of National Greenhouse and Energy Reporting Scheme (NGERS).	Responds to emerging theme S5. Consistent with the intent of amendments to the NGERS.	Medium term

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## Appendix A

# Introduction to CCS

S U P P O R T E D   B Y



GLOBAL  
CCS  
INSTITUTE



Australian Government  
Department of Industry

DEPARTMENT OF  
STATE DEVELOPMENT  
BUSINESS AND  
INNOVATION



Global Carbon Capture and Storage Regulatory Test Toolkit  
01-Aug-2013

# Introduction to Carbon Capture and Storage



AECOM

## Introduction to Carbon Capture and Storage

Client: Department of State Development, Business and Innovation

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## 1.0 Introduction

Carbon Capture and Storage (CCS) is a process where carbon dioxide (CO<sub>2</sub>) emissions are captured, compressed and conveyed to a storage facility, usually a deep geological formation. It is mostly applicable to high emission industrial systems, such as coal-fired power stations and steel production plants. While CCS is a viable option for significantly curbing CO<sub>2</sub> emissions, it crosses many regulatory boundaries and subsequently requires coordination of existing regulatory frameworks. As a result, testing a regulatory framework can help to minimise the time and cost risks associated with regulatory approvals for a CCS project.

The purpose of this report is to provide an introduction to CCS. This includes the rationale for CCS, international and Australian context, key components of the CCS process, an overview of international and Australian CCS projects, and an overview of the Global CCS Institute Regulatory Test Toolkit.

## 2.0 Rationale for CCS

A substantial collection of scientific evidence now indicates that accelerated climate change is occurring due to anthropogenic activities. Furthermore, it indicates that without significant reductions in greenhouse gas emissions, there is a strong possibility of devastating environmental impacts from climate change effects (NRC, 2010). Since the Industrial Revolution, CO<sub>2</sub> emissions from the burning of fossil fuels for energy have increased rapidly (Leggett, 2007), and as a result, there needs to be a concentrated focus on restricting CO<sub>2</sub> emissions from industrial activities.

According to the International Energy Agency (IEA), CCS is necessary to meet urgent climate change mitigation targets, as it provides an option to minimise carbon emissions for industrial and power sectors. Its large scale deployment could contribute about 20 per cent of the mitigation of CO<sub>2</sub> emissions globally (IEA, 2012). Additionally, it is considered one of the few technologies which allow countries with large coal reserves (e.g. Australia) to utilise their vast reserves while helping to mitigate the greenhouse gas emissions from their utilisation. This is particularly important given the extent to which current economic activity is reliant on the combustion of fossil fuels and/or other industrial methods producing CO<sub>2</sub> emissions (KAPSARC, 2012).

## 3.0 Context for CCS

CCS is a technology which covers various regulatory and legislative contexts, both internationally and in Australia. Comprehending the complexity of large scale CCS deployment requires various international and Australian programs, policies and legislations involving CCS to be examined.

### 3.1 International

Various policy forums, legal and regulatory actions internationally have focused on accelerating large scale CCS deployment. CCS initiatives on an international scale include:

- the Global CCS Institute
- Major Economies Forum (MEF) on Energy and Climate
- the Carbon Capture, Use and Storage (CCUS) Action Group, an initiative of the Clean Energy Ministerial (CEM).

#### 3.1.1 Global Carbon Capture and Storage Institute

In 2008, Prime Minister Kevin Rudd pledged \$100 million per year to establish and operate the Global CCS Institute (Global CCS Institute, 2009). The aim of the Global CCS Institute is to accelerate the development of CCS globally through knowledge sharing activities, fact-based influential advice and advocacy to create favourable conditions to implement CCS.

The Global CCS Institute supports the large scale deployment of CCS as a “vital, safe and clean technology” within a range of clean energy technologies required for the minimisation of greenhouse gas emissions. With 370 members from more than 40 countries the Global CCS Institute is one of the largest global centres of CCS expertise internationally. Members encompass several national governments, global corporations and small companies, environmental non-government organisations and research and education institutes. Through its

extensive networks, the Global CCS Institute aims to create a platform for mutual sharing of knowledge which will ensure a quick and efficient deployment of CCS technologies around the world (Global CCS Institute, 2013a).

Regular meetings, committee events and direct engagements are usually held between members to guide the programs and projects of the Global CCS Institute. A number of active partnerships are also in place between the Global CCS Institute and key stakeholders to support the future of CCS technology. Some of these partnerships include:

- International Energy Agency (IEA)
- World Bank
- The Climate Group
- Asian Development Bank (ADB)
- Clinton Climate Initiative
- Carbon Sequestration Leadership Forum (CSLF) (Global CCS Institute, 2013a).

### **3.1.2 Major Economies Forum on Energy and Climate**

Launched in March 2009, the Major Economies Forum (MEF) on Energy and Climate was created to enable an open dialogue to occur between major developed and developing economies and help create the political leadership needed to accomplish an effective outcome at the annual UN climate negotiations. Furthermore, the MEF aims to progress “concrete initiatives and joint ventures” which increase the green energy supply and cut greenhouse gas emissions (MEF, 2009a).

With 17 major economies participating in the MEF, several technology action plans (TAPs) were created prior to the 2009 United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen, which consisted of ten plans of actions to be taken up by each of the participating countries (some of which were joint partnerships). Each TAP corresponded to a unique clean energy technology, which would jointly focus on mitigation of more than 80% of the energy sector CO<sub>2</sub> emission reduction potential identified by the IEA (MEF, 2009b). This helped shape initiatives of the Clean Energy Ministerial (CEM), which in turn produced the Carbon Capture, Use and Storage (CCUS) Action Group, a joint initiative of Australia and the United Kingdom.

### **3.1.3 Clean Energy Ministerial and the Carbon Capture, Use and Storage Action Group**

During the United Nations Framework Convention on Climate Change (UNFCCC) held in 2009, the US Secretary of Energy, Steven Chu declared the first Clean Energy Ministerial (CEM) would be hosted in July 2010 in Washington D.C. to bring together energy ministers from leading clean energy technology countries. Since then, the CEM has been an international forum which advocates programs and policies that develop clean energy technology, discusses best practice technologies and lessons learned and promotes the transition to a global clean energy economy (CEM, 2013a).

The CEM (2013a) is focused on three global climate and energy policy goals:

- improve energy efficiency worldwide
- enhance clean energy supply
- expand clean energy access.

Building on the TAPs provided through the MEF (see section 3.1.2 above), the CEM created various ‘initiatives’ which were implemented by chosen participating countries (as seen in the TAPs). One of these initiatives was the formation of the Carbon Capture, Use and Storage (CCUS) Action Group.

The purpose of the CCUS Action Group is to “provide recommendations to the Clean Energy Ministerial (CEM) on concrete, near-term actions to accelerate the global deployment of CCS”. Formed in 2010 by the governments of Australia and the United Kingdom, it gathers several governments, industries and institutions to “facilitate political leadership” in creating actions and ensuring their progress (CEM, 2013b). It considers the large scale deployment of CCS to be an integral part of a low-cost approach to diminishing greenhouse gas emissions.

The CCUS Action Group endeavours to accelerate CCS deployment globally by highlighting the primary barriers and producing near-term actions to overcome or minimise them. It does this by facilitating an essential dialogue between industries (e.g. Shell, Alstom) and governments (e.g. Australia, China) so that impediments to deployment of CCS can be practically addressed (CEM, 2013b).

## 3.2 Australia

In Australia, there has been a significant push through various programs, policies and legislation for the implementation of CCS technology.

### 3.2.1 CCS Flagships program

The CCS Flagships program was established under the Australian Government's Clean Energy Initiative in 2009 to support the construction of large scale integrated CCS projects in Australia.

The Australian Government has allocated funding of \$1.18 billion to the CCS Flagships program. Two CCS demonstration projects have been awarded flagship status and funding – the Collie South West Hub in Western Australia (2011) and the CarbonNet Project Victoria (2012).

The CarbonNet Project has been allocated the most funds through the CCS Flagships program as of 2012. Up to \$100 million in total (of which \$70 million is from the CCS Flagships program) has been designated to the project for feasibility stage works, which involves the modelling and testing of potential CO<sub>2</sub> storage formations as well as activities around technical integration, commercial frameworks, stakeholder engagement and environmental approvals and regulations. The project aims to capture CO<sub>2</sub> emissions from various industries in Victoria, including coal-fired power plants in the Latrobe Valley, compress the CO<sub>2</sub> and inject it into geological formations deep below ground in the nearby Gippsland Basin (DRET, 2013a).

### 3.2.2 Key Commonwealth CCS legislation and regulation

The primary Commonwealth legislation for CCS is the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (*OPGGS Act*), which applies within Commonwealth waters (the area beyond three nautical miles from the Territorial sea baseline). The OPGGS Act enables a more discrete separation of petroleum industry regulations and CCS regulation (Hester & Harrison, 2010, p. 92-96). The purpose of the Act is to provide a national "effective regulatory framework for the injection and storage of greenhouse gas substances in offshore areas" (OPGGS Act, s.3b). The Act establishes a system for regulating the construction and operation of greenhouse gas infrastructure facilities, such as the integrity of the injection well and pipelines conveying greenhouse gas substances, including in relation to environment and safety. It also regulates the exploration for potential greenhouse gas storage formations and injection of greenhouse gas substances into viable storages. Licences for various CCS activities are required under the Act, including licences for pipelines, greenhouse gas injection and infrastructure in Commonwealth offshore areas.

### 3.2.3 Key Victorian CCS legislation and regulation

In terms of state legislation, Victoria is the only state in Australia with specific legislation in place regarding onshore and offshore geosequestration.

For onshore greenhouse gas emissions sequestration, the *Greenhouse Gas Geological Sequestration Act 2008* (Vic) (*GGGS Act*) was formed to "facilitate and regulate the injection of greenhouse gas substances into underground geological formations" (GGGS Act, s.1). It also facilitates and regulates the exploration of potential underground geological storage formations. As with the OPGGS Act (Cth), the GGGS Act (Vic) requires licences and permits to be acquired for injection, exploration and monitoring activities.

Additionally, the *Offshore Petroleum and Greenhouse Gas Storage Act 2010* (Vic) (OPGGS Act) regulates the construction and operation of greenhouse gas infrastructure and pipelines in the Victorian offshore area. It also regulates exploration of potential greenhouse gas storage formations and the injection of greenhouse gas emissions into these storages.

## 3.3 Impediments to CCS

While large scale CCS projects in operation around the world demonstrate the technology's potential (see section 5.0), challenges remain to deployment on a broad scale. These include technical, financial and social considerations (Stigson et al., 2012; IEA, 2013). The CEM's forth assessment report identifies three primary impediments to the deployment of CCS in industrial applications:

- remaining knowledge gaps around cost and technical performance
- the potential impacts of CCS on market competitiveness
- engagement and developing public understanding of CO<sub>2</sub> transport and storage (IEA, 2013).

According to the International Energy Agency (IEA, 2013), pollution control methods such as CCS require policy action for large scale deployment. This requires alignment and coordination between levels of government in order for CCS projects to succeed, as visible conflict is likely to erode public confidence. It is also necessary to consider public perception and community engagement to bring about a more coordinated and aligned vision (Ashworth et al, 2011).

The CCUS Action Group suggested several initiatives to help overcome the challenges of CCS deployment to the CEM in April 2011, such as:

- developing policies which focus on the financial gap and risks related with early mover CCS demonstration and deployment
- ascertaining applicable funding mechanisms which can support large scale CCS demonstration projects in developing nations
- sharing knowledge of the development of best practice CCS projects
- reviewing the key data gaps in understanding CO<sub>2</sub> storage, particularly with regard to exploration and capacity of potential storages (CEM, 2011).

