Carbon Storage Taskforce

Deployment Scenarios Workshop

Summary of Outcomes

15 May 2009

Menzies Hotel, Sydney

Contents

Executive summary

Background

- This workshop was organised by:

  Carbon Storage Taskforce Unit
  Resources Division
  Department of Resources, Energy and Tourism

- The workshop included 40 invited participant and was facilitated by KPMG

- Key topics in relation to deployment of Carbon Capture and Storage (CCS) were: its implications, support needed and restraints.

Overview of key messages

- Consideration of both scenarios, whether 'fast' or 'slow', showed that we need to start immediately

- Technology is changing so fast that there needs to be a master plan but with plenty of flexibility to accommodate radical changes as required

- There was clear agreement that an effective regulatory framework needed to be in place immediately

- The only way to get a commercially viable CCS up is for government to fund the initial steps when it is impossible to demonstrate viability to an acceptable level for investors

- Both scenarios had common drivers and barriers to change, the main difference appeared to be that the 'fast' scenario required significantly more money to be put at risk

- There was a common view about the need to develop flagship projects as well as demonstration projects and pre-exploration projects and for each of those to be up and running immediately. Flagship projects were described by the group as full scale (and iconic) but with a large proportion of government funds.

- There was considerable debate about whether it was most effective to plan fully scalable projects from the beginning or to build incrementally through hubs that are scalable. The enormous challenges of developing projects of this size, long term nature and strategic complexity were a key theme of the day.

- Capacity building was noted as a key issue and potential constraint to action.

Overview of the Day

Background

The Carbon Storage Taskforce has been charged with developing the National Carbon Mapping and Infrastructure Plan which will prioritise the development of geological storage sites for carbon capture and storage (CCS) and plan necessary pipeline infrastructure. One area of focus for the Taskforce within this brief has been drivers and barriers around the deployment of CCS.

Objectives

To inform this part of their work, the Taskforce agreed to run a workshop seeking input of this issue. The purpose of the workshop was to engage a broad range of stakeholders on the practical issues associated with the deployment of CCS technology. The following outcomes were sought from the workshop:

- Identify the implications of two alternate CCS deployment scenarios
- Identify the policies and actions that support or delay deployment of CCS
- Identify situations where CCS is unlikely to be deployed and why.

The output of the workshop will be integrated by the Taskforce into its final report to Government which is due June 2009.

Workshop logistics

The workshop was held at the Menzies Hotel, Sydney from 9.30am – 4pm on Friday, 15 May 2009. Attendance at the workshop was by invitation by the Carbon Storage Taskforce and encompassed representatives from government, a range of industries, NGOs, consultants and academics. A full list of participants is contained in Appendix 1 of this document. Attendance was by invitation only and the list was compiled by the Carbon Storage Taskforce.

Agenda

The agenda for the day, (Appendix 2), was designed to maximise the input of the group on potential drivers and barriers for deployment of the CCS technology. The agenda was structured around the use of fast and slow deployment scenarios at the request of the Taskforce. Keith Spence, Chair of the Carbon Storage Taskforce introduced these scenarios and noted they were based on a range of sources including those prepared by Shell.

The scenarios provided a framework for understanding key deployment issues over two different timeframes:

- a ‘fast’ scenario (equating to Shell’s “Blueprint” scenario) where some commercial deployment of CCS was in place between 2020 and 2025; and

- a ‘slow’ scenario (equating to Shell’s “Scramble” scenario) where deployment occurs between 2035 and 2045. An outline of the scenarios was provided to the participants as pre-reading for the workshop. The Shell scenarios can be found at: http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/dir_global_scenarios_07112006.html

In order to draw maximum input from the participants, the agenda involved a mixture of plenary and group sessions on specific questions. This report attempts to capture the discussion from each of those sessions as recorded by the facilitators and scribes working with each group.

Facilitation

The workshop was facilitated by KPMG[1].

KPMG have advised the Department that:

- No warranty of completeness, accuracy or reliability is given by KPMG in relation to the statements and representations made by, and the information provided during the workshop.
- No reliance should be placed on additional oral remarks provided during the workshop, unless these are confirmed in writing by KPMG.
- Although the workshop may have involved discussions relating to regulatory compliance, the workshop did not represent legal advice and regulatory compliance is the responsibility of participants.
- Developments and the applicable law in this area are constantly evolving and subject to change and KPMG is under no obligation in any circumstance to update the workshop, in either oral or written form, for new information arising or events occurring after the workshop.
- Neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on the discussions during workshop. Any reliance placed is that party's sole responsibility.

[1] KPMG, an Australian partnership and a member firm of the KPMG network of independent member firms affiliated with KPMG International, a Swiss cooperative.

Output from the sessions

Session 1 - What does success and failure look like in relation to CCS deployment?

Success	• Carbon emissions reducing • Growth in net affect of CCS • Electricity costs increases by 1-3 times • Half baseload power being carried by CCS • Supply price $25/t • Electricity generation costs increased • Australia still global exporter of coal • No major incidents of leakage of environmental damage • CCS is publicly accepted • Big infrastructure • CCS operations regarded as being energy efficient • CO_2 removals from atmosphere during 2050 – 2100 • Transition phase successful • Exports of expertise • No more CCS required globally • Investor confidence • Global tradeable CO_2 market, including China & India

Failure	*Potential reasons for failure* • CCS fail – increasing GHG = worst case – 'Death & destruction' • Pipeline collapse OR • Alternative solutions win - CO_2 reductions success via other technologies • CCS too costly or not enough lead time *Potential Outcomes* • Coal use drops dramatically • Substitution by gas • Stakeholder resistance • Electricity security risk • Energy cost increase (both suppliers / users) • Energy scarcity increase • Regional economic restructure (redundancy) • Decentralised energy supply • Lower cost technology – no change in 2030 • Adaptation action acceptance – huge costs • Inequity increases • New acceptance of ideas that are not accepted now • CCS needed in portfolio to keep costs down • Biodiversity loss • Greater Government intervention and lower market intervention

Session 2 - Analysis of fast and slow scenarios - Key findings from group feedback

2.1 Slow scenario

The timeframe for the slow scenario for the deployment of CCS is between 2035 and 2045. Both groups discussing this scenario began by considering what factors might have led to a 'slow' deployment of CCS before moving on to factors identified as being important drivers, barriers or sources of uncertainty to the successful deployment of CCS.

Assumptions – what might have led to a slow deployment of CCS?

