s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s

Mitigation options

Mitigation of carbon emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable to this project include:

s. 22(1)(a)(ii)

- Carbon management through the deployment of carbon capture and storage technologies;

s. 22(1)(a)(ii)

Increasing energy efficiency

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.63 cm + Indent at: 1.27 cm

The department, through the *Carbon Credits (Carbon Faming Initiative – Facilities) Methodology Determination 2015* gives recommendations on projects that could be undertaken to potentially lower facility energy costs, improve productivity, and lower emissions. These include:

- replacing or modifying boilers;
- improving control systems and processes
- waste heat capture and re-use
- upgrading turbines
- improving the efficiency of crushing or grinding equipment
- replacing low efficiency motors, fans and pumps with high efficiency versions
- installing variable speed drives
- improving compressed air processes
- reducing industrial process emissions
- behavior changes
- installing low emissions-intensity electricity generation equipment
- fuel switching

Carbon Capture and Storage?

~~A range of options for carbon abatement/mitigation exist including:~~**Capture**

Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

- Pre-combustion capture
  - Process of removing CO_2 from fossil fuels before combustion is completed
  - The method is typically applied to coal-gasification combined cycle power plants
- Post-combustion capture
  - Process of removing CO_2 from the flue gas after the fossil fuel has been burned
  - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent
  - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes
  - Post-combustion capture is favoured for carbon capture in gas power plants
- Oxyfuel combustion
  - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion

Formatted: Indent: First line: 0 cm

Commented [CS2]: Found here <https://www.legislation.gov.au/Details/F2015L01346/Explanatory%20Statement/Text>

Legislation in force but superseded. Not sure if it should still be referenced / if I referenced it correctly

Formatted

Formatted: Normal, Indent: Left: 0 cm, Hanging: 0.65 cm, No bullets or numbering

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.63 cm + Indent at: 1.27 cm

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.63 cm + Indent at: 1.27 cm

Commented [CS3]: Unsure whether oxyfuel combustion is applicable to LNG power plants. Most sources reference coal power in terms of carbon capture via oxyfuel

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.63 cm + Indent at: 1.27 cm

- The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
- CO_2 is separated or captured from the flue gas by low-temperature dehydration and desulfurization processes.
- Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density

Formatted: List Paragraph, Indent: Left: 2.54 cm

The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the earths surface.

The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Formatted: Indent: Left: 0.63 cm

Storage

Formatted: Font: Bold

Formatted: Normal, Indent: Left: 0 cm, Hanging: 0.65 cm, No bullets or numbering

- CO_2 Re-Injection
  - e.g. Chevron Gorgon Gas Development have developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100 million tonnes of CO2 over the life of the Gorgon projects.

Formatted: Bulleted + Level: 2 + Aligned at: 1.9 cm + Indent at: 2.54 cm

Formatted: Normal, Indent: Left: 0 cm, Hanging: 0.65 cm

Formatted: Indent: Left: 0.65 cm, No bullets or numbering

- ~~Implementing energy efficiency practices for the proposal such as reductions in the emissions-intensity of transport~~
- ~~Strategy to reduce emissions year on year to feed into lower offset requirements~~
- ~~Upgrading old technology~~

Formatted: Strikethrough

Formatted: List Paragraph, Space After: 6 pt, Bulleted + Level: 1 + Aligned at: 0.63 cm + Indent at: 1.27 cm

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
    - s. 22(1)(a)(ii)
    - Carbon management through the deployment of carbon capture and storage technologies;

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Mitigation: Carbon Capture and Storage

Capture

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

  <u>Pre-combustion capture</u>

  - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

  <u>Post-combustion capture</u>

  - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
  - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
  - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
  - Post-combustion capture is favoured for carbon capture in gas power plants.

  <u>Oxyfuel combustion</u>

  - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.

- The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
- CO_2 is separated or captured from the flue gas by low-temperature dehydration **and desulfurization processes.**
- Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
- Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Storage

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 Mt of CO_2PA - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
    - e.g. Applying Carbon Capture and Storage to gas-fired power plants can substantially reduce the emissions of the gas-fired fleet. Chevron Gorgon Gas Development have developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100Mt of CO_2 over the life of the Gorgon projects. On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.

- The draft EIS discusses that geosequestration for EPBC 2018/8319 and the Browse reservoir CO_2:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:

  s. 22(1)(a)(ii)

  - Carbon management through the deployment of carbon capture and storage technologies.;

Formatted: Not Highlight

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Mitigation: Carbon Capture and Storage

Capture

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

Pre-combustion capture

  - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

Post-combustion capture

  - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
  - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
  - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
  - Post-combustion capture is favoured for carbon capture in gas power plants.