Ashworth et al (2011) advise the importance of engaging the public early with CCS projects. They discuss the importance of understanding the community, identifying the local benefits which the CCS project could bring and highlight the importance of considering how the information is communicated e.g. using multiple information sources and a variety of forums for informal as well as formal engagement. Ashworth et al (2011) recommend establishing and maintaining trust through transparent and frequent communication throughout the course of the project.

Some of the recommendations discussed above are being executed through global knowledge sharing forums such as the Global CCS Institute.

## 4.0 Components of CCS

There are three primary components which constitute the overall CCS process. These are:

- **source and capture** of the CO<sub>2</sub> emissions through the use of various separation processes
- **transport** of the CO<sub>2</sub> by-product from the capture hubs to the storage area
- **storage** of the CO<sub>2</sub> in a geological formation.

An example of the CCS process is shown in Figure 4.1; and the listed components are discussed in detail below.

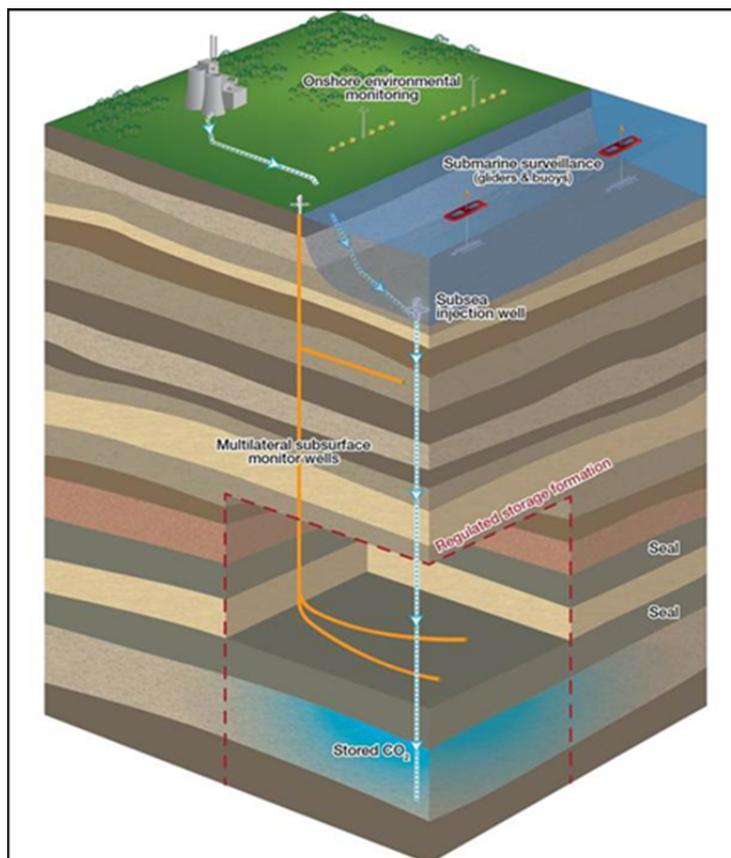


Figure 4.1 The CCS Process (CO2CRC)

## 4.1 Source and capture

Capture of CO<sub>2</sub> at the source is the first step in the CCS process and can occur through a variety of technology options depending on the type of industrial activity. It can be (and has been) sourced from any large scale high CO<sub>2</sub> emitting industrial process, from coal-fired power generation to cement and steel manufacturing and gas processing. Depending on the source, and capture technology, CO<sub>2</sub> can be mixed with traces of other gaseous by-products such as nitrogen or sulphur.

### 4.1.1 Capture methods and technologies

There are a variety of capture methods and technologies for the separation and collection of CO<sub>2</sub> emissions from flue gases. These are:

- **pre-combustion capture** – involves decarbonating the fuel before the combustion process. Alternatively, the fuel can also be converted into a gaseous combination of hydrogen and carbon dioxide. The hydrogen is then diverted into the combustion process while the CO<sub>2</sub> is captured (Global CCS Institute 2013e)
- **post-combustion capture** – is where CO<sub>2</sub> is trapped by a chemical or physical process from the flue gas after the combustion process. Further processing to release a pure gaseous form of CO<sub>2</sub> is then undertaken by heating, applying a pressure reduction or by using chemical absorption (Koorneef et al. 2011) readying it for capture
- **oxyfueling** – where the combustion process itself is altered to use pure oxygen instead of air; or, where oxygen is separated from the air and used in the combustion process. Nevertheless, the process relies on the use of pure oxygen so that CO<sub>2</sub> by-products are not substantially mixed with nitrogen (Hester and Harrison, 2010, p.60-61).

The mechanisms behind the capture methods and technologies listed above are summarised in a flowchart for power generation in Figure 4.2.

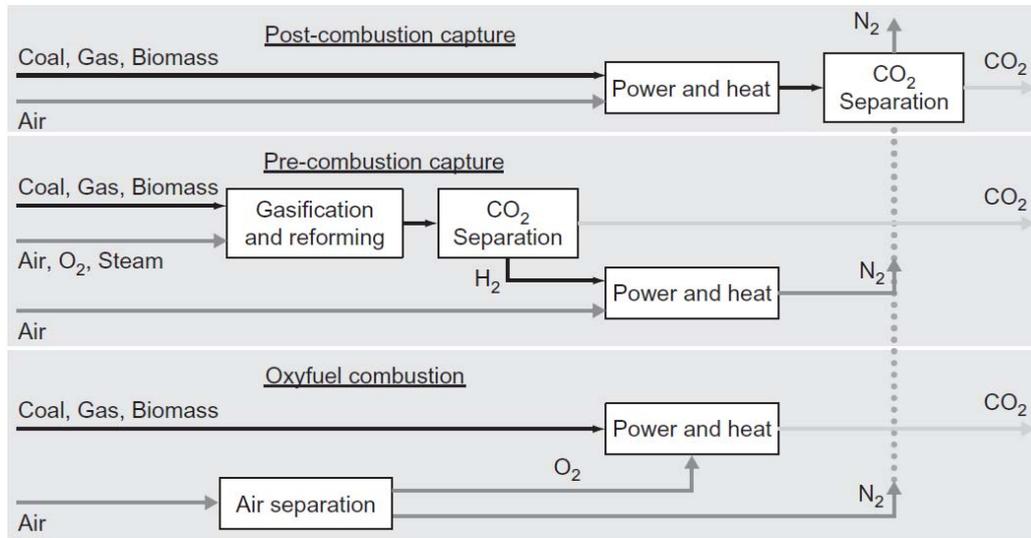


Figure 4.2 The three basic options for CO<sub>2</sub> capture in power generation (Rackley, 2010, p.67)

#### 4.1.2 Key considerations

Key considerations when understanding how to deploy carbon capture in power generation include:

- whether or not the installation of new power plants are **carbon capture ready**
- whether existing power plants can be **retrofitted** to allow for various carbon capture options.

These considerations present economic challenges, such as the capital costs of installation and the potential of a future carbon market to be addressed.

In the case of retrofitting existing power plants, technical challenges may include:

- space for additional capture equipment
- energy capacity of the plant
- capture process-specific factors.

The economic feasibility of retrofitting plants for carbon capture is a key consideration; especially for less efficient plants (i.e. will the retrofitting monetary and energy costs outweigh the energy consumption of the plant itself) (Rackley, 2010, p.84-86).

## 4.2 Transport

There are a number of key considerations around transporting CO<sub>2</sub>, particularly with regards to the extent of transport infrastructure and investment needed to deploy CCS on a large scale (Global CCS Institute, 2013f).

#### 4.2.1 Modes of transport

Three modes of transportation for CO<sub>2</sub> have been utilised previously:

- **pipelines** are often the favoured method of transporting CO<sub>2</sub>, particularly due to their ability to transport significant amounts of various gases. Technology for pipeline transport has already been developed for CO<sub>2</sub> and other gases, such as in the United States (US) which currently has over 5,630 km of CO<sub>2</sub> pipelines in operation primarily for Enhanced Oil Recovery (EOR) projects (Kadnar 2008)
- **marine transportation** is also well developed for transporting gases such as liquefied petroleum gas (LPG) on a large scale. While ships have been used to transport CO<sub>2</sub> on a smaller scale, there is potential to increase this mode of transportation if necessary, drawing on extensive knowledge such as within the LPG industry

- **road and rail transportation** methods are options, but primarily deployed on smaller scales. It is unlikely that this method will be utilised for large scale deployment of CCS (Global CCS Institute, 2013f).

#### 4.2.2 Key considerations

Key considerations when analysing CO<sub>2</sub> transportation options include:

- the safety of CO<sub>2</sub> transportation including actions to prevent any corrosion of the pipe from the presence of water vapour in the CO<sub>2</sub>, and design of the pipeline itself (Gale and Davison (2004)
- ability to develop the transportation infrastructure required for large scale deployment of CCS
- economic considerations - for example, integrated networks of CO<sub>2</sub> pipelines connecting several CO<sub>2</sub> sources to individual storage reservoirs provide better cost and operability advantages (Gale and Davison, 2004).

### 4.3 Storage

A CO<sub>2</sub> storage site will typically consist of a layer of porous, permeable rock – into which the CO<sub>2</sub> will be injected in a condensed, liquid-like state – overlaid by a layer of impermeable, non-porous rock, which acts as a seal and contains the stored CO<sub>2</sub> within the porous layer. This is similar to how oil and gas have remained naturally trapped for millions of years, and in many cases depleted oil and gas reservoirs serve as suitable CO<sub>2</sub> storage sites.

Storage site exploration and selection is a complex and comprehensive process. In Australia, the Carbon Storage Taskforce (CSTF) was created by the Department of Resources, Energy and Tourism (DRET) to identify the storage potential of geological formations around Australia (DRET, 2013b). From these studies, the CSTF produced a National Carbon Mapping and Infrastructure Plan (NCMIP), which ranked sites of geological storage potential around Australia. The Gippsland Basin in Victoria was found to have the highest technical ranking of any storage basin and the largest storage potential of any east coast basin in Australia (CSTF, 2009).

#### 4.3.1 Storage characteristics and options

Storage locations are identified and assessed for the following characteristics:

- **porosity** of the rock needs to be sufficient to allow for the injection of CO<sub>2</sub>
- **permeability** (connectivity of the pores) of the rock needs to be high enough to allow for the movement and spread of CO<sub>2</sub>. This is important for maximising the amount of CO<sub>2</sub> which can be injected into the rock
- **geological barrier** must cap the formation to effectively trap the CO<sub>2</sub> for centuries or millennia (Global CCS Institute, 2013g).

The effectiveness of a geological barrier depends on a combination of physical and geochemical trapping mechanisms, including:

- **structural trapping** where the compressed CO<sub>2</sub> (which is lighter than water) rises within the storage reservoir and is trapped by the overlying cap rock
- **residual trapping** where CO<sub>2</sub> becomes trapped as residual droplets within the pore spaces in the reservoir rock
- **dissolution and mineral trapping** where CO<sub>2</sub> dissolves into formation water present in the porous rock or where dissolved CO<sub>2</sub> reacts with and is bound to the surrounding rock to form solid carbonate minerals (CO<sub>2</sub> Capture Project 2008).

#### 4.3.2 Key considerations

Other key considerations in CO<sub>2</sub> storage selection include:

- **capacity** of the underground storage must be taken into account
- **cost of storage** is an important factor to consider and is influenced by the quality and capacity of the storage site and the cost of establishing infrastructure
- **data availability** is an important issue with storage due to the sheer complexity of the technical aspects of data measurement.

The long-term liability associated with the storage of CO<sub>2</sub> is also an important issue. As geological storage involves extended timeframes, the regulatory framework must efficiently deal with the liability posed by risks associated with geological storage over time. "Unlike under the Commonwealth Offshore CCS regulations, the Victoria Offshore and Onshore CCS regulations do not provide for the transfer of common law liability to the State following the authorised closure of the site" (CO<sub>2</sub> Capture Project, 2012 pg. 10).

