

Submission to Infrastructure, Planning and Natural Resources Committee on the proposed Strong and Sustainable Communities Bill 2016 by Dr Cliff Mallett

Summary

This submission claims that no valid reason has been presented for the minister's proposal of a ban on UCG. The minister presented a recommendation as if this is a matter of ministerial discretion, (as exists with respect to many matters in the legislation on resource development). This proposed ban is a matter of substantial policy change, significantly changing the rights of existing tenement holders and those of future tenement holders, and affects future developments for Queensland. The minister has a responsibility to present evidence that supports such changes and their flow on effects. This submission details how no valid or evidence-based reasons have been provided.

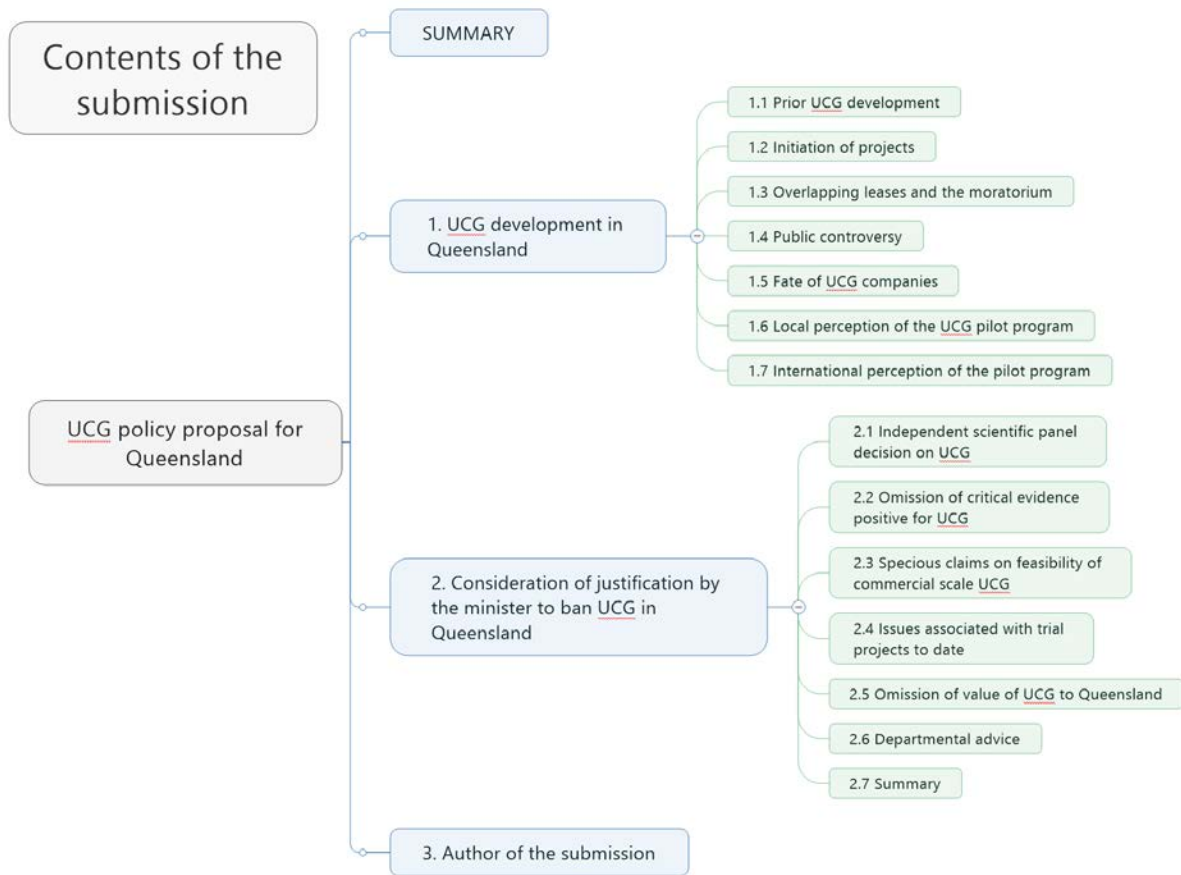
The minister also has a responsibility to detail negative effects of his proposal, in this case the denial of the opportunity provided to Queensland for economic development, jobs and royalties flowing from Queensland's enormous UCG coal resource which is of particular relevance to rural communities.

The submission summarises the history of underground coal gasification in Queensland which led to the imposition of a moratorium on UCG development in favour of coal seam gas leaseholders - How that moratorium was extended by imposition of new demands after satisfactory demonstration of UCG production - How after these additional demands on rehabilitation were met, further additional conditions are demanded on commercial scale operations, while at the same time denying UCG industry the permits which would allow them to answer questions on commercial scale developments. Attention is drawn to the undue influence that has been exerted on government policy for UCG by the competing CSG industry and activists.

It remains a mystery why the minister is proposing this ban on UCG. None of his claimed reasons withstand examination and his reasoning is patently illogical. We have no way of knowing what the most persuasive concepts contributing to the minister's opinion are, only that the reason provided do not support it.

This submission maintains that the main impediment to approving permission for commercial UCG is the lack of a standard for UCG operation which would form the basis of government regulation. UCG poses no unique environmental challenges not present in other chemical and mining industries, and could be efficiently managed by existing government controls if standards and protocols for safe UCG operation are explicit.

Maximum benefit for Queensland would be achieved by encouraging the establishment of national UCG standards, and only permitting those projects that can demonstrate that they can achieve the necessary operational standards. That is, not to apply a blanket ban on UCG, but rigorously assess proposals against documented best practice. This would ensure that all UCG operations that were allowed could operate within the safety and environmental expectations demanded of all other industries.



Part 1 Underground coal gasification development in Queensland

1.1 Prior UCG status

Over 100 UCG trials and projects have operated in the last 100 years. Most have been small, short term experimental trials. From the 1930s to the 1970s commercial scale UCG was done in the former USSR, mainly using a series of small underground gasifiers in a coal seam between *vertical boreholes* drilled down to the coal. One borehole was used for injecting oxygen and one to extract the product syngas. Most activity stopped in the 1970s when huge reserves of natural gas were discovered in Siberia, but one operation has been in continuous production in Uzbekistan since the 1950s.

