

# Chapter 2

## Key issues

2.1 This chapter examines the evidence received by the committee in submissions to this inquiry and during the public hearing. The structure of the chapter reflects that the evidence essentially addresses two interrelated issues: whether carbon capture and storage (CCS) technologies are an emissions reduction option that is proven, commercially viable and safe; and whether it is appropriate for the Clean Energy Finance Corporation (CEFC) to invest in CCS technologies.

2.2 The committee's overall conclusions on the bill are at the end of the chapter.

### **Use of CCS technology to assist with emissions reduction efforts**

2.3 As noted in Chapter 1 (see paragraph 1.26), the explanatory memorandum states that the bill is intended to facilitate potential support for the use of CCS technologies to non-renewable electricity generation, which 'would help provide security and stability for the electricity grid while significantly reducing emissions compared to business-as-usual operation of fossil fuel fired generation'. In addition, the bill would provide 'a potential support' to reduce emissions from carbon-intensive industrial processes.<sup>1</sup>

2.4 The committee received evidence supporting these statements as well as evidence questioning whether CCS is currently ready, or is likely to ever be ready, to be deployed on a commercially viable and safe basis, and on the scale needed for emissions reduction.

### ***Evidence supporting the continued development of CCS technologies and projects***

2.5 The statements in the explanatory memorandum were echoed in the submission from the Department of the Environment and Energy (the department), which argued that CCS technologies have 'the potential to form an important component of global and domestic efforts to combat climate change'.<sup>2</sup>

2.6 Comments made by the International Energy Agency (IEA) regarding the potential for CCS technologies to reduce emissions across the energy system also support these statements. In an IEA report on CCS technologies, Dr Fatih Birol, the Executive Director of the IEA, wrote:

[IEA] scenario analysis has consistently highlighted that CCS will be important in limiting future temperature increases to 2°C, and we anticipate

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1 Explanatory Memorandum, Clean Energy Finance Corporation Amendment (Carbon Capture and Storage) Bill 2017, p. 2.

2 Department of the Environment and Energy, *Submission 5*, p. 3.

that this role for CCS will become increasingly significant if we are to move towards "well below 2°C". Why is this? Because there is no other technology solution that can significantly reduce emissions from the coal and gas power generation capacity that will remain a feature of the electricity mix for the foreseeable future. No other technology solution is capable of delivering the deep emissions reductions needed across key industrial processes such as steel, cement and chemicals manufacturing, all of which will remain vital building blocks of modern society. In the future, it may be a pivotal technological solution for removing large amounts of carbon from the atmosphere—a likely requirement as we move to limit temperature increases to well below 2°C. In short, deployment of CCS will not be optional in implementing the Paris Agreement.<sup>3</sup>

## 2.7 Dr Birol continued:

There are now 21 large-scale CCS projects operating or under construction throughout the world, in addition to more than 100 smaller-scale projects.

Behind this is a large and dedicated group of global researchers, technology developers, utilities and service providers who have been working to develop CCS to the point that there are no insurmountable technology barriers to safe deployment. The IEA Technology Collaboration Programmes, among other international collaborative efforts, have provided essential support in this regard. What is missing is a strengthened climate response to support CCS investment. The need for policy action is now urgent if we are to maintain current momentum in CCS project development to meet the Paris goals.<sup>4</sup>

2.8 Mr Bradley Page, Chief Executive Officer of the Global CCS Institute, commented that other notable supporters of CCS technologies include 'Grantham Research Institute chair and eminent economist Lord Nicholas Stern, Columbia University professor and creator of the term "global warming" Wallace Smith Broecker and international sustainable development expert John Elkington'.<sup>5</sup>

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3 F Birol, 'Foreword' in International Energy Agency (IEA), *20 years of Carbon Capture and Storage: Accelerating Future Deployment*, 2016, [www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage\\_WEB.pdf](http://www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf) (accessed 15 February 2018), p. 7. On the use of CCS technologies for deep emissions reduction in carbon-intensive industries, such as cement, iron and steel, chemicals and refining, the IEA notes that these industries may 'have no alternatives to CCS for deep emissions reduction...because much of the CO<sub>2</sub> is unavoidably generated by their production processes, not only from fuel use'. IEA, 'Industrial applications of CCS', [www.iea.org/topics/ccs/industrialapplicationsofccc/](http://www.iea.org/topics/ccs/industrialapplicationsofccc/) (accessed 15 February 2018).

4 F Birol, 'Foreword' in IEA, *20 years of Carbon Capture and Storage*, p. 7.

5 Mr Bradley Page, Chief Executive Officer, Global CCS Institute, *Committee Hansard*, 18 April 2018, p. 7.

2.9 The Intergovernmental Panel on Climate Change (IPCC) has also considered the potential of CCS technology. As part of the *Fifth Assessment Report*, in 2014 an IPCC working group indicated that, among its author team, there is a 'medium' level of agreement that CCS technologies could reduce the lifecycle greenhouse gas emissions of fossil fuel power plants.<sup>6</sup>

2.10 In its submission to this inquiry, the Global CCS Institute highlighted existing international CCS projects and argued that additional projects are needed to address emission reduction targets. The Institute submitted:

CCS is already curbing greenhouse gas emissions around the globe, with more than 220mn tonnes of anthropogenic carbon dioxide safely and permanently injected deep underground.