Oxyfuel combustion

  - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
  - The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.

s. 22(1)(a)(ii)

Formatted: List Bullet, Space After: 0 pt, No bullets or numbering

    - CO_2 is separated or captured from the flue gas by low-temperature dehydration **and desulfurization processes.**
    - Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
    - Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.
- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Storage

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 ~~Mt~~MT of CO_2PA - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
    - e.g. Applying Carbon Capture and Storage to gas-fired power plants can substantially reduce the emissions of the gas-fired fleet. Chevron Gorgon Gas Development have developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100~~Mt~~MT of CO_2 over the life of the Gorgon projects. On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.
- The draft EIS discusses that geosequestration for EPBC 2018/8319 and the Browse reservoir CO_2:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

Formatted: List Bullet, Space After: 0 pt, No bullets or numbering

Formatted: List Bullet, Space After: 0 pt, No bullets or numbering

Formatted: List Bullet, Space After: 0 pt, No bullets or numbering

Formatted: List Paragraph,DDM Gen Text,List Paragraph1,NFP GP Bulleted List,Recommendation,List Paragraph11,1 heading, Bulleted + Level: 2 + Aligned at: 1.9 cm + Indent at: 2.54 cm

Formatted: List Paragraph,DDM Gen Text,List Paragraph1,NFP GP Bulleted List,Recommendation,List Paragraph11,1 heading

Formatted: List Paragraph,DDM Gen Text,List Paragraph1,NFP GP Bulleted List,Recommendation,List Paragraph11,1 heading, Add space between paragraphs of the same style, Don't keep with next

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
  - s. 22(1)(a)(ii)
  - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 61

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Mitigation: Carbon Capture and Storage

Capture

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

    Pre-combustion capture

    - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

    Post-combustion capture

    - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
    - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
    - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
    - Post-combustion capture is favoured for carbon capture in gas power plants.

    Oxyfuel combustion

    - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
    - The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
    - CO_2 is separated or captured from the flue gas by low-temperature dehydration **and desulfurization processes.**
    - Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
    - Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the

earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Storage

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT of CO_2PA - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
    - e.g. Applying Carbon Capture and Storage to gas-fired power plants can substantially reduce the emissions of the gas-fired fleet. Chevron Gorgon Gas Development have developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects. On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.
- The draft EIS discusses that geosequestration for EPBC 2018/8319 and the Browse reservoir CO_2:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

s. 22(1)(a)(ii)

DRAFT – Not for distribution

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
    - s. 22(1)(a)(ii)
    - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Offsetting and mitigation ***[this section only focuses on CCS – not sure why?]***

Formatted: Highlight

Mitigation: Carbon Capture and Storage

Capture

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

Pre-combustion capture

- Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

Post-combustion capture

- Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
- The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
- Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
- Post-combustion capture is favoured for carbon capture in gas power plants.

Oxyfuel combustion

- Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
- The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
- CO_2 is separated or captured from the flue gas by low-temperature dehydration **and desulfurization processes.**
- Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
- Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the

earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Storage

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT of CO_2PA - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
  - e.g. Applying Carbon Capture and Storage to gas-fired power plants can substantially reduce the emissions of the gas-fired fleet. Chevron Gorgon Gas Development have developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects. On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.
- The draft EIS discusses that geosequestration for EPBC 2018/8319 and the Browse reservoir CO_2:
  - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
  - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
  - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
    - s. 22(1)(a)(ii)
    - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

~~Offsetting and mM~~itigation ~~- Carbon Capture and Storage[this section only focuses on CCS – not sure why?]~~

~~Mitigation: Carbon Capture and Storage~~

Capture

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

Pre-combustion capture

- Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

Post-combustion capture

- Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
- The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
- Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
- Post-combustion capture is favoured for carbon capture in gas power plants.

Oxyfuel combustion

- Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
- The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
- CO_2 is separated or captured from the flue gas by low-temperature dehydration **and desulfurization processes.**
- Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
- Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

DRAFT – Not for distribution

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Storage

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
    - e.g. Applying Carbon Capture and Storage to gas-fired power plants can substantially reduce the emissions of the gas-fired fleet. Chevron Gorgon Gas Development have developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects. On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.
- The draft EIS discusses that geosequestration for EPBC 2018/8319 and the Browse reservoir CO_2:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
    - s. 22(1)(a)(ii)
    - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 133

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

Mitigation - Carbon Capture and Storage

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

  Pre-combustion capture
  - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

  Post-combustion capture
  - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
  - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
  - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
  - Post-combustion capture is favoured for carbon capture in gas power plants.

  Oxyfuel combustion
  - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
  - The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
  - CO_2 is separated or captured from the flue gas by low-temperature dehydration and desulfurization processes.
  - Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
  - Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the

DRAFT – Not for distribution

earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Carbon storage technology

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.

- The Chevron Gorgon Gas Development in Australia has developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects.

- On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.

- The draft EIS for the Browse project notes that geosequestration:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
  - s. 22(1)(a)(ii)
  - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Mitigation - Carbon Capture and Storage

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

  Pre-combustion capture

  - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

  Post-combustion capture

  - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
  - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
  - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
  - Post-combustion capture is favoured for carbon capture in gas power plants.

  Oxyfuel combustion

  - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
  - The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
  - CO_2 is separated or captured from the flue gas by low-temperature dehydration and desulfurization processes.
  - Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
  - Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the

DRAFT

earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Carbon storage technology

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.