- No Global agreement on CCS
- No incentives or drivers for change
- International divergence between countries which obtain their energy primarily from coal and countries which obtain their energy from nuclear and hydropower.
- Technology not evolving quickly enough (due to either technical challenges or lack of investment)
- Low political will and/or support for CCS
- Community unwilling to accept high carbon price
- Community takes considerable time to get 'onside' with CCS

Factors which would drive or create barriers to the successful deployment in a slow scenario

International issues

- Globally agreed upon emissions targets
- Inclusion of CCS in the CDM framework to generate tradable CERs
- Support for CCS amongst key international players

Policy

- Existence of a forward market for carbon to help companies hedge against risks
- Development of a stable regulatory framework for the carbon market
- Rules and regulations for storage and transport of captured carbon
- Assignment of liability for discharged carbon throughout the CCS supply chain
- Level of government imposed caps and their effect on the price of carbon
- Policy and process to obtain easements to build pipelines
- Favourable policies to encourage exploration
- Availability of environmental permits
- Government funding for CCS, demonstration projects and infrastructure

- Unlimited access to CDM and JI
- Level of government support for coal industry
- Introduction of feed in tariffs

Technology

- Success of demonstration projects
- Availability of funding for demonstration projects
- Ability to look beyond the demonstration plants towards the entire CCS supply chain

Capacity

Questions over:

- Availability of skills and people to roll out the technology, specifically in the availability of geologists and skilled manufacturing labour
- Industrial capacity to deliver and build the different technologies and tools
- The strategies in place to build skills from early mover demonstration plants to assist in faster deployment of later plants will be a factor.
- The ability of CCS to react quickly to a scramble scenario
- The amount of exploration for storage options being undertaken. Concerns over cost and risks associated with this exploration.

Infrastructure

Concerns over:

- Availability of pipelines
- The capacity of pipelines to carry multiple services
- Sufficient availability of pipeline easements
- Strategies in place for pipeline expansions
- Availability of storage options
- The economic feasibility of storage capacity, which depends in part on distance between sources and sinks
- The amount of new coal, gas and mining ventures
- Future potential for gas to reach a sufficient threshold to cause a clamour for CCS on gas making CCS on coal less attractive
- The efficiency of infrastructure as scale increases
- Level of complication and level of planning as CCS supply chain (source, sinks and transport) increases in scale

Investment

- Financial incentives are the key driver for private investment
- Currently, there is a lack of financial incentives to encourage fast deployment

- An acceptable cost curve or other compelling evidence to facilitate sufficient funds being invested at scale.
- Certainty of storage must happen before private sector money will be spent on storage
- Uncertainty around the deployment of CCS technologies
- Availability of large amount of funding required for exploration
- Influence of the global financial crisis is likely to slow things down further
- The current and future price of carbon – the lack of a high carbon price is a huge barrier to deployment of CCS

Community

- Concern over reaction of communities at storage site, power plant and the pipelines – 'NIMBY' syndrome (not in my backyard)
- Need successful demonstration sites that shows the safety and environmental impact of CCS projects
- Successful demonstration projects raising awareness and providing positive media coverage
- Engagement strategies in place to address concerns about safety and environmental compliance an protection
- Strategies required for education on the role of CCS in the solutions to climate change (both general and targeted to affected communities)
- Competitive environment for gaining community support in the carbon friendly solutions market (wind, solar and energy efficiency)
- The positive economic impacts on communities (such as employment opportunities)

Alternative energy and energy efficiency may develop faster than CCS in a slow deployment scenario

- Current profitability and effectiveness of alternative technologies likely to improve
- Breakthroughs in alternative energies cause them to become more cost effective
- Improvements in energy efficiency
- East coast gas explorations could be commercially deployed. Gas is less emissions intensive than coal resulting in reduced incentives to pursue CCS.

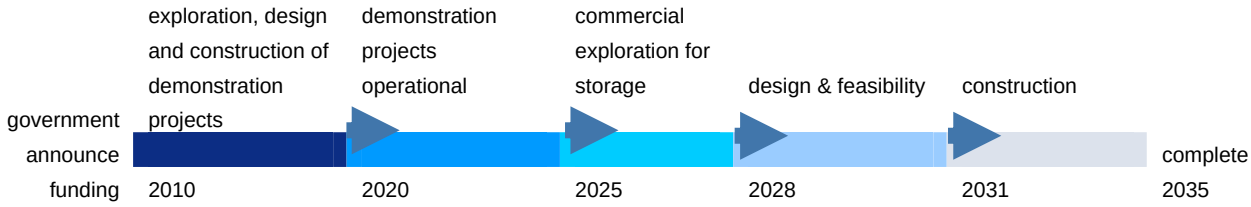
Considerations in Pathways to Deployment

One group analysed the pathways which were required to achieve deployment of CCS in the slow scenario:

- Two categories of time windows - as this technology rolls out, there will be early movers (2030) and then pipelines and infrastructure (not available to first movers). This requires a firm forecast that this technology will move forward. The deployment of pipelines and infrastructure won't happen for 10 years after the early movers begin.
- Relevant timeframes for large pieces of infrastructure (10 year lag-time between economic approval and start-up of plant)

- To commission a unit in 2035, the potential storage site must have been appraised in 2025. Are investors willing to invest in 2025?
- Policy settings must be strong enough to encourage exploration (does this require a public-private partnership?). If policy settings are too slow and come through in 2035, there will be a 7-year lag before plants begin operating.
- Common user pipeline not commercially viable until 2045+ without Government assistance
- Demonstration projects: a number of potential storage sites have to be identified because otherwise every project proponent will have to cover huge exploration costs. Assume information certainty for 3-year lag (geological data etc), if this information certainty is missing, time lag will extend to 7 years.
- Lead-time for demonstration projects: Allow demo plant to run for a few years (e.g. 5 years of operation). Allow 10 years for construction, environmental approvals, stakeholder engagement etc.
- Pathway to deployment is complicated. When deployment sites are completed (15 years), there will be a 13-year lag to larger scale projects. It will be up to govt to provide incentives to encourage these larger projects as private money won't be allocated without certainty.

Diagram 1: Potential timeline for deployment pathway



Key Points from the Group Discussion

- Going slowly may not be a bad thing. It may be the result of careful planning with a view of minimising wasteful expenditure on unsuccessful projects.
- There is an international divergence between countries which obtain their energy primarily from coal and countries which obtain their energy from nuclear and hydropower. The growth of CCS internationally will depend on the growth of coal relative to these other sources of energy.
- Some participants believe central planning was essential for design of a pipeline network
- Participants raised the possibility that government intervention may be necessary in the design of the pipeline to prevent commercial pipeline deployments from becoming monopolies.
- Going slow requires payments to incumbents – if you want coal to stick around, while wind and solar make more money under the right carbon price scenario, then you need to subsidise. Coal power needs to be there for CCS to work later. E.g. there are plans to phase out three coal mines in the Latrobe Valley before CCS is likely to be underway.
- Without a cost curve or other compelling evidence, the required investment will not be available. We wouldn't look at good commercial scale deployments.
- Many small demonstration projects or a portfolio of components around Australia and the world will help identify the best options with which to move forward with CCS. However, with similar small-scale projects, there wouldn't be enough evidence to construct a good cost curve.
- At current levels, CCS for coal and CCS for gas are two different issues. Gas wouldn't have the required scale to deploy CCS and this is coupled with the lower emission intensity of gas.
- There are going to be large lead times just to get community agreement and to get the right to store somewhere. It's going to take 10 years just to start one of these things. So you are going to have a limited amount of projects actually going ahead. But the risk is that this is either not going have the proper funding to be at enough scale, or there is too much money going into it, only to back a demonstration project that fails.
- Massive subsidies for exploration by government needed to move from slow to fast scenario; to move from very slow rollout to slow rollout, some government financial incentives are necessary. This will assist with gaining the level of certainty needed to proceed with the project.