There are currently 17 large-scale CCS facilities operating globally, with five more in development. These facilities are capturing and storing 37 million tonnes of CO<sub>2</sub> per annum, the equivalent of removing eight million cars from the road each year.

However, this is not enough. To make deep, rapid reductions in greenhouse gas emissions and meet Paris climate change targets at least cost, CCS must be deployed swiftly and at scale.<sup>7</sup>

2.11 The potential for CCS technologies was also discussed in other industry and research submissions that supported the bill. In addition to the Global CCS Institute, submissions supporting the bill were received from Bridgeport Energy Limited, the Australian National Low Emissions Coal Research and Development (ANLEC R&D), CO2CRC Limited, the Minerals Council of Australia and the Australian Petroleum Production and Exploration Association. For example, ANLEC R&D submitted:

Carbon Capture and Storage is being adopted at scale internationally. USA and Canada have shown that the technology can be deployed at scale for power generation purposes. Their respective operations at Petra-Nova, Texas and Boundary Dam, Saskatchewan are delivering access to low risk pathway to an affordable, reliable and cleaner energy system.<sup>8</sup>

2.12 The committee was also advised that over the past 18 months, CCS technologies have become supported in China 'at the highest government levels', with eight facilities now under development. Furthermore, tax credits for carbon dioxide storage and use have been enacted in the United States, and new approaches

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6 Intergovernmental Panel on Climate Change, 'Summary for Policymakers' in *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [O Edenhofer et al (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014, p. 21.

7 Global CCS Institute, *Submission 4*, p. 4. See also Mr Bradley Page, Chief Executive Officer, Global CCS Institute, *Committee Hansard*, 18 April 2018, p. 7.

8 Australian National Low Emissions Coal Research and Development, *Submission 7*, p. 1 (citations omitted).

to encourage the sharing of CCS infrastructure are being developed in the United Kingdom, the Netherlands and Norway. Mr Page from the Global CCS Institute concluded that his organisation believes 'CCS is at a turning point globally, and we're eager to see Australia take full advantage of its benefits'.<sup>9</sup>

### ***Concerns about the readiness and financial viability of CCS technologies***

2.13 Several submissions argued that CCS technologies are untested and unlikely to be financially viable. The following statement made in Environmental Justice Australia's submission summarises the position held by these submitters:

CCS has so far failed to deliver on its potential to reduce future carbon dioxide emissions into the atmosphere. It is not a proven technology.<sup>10</sup>

2.14 In expressing doubt about the commercial viability of CCS technologies, past statements regarding the potential of CCS to reduce emissions were noted. For example, Environmental Justice Australia cited a 2000 report by the IPCC, in which it was projected that, by 2020, 9–12 per cent of global emissions would be abated by CCS technologies. Environmental Justice Australia commented that:

As we approach 2020, the world does not speak of percentage of global emissions captured by CCS. Rather, CCS proponents cite the handful of CCS projects that might be successful, yet still have the potential to fail.<sup>11</sup>

2.15 Submissions also discussed efforts to develop and implement CCS technologies globally. Specific CCS projects in North America and the United Kingdom that have been delayed or which submitters argued were unsuccessful were highlighted.<sup>12</sup> In Australia, it was argued that 'more than \$1.3 billion has already been spent by Australian governments attempting to develop CCS technologies, yet Australia has very little to show for it'. In particular, it was noted there are no large-scale power plants operating with CCS technologies in Australia.<sup>13</sup>

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9 Mr Bradley Page, Chief Executive Officer, Global CCS Institute, *Committee Hansard*, 18 April 2018, p. 8.

10 Environmental Justice Australia, *Submission 10*, p. 1.

11 Environmental Justice Australia, *Submission 10*, p. 1.

12 Environmental Justice Australia, *Submission 10*, pp. 2–3. Projects referred to were the Kemper facility in the United States; the Boundary Dam CCS plant in Saskatchewan, Canada; and the FutureGen CCS project in the United Kingdom.

13 The Australia Institute, *Submission 11*, p. 2. For a discussion of Australian and international experiences with CCS projects, see also Mr Simon Holmes à Court, *Submission 13*, pp. 1–2.