- The Chevron Gorgon Gas Development in Australia has developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects.

- On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.

- The draft EIS for the Browse project notes that geosequestration:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 171

DOCUMENT 9a

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

ATTACHMENT A

s. 22(1)(a)(ii)

Assessment of greenhouse gas emissions

s. 22(1)(a)(ii)

- I strongly encourage Woodside to adopt more ambitious commitments in the final EIS to reduce direct emissions to the greatest extent possible. Commitments should be specific and have measurable outcomes.

  If pressed:

  - I encourage Woodside to further explore and commit to adopting technologies such as Carbon Capture and Storage for the project. I understand that this has been successfully delivered for other offshore gas projects in Australia.

  - I also encourage Woodside to consider how greenhouse gas emissions could be offset within Australia. I am open to new and innovative carbon offsetting proposals that also deliver positive environmental outcomes.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

LEX 22340 PAGE 176

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 178

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

ATTACHMENT A

s. 22(1)(a)(ii)

Assessment of greenhouse gas emissions

s. 22(1)(a)(ii)

- I strongly encourage Woodside to adopt more ambitious commitments in the final EIS to reduce direct emissions to the greatest extent possible. Commitments should be specific and have measurable outcomes.

  If pressed:

  - I encourage Woodside to further explore and commit to adopting technologies such as Carbon Capture and Storage for the project. I understand that this has been successfully delivered for other offshore gas projects in Australia.

  - I also encourage Woodside to consider how greenhouse gas emissions could be offset within Australia. I am open to new and innovative carbon offsetting proposals that also deliver positive environmental outcomes.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

LEX 22340 PAGE 186

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Assessment of greenhouse gas emissions

s. 22(1)(a)(ii)

- ~~I~~It is vitally important that Woodside is doing everything it can to reduce and mitigate ~~strongly encourage Woodside to adopt more ambitious commitments in the final EIS to reduce direct~~ emissions to the greatest extent possible, in support of broadening community support for the project.
- Commitments should be specific, ~~and~~ have measurable outcomes and be included in the final EIS for the project to ensure they are able to be accounted for through the formal assessment of the project.

  If pressed:

  - I encourage, for example, Woodside to further explore and commit to adopting technologies such as Carbon Capture and Storage for the project. I understand that this has been successfully delivered for other offshore gas projects in Australia.
  - I also encourage Woodside to consider how greenhouse gas emissions could be offset within Australia. I am open to new and innovative carbon offsetting proposals that also deliver positive environmental outcomes.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 202

ATTACHMENT A

s. 22(1)(a)(ii)

If asked how Greenhouse Gas emissions will be considered in the assessment;

s. 22(1)(a)(ii)

- I encourage Woodside to think proactively on this issue and commit to implementing measures to address direct emissions to the greatest extent possible. Commitments in this space should be specific and have measurable outcomes.

  If pressed:

- I encourage Woodside to explore the potential for Carbon Capture and Storage technologies to be applied to the proposal. I understand that this has been successfully delivered for other offshore gas projects in Australia.
- I would also encourage Woodside to consider how greenhouse gas emissions could be offset within Australia. I am open to new and innovative carbon offsetting proposals that also deliver environmental outcomes.

s. 22(1)(a)(ii)

LEX 22340 PAGE 204

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 207
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

LEX 22340 PAGE 209

s. 22(1)(a)(ii)

ATTACHMENT A

s. 22(1)(a)(ii)

Assessment of greenhouse gas emissions

s. 22(1)(a)(ii)

- Commitments should be specific, have measurable outcomes and be included in the final EIS for the project to ensure they are able to be accounted for through the formal assessment of the project.

  If pressed:

  - I encourage, for example, Woodside to further explore and commit to adopting technologies such as Carbon Capture and Storage for the project. I understand that this has been successfully delivered for other offshore gas projects in Australia.

  - I also encourage Woodside to consider how greenhouse gas emissions could be offset within Australia. I am open to new and innovative carbon offsetting proposals that also deliver positive environmental outcomes.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

DRAFT

LEX 22340 PAGE 213

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Dr

ATTACHMENT B – Options to Mitigate and Offset GHG Emissions

s. 22(1)(a)(ii)

*Other mitigation options available to reduce GHG emissions – Carbon Capture and Storage (**CCS**)*

- The proponent has not proposed to pursue the following mitigation options, at least in the immediate future.

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion. The CO_2 that is captured through these methods is transported via pipeline or ship for storage.