## 5.0 Potential development of CCS

Potential development of CCS is growing, with numerous projects both internationally and in Australia. To minimise time, cost and risk, most CCS projects take a staged approach, where each component is tested at a time.

### 5.1 International CCS projects

Internationally, there are around 70 large scale CCS projects underway, with most of them in planning and development stages. Figure 5.1 below identifies large scale CCS projects in planning, construction or operation.



Figure 5.1 Location of existing large scale CCS projects around the world in planning, construction or operation (Global CCS Institute, 2013b)

Figure 5.1 shows, the majority of large scale CCS projects are in the United States and Europe. Figure 5.2 shows the projects by region and stage.

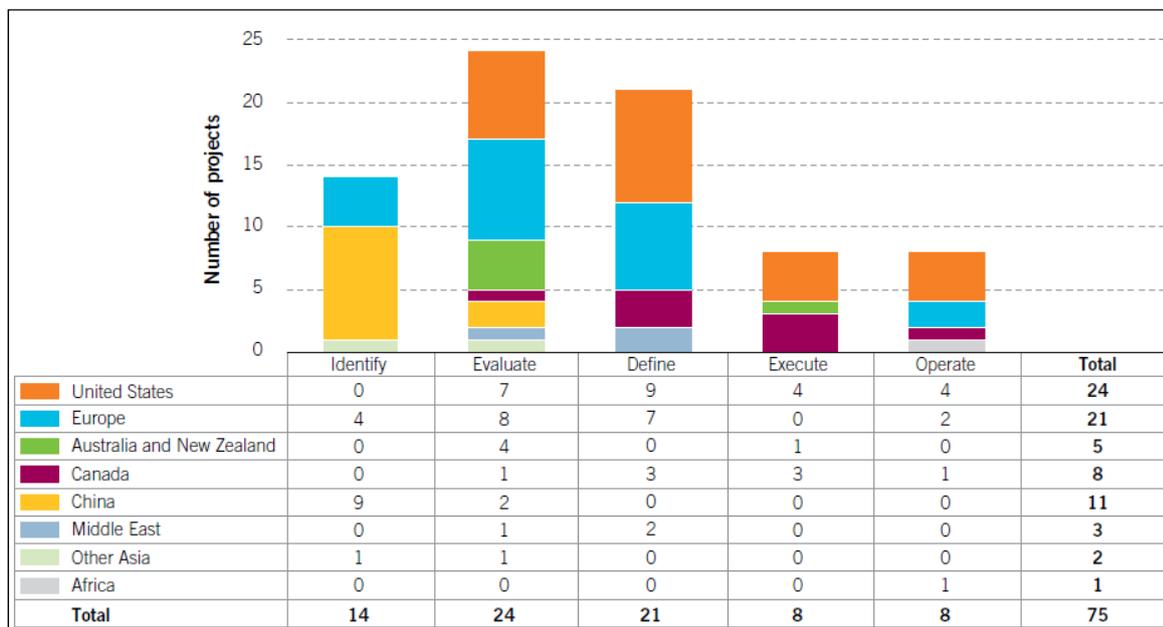


Figure 5.2 Large scale integrated CCS projects by lifecycle stage and region/country (Global CCS Institute, 2012a, p.16).

While many CCS projects are in the planning and development phases ('identify', 'evaluate' or 'define' phases), some large CCS projects are currently in operation, such as the Snohvit CO<sub>2</sub> Injection project in Norway. This project is fully operational and CO<sub>2</sub> emissions have been injected and stored into the Snohvit gas field since 2008 (Global CCS Institute, 2013c). The offshore Snohvit gas field produces approximately 7 billion cubic metres of natural gas per annum, which is pumped into an LNG (liquefied natural gas) plant onshore at Melkoya. Capture of the CO<sub>2</sub> occurs as a pre-combustion process, where around 700,000 tonnes of CO<sub>2</sub> per annum is collected using solvents from the incoming LNG stream and re-injected into a 2.6 kilometre deep offshore saline formation in the Snohvit gas field. A monitoring program has been installed underground to analyse the behaviour of the CO<sub>2</sub> (Global CCS Institute, 2013c). The project was led by Statoil, a Norwegian international oil and gas company, and funded by a combination of Statoil's industrial partners and the Norwegian Government.

Another prominent CCS project is the Weyburn-Midale Carbon Dioxide (WMCD) project in Canada. Since its establishment in 2000, the WMCD project has stored over 20 million tonnes of CO<sub>2</sub> in the Weyburn and Midale fields. This is done through the pre-combustion capture of CO<sub>2</sub>, before it is used in Enhanced Oil Recovery (EOR) and eventually stored. Being one of the older CCS projects, it has provided substantial amounts of data and understanding of CCS storage, with additional injection and production wells being installed to increase the volume of CO<sub>2</sub> (Global CCS Institute, 2013d).

CCS projects scheduled to commence operation in Canada shortly include the Boundary Dam CCS project. Boundary Dam is a demonstration project led by SaskPower Inc. in Saskatchewan, Canada, which involves the post-combustion capture and storage of CO<sub>2</sub>. CO<sub>2</sub> emissions from the Boundary Dam Power Station will be transported via a carbon steel pipeline to either deep onshore saline formations or sold to oil and gas companies for use in EOR projects. The project is anticipated to capture up to one million tonnes of CO<sub>2</sub> per annum starting in early 2014 (SaskPower, 2013).

Another Canadian CCS project which is gaining prominence is the Quest CCS project in Alberta, which aims to capture and store more than one million tonnes of CO<sub>2</sub> annually from oil sands operations. The project included an Environmental Impact Assessment (EIA) and consultation with key stakeholders before investment, was approved in September 2012 and is aiming to be operational in 2015 (Shell Canada, 2013).

## 5.2 Australian CCS projects

As of 2012 in Australia, there are several CCS projects in feasibility, development and operation at present, as shown in Figure 5.3.

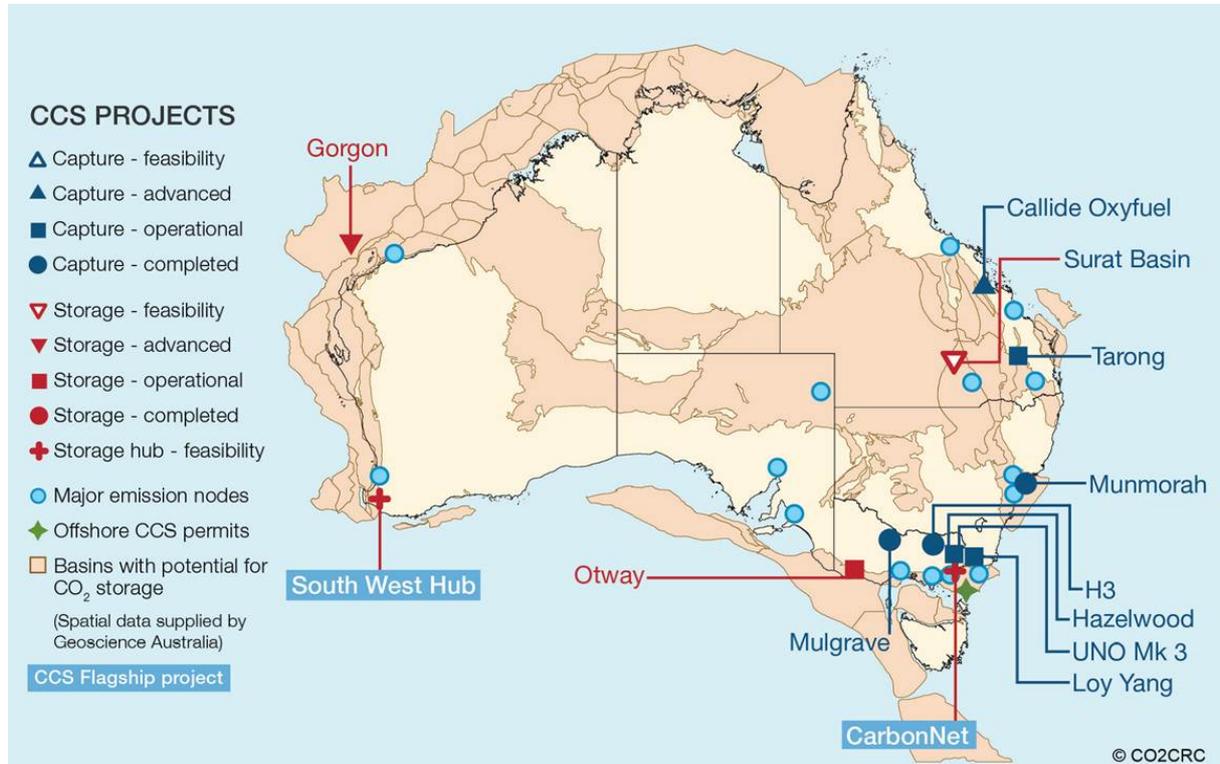


Figure 5.3 CCS Projects in Australia as of 2012 (CO2CRC, 2013a)

Projects such as the Callide-A Oxyfuel in Queensland and the Gorgon in Western Australia are currently in development.

The Callide-A Oxyfuel project is a demonstration project currently operational as of 2013 and involves a conversion of an existing 30 megawatt coal-fired power plant unit. It utilises the oxyfuel process of CO<sub>2</sub> capture, where pure oxygen is fed directly into the combustion process (see section 4.1.1). The project has strong financial investment from several governments, including Australia, Queensland and Japan. Additionally, coal industry members such as Xstrata and CS Energy have helped fund the project to minimise cost impediments to its expansion.

Gorgon in Western Australia is a major sequestration project focussed on pre-combustion capture of CO<sub>2</sub> from LNG production, an industrial process. It aims to utilise offshore storage in the form of deep saline aquifers underneath Barrow Island, around 2.4 kilometres underground. All government approvals have been granted and the final investment decision made. This project is funded by major oil and gas corporations Chevron (which is operating the project), Shell and ExxonMobil, and will be the largest CCS project in the world once operational with between 3.4 and 4 million tonnes of CO<sub>2</sub> expected to be stored each year (Global CCS Institute 2013h).

The CO2CRC Otway project in south-western Victoria is the “world’s largest research and geosequestration project” (CO2CRC, 2013b). The Otway project is being carried out in two stages:

- the first stage involved over 65,000 tonnes of carbon dioxide-rich gas being stored and monitored in a depleted gas reservoir – trapped by a seal rock above the formation and a sealing fault at the side of the formation
- the second stage is currently underway and involves testing the underground CO<sub>2</sub> storage mechanism known as residual gas trapping. This is where the CO<sub>2</sub> is stored within porous rock as miniscule, disconnected bubbles, which restricts the movement of the CO<sub>2</sub>.

The Otway project received regulatory approvals and met various petroleum, water and environmental statutory requirements, such as the *Planning and Environment Act 1987* and *Environment and Protection Act 1970* for its research purposes. Community consultation and reference groups have been integral to the development of this research project to involve and inform the local community (Jenkins et al., 2011). Funding support came largely from major gas, coal and power companies, research organisations and governments, including Australia, Victoria and the US Department of Energy (CO2CRC, 2013b). Additionally, it has been recognised for developing a comprehensive monitoring program for the depleted gas fields where CO<sub>2</sub> is being injected and stored.

## 6.0 Global CCS Institute Regulatory Test Toolkit

The Global CCS Institute Regulatory Test Toolkit was created to assist governments (national and regional) which aim to determine whether their regulatory framework can accommodate CCS deployment. It tests a given CCS project application – either real or hypothetical – by applying it to all stages of the approvals process for a given regulatory framework. By doing so, the test toolkit endeavours to minimise cost, time and risks associated with CCS project applications and provides greater knowledge of the regulatory frameworks existing for CCS processes. Various factors are taken into account when testing regulatory frameworks, including:

- whether the regulatory framework is comprehensive and covers all aspects
- identifying any gaps or overlaps in the regulatory process
- ensuring defined roles for regulators
- investigating whether the regulatory frameworks are best practice
- determining whether the framework minimises the administrative, time, and cost burden for Government, industry, the applicant/proponents and regulators while providing community confidence.