2.16 Given that renewable energy technologies exist, the need for CCS technologies in electricity generation was questioned. Mr Simon Holmes à Court, who argued that certain CCS opportunities for non-electricity generation processes should be pursued but not through CEFC financing, argued that:

With energy technologies, we know how to create zero carbon electricity. CCS on coal is an attempt to clean up coal. We already have a cheaper way of producing electricity with renewables. We don't yet have a cheaper way or a commercially proven cheaper way of producing cement.<sup>14</sup>

2.17 The cost and energy usage associated with CCS was also noted. Some witnesses suggested that CCS technologies would not be viable without a carbon price.<sup>15</sup> In the absence of an economic incentive to capture carbon, it was suggested that CCS activities would be limited. Regarding the Gorgon Project, where the use of CCS was a condition for development approval, Mr Holmes à Court observed that CCS technologies added over \$2 billion to the cost, however, even after this 'the project still stacked up for [the proponent]'.<sup>16</sup> However, Mr Holmes à Court provided the following evidence to explain why the cost and effort involved for CCS as part of the Gorgon Project is likely to differ to the costs associated with CCS in other activities:

With some processes, the separation of CO<sub>2</sub> is already part of an existing process. For example, the well gas feeding into Chevron's Gorgon project in the North-west Western Australia comprises approximately 15% CO<sub>2</sub> which must be removed prior to liquefaction in the normal course of business. As such there is relatively little additional cost in capturing CO<sub>2</sub>.

However, for other processes, such as the combustion of coal, steelmaking and the manufacture of cement, the flue gasses are not separated in the normal course of business. As such, the application of CCS to these processes requires the addition of significant capital equipment and operating expense (energy, staff and consumables) with the sole purpose of capturing CO<sub>2</sub>.<sup>17</sup>

2.18 Mr Matt Rose from the Australian Conservation Foundation also comment on the cost associated with CCS. Mr Rose argued that coal-fired power stations fitted with clean coal technologies 'are much more expensive than any alternatives'. Mr Rose stated:

...the technical aspects of retrofitting, finding appropriate storage sites and all those things quickly add up and make it much more expensive, because you're not actually just dealing with creating the energy like a lot of your

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14 Mr Simon Holmes à Court, *Committee Hansard*, 18 April 2018, p. 26.

15 See Mr Roderick Campbell, Research Director, The Australia Institute, *Committee Hansard*, 18 April 2018, pp. 1, 3; Mr Simon Holmes à Court, *Committee Hansard*, 18 April 2018, pp. 23, 26.

16 Mr Simon Holmes à Court, *Committee Hansard*, 18 April 2018, p. 26.

17 Mr Simon Holmes à Court, *Submission 13*, p. 1.

competitors will be. You have to find appropriate sites for storage and in some cases retrofit, so it's a much more technically demanding process, which adds to the cost.<sup>18</sup>

2.19 Submissions supporting the bill responded to concerns about the readiness and commercial viability of CCS technologies. The Minerals Council of Australia stressed that 'CCS is not an experimental technology, with leading examples in North America already operating in conjunction with coal fired generation'.<sup>19</sup> Similarly, the Global CCS Institute argued that 'CCS technology is verifiably well tested', with large-scale and long running projects operating globally. The Institute submitted:

The Institute's projects database currently tracks 38 large-scale CCS facilities either operating, under construction, or in development, around the world. Some of these facilities have been operational for more than 20 years. The Institute also tracks 72 individual smaller pilot and demonstration facilities.<sup>20</sup>

2.20 Bridgeport Energy acknowledged that CCS technologies have 'always suffered from the issue of high cost and lack of a revenue stream to aid project financial viability'. However, it advised that a revenue stream to support CCS could be created by using carbon dioxide produced from power generation and industrial processes for 'enhanced (or tertiary phase) oil recovery (EOR) in suitable oil fields'. EOR can enable significant additional oil production with the process resulting in carbon dioxide being 'sequestered in parallel as it replaces the oil and water volume in the reservoir'. Bridgeport Energy remarked that EOR:

...not only provides the opportunity to safely sequester CO<sub>2</sub> in a well-defined geological trap structure with existing wells drilled, but also stimulates the tertiary phase production of an oil reservoir, producing additional oil and therefore offsetting carbon capture equipment and supply costs by the CO<sub>2</sub> emitters.<sup>21</sup>

2.21 Evidence from the Global CCS Institute also suggested that the costs associated with CCS should be considered alongside the need to meet international emissions reduction targets. The Institute submitted:

Modelling of least-cost emission pathways consistently identifies the need to deploy CCS in large volumes if Paris emission targets are to be achieved. The importance of CCS in these results is in direct contrast to claims that CCS is either 'too costly' or 'cannot compete with renewables'.<sup>22</sup>

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18 Mr Matt Rose, Economist, Australian Conservation Foundation, *Committee Hansard*, 18 April 2018, p. 20.