Carbon storage technology

- Storage of CO_2 is done through a process called geo-sequestration, or re-injection, where CO_2 is injected into geological formations several kilometers below the earth's surface. There were only two large-scale CCS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 Mt CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
- The CO_2 Injection Project as part of the Chevron Gorgon Gas Development in Australia will involve injection and storage or reservoir CO_2 into a deep reservoir unit known as the Dupey Formation. The project expects to reduce GHG emissions from the Gorgon Projects by roughly 40% and inject an expected 100 Mt of CO_2 over the entire life of the projects.
- The draft EIS for the proposed action notes that geo-sequestration:
    - Has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - Is significantly complex due to gas turbine exhaust capture being an unusual geo-sequestration technique; and
    - Not cost effective when compared with approved carbon farming methodologies used to offset emissions.
- The response to submissions for the proposed action notes that CCS will not be proposed in the initial phase of the proposal, however, the current concept provides space on board the floating production storage and offloading (**FPSO**) to install facilities to reinject reservoir emissions at a future date. The proponent considers that carbon farming methodologies (**bio-sequestration**), is a significantly lower risk and more cost-effective option.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRA

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Wednesday, 27 May 2020 1:39 PM
To: s. 22(1)(a)(ii); Gregory Manning
Cc: s. 22(1)(a)(ii)
Subject: Offset options for Browse to North West Shelf and North West Shelf Projects - DRAFT for deliberation only [SEC=OFFICIAL]

Hi all,

The below list is options for possible offsets to compensate for residual impacts that may occur in the Browse to North West Shelf s. 22(1)(a)(ii) . These options are just for discussion and deliberation and do not represent the current views of the Department given the assessments for both proposals are yet to be undertaken. The quantum of offsets and monetary value would only be determined after an assessment of the impacts of the action has occurred.

Browse

Likely offsets:

- s. 22(1)(a)(ii)
- s. 22(1)(a)(ii)
- s. 22(1)(a)(ii)

  - s. 22(1)(a)(ii)

Possible offsets:

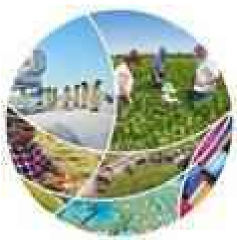
- Greenhouse Gas Emissions (residual impacts on sensitive receptors);
  - Options could include GHG Abatement Plan, commitment to monitor global energy outlooks and develop adaptive management options for the proposed action, Substitution Strategy, Carbon Capture and Storage Plan and/or Emissions cap.
- s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Happy to discuss. Note: this is preliminary thinking noting the assessment has not been undertaken and these measures have not been proposed by the proponent.

Kind regards,
s. 22(1)(a)(ii)

Senior Assessment Officer | Major Projects West Section
Assessments (WA, SA, NT), Post Approval and Policy Branch | Environment Approvals Division
Department of Agriculture, Water and the Environment | GPO Box 787 Canberra ACT 2601 | awe.gov.au
s. 22(1)(a)(ii) awe.gov.au | Ph: s. 22(1)(a)(ii)



s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Wednesday, 27 May 2020 2:45 PM
To: s. 22(1)(a)(ii)
Cc: Gregory Manning; s. 22(1)(a)(ii)
Subject: Re: Offset options for Browse to North West Shelf and North West Shelf Projects - DRAFT for deliberation only [SEC=OFFICIAL]

Thx s. 22(1)(a)(ii)

Sent from my iPhone

On 27 May 2020, at 1:39 pm, s. 22(1)(a)(ii) wrote:

Hi all,
The below list is options for possible offsets to compensate for residual impacts that may occur in the Browse to North West Shelf s. 22(1)(a)(ii) These options are just for discussion and deliberation and do not represent the current views of the Department given the assessments for both proposals are yet to be undertaken. The quantum of offsets and monetary value would only be determined after an assessment of the impacts of the action has occurred.

Browse

Likely offsets:

- s. 22(1)(a)(ii)
- s. 22(1)(a)(ii)
- s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Possible offsets:

- Greenhouse Gas Emissions (residual impacts on sensitive receptors);
    - Options could include GHG Abatement Plan, commitment to monitor global energy outlooks and develop adaptive management options for the proposed action, Substitution Strategy, Carbon Capture and Storage Plan and/or Emissions cap.
- s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Happy to discuss. Note: this is preliminary thinking noting the assessment has not been undertaken and these measures have not been proposed by the proponent.

Kind regards,

s. 22(1)(a)(ii)
Senior Assessment Officer | Major Projects West Section
Assessments (WA, SA, NT), Post Approval and Policy Branch | Environment Approvals Division
Department of Agriculture, Water and the Environment | GPO Box 787 Canberra ACT 2601 | awe.gov.au
s. 22(1)(a)(ii) @awe.gov.au | Ph: s. 22(1)(a)(ii)
<image001.jpg>

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

ATTACHMENT A

s. 22(1)(a)(ii)

Assessment of greenhouse gas emissions

s. 22(1)(a)(ii)

- I strongly encourage Woodside to adopt more ambitious commitments in the final EIS to reduce direct emissions to the greatest extent possible. Commitments should be specific and have measurable outcomes.

  If pressed:

  - I encourage Woodside to further explore and commit to adopting technologies such as Carbon Capture and Storage for the project. I understand that this has been successfully delivered for other offshore gas projects in Australia.