From the late 1970s to early 1990s The Department of Energy in the USA sponsored many trials which tested new designs of underground gasifiers. New drilling technology which could make long horizontal boreholes within a coal seam reduced the number of vertical boreholes required, and individual gasifier cavities were created along the length of the horizontal borehole. This was achieved by continuously retracting the injection point for injected oxygen for each successive gasifier cavity – *the CRIP method*. Advances in UCG design were best represented in the Rocky Mt trial at Hanna in Wyoming where vertical well designs were compared with CRIP methods in the same coal seam. UCG activity ceased in the USA in the 1990s when natural gas prices fell to record low levels.

Little attention was given to environmental impacts of UCG until some of the early US trials when environmental impacts extended from federal lands where the trials were conducted by federal agencies, into the neighbouring state lands. (Much of the USA is divided into one mile grids alternately administered by state and federal authorities.) Subsequent trials emphasised environmental performance and a ‘clean cavern concept’ was developed and demonstrated in the later trials. Although all this information was available to Queensland authorities, including the success of environmental controls, they demanded that it all be done again in Queensland.

CSIRO in Queensland researched UCG performance from 1996 and developed a new gasifier design which eliminated many of the problems that had been encountered in previous trials. This method used a single gasification face to continuously extend a single large gasification cavity between two horizontal boreholes in the coal seam. As movement of the gasification face had to be matched by similar movement in the injection point of oxygen it is referred to as the *parallel CRIP* method.

1.2 Initiation of UCG projects in Queensland

The first UCG site in Queensland was started by Linc Energy at Chinchilla in 1999 and ran till 2002, largely funded by a Queensland government power company. It used the Russian vertical well method and reported minor localised impact on groundwater at levels of no serious concern.

In 2006, Linc Energy under new ownership started new UCG panels at the same site, still using vertical well methods. Around the same time two other companies commenced UCG operations, Cougar Energy (headed by the original owner of Linc Energy) at Kingaroy using the same technology as had been used at Chinchilla), and a spin out company from CSIRO using the new parallel CRIP design, later known as Carbon Energy. The companies were all publicly listed companies on the ASX and attracted large numbers of local ‘mum and dad’ investors. Carbon Energy had over 5000 of

these small, mainly Queensland based investors. All projects were functioning effectively under the Queensland mining regulations as just another coal mining method.

1.3 Overlapping leases and the moratorium

The start-up of the UCG projects coincided with the initiation of the coal seam gas industry in Queensland based on petroleum permits. It was soon realised that a conflict existed between the rights of CSG petroleum lease holders to dewater coal seams to extract coal seam gas, and the rights to operation of UCG which requires that natural groundwater pressure remain in the coal seam. These mutually exclusive extraction technologies had both been granted rights to the same coal seams.

The CSG industry, spearheaded by Richard Cottee of QGC launched a campaign to convince the Queensland government to give preference rights to petroleum lease holders over UCG rights. Professional lobbyists were recruited to help with the campaign. Not only could the CSG companies exert influence through their planned large investments in Queensland, they encouraged environmental activists and rural groups by promoting miss-information on the environmental status of UCG. This enflamed rural and community concerns on the environment and had the advantage of both deflecting some of the focus away from the CSG companies' own problems with the community, and getting the environmental activists to lead the attacks on UCG, disguising the origin of the campaign.

The government recognised the legal implications for compensation in denying coal mining permit holders their rights and looked for a way out. CSG lobbyists provided a solution in dismissing the demonstrated success of environmental controls for UCG in the USA, and exaggerating the risks with UCG. A justification was created for the government to impose a moratorium on commercial UCG (a right to potentially develop UCG held by UCG companies) until long term trials had been conducted to duplicate the environmental performance of UCG, which had been documented 20 years earlier in the USA. This provided the CSG industry with the opportunity to commence dewatering the coal seam aquifers which effectively sterilised the coal deposits for UCG for at least 50 years (far beyond the expected 20 year life of a CSG operation) and allow time for the government to progressively modify the conditions on coal mining leases to be used for UCG, to ensure that coal lease holders could not claim compensation for loss of the rights they held in 2008. These changes to lease conditions have been implemented by government.

It is ironic that while the government was insisting on duplication of environmental performance of UCG, it was allowing the CSG industry to proceed with a portfolio of unresolved environmental problems, some of which still await solution seven years on.

1.4 Public controversy

With the start of the moratorium and UCG pilot program for the three UCG operators that were already operating in 2009, work on the UCG site continued in the confidence that as the environmental credentials of UCG had already been shown in the USA, they would be duplicated in Queensland resulting in the approval of commercial UCG operations.

However the CSG industry were not satisfied with just a moratorium on UCG, they wanted it banned, and continued their campaign. Concerns with the environmental performance of the resource industry escalated in the community, largely as a result of actions of the CSG industry, and although this had negative implications for them, it increased the potential to use environmental issues to attack UCG.

In 2010 the Kingaroy UCG pilot suffered a failure in a production well that had not been correctly installed. They were later prosecuted for non-compliance with their environmental authority for not ensuring the proper construction of the well. Around the time of the failure a routine monitoring well sample was erroneously reported as having significant contamination. While the results were being checked, they were leaked to a local activist group and a local member of parliament up for re-election, who organised meetings, the press seized on the issue, and the government imposed draconian conditions on the UCG site in a belated effort to demonstrate effective regulation. By the time the laboratory acknowledged the results were a mistake, the 'horse had bolted' and a major public controversy was raging. It was discovered that one monitoring well did show contamination in one sample (not replicated subsequently) at 2 parts per billion benzene. For reference, this level is five times lower than the drinking water standards in Europe. It should also be noted that CSG companies occasionally find that levels of benzene higher than this occur naturally in the groundwater in coal seams. The outcome was that the government withdrew the rights of the Kingaroy site to conduct UCG operations, discontinuing their involvement in the UCG pilot demonstration program. The government's action at the Kingaroy UCG site was subsequently soundly criticised in a State Ombudsman report, and there was no justification for their actions. The problem at Kingaroy was clearly related to equipment failure in a poorly constructed borehole which should have been better supervised. The UCG methods used had operated in the former USSR for over 50 years and had also been used for two years at Chinchilla with no recognised problems. Contamination was detected but at levels which pose no significant environmental or health risks, and which are routinely managed in industrial and mining industries. The department issued press releases at the time describing the contamination level in groundwater at Kingaroy as 25 times lower than levels in typical Brisbane air and 400 times lower than air around typical service stations. *Scarcely a basis for a ban on further operations.*