19 Minerals Council of Australia, *Submission 12*, p. 2.

20 Global CCS Institute, *Submission 4*, p. 4.

21 Bridgeport Energy Limited, *Submission 2*, p. 1.

22 Global CCS Institute, *Submission 4*, p. 5.

2.22 Furthermore, the Minerals Council of Australia argued that the development of CCS has been impeded by an imbalance in government funding for CCS compared to other technologies. Since 2003, the Australian Government has provided approximately \$1.3 billion to CCS-related projects.<sup>23</sup> The Minerals Council contrasted this figure with the funding provided for renewable energy technologies; it submitted that:

Renewable technologies have access to over \$2 billion in funding managed by the Australian Renewable Energy Agency, \$200 million in the Clean Energy Innovation Fund (jointly managed by ARENA and the CEFC) and an estimated \$20 billion in indirect support provided by the Renewable Energy Target. The exclusion of CCS from the CEFC exacerbates the current funding imbalance and handicaps the development of a key low emission solution.<sup>24</sup>

2.23 Finally, it was argued that costs associated with CCS will decrease following the development of additional projects. CO2CRC advised that there are CCS projects 'at concept stage that could benefit from access to low cost finance within the CEFC'. CO2CRC suggested that these projects could have costs reduced by 20–30 per cent compared to existing programs due to the benefits of learning-by-doing.<sup>25</sup> The Minerals Council of Australia stated:

CCS is proven at scale and policies that stimulate demand for CCS and further deployment will inevitably deliver technology improvements and cost reductions. This will come through learning by doing, competition between vendors, improved processes, materials and metals, and other developments as has been the case with other technologies.<sup>26</sup>

### ***Concerns about carbon dioxide leakage***

2.24 Mr Richard Horton, who advised that he has 'worked for many years in the extractive and power industries and in the financing of both' and who was a founder member of the Global CCS Institute, commented on the risk of carbon dioxide leakage that could be associated with CCS. Mr Horton noted that 'strong arguments can be presented to justify CCS technically and geologically', however, he argued that there 'can be no certainty that re-injected CO<sub>2</sub> will remain in situ in perpetuity'.<sup>27</sup>

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23 Department of the Environment and Energy, *Submission 5*, p. 4.

24 Minerals Council of Australia, Correspondence dated 19 March 2018 correcting submission, p. 1.

25 CO2CRC Limited, *Submission 9*, p. 1.

26 Minerals Council of Australia, *Submission 12*, p. 3.

27 Mr Richard Horton, *Submission 1*, p. 1.

2.25 Environmental Justice Australia expressed concern that leakage from carbon dioxide stored in a geological formation could have adverse consequences for human health.<sup>28</sup>

2.26 The Global CCS Institute responded to concerns about the potential for carbon dioxide leakage as follows:

Operations undertaken over almost half a century demonstrate that CO<sub>2</sub> can be permanently stored deep below ground. Oil, gas and naturally occurring CO<sub>2</sub> reservoirs have proven that fluids can be safely sealed underground for millions of years. CCS facilities access the same geology.<sup>29</sup>

2.27 The issue of potential carbon dioxide leakage was raised during the public hearing. Mr Brad Archer, a first assistant secretary at the department, noted that the proposition of storing emissions in appropriate geological formations is considered theoretically sound. However, Mr Archer explained that the data needed for 'complete assurance' about the risk of leakage does not exist because of the absence of long-term CCS projects in Australia. Mr Archer added that the department would 'definitely want to have an understanding that these stores of carbon will be enduring' to ensure that Australia's greenhouse gas emissions are tracked accurately.<sup>30</sup>

### **Supporting CCS projects through the CEFC**

2.28 This section considers the evidence received regarding whether the CEFC is an appropriate entity to invest in CCS technologies.

#### ***Support for a more technology neutral approach to emissions reduction programs***

2.29 As noted in Chapter 1, the *Clean Energy Finance Corporation Act 2012* (CEFC Act) expressly prohibits the CEFC from investing in CCS technologies. Industry and CCS research submissions called for the prohibition to be lifted to enable a wider range of low-emission technologies to be considered by the CEFC as part of a more technology neutral policy approach. For example, the Global CCS Institute commented:

In building a reliable, affordable, low emissions power system, and meeting international climate targets, energy policy must abandon ideology and align with reality. The reality is that every low emission technology including CCS is required. All low emissions technologies, including CCS,

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28 Environmental Justice Australia also submitted that increased emissions from CCS processes would result in increased emissions from energy production of 10–25 per cent. Environmental Justice Australia, *Submission 10*, p. 4.

29 Global CCS Institute, *Submission 4*, p. 4.

30 Mr Brad Archer, First Assistant Secretary, International Climate Change and Energy Innovation Division, Department of the Environment and Energy, *Committee Hansard*, 18 April 2018, p. 33.