2.2 Fast scenario

Key Issues of Concern in Deploying at Fast Pace

- Commercial viability is unproven
- Exploration / development of storage sites – cost
- Carbon price and volatility (i.e. certainty around forward price curve and sufficient level to satisfy financiers)
- Who pays? And where, along the value chain
- Flagship projects operating by 2015 and proven by 2018 ("but this is impossible")
- Flagships work
- Flagships have variety as part of global portfolio
- Trade exposed industries are OK
- CCS elements integrate well (differs by state) – technical
- Scaling CCS projects up is likely to be challenging
- Emissions sources / capture profile
- Pipeline access, configuration and cost
- Energy penalties (i.e. parasitic load)
- Other technology curves (high cost)
- Co-operation / co-ordination: Government and industry. Early commitment of large emitters is required
- Knowledge transfer
- Early pathway to commercial viability is demonstrated (price and cost) – (pitched up earlier).
- Retrofit requirement is likely to be expensive
- Importance of community agreement/comfort level
- Timelines: pre-competitive exploration, exploration (3-6 years), development wells (1-3years), pipeline planning and construction (3-5 years, could begin during exploration), power station new (7years including FEED, FID and construction) – power station retrofit (6-7 years for FEED to construction, 2.5 years interruption to load…not going to do this until storage site is proved) Much of this time is taken for approvals/booking equipment rather than construction.
- FEED and FID by 2011-12, 3 years construction, 1 year testing. Operation must occur for several years to grow confidence. But this is only for one technology, the same will need to occur for each technology. Therefore, flagship projects need to be a portfolio of technologies. Some of this should occur overseas as would make more sense.

Discussion of top issues

Issue 1: demonstration projects to commercial

Demonstration (power industry) and commercial (gas) projects are shown to lead to commercially and publicly acceptable CCS.

Key uncertainties

- Project scope – size, location, technologies
- Project costs and learning curves
- Size of commercial gap and how this will be closed – need for Govt funding
- Mix of public/gov't funding,
- Carbon price
- Engineering issues related to scaling
- Emissions/capture profile - Should be getting the biggest emitters, but also take into account the cheapest way to capture the carbon, this may not be in power generation but in process operations such as lime production.

Issue 2: Storage sites

Large scale exploration programs occur & successfully establish significant cost effective storage at scale and to satisfaction of financiers and regulators.

Key uncertainties

- Geological risk (reservoir seal, CO_2 migration paths, site-by-site differences)
- Uncertainty in costs of exploration (big cost very likely)
- Incentives for commercial exploration, exploration expensive with no certainty that it will be used for storage.
- Pipeline access configuration and cost variables

Issue 3: Carbon price and volatility

Certainty and confidence around forward long-term carbon price(s) curve and provide incentive / basis for long term large investment decisions now (note: demonstration projects not reliant on carbon price).

Key uncertainties

- The government has not committed to an emissions trajectory.
- Question whether a carbon price is the most appropriate mechanism for encouraging investment
- The influence of a global carbon price.

Issue 4: Role of government (state and national)

- International property rights
- Policy and stability of policy – is there a long term commitment to CCS? Energy policy and other policies. Price versus alternative mechanisms e.g. feed in tariffs. Includes political will
- Regulations and stability of regulations
- Funding
- Liability for storage leakage, pipeline issues

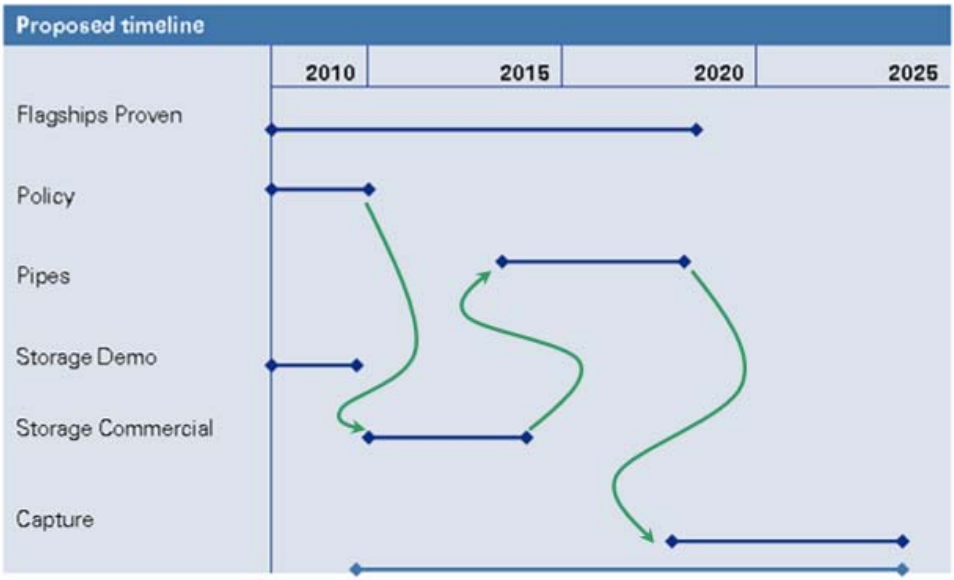
Issue 5: Who Pays? (unfinished)

What is the pass through of electricity costs?

Top 5 issues for action nominated by second group but not elaborated on

- Policy framework
- Pre-competitive exploration/high confidence for storage integrity and capacity
- Flagships proven
- Community acceptance
- Leadership by integrated project proponent(s)

Diagram 2: Proposed timeline



Key points from the discussion

- People won't invest if there is no certainty of investment return. Forward price curve and level must be sufficient to satisfy financiers.
- Climate change policy framework is a driver – i.e. sufficient market support mechanisms in place to make CCS viable. I.e. it creates appetite for investment. No action until it is attractive.
- Forward carbon price curve – CCS demonstration will not be supported by a high or uncertain (fluctuating) carbon price under the CPRS. Long-term carbon price curve will provide incentive / basis for long term large investment decisions. (Note: demonstration projects are not reliant on carbon price)
- Rapid deployment may be difficult with high production costs – but these things take time, like nuclear taking 30 years to become cost effective – the government can subsidise either directly or through insurance and bonds.
- Cooperative structure – coordination between government and industry. Confidence that all parts will come together to ensure investment certainty. Industry to work closely together to have confidence that the whole network is viable. Nothing happens until "all the ducks are lined up". (1) Requires commitment of large emitters

- Get everyone on board for CCS i.e. not just coal, gas also other heavy emitters. Carbon leakage (i.e. emissions intensive industries move offshore) can be prevented by policy framework (assumption). Only needed if there is no global agreement.
- Pathway to commercial viability must occur early – necessary for financial investment. Price and cost – business case
- Integration of CCS networks – technical aspect - this will differ by state. First demo might not be completely successful, but the essential parts must work well

Plenary session on scenarios

Discussion of Slow Group 1

Assumption

- CCS introduced between 2035 and 2045

What are the factors driving the slow start?