The test exercises are designed to be performed by government agencies, with inputs from relevant regulatory agencies. Additionally, stakeholders such as those from industry and academia who are involved with the process are able to gain a greater appreciation for how they can participate in the regulatory process.

The regulatory test exercise investigates regulations already in place for the (real or hypothetical) CCS project, and assesses regulatory requirements at each stage over the life of the project, from feasibility to decommissioning. Some of the benefits of this detailed analysis include:

- a better grasp of the regulatory frameworks and how it affects all stakeholders involved
- clarity on specific requirements, such as licences and permits, information, timescales for planning and approvals, organisations to be engaged and the expertise
- clarity on potential gaps and overlaps
- greater development of community interest and involvement in the process (Global CCS Institute, 2011).

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## Appendix B

# Mock Approvals and Permits Register

S U P P O R T E D   B Y



GLOBAL  
CCS  
INSTITUTE



Australian Government  
Department of Industry

DEPARTMENT OF  
STATE DEVELOPMENT  
BUSINESS AND  
INNOVATION



Global Carbon Capture and Storage Institute Regulatory Test Toolkit  
19-Nov-2013

# Mock Toolkit CCS Project - Approvals and Permits Register



AECOM

## Mock Toolkit CCS Project - Approvals and Permits Register

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			Name/Position	Signature
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2	28-Jun-2013	Draft	Mathew Peel Project Manager	
3	25-Jul-2013	Final draft	Mathew Peel Project Manager	
4	01-Aug-2013	Final Draft	Mathew Peel Project Manager	
5	19-Nov-2013	Final	Mathew Peel Project Manager	

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## Introduction

The Global Carbon Capture and Storage (CCS) Institute Regulatory Test Toolkit was created to assist governments (national and regional) with the aim of determining whether their regulatory framework can accommodate CCS deployment.

## Purpose

This approvals and permits register is for a hypothetical CCS project, the Mock Toolkit CCS Project. The purpose of this Mock Toolkit CCS Project is to determine whether the existing regulatory framework can accommodate a CCS project. By doing so, the test endeavours to minimise cost, time and risks associated with CCS project applications and provides greater knowledge of the regulatory frameworks and their application for CCS processes in Victoria. Various factors are taken into account when testing regulatory frameworks, including:

- whether the regulatory framework is comprehensive and covers all aspects
- identifying any gaps or overlaps in the regulatory process
- ensuring defined roles for regulators
- whether or not the regulatory frameworks are best practice
- determining whether the framework minimises the administrative, time, and cost burden for Government, industry, the applicant/proponent and regulators while providing community confidence.

While the Victorian Government is currently investigating CCS, this Mock Toolkit CCS Project does not reflect any specific details or decision related to any proposed CCS project or investigation. The assumptions include an existing power station (not any specific existing power station) with post combustion capture as the source and storage in Commonwealth Waters.

## Overview of register

The approvals and permits register should be read in conjunction with the description of the Mock Toolkit CCS Project, including each project component.

The approvals and permits register includes relevant statutory requirements for each component of the Mock Toolkit CCS Project, including:

- whole of project
- source and capture
- onshore transport – collector hub and spur, trunk pipeline and distribution hub
- offshore transport – seafloor pipeline to storage formation under Commonwealth waters
- storage formation under Commonwealth waters.

A summary of these requirements is presented in Figure 1.

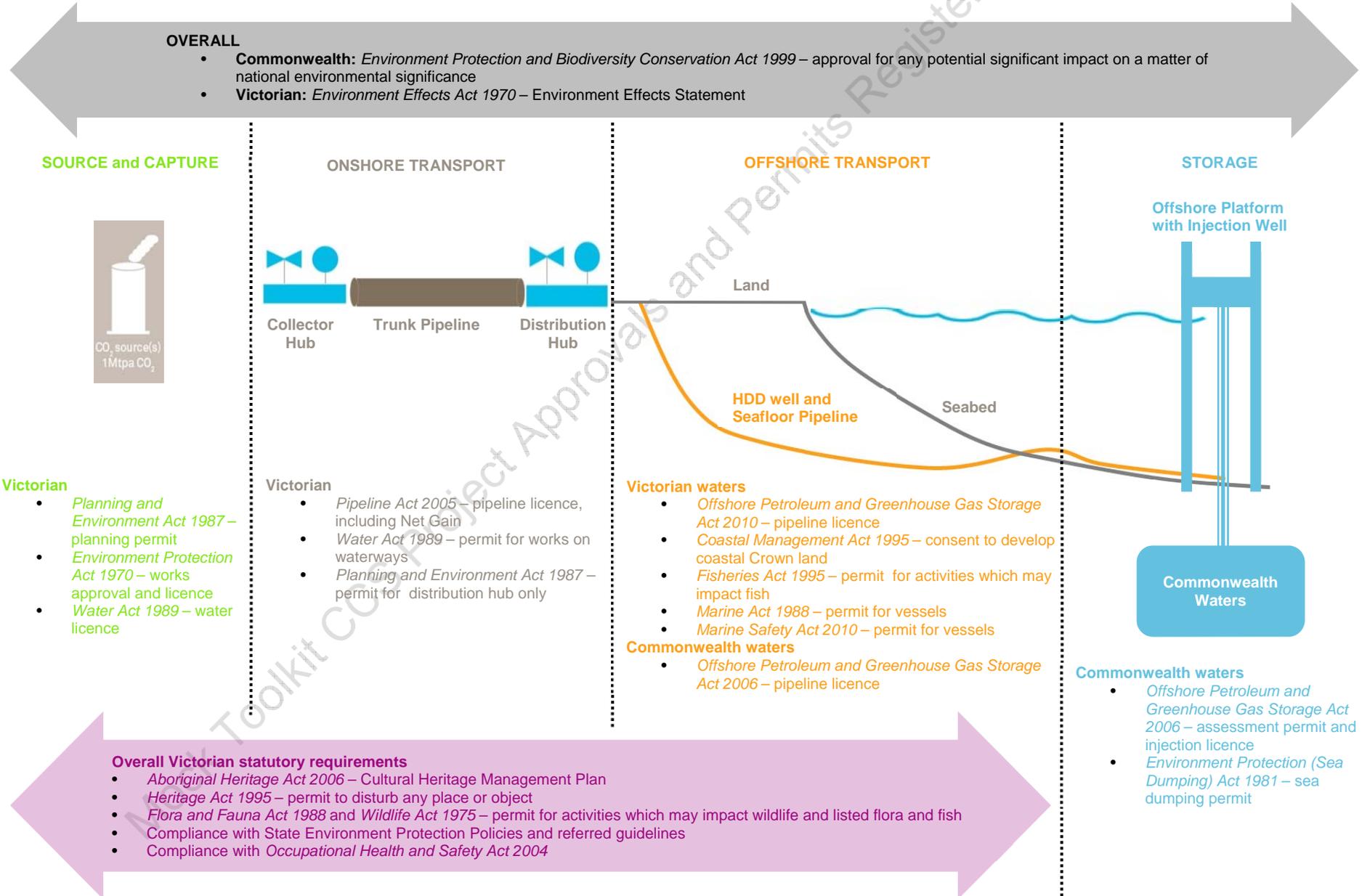
The approvals and permits register also includes relevant statutory requirements for two potential variations to the Mock Toolkit CCS Project, being:

- offshore transport via Extended Reach Drilling (ERD) to storage formation under Victorian waters
- storage formation under Victorian waters.

For each relevant approval and permit, the register identifies the name of the approval, legislation / policy, granting authority and work needed to complete submission, as well as providing a brief description and consideration of timing, relevance to the Mock Toolkit CCS Project and staging (construction, operation and decommissioning).

The approvals and permits register focuses on statutory approvals and so does not address land access and tenure requirements.

Figure 1 Mock Toolkit CCS Project – Key Commonwealth and Victorian statutory requirements



## Appendix A

# Mock Toolkit CCS Project - Approvals and Permits Register

## Mock Toolkit CCS Project - Approvals &amp; Permits Register

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
<b>Whole of project</b>												
1	Whole of Project	General	Ministerial Approval	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) (Cth)	This Act requires that any action that is likely to have a significant impact on matters of national environmental significance be referred to the Commonwealth Minister who determines whether it is a 'controlled action' and if (and what) further assessment is required prior to approval.	The Project may require referral if it is likely to have a significant impact on any matters of national environmental significance. The Minister may determine it is a 'controlled action' and required further assessment prior to approval.	✓	✓	✓	Minister for the Environment Department of the Environment	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Referral with supporting documentation. Further assessment (if required)
2	Whole of Project	General	Environment Effects Statement (EES)	<i>Environment Effects Act 1970</i> (Vic)	This Act provides for the assessment of the environmental effects of projects capable of having a significant effect on the environment. Under section 10 of the Act, the Ministerial Guidelines provide for assessment of Environmental Effects which set out the process for a proponent to refer projects and provide detail of the administration of the Environment Effects Statement (EES) process.	The Project may require referral to the Minister for Planning if the referral criteria are met. The Minister then determines whether an EES is required. The EES assessment is accredited by the Commonwealth under the EPBC Act, allowing for joint assessment where the Project is also considered to be a 'controlled action'. An EPA Works Approval can be jointly advertised with the EES.	✓	✓	✓	Minister for Planning Department of Transport, Planning and Local Infrastructure (DTPLI)	If required, prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Referral with supporting documentation. Further assessment (if required)
3	Whole of Project	Aboriginal cultural heritage	Cultural Heritage Management Plan (CHMP)	<i>Aboriginal Heritage Act 2006</i> (Vic)	This Act provides for the protection and management of Victoria's Aboriginal cultural heritage with processes linked to the Victorian planning system. A Cultural Heritage Management Plan is required where all or part of the activity area is an area of cultural heritage sensitivity and all or part of the activity is a high impact activity. At a local level, this Act provides for Registered Aboriginal Parties (RAPs), who are responsible for evaluating and approving CHMPs.	The Project is likely to require a Cultural Heritage Management Plan for all areas on land in Victoria due to: - all or part of the activity area is an area of cultural heritage sensitivity - all or part of the activity is considered a high impact activity. A CHMP is also mandatory for any project that is required to prepare an EES under the <i>Environment Effects Act 1970</i> (Vic). A CHMP may be required for operation and decommissioning activities depending upon how these differ from construction.	✓	✓	✓	Registered Aboriginal Party - Gunaikurnai Land and Waters Aboriginal Corporation Please note: Under the <i>Native Title Act 1993</i> that the Gunaikurnai people hold native title over much of Gippsland. In addition to this, the Gunaikurnai people have entered into an agreement with the Victorian Government under the <i>Traditional Owner Settlement Act 2010</i> , which formally recognises them as the traditional owners over land within that area.	Prior to works commencing. Potential for requirements during construction.	CHMP
4	Whole of Project	General	Ministerial Approval	<i>Project Development and Construction Act 1994</i> (Vic) 19/11/2013	This Act can be used to facilitate public construction projects in Victoria, where public construction means any matter relating to the construction, maintenance, rehabilitation, alteration, extension or demolition of any improvements on land by, or on behalf of, departments or public bodies and includes: - design and construction practices - tendering processes - project delivery - contract administration.	As a large scale, state run public construction project, the Mock Toolkit CCS Project may seek to use this Act to facilitate development including for the project proposition and nomination, the acquisition of land grants, oversight of modification to state roads and any requisite taxes related to public projects.	✓	x	x	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI)	Prior to works commencing.	Nomination order and supporting documentation
<b>Source and capture project</b>												
5	Source and capture	Greenhouse Gas	Registration and Reporting	<i>National Greenhouse and Energy Reporting Act 2007</i> (Cth)	This Act is the primary legislation governing the monitoring and reporting of organisations to report their greenhouse gas emissions and energy consumption. The Act establishes corporate and facility based thresholds for greenhouse gas reporting. If these thresholds are exceeded, corporations must register and report their greenhouse gas emissions, energy consumption, and energy production.	The project may require registration and reporting if facilities exceed 25kt CO <sub>2</sub> equivalent of emissions and/or 100TJ of energy use per year. The threshold for corporations is 50kt of CO <sub>2</sub> equivalent and/or 200TJ of energy use per year.	x	✓	✓	Minister for Climate Change Clean Energy Regulator	If required, during operation and decommissioning.	Registration and reporting (if required)
6	Source and capture	Land use	Planning Permit / Planning Scheme Amendment	<i>Planning and Environment Act 1987</i> (Vic)	This Act provides a framework for planning the use, development and protection of land, including native vegetation through the Net Gain requirements. It also establishes the Victorian Planning Provisions.	The source and capture project will require planning approval.	✓	✓	x	Minister for Planning Department of Transport, Planning and Local Infrastructure (DTPLI) Latrobe City Council	Prior to works commencing. Potential for requirements during construction and operation.	Application and supporting documentation