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deserve equal access to policy support and concessional finance necessary to accelerate its deployment.<sup>31</sup>

2.30 Mr Bradley Page, the Chief Executive Officer of the Global CCS Institute, summed up his organisation's view on the merits of technology neutrality with the observation that 'one of the things we never know about the future is what's going to turn up'.<sup>32</sup> To illustrate, Mr Page referred to the recently announced pilot project in the Latrobe Valley to produce hydrogen from brown coal (see Chapter 1) and 'some very exciting technological developments in places like the United States'. Mr Page explained:

We are starting to see private capital involved in novel capture processes. NET Power, for example, which is based in Texas on English technology, actually uses the CO<sub>2</sub> instead of steam to drive turbines and has the promise of very low cost capture. It'd be unfortunate if that technology comes through in the next 12 months—and we will know in the next 12 months whether it works—and if the CEFC couldn't then invest in it where it delivered to Australia a clear economic benefit in the power sector.<sup>33</sup>

2.31 ANLEC R&D submitted that it supports the bill 'as one additional step in policies and legislation that takes a technology neutral approach to emissions reduction from the energy sector'. ANLEC R&D argued that CCS:

...is a proven low emissions technology that can make significant inroads to reducing emissions from the electricity generation and industrial sectors of the Australian economy. Including CCS as an eligible technology for investment by the Clean Energy Finance Corporation, provides access to capital on terms that might not otherwise be available from commercial markets due to perceived policy risk.<sup>34</sup>

2.32 In addition, ANLEC R&D commented that permitting the CEFC to invest in CCS would help allow 'the largest section of Australian energy production—both coal and gas—to respond with low emissions solutions'.<sup>35</sup>

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31 Global CCS Institute, *Submission 4*, p. 7.

32 A similar observation was made by Mr Peter Morris, Senior Advisor, Coal, Minerals Council of Australia. Mr Morris noted that 'we don't know what the discovery power of markets will deliver if the CEFC is able to invest in carbon capture and storage'. Mr Morris added that the progress of renewable energy technology development over the past ten years has been assisted by considerable government funding. See *Committee Hansard*, 18 April 2018, p. 31.

33 Mr Bradley Page, Chief Executive Officer, Global CCS Institute, *Committee Hansard*, 18 April 2018, p. 14.

34 Australian National Low Emissions Coal Research and Development, *Submission 7*, p. 2.

35 Australian National Low Emissions Coal Research and Development, *Submission 7*, p. 3.

2.33 Similarly, the Minerals Council of Australia highlighted the potential for the resources sector to be involved in the development and deployment of 'solutions that will provide a secure, reliable, safe and low-emission energy supply for future generations'. The Minerals Council argued that advanced coal combustion through high efficiency, low emissions (HELE) power generation with CCS technologies can result in emissions reductions of up to 90 per cent compared with the oldest technology in place. The Minerals Council added:

The Australian Energy Market Commission has highlighted the importance of technology neutrality in energy policy noting that 'a policy that allows the greatest number of technology options is likely to minimise costs for consumers'.

If the policy goal is to reduce emissions at lowest cost, a technology neutral approach is imperative. That means considering the potential of advanced coal combustion through...HELE power generation and CCS technologies.<sup>36</sup>

2.34 AGL Energy also offered in principle support for the bill on the grounds of enabling 'a more technology neutral policy framework for investment decisions'. AGL Energy submitted:

In our view, a technology neutral approach to investment decisions provides Australia with the best prospects of attracting the scale and diversity of investments required to decarbonise the Australian economy consistent with Australia's commitments made under the Paris Agreement.<sup>37</sup>

2.35 AGL Energy's qualified support for the bill is based on its view that any support provided by the CEFC for CCS technologies should not detract from the resources currently available to the CEFC to support renewable energy, energy efficiency and low-emission technologies. That is, if the CEFC Act is amended to allow investments in CCS, AGL Energy argued that the government should provide the CEFC with 'appropriate incremental funding' to facilitate any investments in CCS. AGL Energy concluded:

With an appropriately expanded budget to focus on CCS, we consider that the CEFC would be well placed to make investment decisions that support both renewable energy and low emissions technologies and CCS technologies, in accordance with its investment mandate and guidelines.<sup>38</sup>

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36 Minerals Council of Australia, *Submission 12*, p. 1. The document cited is Australian Energy Market Commission (AEMC), 'Submission to the Review of the Renewable Energy Target', May 2014, [www.aemc.gov.au/sites/default/files/content/Submission-to-the-Review-of-the-Renewable-Energy-Target.pdf](http://www.aemc.gov.au/sites/default/files/content/Submission-to-the-Review-of-the-Renewable-Energy-Target.pdf), p. 2. See also AEMC, 'Making market transformation work: Overview 2016–2017', [www.aemc.gov.au/sites/default/files/content/AEMC-Overview-28-September-2017.PDF](http://www.aemc.gov.au/sites/default/files/content/AEMC-Overview-28-September-2017.PDF) p. 3.

37 AGL Energy, *Submission 6*, p. 1.

38 AGL Energy, *Submission 6*, p. 2.

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***Whether CCS processes should be considered 'clean energy'***

2.36 As explained in Chapter 1, the CEFC Act provides that the CEFC may only invest in 'clean energy technologies', which are defined as either energy efficiency technologies, low-emission technologies or renewable energy technologies.