- Low carbon price (fundamentally – lots of different scenarios driving this)
- Lack of investment to trial technology
- Unwillingness from community to fund costs
- Lack of international agreement
- Lack of storage capacity
- Success of other renewables
- Setbacks in technology
- Hub economics – CPRS will impact the viability of hubs of Hunter and Latrobe Valley
- Emissions tariffs need to be in place

Issue which need to be addressed

- How do we get the biggest bang for buck for CCS?
- Do we want an integrated system (politically that's where it's at), or distributed?
- Will there be community acceptance? There could be opposition from a moral standpoint.
- Will there be a loss of interest in CCS as alternatives become the solutions?
- Is the impact of the global financial crisis beneficial or not? Right now it impacts the access to capital.
- Will CCS be part of CDM? Australia thinks yes, EU thinks no.
- Energy security will be the major transformation factor.
- If you know you're in a slow world, do you want to fund the demo projects only in Australia? Or in chunks around the world?

Top 5 factors

- Exploration and development of storage
- Carbon price curve
- Role of government (source of funding)
- Alternative technologies
- Community acceptance

Discussion of Slow Group 2 -- Additions to points raised by Slow Group 1

- There are two scenarios: CCS goes slow but well, or CCS goes slow without action (no political will)

Factors which will determine this

- Lack of political will
- Dependant on the path to deployment
    - Scenario: to have a commercially viable plant by 2035
    - 4 years for construction of plant
    - 3 years lead to look at design and feasibility
    - There also needs to be time to explore and develop (exploration takes 3 years and costs $100m)
    - By 2025, there has to be sufficient evidence to make the decision to fund the plant – factors could include, CO_2-e price, an MRET. So demo units need to have shown this to be a viable project
    - By 2015 there is no confidence. So demo projects need to be start up to show the viability of CCS (it requires 5 years of proving and 10 years of exploration, design and construction)
    - Therefore, it requires immediate action
- Fundamental difference between investing in oil exploration and CCS is that with oil exploration, when you take a risk on expenditure, you have a positive expected value (possibility of making good money). With CCS, the reality looks like you are destined to lose money even if you find a good storage spot.
- There would be private incentives and private good created for oil for exploration – the benefits are all captured for the investor. CCS creates a public good that's as valuable as the carbon cost abatement. Government policy needs to address this gap.

Discussion of Fast Group 1

Many applicable points were discussed in the slow group.

Additions to points raised by slow groups

- IP, lack of sharing of knowledge and technology has the potential to be a barrier
- Deployment will be impacted by Integration into CPRS
- Demonstration projects need to show that it is technologically, commercially and socially sound for commercialisation projects
- Key uncertainties include project scope, costs, learning curves, at what level and time do things become commercial (i.e. size of commercial gap)

The priority list

The group tallied their votes on what the most important factors were in CCS deployment:

- commercial (6 votes)

- Exploration for storage (7 votes)
- Who pays (5 votes)

Key uncertainties

- The impact of caps on the carbon price
- Geological risks
- Big changes in costs
- Carbon price volatility – certain around the forward price curve of carbon (investment decisions are based on futures prices)
- Need for government to provide support and funding and setting the policy to support CCS
- The question of who pays is important – do you use tax dollars or create market mechanisms for it

Discussion of Fast Group 2 – Addition Points to Fast Group 1

Critical factors

- Flagships need to be proven by 2018, so start immediately
- Transport, capture and storage issues
- Overarching issues
- High confidence should be provided to Investors
- There will need to be a community engagement process which the demonstration project will not pick up
- There has to be government push to say “right this has to happen” – a very clear policy framework which incentivises commercialisation.
- At a minimum, there has to be a mechanism, i.e. a cap that causes a $100 a tonne cost, electricity feed in tariff or subsidy. How far forward do you have to have regulatory framework certainty to invest?
- How soon does the policy need to be in place to achieve a 2018 scenario?
- The timeline for how things should happen if the policy framework is in place: immediate start in 2010 in terms of policy and by 2018 demonstration projects in place.

Overarching issue

- Will the community be alright with this?
- Where is the infrastructure? Can we have a set of storage that makes commercial sense?
- There needs to be confidence that policy risks will not change the investment decision

Developing action plans

During this session the participants were divided into 4 groups and each rotated through discussions on 3 of the 4 following areas of concern – commercial, technical, community and regulatory. The intent of each of these discussions was to identify key actions required to progress each of the four areas. Each group built on the discussions from the group before. The outcomes from each of these discussions are outlined below.

Commercial

The commercial space is the realm of investor profitability. For CCS deployment to be commercially viable, it should be able to attract willing investments. The idea of developing a CCS hub was central to this discussion for each focus group.

The design of a hub

- The first group suggested 3 business models where the market will be allowed to determine appropriate models in different situations (framework planning needs to be done before this). These include:
  - Integrated – source – sink / entity
  - 2 entities – source + transport / sink
  - 3 entities – source + transport + sink
- The first group suggested that responsibility for evaluating business models (based on identification of risks, costs and returns under different scenarios) needs to be identified
- Amongst subsequent groups there was general consensus that the hub should take the form of a single integrated business model with 3 contracts and single value chain)
- Government has to d o a master plan with integration from industry (with the assistance of government funding)
- Look at the issue of scalability – government and investors looking to invest in bite size sections
- Investigate the intermediary steps required – challenge to intermediary commercialisation
- A NEMCO like operator may need to be involved facilitating the hub process. (NEMCO - National Electricity Market Management Company – changed name and broadened responsibilities in July 2009 to AEMO)
- Identify the tax incentives / disincentives
- Pro forma agreements and corporation agreements, send or pay, and take or pay – a legal firm with gas transport experience needs to be involved upstream, or GCCSI could facilitate this process as well. By definition these will be long term (10+ years).