1.5 Fate of UCG companies

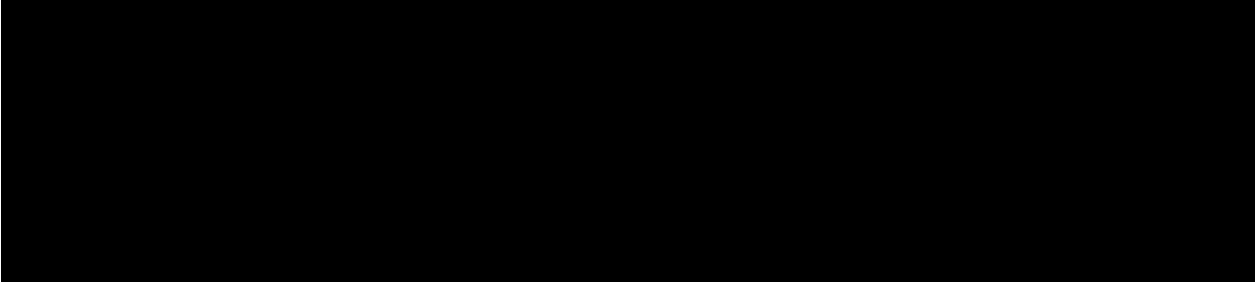
The other two UCG pilots were also restricted in their operations in 2010 and delayed for over a year in their trials, although there was no evidence of any significant problems with their UCG operations. In Carbon Energy's case the excuse was a spill of process water that had occurred nine months previously, had been cleaned up, shown to departmental officers who expressed no concerns, but the offence was that a report on the event had not been submitted in a timely manner.

These companies reported their UCG pilot activities to the independent scientific panel in 2012, who gave their report on the pilots to government in 2013. While the independent scientific panel indicated that commissioning and syngas production at the sites was satisfactory they recommended that the trials be extended to allow demonstration of decommissioning and rehabilitation, and commented that there were uncertainties with upscaling of the pilots to commercial projects. Nowhere did they suggest that issues in upscaling could not be managed, as they have been with the introduction of other new mining technologies.

There is an obvious question as to why the independent scientific panel would recommend delay in approving commercial UCG operations until decommissioning and rehabilitation were demonstrated, when they were well aware that these methods had been effectively demonstrated in the USA. Public concerns about UCG were continuing, fanned by ongoing activities of the CSG industry and anti-any-resource project activist groups, and the government were responding with aggressive scrutinising of UCG projects. Around this time there were half the number of departmental environmental officers assigned to the two small operating (and one shut down) UCG sites as there were to the whole CSG industry that was spending billions in pipelines, roads, CSG wells, gas facilities and water processing plants across a fifth of Queensland. It would have been obvious that the government was not expecting an enthusiastic endorsement of the UCG operations. It is to the credit of the independent scientific panel that they did not compromise their professional integrity by refusing to acknowledge the satisfactory operation of the two UCG pilots, but was also very convenient for the government that they suggested reasons to further delay decisions on a policy for commercial UCG. It rang up another success in the CSG industry campaign to restrict and ultimately abolish UCG.

Cougar Energy who operated the Kingaroy UCG pilot started legal action against the government for restrictions on their project, but their annual reports indicate that they lacked funds to fight the court case which was abandoned and they instead pleaded guilty to failures in environmental authority requirements resulting in a small fine. The company changed ownership in 2013 and no longer has any activities in UCG. The company has implemented a rehabilitation plan for the Kingaroy UCG pilot site.

Carbon Energy continued with the UCG pilot after 2013 as requested by the Queensland government, and in 2014 completed requirements as suggested by the independent scientific panel. Comprehensive reports on decommissioning and rehabilitation, including several thousand pages of data, were submitted in 2014. No confirmation, endorsement or modification of the rehabilitation plan has been received from the department of Environment and Heritage Protection although it is known that external review of the reports have been with the department for over two years. It is significant that on a basis of information provided to government departments, the Queensland government Chief Scientist issued a statement this year that Carbon Energy was the only participant in the UCG pilot program that had successfully completed all the requirements of the independent scientific panel, and that their technology would be a major contributor to an international UCG industry, providing new clean carbon technology to the world. Carbon Energy was placed into administration in November 2016, unable to raise funds for the company to continue. The primary reason has been the destruction of company value from time delays and restrictions at their UCG pilot imposed by government, and the loss of the ability to develop UCG projects on their leases in Queensland. It also affected their ability to market their technology in other countries. This has destroyed the value of thousands of Queensland mum-and-dad investors who thought government UCG policy would be evidence-based.



Of the UCG companies involved in the Queensland government UCG pilot program, at this time none survive or continue in UCG activities.

1.6 Local perception of the UCG pilot program

Stakeholders in the UCG industry in Queensland see the outcome either as a triumph or a disaster.

The CSG industry is on the verge of meeting their objective of removing all threat of access to the whole areas of their petroleum leases from UCG. It has successfully achieved a moratorium on UCG. It has seen that moratorium extended despite success in the UCG pilots, creating a delay that has led to the demise of the small start-up UCG companies with their limited funds. It has seen staff who initiated the campaign against UCG move to other positions in the industry, and even into sensitive advisory roles in government where they could continue to influence decisions.

The activist groups see the outcome for UCG in Queensland as a success, although it may be also considered as a 'sacrificial lamb' to distract them from their inability to stop CSG developments and new coal mines.