2.37 The CEFC explained that, following enactment of the bill, it would consider whether any proposal based on CCS technologies met the statutory definition of a low-emission technology.<sup>39</sup> Under the CEFC Board's current approach to determining whether a technology is a low-emission technology, it is expected that the technology would 'result in emissions of CO<sub>2</sub>e being substantially lower than the current average of the most relevant baseline for the activity being undertaken'. To fulfil this requirement, a proponent of a project is required to demonstrate that:

- if the project is solely for electricity generation, that the technology will:
  - achieve 'an emissions intensity of less than 50 per cent of the existing generation system as connected to the transmission network/grid, or where not connected to a grid, less than 50 per cent of the emissions intensity of the baseline activity', or
  - 'achieve useful-life emissions at 50 per cent less than the relevant current average baseline of the activity being undertaken'; or
- if the project is not solely for electricity generation and does not achieve useful-life emissions at 50 per cent less than the relevant current average baseline of the activity being undertaken, that the technology 'achieves (or has demonstrable ability to achieve) meaningful aggregate emission reductions and other positive externalities'.<sup>40</sup>

2.38 Whether CCS technologies fit within the CEFC's remit attracted comment from both supporters and opponents of the bill.

2.39 The Australia Institute highlighted the CEFC's role as a specialised clean energy financier that has helped to 'catalyse projects and emissions reductions that would otherwise been less likely to occur'. The Australia Institute argued that CCS technologies 'are not low-emission'. The Institute explained:

[CCS technologies] do not reduce the emissions being produced by the energy source. Rather, they use significant energy, itself a source of emissions, to capture and store some of the emissions from the plant, rather than reducing them. The ultimate effectiveness of CCS in reducing the

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39 Mr Ian Learmonth, Chief Executive Officer, Clean Energy Finance Corporation (CEFC), *Committee Hansard*, 18 April 2018, p. 34. Mr Learmonth explained that CCS technologies could not meet the definitions of energy efficiency technologies or renewable energy technologies.

40 CEFC, 'CEFC complying investments guidelines', [www.cefc.com.au/media/303027/cefc-complying-investments-guidelines-may-2017.pdf](http://www.cefc.com.au/media/303027/cefc-complying-investments-guidelines-may-2017.pdf) (accessed 23 April 2018); cited in CEFC, *Submission 14*, p. 6.

quantity of greenhouse emissions that enter the atmosphere relies on long term monitoring of any location used to sequester the emissions. These costs and risks are poorly understood in the long term and will likely be largely borne by the public.

Renewable energy technologies, by comparison, genuinely reduce the emissions of the energy sector if they replace generation that would occur from higher emissions sources.<sup>41</sup>

2.40 Mr Richard Horton similarly argued that CCS is not clean energy. Mr Horton reasoned:

Terrestrial sequestering of carbon pollution from hydrocarbon production and consumption does not make dirty energy clean; it simply relocates the collected and concentrated pollution. This statement holds true even whilst acknowledging that more efficient burning of hydro-carbons (Ultra Super Critical and beyond) can materially reduce the CO<sub>2</sub> footprint per unit of power generated, the facilitation of which is not necessarily beyond the current scope of the CEFC.<sup>42</sup>

2.41 Other submissions, however, argued that it is appropriate for the CEFC to have the option to invest in CCS technologies because these technologies:

- could result in significant emissions reductions by supporting the use of renewables;
- could facilitate the development of other sources of clean energy; and
- enable processes that would qualify as low-emission technologies.

2.42 The Global CCS Institute argued that CCS is 'part of a flotilla of clean technologies needed to turn the tide on climate change'. The Institute emphasised that CCS is not a competitor to renewables, rather it should be seen as 'a supportive adjunct'; that is, CCS is 'part of a flotilla of clean technologies needed to turn the tide on climate change'.<sup>43</sup>

2.43 As noted at paragraph 2.3, it is also considered that CCS could assist to address grid stability issues associated with increasing use of renewable energy. ANLEC R&D submitted:

At about 45% renewables penetration of the grid, the nature of investment to support the energy system increases substantively to where CCS is considered to be among the lowest cost options for deployment...<sup>44</sup>

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41 The Australia Institute, *Submission 11*, p. 1. See also Mr Roderick Campbell, Research Director, The Australia Institute, *Committee Hansard*, 18 April 2018, p. 1.

42 Mr Richard Horton, *Submission 1*, p. 1.

43 Global CCS Institute, *Submission 4*, p. 5.

44 Australian National Low Emissions Coal Research and Development, *Submission 7*, p. 4.

2.44 The Global CCS Institute also indicated that CCS provides an opportunity for new clean energy sources to be developed. As noted in Chapter 1, a pilot project in the Latrobe Valley to produce hydrogen from brown coal was recently announced. The Institute submitted:

As the energy matrix continues to evolve, CCS...facilitates the creation of new energy economies, which are yet to reach their apex. A good example is the work Kawasaki Heavy Industries is undertaking with Iwatani, J-Power and Shell Japan to scope a hydrogen energy supply chain in Australia's Latrobe Valley. The opportunity to turn Victoria's brown coal into clean hydrogen is just one example of the new opportunities CCS can create.