Evaluating and optimising the hub

- Identify the value proposition, or cost minimisation for potential players (including owner/operators, investors and suppliers
- Identify the process – from source all the way to sink

- Identify 2 test locations. Use 3 sources going into pipeline and prove several sinks look at couple of locations and then finalise based on merit.
- Understand the volumes and costs and at the different points of the business model
- Where are the points you can minimise costs? (i.e. minimise the distance to transport by keeping source near sinks)
- Identify the revenue sources and determine the monetary point where model becomes viable
- Assess where the risks are in the process. How do we mitigate and hedge against the risks?
- Look at the viability of parts of the integrated model and then government subsidiaries for those that are not viable
- Assess different scenarios to determine whether it is more commercially viable to have larger pipelines shared between sources (i.e. spine model)
- Models need to identify a broad set of parameters which need to be optimised – i.e. expanded to such factors as water and population
- Determining depreciation rates applicable for assets in the business model
- Determine who bears the risk and title to carbon and its impact on the transferability from source to sink

Highlighted feedback

- The hub needs to be more encompassing or is at least scalable to more than just coal (gas, aluminium etc). Therefore, there a top down approach may need to used that looks at a master vision of how this will look.
- In getting the coal industry on board, we need to demonstrate the costs and risks they face from not going down the CCS path. This needs to look at the effect of exports of coal, and domestic instability of coal companies and the communities they operate in.
- Understand the composition of the electricity market going forward. What is the impact on hubs from the retirement of coal assets? Are existing power plants or only new ones going to be CCS compatible?
- Determine the impact of decarbonisation on industries and communities base around coal. Effect on ports, domestic pricing of coal – potential instability of coal, need to understand forward market in coal both in volume and price and implications for end users (

Issues

- The first group identified that pro forma agreements and corporation agreements for send or pay and take or pay need to be established. However, the second group believed that pro forma agreements only tend to be found in mature industries.
- The first group highlighted the need to be able to pass 100% of the cost of carbon to the consumer. Subsequent groups found this to be commercially unrealistic.
- The third group expressed that the mega pipeline and hubs will not be commercially viable in the short term - there will not be enough CO_2 sources willing to participate. They suggested that the design can think big and plan for future energy projects. Subsequently they raised the trade-off between many small scale projects which would duplicate costs versus a large scale one which could save on these costs but risks being made obsolete.

Technical

Proposed Action – Set Up A Program Management Framework To Manage The Supply Chain

- Should be government funded and cover the range of key issues.

The issues which will occur over a number of projects are:	
• Capacity • People • Skills • Means/ resources	⇐ To avoid bottlenecks (both price and physical) e.g.: drill rigs ⇐ It takes 18 months to get a new onshore drill rig from factory to site

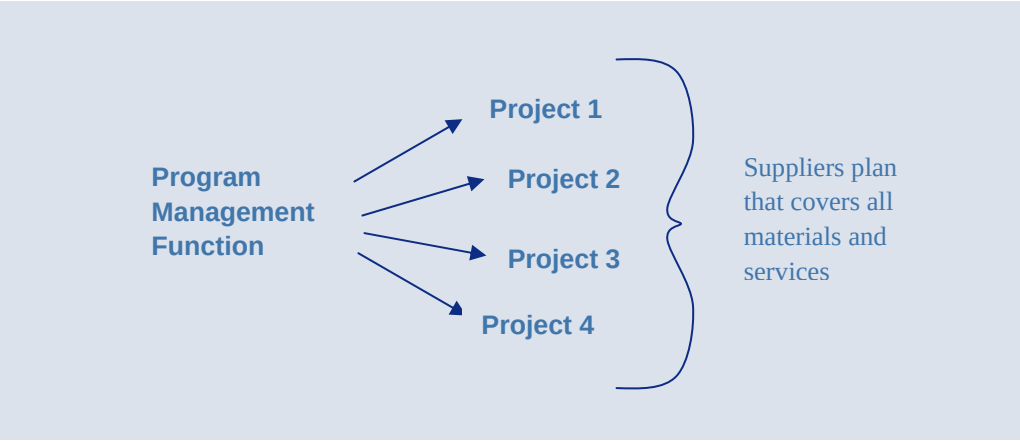
- Need to take a program management approach to this – plan the whole supply chain across both capture and storage functions beginning with flagship projects immediately. This needs to be across multiple storage sites.

- Should be an integrated project team of both industry / government which manages the whole system. Gov funded and managed, especially for pre-competitive phase of CCS deployment. It is important to note that at present there is a large gap between the pre-competitive and the competitive

- Three work streams need to be run in parallel – storage finished just in time for pipelines, pipelines just in time for capture. These three entities have large lead times and need to be centrally managed. For example, no one entity has the need to build the pipeline.

- Technology – the due diligence peer review, who will do this? Maybe a regulatory issue?

Diagram 3: project management function



- Monitoring or verification function – better done by NGO's? The requirements are the same everywhere, but site specific information will differ.

- Need to get everyone together to determine reliability and risks of each part of the chain. This will assist with managing risk and issues of individual projects. What happens if sink goes down etc. There have been no discussions/ integration as yet. Just discreet projects, exploration but not aware of issues and risks of other parts to the chain.

- To be CCS ready, the plant needs a storage plan and pipeline plans. At this stage, no such thing as a CCS Ready power station.

- Skills is a huge issue – there are no people left to work the drills and if the Oil and Gas industry picks up there will be a real issue of competition with that industry for skills.

- Regulator/project – planning where the skills are going to come from? Over the next 20 years, we need to overhaul the whole pipeline network in Australia

Action – Initiate a system design based approach to CCS implementation.

- It has to be designed as a system. Trial everything together, then pick your priorities.

- The design of the system should be facilitated by the government and this should be developing now.

- Some early movers in industry are doing this networking now – looking for government handouts or doing it completely themselves. They are putting in their own pipelines/. Possibility of monopolies which may work for or against the company if the project is successful or fails.

- Collaboration may fail where IP becomes an issue – we should have open source as much as possible? But how do we protect IP while still facilitating widespread commercialisation? Free market may not deliver the best outcome – government may need to intervene.

- Are we looking for hubs? We have demonstration projects already. Get 4-5 and pick the winner.

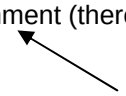
Actions

- Entities need to communicate!