The government has resolved a difficult situation where they had granted mutually incompatible leases over the same coal deposits, and have avoided significant compensation which was due to withdrawal of rights to extract coal that they faced in 2008. They have been able to use the restrictions on UCG to placate to some extent the activist groups they have offended by continuing CSG and mining permits. To restrict UCG they have had to ignore all objective data on the performance of the UCG pilots, exaggerate the significance of UCG environmental impacts with alarmist press statements to build community support for bans, avoid the testing of their claims in objective courts, and string the process out until the undercapitalised UCG companies expire from lack of funds. They have ignored the potential benefit to the state of UCG, preferring to take the short term 'bird in hand' contribution of the CSG industry, which now is largely controlled by large international resource companies that export Queensland's resources with no value adding and very little local employment, and caused massive increases in the domestic price of gas. This is in comparison to a potentially much larger UCG industry that generates employment and new value added industries in regional areas, for possibly another hundred years.

The public have only heard of UCG poisoning prime agricultural land, and government prosecutions of operators. Only a small section of the community has had contact with the UCG operations, and accept the industry on the basis of its performance. Investors in the UCG companies have had their investment savings destroyed, principally by Queensland government policies.

1.7 International perception of the UCG program

In contrast to domestic perceptions, from an international perspective, the Queensland UCG pilot program represents the biggest leap forward for UCG technology since the US program finished thirty years ago.

- A rigorous scientific program was undertaken under supervision of an independent scientific panel, and intense scrutiny by environmental regulators. In addition other external consultants were involved in assessments and recommendations.
- The program included multiple examples of each of the UCG borehole technologies that have been developed around the world, plus the new CSIRO derived Keyseam (*parallel CRIP*) technology which out-performed the earlier methods, and was the only pilot to successfully complete all the requirements of the independent scientific panel.
- It helped define and establish the essential conditions required for safe and efficient operation of UCG. It showed that where a thick coal seam is overlain by a clay seal rock to contain upward loss of gas, and groundwater pressure in the coal seam is high enough to restrict lateral loss of gas through the coal seam fractures, all designs of UCG gasifiers can be safely operated.
- Comparative performance of different UCG gasifier designs was shown at the different pilot sites, including, vertical wells using reverse combustion linkage and borehole linked wells, linear CRIP and variations on linear CRIP, and the new Keyseam parallel CRIP design.
- It proved that when some essential confining condition around an underground gasifier cavity fails and allows a local release of contaminants, adjustment of relative groundwater and gasifier pressure can reverse the effects and restore groundwater to natural conditions.
- The minimum depth and groundwater pressure for safe UCG operation has been identified.

The nature of trials of a new technology is to try various design features to evaluate their efficiency or negative impacts. In these circumstances errors or failure of equipment will always occur, and in fact, more learning is gained from failures than a success. A failure indicates some limit or essential feature that is needed, whereas if a trial goes exactly as predicted no improvements can be identified.

A major impediment to UCG implementation around the world is the lack of comprehensive guidelines for operation that can assist regulators in permitting requirements. The Queensland program is recognised as a major step forward the creation of such standards. The government of China has included UCG as one of the clean coal technologies for the next five year plan. Although China has operated over 20 UCG sites in the last 25 years, it is recognised that their technologies have not succeeded either technically or commercially. They view the Queensland UCG pilot program as the template for future development using borehole based gasifier designs to access deep coal resources. Actions include:

- Establishment of an International UCG Research Centre at the University of Mining and Technology. I have been appointed as director of the Centre based on my experience at CSIRO and as the technical director of the Carbon Energy UCG project at Kogan in the Queensland UCG pilot program.
- Initiation of a project developing National standards for UCG in China for the Energy Standardisation Committee of the Technology Bureau of National Energy Administration

(NEA), by the CUMT International UCG Centre and the China National Administration of Coal Geology. The outcomes on the Queensland UCG program will be the most significant source of information for these standards.

- Coal owners and mines are aggressively seeking access to the best technologies demonstrated in Queensland for their operations

This confirms the predictions of the Queensland government Chief Scientist who identified that the technology proven in Queensland would be the basis of a new generation of clean coal UCG projects around the world, lamenting the probability that Queensland would turn its back on its home grown technology development.

Part 2 A consideration of the justification by minister Lynham to recommend a ban on UCG in Queensland

Hon.A.J.LYNHAM 8 Nov 2016 statement

“The bill also amends the Mineral Resources Act 1989 to prohibit underground coal gasification, or UCG, and in situ oil shale gasification activities. In 2009, the Queensland government established a process for three companies to undertake limited UCG trials to establish the commercial and environmental viability of this potential industry. The government was always going to consider whether this technology was appropriate for Queensland after the trial process.

As part of the process, an independent scientific panel produced a report on the UCG trial. While the panel remained open to the possibility that the UCG concept is feasible, it also found that sufficient scientific and technical information was not yet available to reach a final conclusion, particularly in relation to potential commercial scale UCG projects. This uncertainty, along with issues associated with the trial projects to date, has led the government to the decision that the potential issues of allowing projects to grow to commercial scale are simply not acceptable.

On 18th April 2016, the Minister for Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef and I announced the government’s decision to ban all UCG activity in Queensland”

This statement is factually inaccurate in part, misleading in its selective quotations, and illogical in its conclusion. How does “*information ..not yet available*” justify a decision to ban looking for that information?

2.1 Independent scientific panel decision

The independent scientific panel conducting the review of the UCG pilot program, only considered the commissioning and production phase of underground coal gasification, which had been completed in the UCG pilots at that time. The descriptive phrase above “*While the panel remained open to the possibility that the UCG concept is feasible*” is a misquote of a statement by the panel “*Neither company has yet demonstrated their proposed approach to decommissioning, i.e., the self-cleaning cavity, is effective. The ISP remains open to the possibility that the concept is feasible.*” which was a reference to the, as yet not demonstrated, decommissioning process, not the operation of the UCG gasifier.