  - I also encourage Woodside to consider how greenhouse gas emissions could be offset within Australia. I am open to new and innovative carbon offsetting proposals that also deliver positive environmental outcomes.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

LEX 22340 PAGE 238

s. 22(1)(a)(ii)

LEX 22340 PAGE 239

s. 22(1)(a)(ii)

LEX 22340 PAGE 240

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

ATTACHMENT B – Options to Mitigate and Offset GHG Emissions

s. 22(1)(a)(ii)

Other mitigation options available to reduce GHG emissions – Carbon Capture and Storage (CCS)

- The proponent has not proposed to pursue the following mitigation options, at least in the immediate future.

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion. The CO_2 that is captured through these methods is transported via pipeline or ship for storage.

Carbon storage technology

- Storage of CO_2 is done through a process called geo-sequestration, or re-injection, where CO_2 is injected into geological formations several kilometers below the earth's surface. There were only two large-scale CCS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
- The CO_2 Injection Project as part of the Chevron Gorgon Gas Development in Australia will involve injection and storage or reservoir CO_2 into a deep reservoir unit known as the Dupey Formation. The project expects to reduce GHG emissions from the Gorgon Projects by roughly 40% and inject an expected 100 MT of CO_2 over the entire life of the projects.
- The draft EIS for the proposed action notes that geo-sequestration:
  - Has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
  - Is significantly complex due to gas turbine exhaust capture being an unusual geo-sequestration technique; and
  - Not cost effective when compared with approved carbon farming methodologies used to offset emissions.
- The response to submissions for the proposed action notes that CCS will not be proposed in the initial phase of the proposal, however, the current concept provides space on board the floating production storage and offloading (**FPSO**) to install facilities to reinject reservoir emissions at a future date. The proponent considers that carbon farming methodologies (**bio-sequestration**), is a significantly lower risk and more cost-effective option.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT

ATTACHMENT B

Options to Mitigate and Offset GHG Emissions

s. 22(1)(a)(ii)

Other mitigation options available to reduce GHG emissions – Carbon Capture and Storage (CCS)

- The proponent has not proposed to pursue the following mitigation options, at least in the immediate future.

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion. The CO_2 that is captured through these methods is transported via pipeline or ship for storage.

Carbon storage technology

- Storage of CO_2 is done through a process called geo-sequestration, or re-injection, where CO_2 is injected into geological formations several kilometers below the earth's surface. There were only two large-scale CCS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.
- The CO_2 Injection Project as part of the Chevron Gorgon Gas Development in Australia will involve injection and storage or reservoir CO_2 into a deep reservoir unit known as the Dupey Formation. The project expects to reduce GHG emissions from the Gorgon Projects by roughly 40% and inject an expected 100MT of CO_2 over the entire life of the projects.
- The draft EIS for the Browse project notes that geosequestration:
  - Has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
  - Is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique; and
  - Not cost effective when compared with approved carbon farming methodologies used to offset emissions.
- The response to submissions for the Browse project notes that CCS will not be proposed in the initial phase of the proposal, however, the current concept provides space on board the floating production storage and offloading (FPSO) to install facilities to reinject reservoir emissions at a future date. The proponent considers that carbon farming methodologies (bio-sequestration), is a significantly lower risk and more cost-effective option.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT – Not for distribution

s. 22(1)(a)(ii)

- Recent media articles published by the Australian on 27 March 2020, suggest that Woodside is further exploring a willingness to invest in carbon capture and storage (CCS) options to reduce GHG emissions into the atmosphere. The draft Environmental Impact statement (EIS) for Browse to NWS does not commit to implement CCS.
- A number of offset mechanisms could be considered if it was determined that the proposed action would result in a significant residual impact from GHG emissions (Attachment A). These mechanisms aim to align with either the commitment proposed by Woodside (within their draft EIS or through general media announcements), precedents set by previous EPBC Act decisions (Attachment C) or alternative options investigated by the Department. The Department considers these options are a starting point for negotiations.

Commented [CS1]: Summary GHG talking point doc only says offsets should be required. Doesn't go into details on the potential offset mechanisms considered

s. 22(1)(a)(ii)

ATTACHMENTS

A: Options to mitigate and offset GHG emissions

B: GHG Regulation in Australia – Background

C: Table on GHG emissions and other EPBC Act assessments

DRAFT – Not for distribution

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
    - s. 22(1)(a)(ii)
    - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

DRAFT – Not for distribution

s. 22(1)(a)(ii)

Mitigation - Carbon Capture and Storage

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

  Pre-combustion capture

  - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

  Post-combustion capture

  - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
  - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
  - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
  - Post-combustion capture is favoured for carbon capture in gas power plants.

  Oxyfuel combustion

  - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
  - The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
  - CO_2 is separated or captured from the flue gas by low-temperature dehydration and desulfurization processes.
  - Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
  - Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the

DRAFT – Not for distribution

earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Carbon storage technology

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.

- The Chevron Gorgon Gas Development in Australia has developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects.

- On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.