- Role for GCCSI – to remove barriers to communication & to address IP issues

Who

- Government (there examples of this now in certain industry sectors)



This could be a facilitation role

When

- Now
- This will have benefits in the finance risk assessments. There are technical aspects to how take and pay would work! E.g.: Interrupt or peak load.
- Industry / government to provide an integrated project team
- Technology is a lever to close commercial gap

Action: Identify Storage Options

- Characterise the sink technologies - commercial implications. We need to find more sites than we need because not all of them will be viable
- The aim is to get exploration portfolio and appraisal methodology to determine when to deploy

This should be by a portfolio approach – outlined below.
Concurrency is a key issue. These need to happen at same time:

- Location
- Size / efficiency / capacity of the well (This should include cost + efficiency)
- Land access
- Stakeholders (there should be a standard method for this)
- Risk / hazards (there should be a standard method for this)

Diagram 4: roles of participants in information gathering

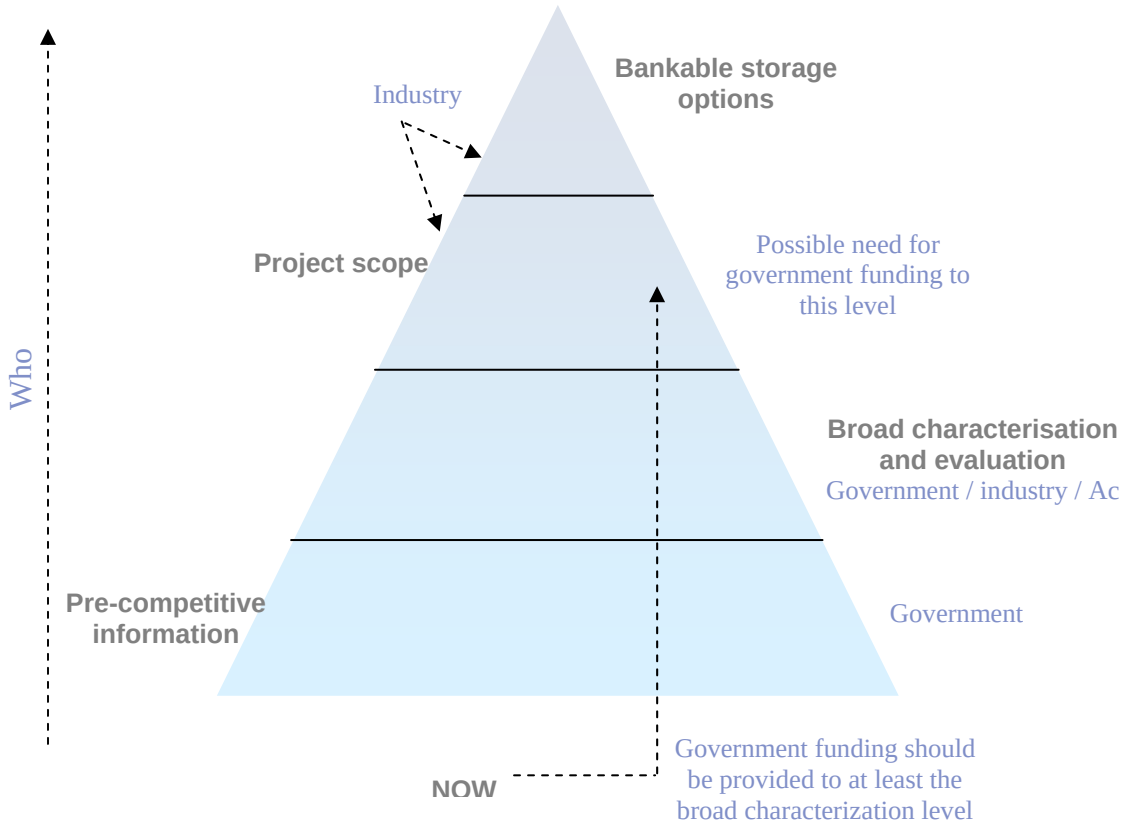


Diagram 4 above– represents the number of viable sinks, the action and who is taking the action. At the pyramid bottom is pre-competitive information (government should be responsible), then broad character evaluation (government, industry, academic), then project scope (industry), then whether it is bankable (industry).

Commentary on the pyramid:

- The lines across the pyramid should not be firm, multiple activities should be occurring at the same time. Government funding should be occurring at the same time. Government funding should occur for pre-competitive and character evaluation, possibly also at the project scope level.

- View was expressed that if academics get involved and start questioning a technology it will be harder to move forward towards bankability. However the technology may be improved for the next generation. BUT necessary for long term viability

Regulatory

The first regulatory group provided a MACRO to MICRO framework for regulatory issues. Macro issues are at the global scale and micro issues are at the local Govt scale. Subsequent contributions were collated using this framework.

Macro (International and National Regulators)

Global (or nearly global) agreement is needed at the Copenhagen conference (December 2009) to accelerate CCS (***International and National Regulators***)

Federal Government needs an aggressive long term price signal to get private investment into CCS. This could be done solely by an ETS measure or in conjunction with other suggested penalty or incentive measures such as:

- Direct subsidies and/or levies for both exploration and project development

- An MRET mechanism for CCS

- Mandatory performance standards for emitters (Federal and/or State imposed but must be nationally aligned)

- CCS based tariffs or generator targets (baseline and credit)

The overwhelming message was that some certainty and long term price signals were needed to get private investment. (***International and National Regulators***)

Enabling legislation was proposed on a project-by-project basis. This would limit the liability of developers for future regulatory changes for the life of this project. It may also give fast track approvals where there may be blockages, conflicts or lack of clarity in other regulations. There may be similar models in other major projects (eg Gorgon gas field project). Some reservation was expressed about the political appetite for such a “developer friendly” mechanism”.

Governments often respond to regulating new areas like a pendulum. Initially the regulatory pendulum is risk adverse and over regulation is the initial response. This gets stripped back somewhat and then needs to be rebuilt as it goes too far and is exploited.

Micro

Transport (State regulators)

- There are already mechanisms for dealing with multi – user access to pipelines.
- Government owned models may be needed in some cases.
- Regulated monopoly arrangements may be needed.
- Most jurisdictions have Acts that enable compulsory acquisition for pipeline easements.

Storage (Mostly State regulators)

- Monitoring guidelines, standards and authorities may need more development
- Access arrangements may need more clarity
- Obligations and liability (especially post injunction need to clear). Common law liability may exist and may need to be specifically removed.
- Further divergence of regulations between States should be avoided and existing mechanisms should be aligned.
- Conflicts with other resource entitlements or rights needs to be clear (eg native title, water, oil and gas, coal, forestry and grazing rights)
- Priority uses in overlapping tenements (e.g. CCS and gas) may need to be addressed
- CO_2 leakage across storage boundaries needs attention especially tenement and jurisdictional boundaries. *(State and Federal)*
- Most states have started and will be ready for a rush if it comes but some are behind, particularly with regulations. There was doubt expressed on the capacity of governments to develop and implement regulations in time.
- Secondments to Government from industry may assist in developing regulations.
- Better funding for relevant Departments may reduce legislative bottlenecks.

General view that the micro level of regulations are progressing better than the national measures such as carbon price for investor certainty but greater effort is needed in all areas.

Community/ Stakeholders

Objectives of community/stakeholder engagement

- Community/stakeholders support public funding of CCS
- Community/ stakeholder recognise value of CCS and accept development of infrastructure in communities

Issues, action, responsibility and timeframes for community / stakeholder engagement

Issue 1: Lack of community understanding regarding energy

- Community concerned that industry should be providing funding for CCS not government
- Community concerned that government favouring CCS over 'proven' renewables with funding
- Community don't understand issues such as baseload and why CCS necessary as part of low-carbon energy solution.