The independent scientific panel report actually said “*Underground coal gasification could, in principle, be conducted in a manner that is acceptable socially and environmentally safe when compared to a wide range of other existing resource-using activities*” and also “*Both companies have demonstrated capability to commission and operate a gasifier*” It is obvious that the conclusion is a positive one with respect to commissioning and syngas production, but appears as if they are qualifying the opinion in some undefined way. There could be a number of reasons for this apparent reluctance, including:

- It is a matter of public record that government officers were forensically monitoring UCG operations in response to CSG lobbying and community and activist’s

campaigns with respect to the Kingaroy UCG site. The regulatory response to events at the UCG site was aggressive and extreme, and in hind sight “over-the-top”. The situation was also inflamed by an existing anti-mining activist group at Kingaroy opposing expansion of the Tarong power station coal mines, state parliamentary candidates vying for publicity, and an irresponsible press campaign. It would have been obvious to the panel that an enthusiastic endorsement of UCG was not being expected by the government.

- As discussed elsewhere in this submission, a major factor for UCG was the lobbying by the coal seam gas industry against the granting of UCG permits over areas of potential coal seam gas activity. The chairman of the independent scientific panel would have found himself in a difficult position as director of the Sustainable Mining Institute of the University of Queensland, as it had accepted very significant funding from the coal seam gas industries to set up a research group on coal seam gas, which he was the director of.

The minister is [REDACTED] creating the impression that the independent scientific panel did not acknowledge that the UCG pilots had been conducted in a satisfactory way by miss-quoting their report and confusing their endorsement of the process with their reluctance (possibly for other reasons) to sound too enthusiastic.

2.2 Omission of critical evidence positive for UCG

The panel drew attention to facts not yet demonstrated at the time of their report, (because UCG pilots had not proceeded past the production phase, not because of doubt that they could) principally the ability to decommission and rehabilitate a UCG site, and with less emphasis, the lack of demonstration of upscaling to commercial projects. They recommended the current pilots be extended to demonstrate decommissioning and rehabilitation, which was taken up by the government, delaying the need for a government policy decision. As the need to demonstrate rehabilitation strategy was never included in the original brief for the independent scientific panel or the UCG participants, the independent scientific panel concluded its work. Participants could hardly have been expected to have demonstrated rehabilitation while syngas production was still occurring, and when rehabilitation had not been specified as a requirement. Nevertheless participants have subsequently worked on rehabilitation of the pilot sites and at least two of them have initiated successful rehabilitation strategies, but still await, two and a half years later, a response from the Department of Environment and Heritage Protection on the plans. It is worth noting that one company has been endorsed by the Queensland government chief scientist as completing the independent review panel requirements for acceptably operating and rehabilitating a UCG project.

Why was no reference made by the minister to the main recommendation by the panel for further work on rehabilitation, which has subsequently been completed and submitted to government over two years ago by some participants, and is the most critical issue in consideration of UCG policy?

2.3 Specious claims on feasibility of commercial scale UCG

The following phrase “*it also found that sufficient scientific and technical information was not yet available to reach a final conclusion, particularly in relation to potential commercial scale UCG projects*” is grossly misleading.

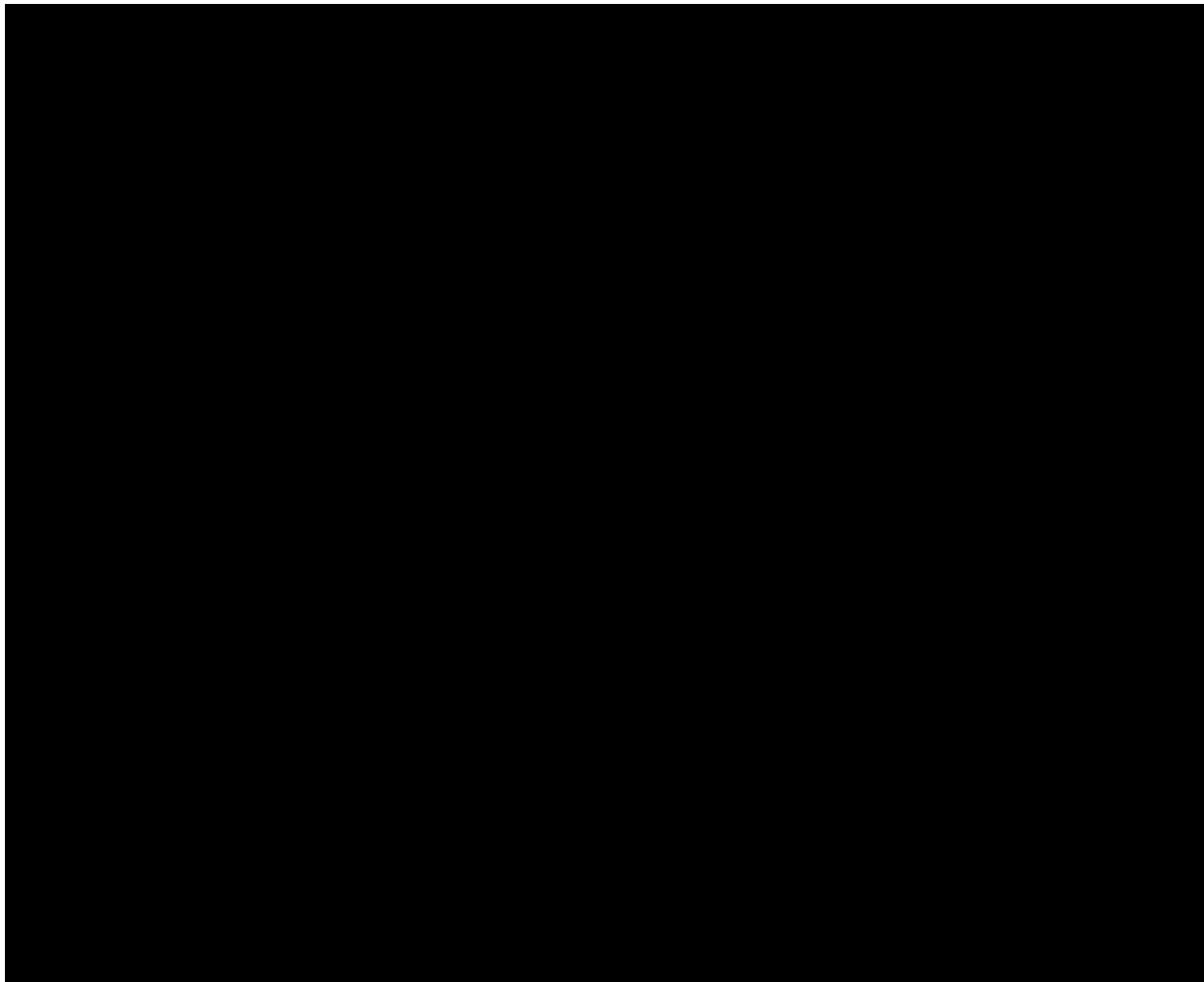
The specious claim with respect to commercial scale demonstration of UCG is even more glaring than omissions of rehabilitation success, as it is the principle basis claimed by the minister for his proposed ban.