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
7	Source and capture	European heritage	Heritage Permit	<i>Victorian Heritage Act 1995 (Vic)</i>	This Act provides for the protection and conservation of places and objects of cultural heritage significance and the registration of such places and objects.	The Project may require a permit if it disturbs any place or object.	✓	x	x	Heritage Victoria Heritage Council of Victoria	Prior to works commencing.	Application and supporting documentation
8	Source and capture	Catchments, surface water and flooding	Works on Waterways Permit	<i>Water Act 1989 (Vic)</i>	This Act promotes the orderly, equitable and efficient use of Victoria's water resources by governing the way water entitlements are issued and allocated in Victoria. In addition to provide a formal means for the management and protection of catchments and to encourage community participation in the management of land and water resources.	In accordance with the Waterway Protection By-law, the Project will require a Works on Waterways Permit for any works or activities in, on, or over a designated waterway.	✓	x	x	West Gippsland Catchment Management Authority	Prior to works commencing. Potential for requirements during construction.	Application and supporting documentation
9	Source and capture	Catchments, surface water and flooding	Water Licence(s)	<i>Water Act 1989 (Vic)</i>	This Act promotes the orderly, equitable and efficient use of Victoria's water resources by governing the way water entitlements are issued and allocated in Victoria. In addition to provide a formal means for the management and protection of catchments and to encourage community participation in the management of land and water resources.	The Project may require a s51 take and use licence if additional water is taken or used from a waterway or groundwater. A s67 licence may be required to construct or operate a groundwater bore.	✓	✓	✓	Southern Rural Water	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Application and supporting documentation
10	Source and capture	Ecology	Permit	<i>Flora and Fauna Guarantee Act 1988 (Vic)</i>	This Act promotes and enables the conservation of Victoria's native flora and fauna and provides procedures which can be used for: - the conservation and management or control of flora and fauna. - the management of potentially threatening processes including: Net Gain processes, permits for research and for the translocation of species.	A permit is required under this Act for Project activities on public land which include: - the removal and translocation of protected plants and to collect samples of taxonomic identification - the removal of protected fish for the purposes of translocation - the clearing of very high conservation vegetation - conducting surveys for monitoring.	✓	x	x	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, during construction	Application and supporting documentation
11	Source and capture	Ecology	Management Authorisation	<i>Wildlife Act 1975 (Vic)</i>	This Act promotes the protection and conservation of wildlife, the prevention of taxa of wildlife becoming extinct and the sustainable use of and access to wildlife and to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife.	An authorisation is required under this Act for Project activities which may impact wildlife.	✓	x	x	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, during construction	Application and supporting documentation
12	Source and capture	Greenhouse Gas	Works Approval and Licence	<i>Environment Protection Act 1970 (Vic)</i>	This Act requires a works approval and licence for premises which capture, separate, process or store waste carbon dioxide for the purpose of geological disposal. The regulations provide exemptions from these requirements where operations as defined by and carried out in accordance with the <i>Greenhouse Gas Geological Sequestration Act 2008 (Vic)</i> .	The source and capture project is likely to require a new works approval and new or amended licence. The exemptions for premises which capture, separate and process carbon dioxide are unlikely to apply given the storage formation is in Commonwealth waters and so not licenced under the <i>Greenhouse Gas Geological Sequestration Act 2008 (Vic)</i> . An EPA Works Approval can be jointly advertised with the EES, which can streamline the process.	✓	✓	✓	Environment Protection Authority Victoria Department of Health (referral authority)	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Application and supporting documentation
13	Source and capture	Groundwater contamination	Demonstrate compliance	State Environment Protection Policies (SEPP) (Groundwaters of Victoria)	This SEPP aims to maintain and, where necessary, improve groundwater quality to a standard that protects existing and potential beneficial uses of groundwaters. It sets a consistent approach to, and provides quality objectives for groundwater protection throughout Victoria.	The source and capture must demonstrate compliance with the SEPP (Groundwaters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
14	Source and capture	Catchments, surface water and flooding	Demonstrate compliance	State Environment Protection Policies (SEPP) (Waters of Victoria)	This SEPP sets the framework for government agencies, businesses and the community to work together to protect and rehabilitate the environmental quality of Victoria's streams, lakes, estuaries, and marine environments.	The source and capture must demonstrate compliance with the SEPP (Waters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
15	Source and capture	Air Quality	Demonstrate compliance	State Environment Protection Policy (SEPP) (Air Quality Management)	This SEPP establishes the framework for managing emissions into the air environment in Victoria from all sources of air pollutants, so that the air quality objectives outlined in the SEPP (Ambient Air Quality) are met and the cleanest air possible is achieved, having regard to the economic and social development of Victoria. The management framework and attainment program for protection of the air environment contained in SEPP (Air Quality Management) addresses not only ambient (or regional) air quality, but also the management of particular sources (for example, industry, motor vehicles and open burning) and local air quality impacts, including air toxics, odorous pollutants, greenhouse gases and ozone depleting substances.	The source and capture must demonstrate compliance with the SEPP (Air Quality Management).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
16	Source and capture	Noise and Vibration	Demonstrate compliance	Noise from industry in regional Victoria (NIRV) - Environment Protection Authority publication -1411	The NIRV is a non-statutory guideline published by EPA Victoria, it recommends maximum noise levels from commerce, industry and trade premises in regional Victoria. NIRV's recommended levels do not have the force of law. Statutory instruments, such as a planning permit or notice, can be used to give legal effect to the recommended levels.	The source and capture must demonstrate compliance with the NIRV recommended noise levels in accordance with the relevant planning controls.	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
17	Source and capture	Geology and Soils (Acid Sulfate Soils)	Demonstrate compliance	Industrial Waste Management Policy (Waste Acid Sulfate Soils)	This policy aims to protect human health and the environment from this risk by providing a management framework and specific requirements for the management of acid sulfate soils in an environmentally responsible manner.	The source and capture must demonstrate compliance with the Industrial Waste Management Policy concerning Waste Acid Sulfate Soils (including waste disposal licence or approved EMP where required).	✓	x	x	Environment Protection Authority Victoria	Prior to works commencing	Demonstrate compliance
18	Source and capture	Contaminated land	Demonstrate compliance	State Environment Protection Policy (SEPP) (Prevention and Management of Contamination of Land)	This SEPP sets out requirements for the prevention of contamination, reinforces the role of the waste hierarchy in selecting preferred approaches for site clean-up and identifies measures by which people can access relevant information on site contamination.	The source and capture must demonstrate compliance with the SEPP (Prevention and Management of Contamination of Land).	✓	x	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
19	Source and capture	Health and Safety	Major hazard facility (MHF) licence	Occupational Health and Safety Act 2004 (Vic)	Under this Act notification and registration of any facility holding above 100% of the threshold quantities for dangerous goods listed in Schedule 9 of the Victorian Occupational Health and Safety Regulations 2007, is considered a Major Hazard Facility (MHF). Facilities which are between 10% and 100% of the threshold quantities must notify WorkSafe when quantities first exceed 10% in order for WorkSafe to determine if the facility is a MHF. Where it is known prior to modification or construction being complete early notification is advisable.	The source and capture projects must determine whether they will exceed the threshold quantities for dangerous goods set out in Schedule 9 of the Victorian Occupational Health and Safety Regulations 2007 post construction and/or modification.	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
20	Source and capture	Health and Safety	Demonstrate compliance	Occupational Health and Safety Act 2004 (Vic)	Provides a framework to control health and safety issues in the workplace.	The source and capture project must demonstrate compliance with the Occupational Health and Safety Act 2004.	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
21	Source and capture	Health and Wellbeing	Demonstrate compliance	Public Health and Wellbeing Act 2008	The purpose of this Act is to enact a legislative scheme which promotes and protects public health and wellbeing in Victoria. The Act covers a wide range of matters and has implied provisions, such as for the development of public health policy through municipal public health and wellbeing plans, a State public health and wellbeing plan and in some circumstances, health impact assessments.	The source and capture project must demonstrate compliance with the Public Health and Wellbeing Act 2008.	✓	✓	✓	Latrobe City Council Department of Health	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
<b>Collector hub and spur</b>												
22	Onshore Transport	Environment	Licence	<i>Pipelines Act 2005</i> (Vic)	This Act facilitates and establishes all aspects of pipeline licencing and construction for onshore pipelines (including apparatus and works in relation to a pipe or system of pipes) carrying petroleum, oxygen, carbon dioxide, hydrogen, nitrogen, compressed air, sulphuric acid or methanol. This includes native vegetation Net Gain requirements.	A licence under this Act is required for the construction and operation of the collector hub (which satisfies the definition of "apparatus and works" under this Act).	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI) Energy Safe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Environment Management Plan Safety Management Plan Consent to Operate a Pipeline from DSDBI and Energy Safe Victoria Pipeline Consultation Plan Guideline
23	Onshore Transport	European heritage	Heritage Permit	<i>Victorian Heritage Act 1995</i> (Vic)	This Act provides for the protection and conservation of places and objects of cultural heritage significance and the registration of such places and objects.	The Project may require a permit under this Act if it disturbs any place or object.	✓	✗	✗	Heritage Victoria Heritage Council of Victoria	If required, prior to works commencing	Application and supporting documentation
24	Onshore Transport	Ecology	Permit	<i>Flora and Fauna Guarantee Act 1988</i> (Vic)	This Act promotes and enables the conservation of Victoria's native flora and fauna and provides procedures which can be used for: - the conservation and management or control of flora and fauna. - the management of potentially threatening processes including: Net Gain processes, permits for research and for the translocation of species.	A permit is required under this Act for Project activities on public land which include: - the removal and translocation of protected plants and to collect samples of taxonomic identification - the removal of protected fish for the purposes of translocation - the clearing of very high conservation vegetation - conducting surveys for monitoring	✓	✗	✗	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
25	Onshore Transport	Ecology	Management Authorisation	<i>Wildlife Act 1975</i> (Vic)	This Act promotes the protection and conservation of wildlife, the prevention of taxa of wildlife becoming extinct and the sustainable use of and access to wildlife and to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife.	An authorisation is required under this Act for Project activities which may impact wildlife.	✓	✗	✗	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
26	Onshore Transport	Air Quality	Demonstrate compliance	State Environment Protection Policy (SEPP) (Air Quality Management)	This SEPP establishes the framework for managing emissions into the air environment in Victoria from all sources of air pollutants, so that the air quality objectives outlined in the SEPP (Ambient Air Quality) are met and the cleanest air possible is achieved, having regard to the economic and social development of Victoria. The management framework and attainment program for protection of the air environment contained in SEPP (Air Quality Management) addresses not only ambient (or regional) air quality, but also the management of particular sources (for example, industry, motor vehicles and open burning) and local air quality impacts, including air toxics, odorous pollutants, greenhouse gases and ozone depleting substances.	The collector hub must demonstrate compliance with the SEPP (Air Quality Management).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning	Demonstrate compliance
27	Onshore Transport	Noise and Vibration	Demonstrate compliance	Noise from industry in regional Victoria (NIRV) - Environment Protection Authority publication -1411	The NIRV is a non-statutory guideline published by EPA Victoria, it recommends maximum noise levels from commerce, industry and trade premises in regional Victoria. NIRV's recommended levels do not have the force of law. Statutory instruments, such as a planning permit or notice, can be used to give legal effect to the recommended levels.	The collector hub must demonstrate compliance with the NIRV recommended noise levels in accordance with the relevant planning controls.	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
28	Onshore Transport	Geology and Soils (Acid Sulfate Soils)	Demonstrate compliance	Industrial Waste Management Policy (Waste Acid Sulfate Soils)	This policy aims to protect human health and the environment from this risk by providing a management framework and specific requirements for the management of acid sulfate soils in an environmentally responsible manner.	The collector hub must demonstrate compliance with the Industrial Waste Management Policy concerning Waste Acid Sulfate Soils (including waste disposal licence or approved EMP where required).	✓	✗	✗	Environment Protection Authority Victoria	Prior to works commencing	Demonstrate compliance
29	Onshore Transport	Contaminated land	Demonstrate compliance	State Environment Protection Policy (SEPP) (Prevention and Management of Contamination of Land)	This SEPP sets out requirements for the prevention of contamination, reinforces the role of the waste hierarchy in selecting preferred approaches for site clean-up and identifies measures by which people can access relevant information on site contamination.	The collector hub must demonstrate compliance with the SEPP (Prevention and Management of Contamination of Land).	✓	✗	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
30	Onshore Transport	Health and Safety	Demonstrate compliance	<i>Occupational Health and Safety Act 2004</i> (Vic)	Provides a framework to control health and safety issues in the workplace.	The collector hub must demonstrate compliance with the <i>Occupational Health and Safety Act 2004</i> .	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
<b>Trunk pipeline</b>												
31	Onshore Transport	Environment	Licence or Permit	<i>Pipelines Act 2005 (Vic)</i>	This Act facilitates and establishes all aspects of pipeline licencing and construction for onshore pipelines (including apparatus and works in relation to a pipe or system of pipes) carrying petroleum, oxygen, carbon dioxide, hydrogen, nitrogen, compressed air, sulphuric acid or methanol. This includes native vegetation Net Gain requirements.	A licence under this Act is required for the construction and operation of an onshore pipeline.	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI) Energy Safe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning,	Environment Management Plan Safety Management Plan Consent to Operate a Pipeline from DSDBI and Energy Safe Victoria Pipeline Consultation Plan Guideline
32	Onshore Transport	Land use (includes marine)	Application for consent	<i>Coastal Management Act 1995 (Vic)</i>	Under this Act a consent is required for the use or development of coastal Crown land.	A permit under this Act is required for the development of the Project if on: - land reserved for the protection of the coastline - Crown land within 200 m of high water mark - the coastal waters of Victoria - the sea within the limits of Victoria - the sea-bed of the coastal waters of Victoria.	✓	✗	✗	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
33	Onshore Transport	European heritage	Heritage Permit	<i>Victorian Heritage Act 1995 (Vic)</i>	This Act provides for the protection and conservation of places and objects of cultural heritage significance and the registration of such places and objects.	The Project will require a permit under this Act to disturb any place or object.	✓	✗	✗	Heritage Victoria Heritage Council of Victoria	If required, prior to works commencing	Application and supporting documentation
34	Onshore Transport	Catchments, surface water and flooding	Works on Waterways Permit	<i>Water Act 1989 (Vic)</i>	This Act promotes the orderly, equitable and efficient use of Victoria's water resources by governing the way water entitlements are issued and allocated in Victoria. In addition to provide a formal means for the management and protection of catchments and to encourage community participation in the management of land and water resources.	In accordance with the Waterway Protection By-law, the Project will require a Works on Waterways Permit for any works or activities in, on, or over a designated waterway.	✓	✗	✗	West Gippsland Catchment Management Authority	Prior to works commencing	Application and supporting documentation
35	Onshore Transport	Ecology	Permit	<i>Flora and Fauna Guarantee Act 1988 (Vic)</i>	This Act promotes and enables the conservation of Victoria's native flora and fauna and provides procedures which can be used for: - the conservation and management or control of flora and fauna. - the management of potentially threatening processes including: Net Gain processes, permits for research and for the translocation of species.	A permit is required under this Act for Project activities on public land which include: - the removal and translocation of protected plants and to collect samples of taxonomic identification - the removal of protected fish for the purposes of translocation - the clearing of very high conservation vegetation - conducting surveys for monitoring.	✓	✗	✗	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
36	Onshore Transport	Ecology	Management Authorisation	<i>Wildlife Act 1975 (Vic)</i>	This Act promotes the protection and conservation of wildlife, the prevention of taxa of wildlife becoming extinct and the sustainable use of and access to wildlife and to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife.	An authorisation is required under this Act for Project activities which may impact wildlife.	✓	✗	✗	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
37	Onshore Transport	Groundwater contamination	Demonstrate compliance	State Environment Protection Policies (SEPP) (Groundwaters of Victoria)	This SEPP aims to maintain and, where necessary, improve groundwater quality to a standard that protects existing and potential beneficial uses of groundwaters. It sets a consistent approach to, and provides quality objectives for groundwater protection throughout Victoria.	Onshore transport must demonstrate compliance with the SEPP (Groundwaters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning,	Demonstrate compliance
38	Onshore Transport	Catchments, surface water and flooding	Demonstrate compliance	State Environment Protection Policies (SEPP) (Waters of Victoria)	This SEPP sets the framework for government agencies, businesses and the community to work together to protect and rehabilitate the environmental quality of Victoria's streams, lakes, estuaries, and marine environments.	Onshore transport must demonstrate compliance with the SEPP (Waters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning,	Demonstrate compliance