Action

- Educate community about energy and supply options; inevitable rising cost of electricity and feasibility, cost and environmental issues associated with various options
- Roll out Education strategy in schools so issues well understood to embed knowledge in future generations
- Utilise Energy White Paper
- Treat education around energy separately to climate change

Who

- Government and credible 3rd party endorsement

Time

- NOW!!

Issue 2: Safety

- Community perceive that catastrophic failure of storage or pipeline could lead to 'Chernobyl' type disaster
- Community don't understand that CCS safe and proven technology that is well regulated
- Potential that plans to roll-out CCS in Australia could be delayed if CCS fails overseas – want to differentiate Australia from less regulated projects overseas

Action

- Appropriate regulation, reporting and assurance in place needs to ensure sites appropriately run and managed:
- Educate communities using real examples to demonstrate that safety issues are being appropriately managed
- Demonstrate what a 'fail safe' site looks like and that this technology is being deployed elsewhere (ie: Berlin)

Who

- Government and project proponent – supported by research, science

When

- NOW, during CCS discussions (and monitoring during project and post)

Issue 3: Project Risk **(**i.e.: Environment / social / economic / heritage

- Who will wear the risk of a CCS facility? community want certainty around who will be responsible for issues which may arise from the exploration phase of a project through to long term capacity of storage.

Action

- Unsure regulatory framework clearly addresses risk and liability through all project phases
- Educate insurers about CCS and use actuarial models to manage risk
- Identify show-stoppers and ensure these are address in regulation

Who

- Government and insurance (private entity can't hold liability for life of risk profile (after closure)

When

- When drafting and reviewing regulation

Note: Regulation already in place in Qld, VIC, SA and Federally for offshore facilities

Issue 4: Community and stakeholder acceptance of CCS

- Communities and stakeholders currently have little understanding of CCS and there is currently no mechanism to educate or respond to misinformation
- There is not currently a high-degree of acceptance of CCS

Action

- Develop stakeholder engagement strategy that broader stakeholder and community issues as well as project level issues. The strategy should include the following components:
  - Project specific strategy for storage facility, pipeline and power plant
  - School education program
  - Business leader education strategy
  - Key messages for specific audiences including 'myth busting'
  - A strategy to convince and engage 'trusted voices' to assist in delivering the message and add credibility. Suggested 'trusted voices' include: CSIRO, state government, environmental NGOs, opinion leaders
  - A forum should be developed to allow 'communicators' to share and learn from each other
  - Open up demonstration sites to key influencers so they can see technology in action

Note: the engagement strategy should position CCS as part of a portfolio of low carbon energy solutions (ie: as well as solar, wind etc) that will all need to be implemented to meet growing energy needs in a carbon constrained economy

- Work with key political parties to develop tripartite support for CCS (Labour / Liberal / Green) with NGO support

Who

- GCCSI – C02CRC
- National low emissions coal council

- CSIRO

When / Time – staged approach (builds on flagships)

- Prepare stakeholder engagement strategy now so that interim support can be provided to flagship projects
- Commence full delivery when there is certainty that CCS will be deployed (don't want to deliver messages too early – or lose impact)
- Invest now in tools and knowledge / understanding of communities / stakeholders -> e.g.: CSIRO research

Issue 5: Don't reinvent the wheel

- There is a danger that communication and engagement on CCS will occur on a project level and in isolation. This could waste resources and compromise consistent messaging.

Actions

- Share knowledge learnt from projects (demo)
- Develop Principles for stakeholder engagement on CCS that are: objective based, transparent, flexible (non per scripture), efficient, practical and demonstrate openness
- Set up working group to explore community and stakeholder issues regarding CCS that includes: Government, Industry, NGOs and Communities
- Build on existing stakeholder engagement frameworks to develop best practice

Who

- Convened by government when building regulatory framework
- GCCSI

When

- Build on GCCSI workplan scheduled to start in 2010
- Research on value and power mixture of remix of industry and NGO's in communication
- Importance of network of non-conflicted talking heads delivering consistent messages to the community

Plenary discussion on action plans

Commercial

- There were different views on what sort of business model, i) integrated model or ii) multiple options?
- Groups disagreed on whether 100% of carbon costs can be passed on to the customer
- To what point do you develop pro-forma agreements etc. and to what degree do you put a framework around that?
- How can you test this as a project – costs, volumes and risks?
- Hub versus project – do you start with a small project, or do you build in scale for the longer term. Costs and benefits to both approaches
- There is some scope to duplicate successful projects. Then there is the argument that you think big, and you just go for it. Parallels can be drawn to canals, rails to roads.
- Need to model with probabilities and NPVs at the energy production points. At the moment the NPVs are negative. But there are a lot of inherent uncertainties. So need to look at the different business models, incorporating the different factors. Only through this can the government pick the winners.
- This may need to be balanced against the view that you create a smaller market, let the forces play out to pick a winner.
- Need to take into account that certain technologies may in fact overtake CCS, making it obsolete and the impact of this decarbonising on the global economy.
- The coal question needs to be addressed on a global scale from an Australian perspective.
- A ‘real options’ approach is a viable way of looking at the problem
- This has to be done on a value chain basis. ACCC has done a lot of work on value chain analysis.

Technical

Managing the supply chain

- Need to get a portfolio of storage options, based on size, land access, capacity, stakeholders, and risks/hazards

- Government needs to do more work around the pre-competitive information phase now, and as it is moving towards a more competitive scenario, industry takes on more of these assessments with academia being involved as well
- The key issues are capacity, skills and means/ resources

Key actions

- Essentially supply chain planning
- Identify the bottle-necks in the supply chain
- Need to have a government funded body to develop a framework to manage the supply chain

System Design

- No such thing as a CCS ready power station
- Need to design the entire system
- Need to think about a methodology/ framework for approaching this (sink, source, transport for e.g.)
- GCCSI needs to remove barriers to entry, mitigate issues of IP and knowledge sharing
- Analyse key risks, and the financial aspects of mitigation
- Develop plan to smooth out technological risks anticipated going forward
- From the perspective of existing Australian design, performance and safety standards there are no technology standards which will help inform each step of the supply chain.
- There is a huge challenge in standardising the different steps of the process to work with each other
- There may be a design standard for each component of the supply chain. But a national standard may be cumbersome.

Regulatory

Actions from the regulatory perspective need a framework as wide as possible: from the UN (macro) right down to state (micro).