This issue was addressed by participants in their reports to the independent scientific panel, with modelling showing that with appropriate geological conditions using appropriate UCG technology large scale UCG is feasible. Not every possible variation in conditions can be specifically addressed, and as with conventional mining, for some deposits it will not be possible to extract resources where geological conditions do not match the characteristics of a particular technology. However it was shown that where geological conditions match the requirements of UCG technology, it should be feasible to safely conduct UCG. Uncertainty is associated with specific site conditions, and it is in the environmental assessment studies of individual sites that the feasibility of UCG at that site is determined. This situation is the same as that applying to any conventional mining operation. Solutions which are site specific can not be expected to be demonstrated until permits for initial feasibility and environmental work are available, and the work undertaken. A ban on UCG operation can only be justified if the plans for commercial scale UCG project cannot satisfy environmental, safety and social standards, and for this, the opportunity to demonstrate capability is required.

It is a spurious conclusion of the minister to ban UCG on the basis that “sufficient scientific and technical information was not yet available ... in relation to potential commercial scale UCG projects” when the reason for the deficit is his refusal to allow development and demonstration of the very information he demands for commercial scale UCG permitting.

2.4 Issues associated with trial projects to date

“*along with issues associated with the trial projects to date*” This is a particularly objectionable assertion. None of the pilot UCG sites have been proven to cause environmental harm. The site at Kingaroy was shut down early, with subsequent court decisions on non-compliance with environmental agreement conditions, not claims of any significant environmental harm. The slight traces of contaminant found at depth pose no risks to people or biota, and as pointed out in government press releases at the time, contamination levels of benzene in the groundwater were ten times lower than in the air in Brisbane, and hundred times less than typical air around service stations. The UCG site at Kogan has demonstrated successful operation and rehabilitation of the UCG operation. It only had ‘housekeeping’ non-compliance issues with disposal of process water, not the UCG process. Again the government has never taken action for environmental harm but only for non-compliance with procedures in environmental approvals. [REDACTED]



2.5 Departmental advice to the minister's office

The question relates to what departmental advice, reports or information had been provided to the minister's office in regards to underground coal gasification, which would have informed him and led the minister to a decision to ban UCG.

Members of the public do not have access to such documents unless they are released, so it is not possible to know, and officers of the relevant ministries have (correctly) refused to provide any details when requested. They have commented that they were 'surprised' by the announcement of a ban on UCG. An implication of this is that the decision arose within the minister's office, rather than being based on the independent investigations and reports of departmental officers.

It is a matter of concern if the minister is basing such fundamental decisions solely on his office advisers, which have a political rather than an objective focus, without adequate consideration of a departmental perspective. His office is a target for influential lobbyists which in this case would include such powerful groups as green activists and the coal seam gas industry, both committed to annihilation of the UCG industry.

Can the minister indicate what (if any) advice on the performance of the UCG pilots he received from relevant departments in making a decision on UCG?

2.6 Omission of UCG value to Queensland

As the minister's 8 November 2016 statement reported, the government approved UCG trials were to undertake trials to "establish the commercial and environmental viability" of a UCG industry. Participants were required to present evidence of the value of a UCG industry to Queensland. Reports were provided to government (not the independent scientific panel) which indicated a gigantic potential for economic development. The possibilities are so enormous that they seem unbelievable, equal or greater than the conventional coal industry to Queensland, and far greater than the CSG industry will be. Some facts that help explain this:

- Queensland has enormous resources of deep coal, significantly greater than present mining reserves at shallow depths and in the order of hundreds of billion tonnes.
- The coal basins in Queensland (Surat, Gallilee and Bowen) all have large areas with the essential conditions for UCG which are thick undisturbed coal seams, with overlying seal rocks which control the loss of gas and isolate UCG operations from any useful aquifers. We have spent the last fifteen years investigating coal basins globally, and I am convinced that Queensland has the best conditions for UCG in the world
- UCG syngas has to be converted to a market product on site, creating value adding industries and employment in regional areas
- A UCG project has a small footprint but high returns. The relatively small 300Mt coal deposit used for the pilot at Kogan occupies around 12km² and is capable of supporting a syngas fed fertiliser plant producing 3000t/day for more than 50 years, with a direct product value of \$10-20 billion.
- Potential products from syngas are many and include electrical power, fertiliser, chemicals, methanol, plastics, synthetic natural gas and liquid fuels.
- Given the number of UCG projects that could be established, the impact on the Queensland economy is so great it looks unbelievable when written down.

Has the minister considered the value of a successful UCG industry to Queensland?

2.7 In summary

A truer representation of the situation is:

- a. The independent scientific panel agreed UCG had been carried out acceptably
- b. A new requirement for environmental rehabilitation was recommended and the panel concluded its work
- c. Successful rehabilitation plans have been demonstrated by at least some participants
- d. Commercial scale UCG cannot be verified if it is not permitted to demonstrate the capability, and there is no reason to think the application of proven underground mining methods will not work for large scale UCG
- e. No significant environmental harm has been shown at two UCG sites and it is premature to judge the outcome of investigations at the third site.

There is no evidence to suggest that a UCG industry would pose environmental risk which could not be managed by existing regulation as applied to industrial and mining projects. However standards and protocols for UCG operation are yet to be developed which could guide specific regulation of a UCG industry in large commercial projects. In the light of the huge potential for a UCG industry, the logical step is not to ban the industry, but to develop the requisite national standards for UCG, and encourage development to prove UCG can deliver the prospective benefits safely. No one wants to see the situation as occurred at Kingaroy in the UCG pilot program, where a proven UCG technology project failed because known procedures to ensure production wells were constructed properly, were not implemented. This can be avoided if comprehensive listing of operational standards for UCG projects is available, and regulated to be adhered to in all projects. Each project would be required to demonstrate that they were operating in a way that guaranteed they would achieve the standard's objectives.