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
39	Onshore Transport	Air Quality	Demonstrate compliance	State Environment Protection Policy (SEPP) (Air Quality Management)	This SEPP establishes the framework for managing emissions into the air environment in Victoria from all sources of air pollutants, so that the air quality objectives outlined in the SEPP (Ambient Air Quality) are met and the cleanest air possible is achieved, having regard to the economic and social development of Victoria. The management framework and attainment program for protection of the air environment contained in SEPP (Air Quality Management) addresses not only ambient (or regional) air quality, but also the management of particular sources (for example, industry, motor vehicles and open burning) and local air quality impacts, including air toxics, odorous pollutants, greenhouse gases and ozone depleting substances.	Onshore transport must demonstrate compliance with the SEPP (Air Quality Management).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
40	Onshore Transport	Noise and Vibration	Demonstrate compliance	Noise from industry in regional Victoria (NIRV) - Environment Protection Authority publication -1411	The NIRV is a non-statutory guideline published by EPA Victoria, it recommends maximum noise levels from commerce, industry and trade premises in regional Victoria. NIRV's recommended levels do not have the force of law. Statutory instruments, such as a planning permit or notice, can be used to give legal effect to the recommended levels.	Onshore transport must demonstrate compliance with the NIRV recommended noise levels in accordance with the relevant planning controls.	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
41	Onshore Transport	Geology and Soils (Acid Sulfate Soils)	Demonstrate compliance	Industrial Waste Management Policy (Waste Acid Sulfate Soils)	This policy aims to protect human health and the environment from this risk by providing a management framework and specific requirements for the management of acid sulfate soils in an environmentally responsible manner.	Onshore transport must demonstrate compliance with the Industrial Waste Management Policy concerning Waste Acid Sulfate Soils (including waste disposal licence or approved EMP where required).	✓	x	x	Environment Protection Authority Victoria	If required, prior to works commencing	Demonstrate compliance
42	Onshore Transport	Contaminated land	Demonstrate compliance	State Environment Protection Policy (SEPP) (Prevention and Management of Contamination of Land)	This SEPP sets out requirements for the prevention of contamination, reinforces the role of the waste hierarchy in selecting preferred approaches for site clean-up and identifies measures by which people can access relevant information on site contamination.	Onshore transport must demonstrate compliance with the SEPP (Prevention and Management of Contamination of Land).	✓	x	x	Environment Protection Authority Victoria	Prior to works commencing	Demonstrate compliance
43	Onshore Transport	Health and Safety	Demonstrate compliance	Occupational Health and Safety Act 2004 (Vic)	Provides a framework to control health and safety issues in the workplace.	Onshore transport must demonstrate compliance with the Occupational Health and Safety Act 2004.	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
<b>Distribution hub</b>												
44	Onshore Transport	Land use	Planning Permit / Planning Scheme Amendment	Planning and Environment Act 1987 (Vic)	This Act provides a framework for planning the use, development and protection of land, including native vegetation through the Net Gain requirements. It also establishes the Victorian Planning Provisions.	The distribution hub may will require planning approval under this Act.	✓	✓	x	Minister for Planning Department of Transport, Planning and Local Infrastructure (DTPLI) Wellington Shire Council	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning	Application and supporting documentation
45	Onshore Transport	Environment	Licence	Pipelines Act 2005 (Vic)	This Act facilitates and establishes all aspects of pipeline licencing and construction for onshore pipelines (including apparatus and works in relation to a pipe or system of pipes) carrying petroleum, oxygen, carbon dioxide, hydrogen, nitrogen, compressed air, sulphuric acid or methanol. This includes native vegetation Net Gain requirements.	A licence under this Act is required for the construction and operation of the distribution hub (for the component which satisfies the definition of "apparatus and works" under this Act).	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI) Energy Safe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning	Environment Management Plan Safety Management Plan Consent to Operate a Pipeline from DSDBI and Energy Safe Victoria Pipeline Consultation Plan Guideline
46	Onshore Transport	European heritage	Heritage Permit	Victorian Heritage Act 1995 (Vic)	This Act provides for the protection and conservation of places and objects of cultural heritage significance and the registration of such places and objects.	The Project will require a permit to disturb any place or object.	✓	x	x	Heritage Victoria Heritage Council of Victoria	If required, prior to works commencing	Application and supporting documentation
47	Onshore Transport	Catchments, surface water and flooding	Works on Waterways Permit	Water Act 1989 (Vic)	This Act promotes the orderly, equitable and efficient use of Victoria's water resources by governing the way water entitlements are issued and allocated in Victoria. In addition to provide a formal means for the management and protection of catchments and to encourage community participation in the management of land and water resources.	In accordance with the Waterway Protection By-law, the Project will require a Works on Waterways Permit for any works or activities in, on, or over a designated waterway.	✓	x	x	West Gippsland Catchment Management Authority	If required, prior to works commencing	Application and supporting documentation