Macro

- Need to have a deal at Copenhagen which makes sense

- Need for a long-term signals (such as a carbon price set by an ETS, mandatory performance standards, levies or subsidies) which are robust. The government needs to pick signals that work
- Price signal is what the government has to get right (this is bigger than just an ETS)

Enable legislation for significant projects

- Need to enable certainty for investors (no additional risk or liabilities) – The government accepts the other risks. Need to determine whether this applies to the entire supply chain or to specific elements
- Regulatory framework should not be divergent
- Have the right people in parliament and government to make the process run more effectively Industry could possibly second people to government
- Incentive to go commercial needs to be there
- The regulatory pendulum poses a risk to business which needs to be mitigated with the right mechanisms
- There is no firm link between what happens in the UN and at federal regulatory levels

Community

- Branding and marketing exercise needs to be targeted to the important stakeholders (e.g. the younger generation)
- Need to frame the communications in terms of social, community, economic and environmental benefits. However, don't shy away from the risks. Be myth busters. And discuss how risks are going to be addressed
- GCCSI's role will be to engage with community and communicate with them

Safety Issues

- Whose liability is it when things go wrong?
- Need to identify who bears the safety risks throughout the supply chain.

Other things

- Need trusted talking heads propping up the CCS
- Have different NGOs, governments and businesses all singing the same song
- Don't re-invent the wheel: objectiveness, transparency and Integrity still the key ways to go about winning community over

Common Themes

The Scenarios Workshop highlighted a range of barriers to CCS deployment in Australia. The overwhelming theme from the day is that these barriers will be challenging to be addressed to the satisfaction of commercial investors as both the costs and risks are high in any near or medium term timeframe.

From the discussions held during the workshop, there seemed to be strong agreement that the only possible model for short to medium term CCS deployment would be where many of these risks are underwritten, partially or wholly, by Government.

The participants reflected the likelihood of high technical confidence in most of the components of CCS (capture, transport and storage) and noted there are existing examples that are proven or could be borrowed from other sectors. The primary barrier will continue to be the high cost of each of these stages and the challenges of integration.

Regulatory frameworks for exploration, storage liability, easements and resource conflicts should be able to be developed in time for large scale roll out. However, the main concern is that a compelling price signal and or policy framework may not be strong enough or certain enough to encourage deployment.

Clearly from the work completed during the day, CCS is a long term GHG emission reduction solution. It is currently in its early stages but could be an important long term solution especially if atmospheric CO_2 removals are required to reduce the risks of dangerous climate change.

Australia needs to continue to invest as it has high dependence on its mature coal industry. Global efforts to reduce GHG emissions will mean coal will continually become less competitive as an energy source. This risk could be mitigated if CCS technology can become cheap and widespread as coal based energy so that costs can then remain competitive.

The scale of investment needed to develop a competitive CCS industry is large and there seemed common agreement from the group that global investments should be harmonised to maximise returns for community, industry and investors. The development of pilots and flagship projects should be undertaken as a portfolio rather that competing alternative solutions.

Community acceptance of CCS remains an important unresolved issue. Considerable attention may be needed to bolster the political support needed for CCS deployment.

Government support required for CCS is likely to be challenged by other sectors and technologies also seeking support. It could be argued that it is too early to “pick a winner” in any of these solutions so they all warrant some investment. CCS should be seen as one of the “reserve bench” of solutions that need still needs nurturing. One or all of these solutions may become widely applicable. Having a robust framework to managing this uncertainty justifies ongoing investment in this emerging technology.

Appendix 1: List of Attendees

ACA
Burt Beasley
Thomas Berly

AngloCoal
Bill Koppe

APIA
Steve Davies

CFMEU
Tony Maher

Chevron
John Torkington

Clinton Foundation
Tony Wood

CO2CRC
Guy Allinson
Peter Neal
Barry Hooper
Peter Cook

CS Taskforce
John Burgess
Andy Rigg
Keith Spence

CSIRO
Peta Ashworth

Exxon Mobil
Bob Griffith

Geoscience Australia
Rob Langford
Rick Causebrook

GGSS
John Bradshaw

Hydrogen Energy
Lewis Jeffery

International Power
Patrick Gibbons

NLECC
Bruce Godfrey

NSW DPI
Brad Mullard

PIRSA
Barry Goldstein

QLD DME
Rob Metcalfe
John Draper

RET
Peter Wilson

Rio Tinto Coal
Jon Davis

Santos
Mike Congreve

Schlumberger
Alf Garnett

Vic DPI
Fiona Clarke

Worley Parsons
Peter Cox

WWF
Greg Bourne

Xstrata
Barry Isherwood

Zero Gen
Rod Brown
Howard Morrison

RET
Larissa Cassidy
Meredith Dinneen
Jenessa Rabone

Appendix 2: Workshop Agenda

Carbon Storage Taskforce
Deployment Scenarios Workshop
Agenda

The Menzies Hotel, Carrington St Sydney 2000

15 May 2009
9:30am - 4.30pm

Time	Topic	Responsibility
9.30am	*Introduction & Overview of Agenda* Welcome and Workshop Objectives • Overview of the Carbon Storage Taskforce o Terms of Reference o Role of this workshop in the achieving the Taskforce goals o Taskforce progress to date • Today's outcomes: o Identify the implications of two CCS deployment scenarios o Identify the policies and actions that support or delay deployment of CCS o Identify situations where CCS is unlikely to be deployed and why? • Update on previous day's CCS Finance workshop	Facilitators Taskforce Chair
10.00am	*Session 1 - Framework for the day* • Overview of scenarios • What does success look like (short term and long term)? • What does failure look like (short term and long term)?	Taskforce Chair

10.20am	*Session 2 – Analysis of fast and slow scenarios* Break into 4 groups – 2 on fast scenario; 2 on slow scenario Consider facilitators and barriers to action and any key uncertainties. Some areas to consider include: • Demonstration projects priorities • Scaling issues • Emissions/capture profile • Exploration, development of storage sites • Pipeline access, configurations and cost variables • Carbon price and volatility • Energy penalties • Community acceptance • Other technology curves • Role of government (State and National) • Who pays? • Other Factors – what has been missed?	Group sessions
11am	*Morning tea to be available during group work*	
11.20	Plenary session Feedback from groups • Identifying key barriers and facilitators of progress using the following themes o Commercial o Regulatory/Planning o Technical o Community/Stakeholders • What are the key issues where collaboration is needed?	All
12.30pm	*Lunch*	
1.15 pm	Update on transport and storage tariffs modelling	Guy Allinson

1.35 pm	Developing Action Plans – What is required to facilitate action on CCS deployment? Participants split in one of four groups: • Commercial	Group Work

	• Technical • Regulatory • Community/Stakeholders	
2.05	Participants rotate into second different group (i.e. all participants will have the opportunity to contribute to 2 of the 4 groups)	Group Work
2.30 pm	*Afternoon tea*	
3.00pm	Plenary Discussion – Summary of required actions by government, industry and other stakeholders	All
4.00pm	Confirmation of key messages and outputs including any consensus or area s of significant dissent • What are the key messages? • What issues need to be referred for further action?	All
4.15 pm	Closing remarks from the Chair, including next steps	Taskforce/Chair
4.30pm	Workshop Close	