It remains a mystery why the minister is proposing this ban on UCG. None of his claimed reasons withstand examination and his reasoning is patently illogical. Is it possible they actually believe their propaganda on environmental impacts at the UCG sites and don't understand the real situation? Is it because the minister and his advisors cannot or do not want to publish the actual basis for their opinions? That is simply inconsistent with ministerial responsibility in a democratic parliamentary system. It has been noted that powerful lobby forces are deployed in the debate on UCG permitting and there are any number of factors that might affect such a decision. We have no way of knowing which are the most persuasive factors or what pressure may have been directed to the minister or government, only that the reasons provided do not support it.

3 Experience of the author of the submission

Dr Cliff Mallett; mallettclifford@gmail.com

Professional roles:

Company founder and technical director of Carbon Energy

Director, International UCG Research Centre, China University of Mining and Technology, Xuzhou

Chairman, UCG Association 2013-15, the London based international UCG industry association

CSIRO: 30 years research into mining technology; acting 2004-6 Chief of Division of Exploration and Mining; Executive manager QCAT Pullenvale; Project leader for UCG research 1996-2006.

Underground coal gasification

As part of CSIRO research into new mining methods I started a research project on UCG in 1996. The project investigated all information available on prior UCG operations, and over 65 trials or operations were analysed. The strategy was to identify factors that led to good outcomes and the features that led to failure or poor performance. From this a list of essential or desirable characteristics of coal deposits and UCG designs was compiled, along with a list of characteristics and design features to be avoided. The performance of various UCG designs were compared. From this a new UCG gasifier design was developed which would avoid many of the issues which caused problems in earlier UCG sites.

In 2004 I briefed the Queensland government on CSIRO developments and the potential for UCG in the Surat basin, at that time not considered a coal mining prospect for other than very shallow coal. The suggestion was for the government to reserve the areas of deep coal while a UCG demonstration was carried out, and tendering the coal once its value had been established. This would prevent land banking and a repeat of the 1960's situation when the Utah company held most of the Bowen basin under lease for conventional coal mining. The advice was that it would be too difficult administratively and to just go and take out coal exploration licences, which I did personally as CSIRO lawyers did not think a commonwealth statutory body was qualified as a lease holder in Queensland. These leases subsequently became the basis of Carbon Energy's UCG resource.

At CSIRO the work not only focussed on a new and a more efficient UCG gasifier, but paid particular attention to the environmental controls that ensure UCG does not cause environment harm. As a CSIRO researcher I had spent a major part of my professional life working on the safety and environmental performance of coal mines, that is the pervasive ethic of the organisation. CSIRO was never going to advocate the uptake of a new technology if it was not been convinced that new technology could meet community expectation for safety and the environment. I take personal offence that the minister thinks that I and my CSIRO research team would consider promoting a technology if we had not thoroughly verified successful environmental management procedures.

In 2006, I and other members of the CSIRO UCG research project left CSIRO to form a company based on CSIRO's UCG technology and financing from a public company. From the start, conditions to ensure that UCG was safe and environmentally compliant were foremost in planning, which resulted in a successful demonstration at the Kogan site. Over the last ten years I have been intimately involved in the conduct of the Carbon Energy UCG pilot, and all the issues of government relations and permitting.

On the basis of my extensive experience in the theory and practice of UCG, in 2016 I was headhunted to lead the new International UCG research centre in China, help develop the national UCG standards for China, and lead the technology teams introducing the new generation of UCG technology for commercial developments in China. I would love to be doing this for Queensland, rather than China.

CARBON ENERGY MEDIA

Energy News Bulletin

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Ex-Chief Scientist lashes Qld UCG ban

<http://www.energynewsbulletin.net/storyview.asp?storyID=826963625§ion=0n+the+Record§ionsourc=s121&aspdsc=yes>

FORMER Australian Chief Scientist (1999–2005) Professor Robin Batterham, who was on the review team for the report of the Independent Scientific Panel Queensland's government set up to overview UCG operations to ensure a safe and reliable path towards commercialisation, writes exclusively for *Energy News* criticising the state's knee-jerk reaction by banning UCG extraction.

Innovation is the buzz word of politics right now. That is most encouraging as it is what Australia needs, but should it be politics that determines the outcomes of innovation or is a sound base of science and technology a better driver?

A recent policy decision in Queensland banned an emerging industry, underground coal gasification, due to two trial participants not having the appropriate process controls in place.

There was also another company, Carbon Energy, which did demonstrate solid environmental results and followed a transparent and scientific methodology. Despite this it was also banned from operating in the state, posing the question – what was the purpose of the trials?

Large scale trials that are first of their kind, by nature, always take time to develop and successes are renowned for coming after a series of failures. As we have discovered not all technological trials are created equal nor do they have the same adequate risk based controls in place.

The Queensland UCG trials began in the late 2000s and were seen as an opportunity to demonstrate innovation on extracting gas from coal without the need for mining. Since then a very different process, CSG, has mushroomed and the shine from coal to gas operations has dulled.

Carbon Energy is a relatively small company of about 15 employees now, and about 5000 mum and dad investors who strongly believe in its technology, investing over \$150 million which has been developed with over 10 years of research with the CSIRO.

This innovative company has utilised a rigorous and scientific methodology that it appears other trials in Australia have not.

- Firstly, its process identified early on that site selection and depth of operations was critical to success.

- Process controls and design of its technology meant it was fully in control of operations. Its unique technology allowed for control that was environmentally safe and could be managed in a responsible risk-based manner.
- Its trial included decommissioning and a rehabilitation plan (which involved allowing for natural remediation), which no other proponent has done and now Carbon Energy can demonstrate.

This all adds up to a world first scientific demonstration of an emerging technology from site selection, underground coal gasification with no deleterious impact and finally rehabilitation to conditions no worse than what existed at the start. In my opinion it is simply irrational to ban such a process based on the evidence available.