- The draft EIS for the Browse project notes that geosequestration:

    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Comments on the Supplement Report to the draft EIS/ERD for Browse to North West Shelf Development, Indian Ocean, WA (EPBC 2018/8319) (Issued to DAWE on 03/12/2020, A757906)

Amended to include DAWE review of comments (09/12/2020)

Comment No. (Relevant section of the supplement)	DAWE Comment	Woodside response	NOPSEMA advice on adequacy	DAWE comment

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

11 (Table 3-1 row 6)	Please make a clear statement whether or not geo-sequestration is proposed in the supplement, rather than reflecting that the draft EIS/ERD did not propose it.	The response has been amended to read as follows. Note that the corresponding additions have also been added to response to comment submissions in relation to CCS (Section 5.10). As outlined in Section 7.7.3 of the draft EIS/ERD and Section 5.1 of this Supplement Report to the draft EIS/ERD, geo-sequestration is presently a high risk, high cost mitigation option for Browse reservoir CO_2, and is not proposed in the draft EIS/ERD or this Supplement Report to the draft EIS/ERD. CCS opportunities will continue to be monitored and assessed, as the technology is likely to improve in the future. As such, the BJV is continuing to assess the feasibility of carbon capture and storage opportunities, but these do not form part of the referred Proposed Action. Should an opportunity be considered feasible in future from a technical, commercial and regulatory perspective and be able to be progressed by the BJV in relation to the Browse titles, this will be separately referred by Woodside as Operator for and on behalf of the BJV.	**NOPSEMA finding:** A minor amendment has been made to Topic 6 in Table 3.1 of the Supplement which clarifies that CCS is not proposed as part of the Browse project. There are no environmental management commitments for adopting CCS technologies in the future though WEL will continue to assess options for managing reservoir CO_2. On face value, this approach does not appear consistent with the public remarks made by the WEL CEO regarding carbon sequestration for the Browse project (https://www.thechemicalengineer.com/news/woodside-ceo-browse-project-could-get-carbon-capture-from-day-one/#:~:text=Company%20CEO%20Peter%20Coleman%20told,project%20in%20a%20material%20way) **NOPSEMA Advice:** **Partially adequate.** In view of the above finding, Department may wish to consider whether: • The EIS should be revised to address WEL CEO public remarks relating to carbon sequestration; or • Requiring outcome based conditions that ensure that the engineering design of the FPSOs factor in the deck space and other design specifications should CCS (or other GHG engineering controls) become a feasible and an appropriate option for mitigating reservoir CO_2.	**Adequate response to submission** **Adequate** **Adequate for assessment** **Adequate** **Additional comment:** DAWE may seek outcomes-based conditions to ensure that appropriate management methodologies are adopted whilst ensure flexibility to facilitate adoption of best practice reservoir CO_2 management into the future. It should be clear that a CCS operation has not been approved as part of the proposed action, as potential impacts have not been assessed.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Supplement Report to the draft EIS/ERD – amendments register (for amendments made that are not in relation to a regulator comment on Rev 0)

Section/ Page	Change
s. 22(1)(a)(ii)	
Table 3-1 GHG emissions	Additional context provided for constancy with ERD RtS "As such, the BJV is continuing to assess the feasibility of carbon capture and storage opportunities, but these do not form part of the referred Proposed Action. Should an opportunity be considered feasible in future from a technical, commercial and regulatory perspective and be able to be progressed by the BJV in relation to the Browse titles, this will be separately referred by Woodside as Operator for and on behalf of the BJV."

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Woodside - DAWE briefing

Attending: s. 47F(1) – Woodside, s. 22(1)(a)(ii) , NOPSEMA s. 47F(1) from Jacobs, s. 22(1)(a)(ii)
,

Woodside – we are referring to operator on or behalf of browse JV representations Woodside, BO, Mimi browse, PetroChina, Shell

s. 22(1)(a)(ii) leading the presentation

DAWE briefing: Summary of Woodside's approach to addressing DAWE comments on draft supplementary documentation

s. 22(1)(a)(ii)

CCS – carbon capture and sequestration – No carbon capture and storage and not proposed as part of the current browse EIS

What does ACCU mean? - Australian carbon credit unit

Is it a commitment in the document to undertake a feasibility study into CCS? Q by nopsema and the answer is yes

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Recent media articles published by the Australian on 27 March 2020, suggest that Woodside is further exploring a willingness to invest in carbon capture and storage (CCS) options to reduce GHG emissions into the atmosphere. The draft Environmental Impact statement (EIS) for Browse to NWS does not commit to implement CCS.

s. 22(1)(a)(ii)

ATTACHMENTS

A: Options to mitigate and offset GHG emissions

B: GHG Regulation in Australia – Background

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

- Mitigation of GHG emissions from the combustion of fossil fuels can be achieved through several different ways. The main methods applicable include:
  - Is. 22(1)(a)(ii)
  - Carbon management through the deployment of carbon capture and storage technologies.

s. 22(1)(a)(ii)

DRAFT – Not for distribution

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Mitigation - Carbon Capture and Storage

Carbon capture technology

- Capture technologies allows for the separation of CO_2 gas produced through generation and industrial processes. Three methods exist for carbon capture: Pre-combustion capture; post-combustion capture; and oxyfuel combustion.

  Pre-combustion capture

    - Process of removing CO_2 from fossil fuels before combustion is completed. The method is typically applied to coal-gasification combined cycle power plants.