It sets the stage for a clean energy hub in Australia which preserves jobs, creates new employment opportunities and creates a new, sustainable, decarbonised economy.<sup>45</sup>

2.45 Continuing with the potential for EOR to improve the financial viability of CCS (see paragraph 2.20), Bridgeport Energy argued that the use of CCS for EOR opportunities in the Surat and Cooper Basins would 'see the reduction of CO<sub>2</sub> emissions from Australia's newest, most efficient and reliable supercritical power stations by up to 90%'. Accordingly, Bridgeport argued that EOR using carbon dioxide from CCS would be a 'low emission technology' for the purposes of the CEFC Act.<sup>46</sup>

2.46 The likelihood of the CEFC investing in EOR-based projects was questioned, however. Mr Simon Holmes à Court noted that the oil extracted under EOR 'follows the same lifecycle as any other crude oil—it is refined and burnt, generally in internal combustion engines, resulting in atmospheric carbon emissions'. Mr Holmes à Court reasoned that 'the immense efforts of capturing and sequestering CO<sub>2</sub> is undermined by fugitive emissions within the EOR process and the ultimate emissions of the oil extracted'.<sup>47</sup> Mr Holmes à Court concluded:

Any lifecycle assessment of the entire process from capturing carbon to bringing up and burning the extracted oil shows that the projects are actually responsible for an increase in atmospheric carbon.<sup>48</sup>

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45 Global CCS Institute, *Submission 4*, p. 6.

46 Bridgeport Energy Limited, *Submission 2*, p. 2.

47 Mr Simon Holmes à Court, *Submission 13*, p. 3.

48 Mr Simon Holmes à Court, *Committee Hansard*, 18 April 2018, p. 23.

### ***Other matters regarding the role of the CEFC***

2.47 As the department made clear in its submission, the bill would not require the CEFC to invest in CCS projects; it simply would remove the current prohibition on doing so. Following the bill being enacted, the CEFC would have the option to invest in CCS projects 'should any projects of sufficient commercial merit come forward following the change'.<sup>49</sup>

2.48 The CEFC noted that 'legal eligibility as a complying investment is only one element of whether the CEFC Board will decide to invest in a project or not'. The CEFC explained that investment decisions are subject to other requirements of the CEFC Act, the CEFC's investment mandate and the application of the CEFC's Investment Policies and risk management practices.<sup>50</sup>

2.49 The CEFC added that, as it 'presently understands CCS',<sup>51</sup> 'it is still a challenging technology with elevated levels of construction, implementation and economic risks'.<sup>52</sup> Nevertheless, the CEFC stated:

If an investment proposal was presented with an appropriate risk and return profile, or if complementary policy settings are put in place to support CCS, then with the proposed legislative amendment, CCS may not only be an eligible technology but also an investable technology.<sup>53</sup>

2.50 Ms Tania Constable, Chief Executive Officer, CO2CRC, indicated that there are projects under consideration that could meet the CEFC's conditions for investment.<sup>54</sup> However, given the history of CCS projects and the CEFC's commercial approach to investment decisions, other individuals and organisations questioned whether the proposed amendment would result in any investments by the CEFC in CCS projects.

2.51 Environmental Justice Australia highlighted the small number of successful CCS projects and referred to comments made by the IEA about the commercial challenges associated with the use of CCS technologies. Environment Justice Australia characterised CCS as being 'an untested technology', which it argued 'should

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49 Department of the Environment and Energy, *Submission 5*, p. 4.

50 CEFC, *Submission 14*, p. 2.

51 The CEFC noted that 'at present the CEFC has no particular expertise in CCS technologies or their application, but would have to acquire necessary expertise in the event the legislation passed and the prohibition on investing in technology for CCS was removed from the CEFC Act'. CEFC, *Submission 14*, p. 5.