I first came into contact with Carbon Energy in 2011 when I was asked to peer review a report developed by a government-appointed Independent Scientific Panel on the UCG industry. At the time I was impressed by the company's scientific rigor, the results of its gas quality and the low environmental impact of its operations.

Carbon Energy's results opened my eyes to a modern and responsible way to harness energy from coal in a way that outperformed competitor technologies.

The ISP Report positively viewed the potential of UCG, however it further challenged the proponents to extend their results and go on to decommission and provide a plan for rehabilitation. This recommendation set a new benchmark for the proving of a resources technology.

Previously, decommissioning (the stopping of operations) and rehabilitation (determining what is required to return a site to a benchmark level) are only considered once resource operations are coming to an end. Nowadays, such matters are considered up front and it was appropriate that Carbon Energy had to jump this hurdle, despite the technology being new.

Carbon Energy was the only company to complete the recommendations of the ISP and in doing so have become a trailblazer in resources innovation, setting a new bench mark in trial innovation testing in the resources industry.

The technology used (Keyseam) is now more advanced than other unconventional mining technologies in that it has proven its entire lifecycle process to be under control. Where others companies failed, Carbon Energy and its science based methodology succeeded.

Queensland which has previously been a proud innovator and supporter of the coal industry has now banned one of its most significant scientific advancements in coal and effectively thrown its baby out with the bath water. Why?

Carbon Energy is a relative minnow in comparison to the giant companies in the same industry, but not all innovations come from billion dollar conglomerations and

this quiet achiever warranted support. If we are going to seriously foster innovation, and propose companies invest heavily on scientific methodologies, we need to nurture those that demonstrate achievements and not disregard the science.

This company's 5000 investors did.

Carbon Energy, by its own admissions, advises the ISP process gave it "great confidence" in its technology and it is now focussed on developing projects in China where it has been invited to head up an International UCG Research Centre.

The Centre has been established by China's largest mining institute, the China University of Mining Technology.

The Chinese government is leading the world having identified UCG as one of the technologies that can safely and responsibly utilise the country's significant coal reserves for energy generation.

As another of our bold and ever so important innovations heads off-shore I feel for Carbon Energy which has been pushed to prove its innovation in Queensland, following a path outlined by scientific experts appointed by the State and then shunned by the policy makers who defined the path.

Even if Queensland policy makers have chosen not to use this successful technology locally in a political response to issues unrelated to Carbon Energy, then let's hope the Queensland Government can still recognise this local innovation and its technology success.

Otherwise why would others seek to partner and invest in Queensland and risk innovation success being sacrificed for politics?

Professor Batterham was recently appointed to the technical advisory committee to oversee the UCG centre in China.



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Author: Professor Robin Batterham AO

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Australian Innovation Could Answer East Coast Gas Shortage Predictions

Tony Abbott was half right when he said in October this year "Coal is good for humanity, coal is good for prosperity, coal is an essential part of our economic future, here in Australia and right around the world".

But what is also needed is a discussion on how best to use coal as we move towards a lower carbon emission future and grapple with the looming threat of a gas supply shortage in Australia's eastern states. The question must become one of emission intensity and timescales. Underground Coal Gasification (UCG) looks ready to step in and help.

Coal's low cost and abundance is the main reason it will continue to be the world's major source of energy production for decades to come – coal is after all simply stored sunshine. So we must embrace other ways to extract one of our most valuable resources and harness its energy with a smaller environmental impact. Thankfully methods to achieve this are available.

Underground Coal Gasification – a technology developed in Russia - has been on the fringes for the past 80 years. Australia's leading research agency the CSIRO and Queensland business Carbon Energy have spent considerable investment dollars and over 16 years combined to perfect and commercially prove the technology as more efficient and sustainable than current methods of turning coal into energy.

UCG uses oxygen and steam to turn deep, traditionally uneconomical coal into gas. Given that gas is predicted to be in short supply for users on Australia's east coast

deep coal with UCG looks a winning combination. This in-control and scientifically understood process involves no mining – only the gas is brought to the surface.

UCG involves no fracking, no excavating and no waste piles. It is also cheaper than conventional mining.

Importantly UCG has a very small surface footprint for the volume of energy recovered as well as preserving groundwater volumes and quality.

In more detail, we now know that technological advancements in hydrology and very specific site selection have shown UCG to have an insignificant impact to the environment. Importantly, aquifers around the UCG site are not polluted and the water in the cavity that remains after UCG can be remediated to the same chemical standard as applied before the UCG.

Real experience suggests that the very low level of contamination left following operations will naturally and quickly degrade.

It may sound too good to be true, especially when compared to other methods of extracting gas, but the trick is much to do with site selection. Two hundred metres of overlying rock ensures no possibility of breakthroughs.

Equally, above and below the targeted coal seam must be thick layers of impervious material. Finally, during operation, the UCG cavity must be kept at pressures lower than the surrounding pressures in the coal. This is easy to do and allows water to flow into the UCG cavity rather than contaminants out.

The lower pressure in the cavity enables it to be “self-cleaning”. During gasification, small amounts of water flow into the cavity which forms steam that eliminates most of the contaminants.

A recent Carbon Energy demonstration of one of these self-cleaning cavities 200 metres underground found that much of the by-product was destroyed during operations. What remains in the cavity has not and cannot travel beyond the containment zone and will be remediated by natural attenuation.

Australia's domestic gas supply is coming under pressure: Warnings of east coast gas supply shortages abound. Prices are predicted to skyrocket as Australia's big LNG projects start delivering to Asian customers hungry for energy. Finding gas from new sources has to become a necessity for our State governments: UCG could be that source.

As we continue to try to develop affordable and sustainable energy, coal remains a necessary and viable source. UCG should become an accepted, safe and more environmentally thoughtful way to deliver important energy to our nation.

Professor Robin Batterham AO

President Australian Academy of Technological Sciences and Engineering (2007-2012) Australian Chief Scientist (1999-2005), Rio Tinto Group Chief Scientist (1999-2009)

Professor Batterham, with others, has been part of the review team for the report of Independent Scientific Panel that was set up by the Queensland Government to overview UCG operations to ensure a safe and reliable path towards commercialisation.