  Post-combustion capture

    - Process of removing CO_2 from the flue gas after the fossil fuel has been burned.
    - The technology for this method is based on chemical absorption/desorption with the use of liquid sorbent.
    - Post-combustion is preferred for its near-term applicability due to its ease of retrofitting to existing power plants, and operational flexibility of switching between capture and no-capture modes.
    - Post-combustion capture is favoured for carbon capture in gas power plants.

  Oxyfuel combustion

    - Process of combusting fossil fuels in a nearly pure oxygen environment, as opposed to air. The oxygen is separated from the air prior to combustion.
    - The burning of fossil fuel in an oxygen-rich, nitrogen-free environment results in flue gases that consist mainly of CO_2 and H_2O, producing a more concentrated stream of CO_2 which would otherwise not be possible through ignition with air.
    - CO_2 is separated or captured from the flue gas by low-temperature dehydration and desulfurization processes.
    - Benefits of oxy-fuel is reduction in NO_x emissions, high CO_2 concentrations, and lower gas volumes due to increased density.
    - Oxyfuel combustion is well-developed for coal-fired power plants, however, less developed for natural-gas-fired turbine cycles.

- The CO_2 that is captured through these methods is transported via pipeline or ship for storage. CO_2 is re-injected into geological formations that are several kilometers below the

DRAFT – Not for distribution

earth's surface. The capture of CO_2 adds substantially to the cost of power generation and reduces plant efficiency.

Carbon storage technology

- CO_2 Re-Injection (geosequestration). There were only two large-scale CCUS power projects in operation at the end of 2018 and a combined capture capacity of 2.4 MT CO_2 pa - the Petra Nova project in Texas has been operating successfully since 2017 and the Boundary Dam project in Saskatchewan, Canada, which started operations in 2014.

- The Chevron Gorgon Gas Development in Australia has developed a CO_2 Injection Project which involves injection and storage of reservoir CO_2 into a deep reservoir unit known as the Dupuy Formation. It is expected that this project will reduce GHG emissions from the Gorgon Projects (EPBC 2011/5942, 2003/1294 and 2008/4178) by approximately 40% and inject an expected 100MT of CO_2 over the life of the Gorgon projects.

- On 8 August 2019 the Gorgon Joint Venture Participants announced the safe start-up and operation of the carbon dioxide injection system following commencement of injection on 6 August 2019. The volume of reservoir carbon dioxide injected in the 2019–2020 financial year will be included in the 2020 Environmental Performance Report due in August/September to the Department.

- The draft EIS for the Browse project notes that geosequestration:
    - has high technical, operational and safety risk due to the offshore environment at the investigated location, the Calliance reservoir;
    - is significantly complex due to gas turbine exhaust capture being an unusual geosequestration technique
    - not cost effective when compared with approved carbon farming methodologies used to offset emissions.

DRAFT

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

ATTACHMENT A

s. 22(1)(a)(ii)

- I also note with interest the public commitments made by Woodside regarding offsetting greenhouse gas emissions at a corporate level, and recent media reports that Woodside may be exploring carbon capture and storage technology for the Browse project.
- I'm interested to know what firm commitments Woodside may be contemplating including in the final EIS to reflect this.
- Commitments should ideally be specific, have measurable outcomes and be included in the final EIS for the project to ensure they are able to be accounted for through the formal assessment of the project.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

ATTACHMENT C

- On 28 March 2020, an article was printed in the Weekend Australian citing the CEO on matters relating to carbon capture and storage. s. 22(1)(a)(ii) .
- The following extract was taken from Woodside's Website on 21 April 2020.

Source: https://www.woodside.com.au/sustainability/climate-change

We are pursuing a range of initiatives independent of our joint venture partners to reach our aspiration to be carbon-neutral by 2050, including:

- A commitment to **offset equity reservoir CO_2 emissions** across our global portfolio from 2021 (approximately 20% of our current GHG emissions).
- A partnership with Greening Australia to plant about **7.5 million native trees** in 2020. We have invested over A$100 million in biosequestration to date.
- A target to **improve energy efficiency by 5%** against baseline over 2016-20, with a new 5% target for 2021-25.
- Using **battery storage** to reduce fuel gas consumption.
- Developing **new markets for LNG as a lower-emissions fuel** in trucking and shipping.
- **Supporting international efforts**, signing up to the World Bank's Zero Routine Flaring by 2030 initiative, the Guiding Principles for Reducing Methane Emissions Across the Natural Gas Value Chain, and the International Energy Trading Association's Markets for Natural Climate Solutions initiative.
- **Investing A$40 million in research** to progress Australia's transition to a lower-carbon economy through the Woodside Monash Energy Partnership.
- **Diversifying our business** into supplying lower and zero carbon energy sources for the future. We are investigating the potential for hydrogen and exploring technologies that use carbon dioxide at scale.

isentia

AUTHOR: Perry Williams SECTION: BUSINESS NEWS ARTICLE TYPE: NEWS ITEM AUDIENCE : 219,242
PAGE: 28 PRINTED SIZE: 127.00cm² REGION: National MARKET: Australia ASR: AUD 12,349
WORDS: 307 ITEM ID: 1253857812

28 MAR, 2020

Woodside carbon capture plan for Browse gas plant

Weekend Australian, Australia

Woodside carbon capture plan for Browse gas plant

Woodside Petroleum plans to add a carbon capture facility to its $US20.5bn ($33.7bn) Browse LNG project in response to growing concerns over its emissions from the development.