52 CEFC, *Submission 14*, p. 2.

53 CEFC, *Submission 14*, p. 2.

54 Ms Tania Constable PSM, Chief Executive Officer, CO2CRC, *Committee Hansard*, 18 April 2018, p. 14.

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not be seriously considered as a sound option to reduce carbon emissions, let alone by a government body with capital return requirements'.<sup>55</sup>

2.52 Similar observations were made in other submissions. The Australia Institute contended that the Australian Government has 'very little to show for' the \$1.3 billion spent in support of CCS technologies and that this indicates 'CCS technologies are not yet developed and demonstrated sufficiently to fit the CEFC's focus on technologies in the later stages of development and commercialisation'.<sup>56</sup>

2.53 Likewise, Mr Simon Holmes à Court commented that the CEFC 'is not a research and development program' and that CCS projects 'have yet to demonstrate technical and commercial readiness to the CEFC's standards'. Mr Holmes à Court commented that, with 'a lack of commercial viable CCS opportunities on offer', if the CEFC's current investment approach is maintained, the bill 'is highly unlikely to have any difference to either the CEFC or the development of CCS'.<sup>57</sup>

2.54 Furthermore, Mr Holmes à Court expressed doubt that the CEFC would provide funding on the scale that CCS projects have required to date. Mr Holmes à Court commented:

...the largest loan that CEFC has ever made is in the order of \$200 million, and \$200 million is pretty much what we spent on the feasibility of Queensland's ZeroGen project, so the orders of magnitude for these projects are well above anything that the CEFC normally looks at.<sup>58</sup>

2.55 There is also concern that the addition of CCS as a possible investible technology would dilute the CEFC's focus. The Australian Conservation Foundation (ACF) noted that the projects financed by the CEFC to date 'are forecasted to reduce Australia's annual emission by 11.1 million tonnes of CO<sub>2</sub>-e'.<sup>59</sup> The ACF argued that a contributing factor to the CEFC's success to date has been 'its adherence to a narrowly defined investment mandate, focused on promoting investment in clean, renewable technologies'.<sup>60</sup> Mr Roderick Campbell from The Australia Institute also commented that the need for the CEFC to acquire knowledge about CCS technologies would be a 'drain' on the limited resources of 'a relatively small body'.<sup>61</sup>

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55 Environmental Justice Australia, *Submission 10*, p. 1 (emphasis omitted).

56 The Australia Institute, *Submission 11*, p. 2.

57 Mr Simon Holmes à Court, *Submission 13*, pp. 4, 6.

58 Mr Simon Holmes à Court, *Committee Hansard*, 18 April 2018, p. 25.

59 Australian Conservation Foundation, *Submission 8*, p. 2.

60 Australian Conservation Foundation, *Submission 8*, p. 2.

61 Mr Roderick Campbell, Research Director, The Australia Institute, *Committee Hansard*, 18 April 2018, pp. 1–2.

2.56 It was also questioned whether the CEFC has adequate resources to invest in CCS technologies in addition to its existing work. This evidence can be divided into two categories:

- First, as noted above (paragraph 2.35), AGL Energy argued that the government should provide the CEFC with 'appropriate incremental funding' to facilitate investments in CCS technologies so as not to detract from the types of investments it currently considers.<sup>62</sup>
- Secondly, The Australia Institute expressed concern that once CCS is a possible investible technology, the CEFC's investment mandate could be changed to reserve part of the CEFC's investment finance for investments in CCS projects only, reducing the potential funding available for renewable energy or energy efficiency technologies.<sup>63</sup>

2.57 Finally, it was questioned whether the CEFC is the most appropriate entity for supporting the successful development of CCS. The Australia Institute acknowledged the potential of CCS technology, such as in industrial applications 'where zero emission alternatives to production processes are not yet known'.<sup>64</sup> However, the Institute argued that, when CCS technologies 'are a little more advanced', whether the CEFC should invest in these technologies would be 'better addressed as part of a wider review of our environment and energy bodies rather than tacking something onto the CEFC now'.<sup>65</sup>

### **Committee view**

2.58 The committee supports amending the CEFC Act to remove the prohibition on the CEFC investing in CCS technologies as proposed by this bill. Fundamentally, the committee supports the bill because it considers the public interest would be better served by a more technology neutral approach to energy policy.

2.59 CCS is a proven low-emission technology. In the committee's view, the prohibition on the CEFC investing in CCS technologies is arbitrary and inappropriate given the expert advice that a wide range of technologies is needed to achieve the emissions reductions required under the Paris Agreement. A more technology neutral approach to the CEFC Act will ensure that the widest possible range of cost-effective low-emission solutions can be considered by the CEFC, noting that it would still be

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62 AGL Energy, *Submission 6*, p. 2.

63 The Australia Institute, *Submission 11*, p. 2. See also Mr Simon Holmes à Court, *Submission 13*, p. 6.

64 Similarly, Mr Holmes à Court commented that 'some decades from now, when all low cost abatement opportunities are exhausted, CCS will likely be necessary for any remaining processes with "stubborn emissions" or for atmospheric carbon removal'. Mr Simon Holmes à Court, *Submission 13*, p. 2.

65 Mr Roderick Campbell, Research Director, The Australia Institute, *Committee Hansard*, 18 April 2018, p. 3. See also The Australia Institute, *Submission 11*, pp. 2–3.



for the CEFC to decide, independent of government and with commercial rigour, whether to invest in any suitable projects involving CCS.

**Recommendation 1**

**2.60 The committee recommends that the bill be passed.**

**Senator Jonathon Duniam  
Chair**