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
48	Onshore Transport	Ecology	Permit	<i>Flora and Fauna Guarantee Act 1988</i> (Vic)	This Act promotes and enables the conservation of Victoria's native flora and fauna and provides procedures which can be used for: - the conservation and management or control of flora and fauna. - the management of potentially threatening processes including: Net Gain processes, permits for research and for the translocation of species.	A permit is required under this Act for Project activities on public land which include: - the removal and translocation of protected plants and to collect samples of taxonomic identification - the removal of protected fish for the purposes of translocation - the clearing of very high conservation vegetation - conducting surveys for monitoring.	✓	×	×	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
49	Onshore Transport	Ecology	Management Authorisation	<i>Wildlife Act 1975</i> (Vic)	This Act promotes the protection and conservation of wildlife, the prevention of taxa of wildlife becoming extinct and the sustainable use of and access to wildlife and to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife.	An authorisation is required under this Act for Project activities which may impact wildlife.	✓	×	×	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	Application and supporting documentation
50	Onshore Transport	Greenhouse Gas	Works Approval and Licence	<i>Environment Protection Act 1970</i> (Vic)	This Act requires a works approval and licence for premises which capture, separate, process or store waste carbon dioxide for the purpose of geological disposal. The regulations provide exemptions from these requirements where operations as defined by and carried out in accordance with the <i>Greenhouse Gas Geological Sequestration Act 2008</i> (Vic).	The distribution hub may require a works approval and licence if it has storage facilities. The exemptions for premises which store carbon dioxide are unlikely to apply given the storage formation is in Commonwealth waters and so not licenced under the <i>Greenhouse Gas Geological Sequestration Act 2008</i> (Vic). An EPA Works Approval can be jointly advertised with the EES, which can streamline the process.	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning	Application and supporting documentation
51	Onshore Transport	Groundwater contamination	Demonstrate compliance	State Environment Protection Policies (SEPP) (Groundwaters of Victoria)	The SEPP aims to maintain and, where necessary, improve groundwater quality to a standard that protects existing and potential beneficial uses of groundwaters. It sets a consistent approach to, and provides quality objectives for groundwater protection throughout Victoria.	The distribution hub must demonstrate compliance with the SEPP (Groundwaters of Victoria).	✓	✓	✓	Environment Protection Authority	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
52	Onshore Transport	Catchments, surface water and flooding	Demonstrate compliance	State Environment Protection Policies (SEPP) (Waters of Victoria)	This SEPP sets the framework for government agencies, businesses and the community to work together to protect and rehabilitate the environmental quality of Victoria's streams, lakes, estuaries, and marine environments.	The distribution hub must demonstrate compliance with the SEPP (Waters of Victoria).	✓	✓	✓	Environment Protection Authority	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
53	Onshore Transport	Air Quality	Demonstrate compliance	State Environment Protection Policy (SEPP) (Air Quality Management)	This SEPP establishes the framework for managing emissions into the air environment in Victoria from all sources of air pollutants, so that the air quality objectives outlined in the SEPP (Ambient Air Quality) are met and the cleanest air possible is achieved, having regard to the economic and social development of Victoria. The management framework and attainment program for protection of the air environment contained in SEPP (Air Quality Management) addresses not only ambient (or regional) air quality, but also the management of particular sources (for example, industry, motor vehicles and open burning) and local air quality impacts, including air toxics, odorous pollutants, greenhouse gases and ozone depleting substances.	The distribution hub must demonstrate compliance with the SEPP (Air Quality Management).	✓	✓	✓	Environment Protection Authority	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
54	Onshore Transport	Noise and Vibration	Demonstrate compliance	Noise from industry in regional Victoria (NIRV) - Environment Protection Authority publication -1411	The NIRV is a non-statutory guideline published by EPA Victoria, it recommends maximum noise levels from commerce, industry and trade premises in regional Victoria. NIRV's recommended levels do not have the force of law. Statutory instruments, such as a planning permit or notice, can be used to give legal effect to the recommended levels.	The distribution hub must demonstrate compliance with the NIRV recommended noise levels in accordance with the relevant planning controls.	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
55	Onshore Transport	Geology and Soils (Acid Sulfate Soils)	Demonstrate compliance	Industrial Waste Management Policy (Waste Acid Sulfate Soils)	This policy aims to protect human health and the environment from this risk by providing a management framework and specific requirements for the management of acid sulfate soils in an environmentally responsible manner.	The distribution hub must demonstrate compliance with the Industrial Waste Management Policy concerning Waste Acid Sulfate Soils (including waste disposal licence or approved EMP where required).	✓	×	×	Environment Protection Authority Victoria	If required, prior to works commencing	Demonstrate compliance

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
56	Onshore Transport	Contaminated land	Demonstrate compliance	State Environment Protection Policy (SEPP) (Prevention and Management of Contamination of Land)	This SEPP sets out requirements for the prevention of contamination, reinforces the role of the waste hierarchy in selecting preferred approaches for site clean-up and identifies measures by which people can access relevant information on site contamination.	The distribution hub must demonstrate compliance with the SEPP (Prevention and Management of Contamination of Land).	✓	*	*	Environment Protection Authority Victoria	Prior to works commencing	Demonstrate compliance
57	Onshore Transport	Health and Safety	Major hazard facility (MHF) licence	Occupational Health and Safety Act 2004 (Vic)	Under this Act notification and registration of any facility holding above 100% of the threshold quantities for dangerous goods listed in Schedule 9 of the Victorian Occupational Health and Safety Regulations 2007, is considered a Major Hazard Facility (MHF). Facilities which are between 10% and 100% of the threshold quantities must notify WorkSafe when quantities first exceed 10% in order for WorkSafe to determine if the facility is a MHF. Where it is known prior to modification or construction being complete early notification is advisable.	Prior to the construction of the distribution hub, determination of whether it will exceed the threshold quantities for dangerous goods set out in Schedule 9 of the Victorian Occupational Health and Safety Regulations 2007 is required.	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
58	Onshore Transport	Health and Safety	Demonstrate compliance	Occupational Health and Safety Act 2004 (Vic)	Provides a framework to control health and safety issues in the workplace.	The distribution hub must demonstrate compliance with the Occupational Health and Safety Act 2004.	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
<b>Offshore transport - Seafloor pipeline to storage formation under Commonwealth waters</b>												
59	Offshore Transport	Transport	Permit and licence	Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGGS Act) (Cth)	This Act provides regulation for infrastructure on the seabed (and for the storage formation) in the Commonwealth offshore area (area in excess of three nautical miles from the Territorial sea baseline). Activities require an Environment Plan and facilities OHS must be in accordance with a Safety Case, both accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).	This Act is relevant to pipelines within the Commonwealth offshore area which are authorised by pipeline licences under the OPGGS Act 2006 (Cth). For this project this pipeline will also require a licence under the Victorian OPGGS Act (for Victorian waters) and Pipeline Act 2005 (for land) (refer to those Acts in this register).	✓	✓	✓	Joint Authority (pipeline component only) consisting of the Commonwealth Minister for Industry and Victorian Minister for Energy and Resources (for Victorian waters) Commonwealth Minister for Industry / Department of Industry (for injection well infrastructure) National Offshore Petroleum Titles Administrator (NOPTA) (pipeline component only) National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (environment and OHS)	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Environment Plan Safety Case Well Operations Management Plans (WOMP)
60	Offshore Transport	Transport	Certificate	Navigational Act 1912 (Cth)	This Act relates to aspects of navigation and shipping and requires a certificate of compliance.	This Act is relevant to Australian works vessels as well as research craft undertaking monitoring	✓	✓	✓	Maritime Safety Authority	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
61	Offshore Transport	Transport	Permit and licence	Offshore Petroleum and Greenhouse Gas Storage Act 2010 (OPGGGS Act) (Vic)	Relates to granting titles to any offshore seafloor pipeline within the Victorian offshore area including: - construction and operation of infrastructure facilities relating to greenhouse gas construction and operation of pipelines for conveying greenhouse gas - exploration for potential greenhouse gas storage formations - injection and storage of greenhouse gas substances	This Act relates to any offshore seafloor pipeline within the Victorian offshore area. For this project this pipeline will also require a licence under the Commonwealth OPGGS Act (for Commonwealth waters) and Pipeline Act 2005 (for land) (refer to those Acts in this register).	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) - health and safety	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Environment and Safety Plan Well Operations Management Plans (WOMP)

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
62	Offshore Transport	Transport	Licence or Permit	<i>Pipelines Act 2005</i> (Vic)	All aspects of pipeline licencing and construction, including safety practices for <u>onshore pipelines</u> carrying petroleum, oxygen, carbon dioxide, hydrogen, nitrogen, compressed air, sulphuric acid or methanol.	This Act requires a permit for the construction of a single directional drilling operation commencing on land in Victoria. For this project this pipeline will also require a licence under the Victorian OPGGS Act (for Victorian waters) and Commonwealth OPGGS Act (for Commonwealth waters) (refer to those Acts in this register).	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI) Energy Safe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Environment Management Plan Safety Management Plan Consent to Operate a Pipeline from DSDBI and Energy Safe Victoria Pipeline Consultation Plan Guideline
63	Offshore Transport	Transport	Licence or Permit	<i>Marine Act 1988</i> (Vic)	This Act provides detail on registration of vessels and the pollution of Victorian waters, the implementation of certain international conventions and to provide for the efficient and safe operation of vessels on Victorian waters.	Relevant to works vessels as well as research craft undertaking monitoring that may be required for the Project offshore component located in Victorian waters.	✓	✓	✓	Minister for Ports Department of Transport, Planning and Local Infrastructure (DTPLI)	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Application and supporting documentation Demonstrate compliance
64	Offshore Transport	Transport	Licence or Permit	<i>Marine Safety Act 2010</i> (Vic)	This Act promotes safety of marine operations.	Relevant to marine vessels, workers and equipment required that may be required for the Project offshore component located in Victorian waters.	✓	✓	✓	Minister for Ports Transport Safety Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Application and supporting documentation Demonstrate compliance
65	Offshore Transport	Ecology	Licence or Permit	<i>Fisheries Act 1995</i> (Vic)	This Act provides for the regulation, management and conservation of Victorian fisheries including aquatic habitats.	Relevant to works vessels as well as research craft undertaking monitoring that may be required for the Project offshore component located in Victorian waters.	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI)	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Application and supporting documentation
66	Offshore Transport	Land use (includes marine)	Application for consent	<i>Coastal Management Act 1995</i> (Vic)	Under this Act a consent is required for the use or development of coastal Crown land.	A permit under this Act is required for the development of the Project if on: - land reserved for the protection of the coastline - Crown land within 200 m of high water mark - the coastal waters of Victoria - the sea within the limits of Victoria - the sea-bed of the coastal waters of Victoria.	✓	x	x	Minister for Environment and Climate Change Department of Environment and Primary Industries (DEPI)	If required, prior to works commencing	
67	Offshore Transport	Health and Safety	Demonstrate compliance	<i>Occupational Health and Safety Act 2004</i> (Vic)	Provides a framework to control health and safety issues in the workplace.	The offshore component must demonstrate compliance with the <i>Occupational Health and Safety Act 2004</i> .	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
<b>Storage - Storage formation under Commonwealth waters</b>												
68	Storage	Greenhouse Gas	Assessment permit	<i>Offshore Petroleum and Greenhouse Gas Storage Act 2006</i> (OPGGGS Act) (Cth)	Regulatory framework for injection and storage of greenhouse gas substances within Commonwealth waters. Activities require an Environment Plan and potentially a Well Operations Management Plan (WOMP) for wells accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).	The Project will require a greenhouse gas assessment permit for exploration in the permit area for potential greenhouse gas storage formations and potential greenhouse gas injection sites.	✓	x	x	Minister for Industry Department of Industry National Offshore Petroleum Titles Administrator (NOPTA) (pipeline component only) National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	Prior to works commencing	Site Plan Environment Plan Safety Case Well Operations Management Plans (WOMP)
69	Storage	Greenhouse Gas	Injection licence	<i>Offshore Petroleum and Greenhouse Gas Storage Act 2006</i> (OPGGGS Act) (Cth)	Regulatory framework for injection and storage of greenhouse gas substances within Commonwealth waters. Activities require an Environment Plan and operations require a site plan accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).	The Project will require a greenhouse gas injection licence to carry out operations for the injection and permanent storage of greenhouse gas substances in a licence area within an identified greenhouse gas storage formation.	x	✓	✓	Minister for Industry Department of Industry National Offshore Petroleum Titles Administrator (NOPTA) (pipeline component only) National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	Prior to operation commencing. Potential for requirements during operation and in decommissioning.	Site Plan Environment Plan Safety Case Well Operations Management Plans (WOMP)
70	Storage	Greenhouse Gas	Permit	<i>Environment Protection (Sea Dumping) Act 1981</i> (Cth)	For offshore sub-seabed geological storage of CO <sub>2</sub> in Australian waters (the territorial sea of Australia and any sea that is on the landward side of the territorial sea of Australia, other than any part of the sea within the limits of a State e.g. Port Phillip Bay).	A permit will be required to store greenhouse gas substances.	x	✓	✓	Minister for the Environment Department of the Environment		Application and supporting documentation