While the West Australian gas project was delayed on Friday due to the oil price crash, Woodside said when it did resume it was likely to include a sequestration component from the start, rather than 10 years into the project as originally forecast.

Two of Woodside's Browse joint venture partners, Shell and BP, may hold concerns about the high emissions of the project, according to the Conservation Council of WA.

"We're looking at options now around sequestration not just in the immediate field area but other aquifers some distance from Browse," Woodside chief executive Peter Coleman told investors. "You can see a world where that will be a licence to operate requirement for Browse."

Woodside last year was among vocal critics of a plan by WA's environmental regulator for companies to fully offset their emissions to help meet the state's goal of net zero emissions by 2050.

Chevron is close to reaching full operations at its $2.5bn underground carbon capture and storage project at WA's Gorgon project, which aims to cut emissions by 40 per cent, while Santos is pursuing a sequestration plan for its Cooper Basin fields in South Australia.

Still, Woodside faces a number of obstacles given its remote location, including cost, according to consultancy Wood Mackenzie.

"Onshore in the Cooper Basin, which is near existing infrastructure, the process has been estimated at between $US25-$30 per tonne. Offshore is likely to be closer to triple that number, especially in remote areas such as the Browse basin," WoodMac analyst Angus Rodger told The Weekend Australian.

"In fact, we believe there are no obvious CCS solutions at the moment for Browse. There are no fields nearby that stand out."

PERRY WILLIAMS

Licensed by Copyright Agency. You may only copy or communicate this work with a licence.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

The meeting is also an opportunity to encourage Woodside to provide clearer, firmer commitments to manage greenhouse gas emissions, and enquire about how the company is intending to give effect to recent public statements to offset emissions at a corporate level within the Supplementary assessment documentation for these projects (see Attachment B for further information).

a. The Department notes Woodside's corporate level commitment to offset its equity share of reservoir carbon dioxide emissions and the recent comments by the Woodside CEO in the Weekend Australian in relation to the potential for carbon capture and storage to be implemented for the Browse to North West Shelf Project (Attachment B).

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

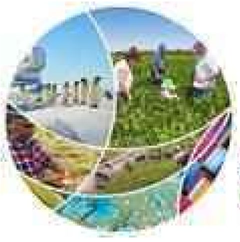
From: s. 22(1)(a)(ii)
Sent: Friday, 3 April 2020 11:50 AM
To: s. 22(1)(a)(ii)
Cc: Gregory Manning; s. 22(1)(a)(ii)
Subject: Media - Browse to commit to carbon capture and storage [SEC=OFFICIAL]

Interesting article citing that Woodside are looking to commit to implementing Carbon capture and storage technologies for Browse. The article quotes Peter Coleman as saying that you can see a world where CCS will be a license to operate requirement for Browse.

https://readnow.isentia.com/Temp/82256-265860/1253857812.pdf

s. 22(1)(a)(ii)

Major Projects West Section
Assessments (WA, SA, NT), Post Approval and Policy Branch | Environment Approvals Division
Department of Agriculture, Water and the Environment | GPO Box 787 Canberra ACT 2601 | awe.gov.au
s. 22(1)(a)(ii) @awe.gov.au | Ph: s. 22(1)(a)(ii)



Be Green...Read from the Screen

The Department acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

OFFICIAL

s. 22(1)(a)(ii)

LEX 22340 PAGE 356

s. 22(1)(a)(ii)

LEX 22340 PAGE 357

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Possible approval conditions for GHG emissions (slide 7)

s. 22(1)(a)(ii)

- Greenhouse gas emissions avoidance, mitigation and/or compensation measures
    - This could include the development and implementation of a strategy to demonstrate how these measures would be designed and implemented.

- For example, in previous EPBC Act assessments and approvals, approval conditions have been set requiring the development of a Greenhouse Gas Management and Abatement Strategy, to be approved by the Minister prior to project commencement.
- The strategy could cover a range of emissions associated with the project (e.g. scope 1 & 2 only, or scope 1, 2 & 3).

- Compensatory and mitigation measures for greenhouse gas emissions could include:
  - Purchasing Australian Carbon Credit Units, which contribute to the Emissions Reduction Fund.
  - Energy efficiency projects
  - Preserving trees or planting new trees (biological sequestration) and reforestation
  - Savannah fire management
  - Blue Carbon (e.g. protection and restoration of tidal marshes, mangroves and seagrass)
  - Renewable energy projects – producing energy without producing carbon e.g. wind and solar
  - Carbon capture and storage
  - Increasing soil carbon
  - Reducing livestock emissions