Energy Policy ∎ (∎∎∎∎) ∎∎∎–∎∎∎

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Disordering fantasies of coal and technology: Carbon capture and storage in Australia

Jonathan Paul Marshall

FASS, University of Technology Sydney, Broadway 2007, Australia

HIGHLIGHTS

- Clean coal and geological sequestration is part of Australian climate policy.
- Governments have offered much to carbon capture and storage (CCS) projects.
- Coal, and coal power, industries have been relatively uninterested.
- Progress with CCS is problematic and has not lived up to expectations.
- CCS defends against tackling the connection between coal and climate.

ARTICLE INFO

Article history:
Received 25 November 2015
Received in revised form
17 May 2016
Accepted 25 May 2016

Keywords:
Carbon capture and storage
Social defence mechanisms
Climate politics

ABSTRACT

One of the main ways that continued use of coal is justified, and compensated for, is through fantasies of technology. This paper explores the politics of 'Carbon Capture and Storage' (CCS) technologies in Australia. These technologies involve capturing CO_2 emissions, usually to store them 'safely' underground in a process called 'geo-sequestration'. In Australia the idea of 'clean coal' has been heavily promoted, and is a major part of CO_2 emissions reduction plans, despite the technological difficulties, the lack of large scale working prototypes, the lack of coal company investment in such research, and the current difficulties in detecting leaks. This paper investigates the ways that the politics of 'clean coal' have functioned as psycho-social defence mechanisms, to prolong coal usage, assuage political discomfort and anxiety, and increase the systemic disturbance produced by coal power.

1. Introduction

Coal mining and burning increasingly contributes to climate change and other forms of ecological destruction. If this continues at near to current rates, this will eventually undermine the social orders which depend upon coal. Mine sites can displace people or destroy environments and are rarely rehabilitated to their original forms, while coal-powered technology is a major source of directly harmful gas emissions (Lockwood et al., 2009). The IPCC, 2014 Mitigation report states: "Increased use of coal relative to other energy sources has reversed the long-standing trend of gradual decarbonization of the world's energy supply" (IPCC, 2014: 8). "The energy supply sector is the largest contributor to global greenhouse gas emissions… GHG [greenhouse gas] emissions from the energy sector grew more rapidly between 2001 and 2010 than in the previous decade" (ibid: 516). The report recommends "the long-term phase-out of unabated fossil fuel conversion technologies and their substitution by low-GHG alternatives" (ibid: 69).

Some argue we cannot open new mines, or increase coal burning, and hope to prevent climate turmoil.[1] An article in the *New Scientist* summarises the initial 2013 release of the IPCC report as follows: "Here, in 10 words, is the bottom line: *we have to leave most fossil fuels in the ground*. It really is that simple" (Le Page, 2013). Likewise:

> To have just a 50:50 chance of preventing a 2 °C rise in global temperature: 88% of global coal reserves, 52% of gas reserves and 35% of oil reserves are unburnable and must be left in the ground… For Australia to play its role in preventing a 2 °C rise

[1] I prefer 'climate turmoil' to 'climate change' because the latter term implies a degree of evenness or order. Climate turmoil indicates unexpected, marked and destructive weather patterns: floods, droughts, storms and sea level rises (Baer et al., 2014: 11ff.). This turmoil may eventually settle into a relatively stable system. How long this will take is uncertain, but will probably depend upon human action, and levels of emissions from fossil fuels.

E-mail address: jon.marshall@uts.edu.au

http://dx.doi.org/10.1016/j.enpol.2016.05.044

in temperature requires over 90% of Australia's coal reserves to be left in the ground" (Climate Council, 2015: iii-iv. Cf. McGlade et al., 2015).

As the '50:50' implies, such restrictions may not be enough. Similarly, the International Energy Agency stated that climate stability "requires coal consumption to peak well before 2020 and then decline" (IEA, 2011: 43). The recent Paris agreement may necessitate not only reduction of emissions, but removal of greenhouse gases from the atmosphere with unready technology (Anderson, 2015; Shepherd, 2016).

Coal has become a locked-in technology (Unruh, 2000), with social orders, modes of conception, regimes of problem solving and power relations built around it. The social orders around coal produce disorders of climate and ecology which threaten those orders. There is, in that sense, a coal paradox: coal leads to social stability *and* to social destruction. However, coal is plentiful and profitable; the coal industry is not planning to phase itself out and gains political support easily. While these social orders contribute to climate turmoil, challenges to these habits of action and conception can produce social and psychological disturbance. Such challenges provoke group attempts to lessen existential crisis through psychological defence mechanisms which direct people into fantasy, produce a sense of accomplishment, distract from the paradox and hinder attempts to prevent increasing climate turmoil. One technologically based fantasy, of continuing import, is known as 'carbon capture and storage' (CCS) in which carbon dioxide emitted from coal burning is prevented from entering the atmosphere, captured, and stored. Storage usually involves putting the CO_2 underground (geo-sequestration), although burying biochar, planting trees and developing algae which consume CO_2 can also be considered.