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
<b>Variation - Offshore transport - Extended Reach Drill (ERD) well to storage formation under Victorian waters</b>												
71	Offshore Transport	Transport	Licence Special Authority	Offshore Petroleum and Greenhouse Gas Storage Act 2010 (OPGGGS Act) (Vic)	This Act provides for access for pipelines within the Victorian offshore area including: - construction and operation of infrastructure facilities relating to greenhouse gas construction and operation of pipelines for conveying greenhouse gas - exploration for potential greenhouse gas storage formations - injection and storage of greenhouse gas substances	The construction and operation of the ERD well will be licenced under this Act.	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) - health and safety	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Environment and Safety Plan Well Operations Management Plans (WOMP)
72	Offshore Transport	Transport	Special Drilling Authorisation	Greenhouse Gas Geological Sequestration Act 2008 (Vic) (GGGS Act)	This Act facilitates and regulates the injection of greenhouse gas substances into underground storage formations for the purpose of permanent storage, including facilitating and regulating the exploration for suitable underground geological storage formations.	This Act provides a Special Drilling Authority to be issued for drilling operations and approval requirements from the location of the onshore well to the tide line.	✓	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation (DSDBI)	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Environment Plan Well Operations Management Plans (WOMP) Safety Case
73	Offshore Transport	Catchments, surface water and flooding	Demonstrate Compliance	State Environment Protection Policies (SEPP) (Waters of Victoria)	This SEPP sets the framework for government agencies, businesses and the community to work together to protect and rehabilitate the environmental quality of Victoria's streams, lakes, estuaries, and marine environments.	The offshore transport must demonstrate compliance with the SEPP (Waters of Victoria) particularly in relation to the drilling site and its proximity to streams, lakes or estuaries.	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
74	Offshore Transport	Groundwater contamination	Demonstrate Compliance	State Environment Protection Policies (SEPP) (Groundwaters of Victoria)	This SEPP aims to maintain and, where necessary, improve groundwater quality to a standard that protects existing and potential beneficial uses of groundwaters. It sets a consistent approach to, and provides quality objectives for groundwater protection throughout Victoria.	The offshore transport must demonstrate compliance with the SEPP (Groundwaters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
75	Offshore Transport	Health and Safety	Demonstrate compliance	Occupational Health and Safety Act 2004 (Vic)	Provides a framework to control health and safety issues in the workplace.	The offshore transport must demonstrate compliance with the Occupational Health and Safety Act 2004.	✓	✓	✓	Worksafe Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance

Item No.	Place in CCS Chain	Aspect	Name of Approval	Legislation / Policy	Description	Relevance to project	Construction	Operation	Decommissioning	Granting Authority	Timing	Work needed to complete submission
<b>Variation - Storage formation under Victorian waters</b>												
76	Storage	Greenhouse Gas	Permit	<i>Environment Protection (Sea Dumping) Act 1981 (Cth)</i>	For offshore sub-seabed geological storage of CO <sub>2</sub> in Australian waters (the territorial sea of Australia and any sea that is on the landward side of the territorial sea of Australia, other than any part of the sea within the limits of a State e.g. Port Phillip Bay).	A permit will be required to store greenhouse gas substances.	x	✓	✓	Minister for the Environment Department of the Environment		Application and supporting documentation
77	Storage	Greenhouse Gas	Assessment permit	<i>Offshore Petroleum and Greenhouse Gas Storage Act 2010 (OPGGGS Act) (Vic)</i>	The regulation of geological storage of CO <sub>2</sub> in the Victorian offshore area (area to three nautical miles from the Territorial sea baseline).	The Project will require a greenhouse gas assessment permit to explore in the permit area for potential greenhouse gas storage formations and potential greenhouse gas injection sites.	✓	x	x	Minister for Energy and Resources Department of State Development, Business and Innovation National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) - health and safety	Prior to works commencing.	Site Plan Environment and Safety Plan Well Operations Management Plans (WOMP)
78	Storage	Greenhouse Gas	Injection licence	<i>Offshore Petroleum and Greenhouse Gas Storage Act 2010 (OPGGGS Act) (Vic)</i>	The regulation of geological storage of CO <sub>2</sub> in the Victorian offshore area (area to three nautical miles from the Territorial sea baseline).	The Project will require a greenhouse gas injection licence to carry out greenhouse gas injection and storage operations in the licence area.	x	✓	✓	Minister for Energy and Resources Department of State Development, Business and Innovation National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) - health and safety	Prior to operations commencing. Potential for requirements during operation and in decommissioning.	Environment and Safety Plan Well Operations Management Plans (WOMP)
79	Storage	Greenhouse Gas	Works Approval and Licence	<i>Environment Protection Act 1970 (Vic)</i>	A works approval and licence are required for premises which capture, separate, process or store waste carbon dioxide for the purpose of geological disposal. The regulations provide exemptions from these requirements where operations as defined by and carried out in accordance with the GGGGS Act.	The application of this Act needs to be further considered in consultation with the EPA. The exemptions for premises which capture, separate and process carbon dioxide are unlikely to apply given the storage formation is in Victorian waters and so not licenced under the Greenhouse Gas Geological Sequestration Act 2008 (Vic). Where an EPA Works Approval is required, it can be jointly advertised with an EES, which can streamline the process.	?	?	?	Environment Protection Authority Victoria		Application and supporting documentation
80	Storage	Groundwater contamination	Water Licence	<i>Water Act 1989 (Vic)</i>	This Act promotes the orderly, equitable and efficient use of Victoria's water resources by governing the way water entitlements are issued and allocated in Victoria. In addition to provide a formal means for the management and protection of catchments and to encourage community participation in the management of land and water resources.	The Project may require approval under s76 of the Act for underground disposal in Victorian waters.	x	✓	✓	Minister for Water Department of Environment and Primary Industries (DEPI)	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Application and supporting documentation
81	Storage	Groundwater contamination	Demonstrate Compliance	State Environment Protection Policies (SEPP) (Groundwaters of Victoria)	This SEPP aims to maintain and, where necessary, improve groundwater quality to a standard that protects existing and potential beneficial uses of groundwaters. It sets a consistent approach to, and provides quality objectives for groundwater protection throughout Victoria.	The storage must demonstrate compliance with the SEPP (Groundwaters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance
82	Storage	Catchments, surface water and flooding	Demonstrate Compliance	State Environment Protection Policies (SEPP) (Waters of Victoria)	This SEPP sets the framework for government agencies, businesses and the community to work together to protect and rehabilitate the environmental quality of Victoria's streams, lakes, estuaries, and marine environments.	The storage must demonstrate compliance with the SEPP (Waters of Victoria).	✓	✓	✓	Environment Protection Authority Victoria	Prior to works commencing. Potential for requirements during construction, operation and in decommissioning.	Demonstrate compliance

## Appendix C

# Workshop Agenda

GLOBAL CCS INSTITUTE REGULATORY TEST TOOLKIT WORKSHOP AGENDA  
 9:00am – 5:00PM, FRIDAY 16 AUGUST 2013  
 VENUE: LEVEL 27, 121 EXHIBITION STREET, MELBOURNE

Session	Time	Agenda item
<i>8:30am – 9:00am</i>		<i>Arrival and coffee</i>
1	9:00am – 9.45am	Open workshop Welcome Global context of CCS Workshop objectives / house rules: Mock project scenario overview
2	9:45am – 11:00am	Source and capture session Technical overview Regulatory overview Group activity (30 mins) <ul style="list-style-type: none"> <li>• Key regulatory risks</li> <li>• Key regulatory overlaps/gaps</li> <li>• Strategic opportunities/solutions</li> </ul> Group report-back (30mins)
<i>11:00am – 11:15am</i>		<i>Morning Tea</i>
3	11:15am- 12:15pm	Transport session Technical overview Regulatory overview) Group activity (30 mins) <ul style="list-style-type: none"> <li>• Key regulatory risks</li> <li>• Key regulatory overlaps/gaps</li> <li>• Strategic opportunities/solutions</li> </ul> Group report-back (15 mins)
<i>12:15pm – 1:00pm</i>		<i>Lunch</i>
4	1:00pm – 2:30pm	Storage session Technical overview Regulatory overview Group activity (45 mins) <ul style="list-style-type: none"> <li>• Key regulatory risks</li> <li>• Key regulatory overlaps/gaps</li> <li>• Strategic opportunities/solutions</li> </ul> Group report-back (30mins)

Session	Time	Agenda item
<i>2:30pm – 2:45pm</i>		<i>Afternoon Tea</i>
5	2:45pm – 3:45pm	<p>Cross-cutting issues Q&amp;A panel discussion covering:</p> <ul style="list-style-type: none"> <li>• Environmental &amp; planning</li> <li>• Community</li> <li>• Monitoring &amp; reporting</li> </ul>
6	3:45pm – 5.00pm	<p>Review of key issues  Participants will be asked to individually review the key issues captured in the prior sessions, particularly in light of cross-cutting issues discussion in Session 5. Participants will be asked to record on an A3 feedback sheet at their table, what they consider to be the most material areas of concern, considering:</p> <ul style="list-style-type: none"> <li>• Major Cth vs State regulatory overlaps</li> <li>• Areas of regulatory 'vacuum'?</li> <li>• Sequencing or integration issues</li> <li>• Potential blockages/log jams</li> </ul> <p>Report-back / discussion  Participants will be encouraged to provide feedback on their observations of the prioritisation exercise and raise any additional issues which may have made the prioritisation process challenging. Additional issues will be captured on the 'parking lot' white board.</p> <p>Key findings and next steps  Summary wrap up of the key findings from the day and an outline of next steps and the issuing of a report. Summary of parking lot issues and allocated participants for follow up.</p>
7	5:00pm	Session closeout

## Appendix D

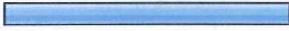
# Workshop Worksheet



## Appendix E

# Workshop Feedback

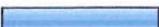
An objective of the workshop was to help increase regulators' understanding of the regulatory and permitting approvals pathways for a potential Victorian CCS project. How successful do you feel the workshop was in achieving this objective? (Please rank from 1 - 5, where 5 is very successful, and 1 not very successful)

		Response Percent	Response Count
1		0.0%	0
2		0.0%	0
3		31.6%	6
4		57.9%	11
5		10.5%	2
	Comments		7
	answered question		19
	skipped question		0

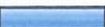
The workshop aimed to identify any issues, gaps and overlaps in the regulatory framework for CCS. How successful do you feel the workshop was in achieving this objective? (Please rank from 1 - 5, where 5 is very successful, and 1 not very successful)

		Response Percent	Response Count
1		0.0%	0
2		0.0%	0
3		36.8%	7
4		57.9%	11
5		5.3%	1
	Comments		7
	answered question		19
	skipped question		0

### What did you find the most useful part(s) of the workshop?

		Response Percent	Response Count
The opportunity to learn more about CCS from the experts		47.4%	9
The chance to work together as regulators to identify issues		73.7%	14
Reviewing areas specific to my area of responsibility		10.5%	2
Reviewing 'cross cutting issues'		31.6%	6
Identifying how we can work together to address issues		26.3%	5
	Comments		6
answered question			19
skipped question			0

### How effective did you find the workshop format? Please rank 1 - 5 where 5 is very effective and 1 is not very effective, and provide any comments)

		Response Percent	Response Count
1		0.0%	0
2		0.0%	0
3		21.1%	4
4		57.9%	11
5		21.1%	4
	Comments		7
answered question			19
skipped question			0