The IPCC first reported on CCS in 2005 (IPC, 2005), and more recently stated its social value, as CCS should "reduce the adverse effect of mitigation on the value of fossil fuel assets" (IPCC, 2014: 462). The International Energy Agency states: "If CCS is not widely deployed in the 2020s, an extraordinary burden would rest on other low-carbon technologies to deliver lower emissions" (IEA, 2011: 43). CCS theoretically could provide a smooth transition while reducing "the risk that capacity is idled before recovering its investment costs" (IEA, 2014: 3). Defence of established asset-values is vital: CCS theoretically saves the coal and coal power industries. Many studies of CCS imply that CCS is hampered by technological, political or business difficulties (see Section 2.2). These difficulties and delays stand out, given the claimed ability of CCS to solve emission problems, and the usual consensus that no major scientific or technological breakthroughs are required. Ongoing delays suggest that CCS primarily serves as a defensive fantasy preserving the current political and social order.

The paper argues this case through a history of CCS politics in Australia. Australia is a 'good example' for investigation because it is a large coal exporter, with one of the highest per capita CO_2 emissions in the world; 17.2t per person in 2014 (PBL, 2015: 31). Australia would appear to have an interest in developing CCS technology, both to reduce its share of emissions and to maintain coal sales, and CCS has been a pillar of its climate action. Given these conditions, the failure of CCS is marked. Its main policy value, intended or not, has been to defend coal burning and sales, and distract from other solutions.

2. Methods and previous literature

2.1. The general focus

After looking at recognised problems with CCS, this paper analyses the post-1996 politics and actions of CCS supporters in Australia. The legal aspects of CCS in Australia have been detailed by Dwyer, 2015. Data came from political party and Ministerial websites, the Parliamentary e-library (http://parlinfo.aph.gov.au/), news media (primarily the *Sydney Morning Herald* and the *Guardian*). These texts led to industry websites, reports and press releases. The texts led to the construction of the historical narrative in Section 3, and the account of CCS installations in Appendix A, which provide the basis for policy recommendations. The dynamics of policies and technical work are more easily perceived over time and the narrative provides contexts for the statements and events, giving them meaning and connection while lessening the risk of misreading them. The single country focus allows consideration of the dynamics in detail. Discovering whether the arguments can be generalised elsewhere requires further research, but repeated local themes gives force to the policy suggestions.

2.2. Previously identified problems with CCS

Assuming the technology can be developed, then among the foreseen (as opposed to unforeseen) problems of CCS are:

1) No examples exist of either carbon capture or storage working at anything like the volumes required. "CCS has not yet been applied at scale to a large, operational commercial fossil fuel power plant" (IPCC, 2014: 517). Gibbins and Chalmers (2008) point out that given the short lead times necessary to contain climate turmoil, the technology deployed cannot be innovative, must have few problems of scale, and require only limited technological refinement (2008: 4317); this is unlikely.

2) Possible long-term leaks and difficulties monitoring those leaks, especially with offshore storage. If the storage site is an old oil or gas field then exit points are often plentiful. Leaks are also possible in transport. Identifying leaks can be a confusing process as with the Weyburn field in Canada where local farmers reported observations indicating CO_2 leaks and funded their own research, released in 2011, which prompted a priori refutations and calls for further research. It is unclear if this research occurred. The project closed in 2011–12. The MIT CCS site currently reports the leak "is still being investigated" (Nikiforuk, 2011; Orcutt, 2011). Even small leaks may undo the whole venture.

3) CO_2 storage may increase the possibility of earthquakes, therefore increasing the possibility of leaks (Zoback et al., 2012; Verdon, 2014; National Research Council, 2013).

4) Sudden leaks may produce fatalities: "Natural escapes from volcanic lakes in Cameroon have killed thousands of people" (Kemp, 2013). Concentrations of CO_2 over 10%, even in the presence of oxygen, can be fatal (IPCC, 2005: 392).

5) Leaks and underground flow may introduce unpleasant tastes or poisons to underground water supplies (Folger, 2009: 11–12; Little et al., 2010).

6) CCS requires extra energy to run, adding to operational costs and possibly increasing coal consumption.

7) CCS will significantly increase energy prices (IPCC, 2005: 27, 168–70; IRENA, 2015: 42). The director of the Callide Oxyfuel CCS project stated that CCS technology "would double the cost of wholesale electricity and add about 30 per cent to retail costs" (McCarthy, 2015). Using figures from the US Energy Information Administration, Ash (2015) argues that CCS would cost almost 40% more per kilogram of avoided CO_2 emissions than photovoltaic energy, 125% more than wind and 260% more than geothermal.

8) As securities analyst Andrew Harrington warned: "Companies claiming credits for putting CO_2 in the ground need to be solvent forever. Very few companies are solvent forever" (q La Canna, 2009). Liability will usually end up with taxpayers. Consequently, private companies have little incentive to guarantee storage is stable as they will avoid long-term responsibility.

Please cite this article as: Marshall, J.P., Disordering fantasies of coal and technology: Carbon capture and storage in Australia. Energy Policy (2016), http://dx.doi.org/10.1016/j.enpol.2016.05.044