

Chapter 11 – Atmospheric Processes AAP01-000-GEG-GGEN-00002

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11 Atmospheric processes

11.1 Introduction

This chapter assesses the potential for impacts to the environment as a result of GHG emissions and the potential contribution of previously unassessed changes to the Project's scope with regards to the NTG's target of achieving net zero GHG emissions by 2050 (NTG, 2020). For the purpose of assessment under the *EP Act*, GHG emissions are considered under the NT EPA's Atmospheric processes factor, the objective of which is to:

Minimise GHG emissions so as to contribute to the NT Government's aspirational target of achieving net zero GHG emissions by 2050 and adapt to a changing climate to protect ecological integrity and maintain the welfare and amenity of people.

The potential impacts to atmospheric processes considered in this chapter were identified with reference to the NT EPA Direction Response (Appendix 1.1), the Draft EIS TOR, issues raised by stakeholders and professional judgement of the SEIS Team (Appendix 1.5) based on their knowledge and understanding of the Project's components and activities described in Chapter 2 Project Refinements.

Other emissions to air associated with the Project are particulate matter and exhaust emissions during the construction and operations phase, which are assessed in Chapter 10 Amenity and Chapter 14 Human Health, and which are therefore not covered in this chapter.

11.2 Information Sources

The Carbon Emissions Study and Greenhouse Gas Abatement Plan (GGAP) included in Appendix H of the Draft EIS has not been updated since lodgement; Section 11.5.2 provides the basis for this determination.

11.3 **Project Refinements since Draft EIS**

Project refinements presented in this SEIS (Chapter 2) that have been assessed for potential changes to previously reached impact assessment conclusions for atmospheric processes include changes in the disturbance footprint of the following components:

- Powell Creek Solar Precinct and Al
- OHTL Corridor
- Electrodes, HVDC Electrode Lines and Access Tracks¹
- Cable Transition Facilities.

11.4 Existing Environment and Values

There are no significant changes to the existing environmental values as understood in Chapter 12 of the Draft EIS. Baseline information describing these footprint areas can be found in relevant chapters of the SEIS (e.g., Chapter 5 Terrestrial Ecosystems).

¹ The term 'Electrodes' is used throughout this chapter to refer to the Electrodes, HVDC Electrode Lines and Access Tracks.

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11.5 Potential Impacts

The potential impacts to atmospheric processes associated with the construction and operation of the Project have been assessed using the impact assessment methodology described in Chapter 3 of the Draft EIS, which is also summarised in Chapter 1 of this SEIS. The Draft EIS identified and evaluated the following potential impacts that may occur during construction or operations:

- GHG emissions from the combustion of fuel from vessels, plant and equipment for earthworks, air and land travel, logistics and power generation
- GHG emissions from land clearing and land use change
- GHG emissions from the decomposition of organic debris and loss of soil carbon during operation
- Positive impact overall reduction in GHG emissions from generation of renewable energy.

11.5.1 Assessment Scope and Boundaries

There are no changes to the scope and boundary of the GHG emission estimate defined in the Draft EIS. The GHG emissions estimate remains compliant with the EIS TOR and the GHG Emissions Management for New and Expanding Large Emitters Policy (NTG, 2021).

The GGAP has not been updated as data inputs and assumptions, including the 20 % uplift in emissions², remain appropriate given the scale of the proposed changes to the disturbance footprint (Section 11.5.3), the current level of engineering and detail for the construction program and operations.

11.5.2 Emissions Inventory

The Project will make 800 MW of renewable energy available to the Darwin Region, positively supporting the NTG's aspiration to reduce GHG emissions.

AAPowerLink GHG emissions are primarily generated from the combustion of fuel (69 %) associated with vessels, plant and equipment from earthworks, construction and maintenance, air and land travel, logistics and power generation. Nearly one-third of emissions (28 %) come from the decomposition of organic debris and loss of soil carbon over the 70-year operational life of the infrastructure before decommissioning. Emissions from land clearing and land use change account for 3 % of the Projects' total GHG emissions.

Refinements to the disturbance footprint of the Powell Creek Solar Precinct and AI, OHTL Corridor, Electrodes, and Cable Transition Facilities are not anticipated to materially change the source or distribution of GHG emissions across the project life.

11.5.3 GHG emissions from land clearing, land use change, decomposition of organic debris and loss of soil carbon during operation

The adjusted disturbance footprint of project components identified in Section 11.3 is primarily in remote areas where GHG emissions do not impact locally sensitive receptors. The Draft EIS considered the potential impacts to atmospheric processes inclusive of all sites within the scope of the Atmospheric Processes assessment, as opposed to individually. The Draft EIS concludes the scale of the potential impacts to be widespread, the most severe rating.

² Given the complexity of the Project and the level of residual uncertainty, an uplift of 20 % has been applied to the GHG emissions estimate presented in the GGAP in alignment with best practices outlined in the *Climate Active Carbon Neutral Standard*.

The changes to the construction disturbance footprint³ of the Powell Creek Solar Precinct and AI, OHTL Corridor, Electrodes and Cable Transition Facilities summate to an approximate 1 % overall increase⁴ compared to the Draft EIS. Table 2-2 in Chapter 2 outlines the adjusted area of disturbance for the respective project components. The proposed land use changes within the SEIS disturbance footprint are similar to those assessed in the Draft EIS. The project refinements (refer to Chapter 2) therefore do not substantiate a change as the assessment rating of the potential impacts and proposed mitigation measures are consistent with the Draft EIS.

11.5.4 GHG emissions from the combustion of fuel from vessels, plant and equipment for earthworks, air and land travel, logistics and power generation

The SEIS does not propose changes to vessels, logistics or power generation presented in the Draft EIS. Section 2.7.5 of the Draft EIS presents further details around cable laying vessel options being considered in construction. While there is additional footprint and earthworks required, the proposed change is minor (Section 11.5.3) and the mitigation measures are consistent with the Draft EIS.

11.5.5 Overall reduction in GHG emissions from the generation of renewable energy

The Project will be a carbon-positive supplier of renewable solar electricity, supporting the NT and Singapore to reduce GHG emissions from fossil fuel power generation and ultimately achieve their respective net zero GHG emission targets. An analysis of the total emissions (Figure 11-1) indicates the Project will be carbon neutral after four years of operation, and at this point the Project will become carbon positive for the remaining asset life.

Each GWh of electricity generated by the Project will avoid between 410 and 540 T CO₂e emissions from fossil fuel generated power in the NT or Singapore. The avoided emissions in the NT and Singapore across the life of AAPowerLink equate to an estimated combined total of 485 million T CO₂e. These emissions avoided are considered carbon abatement or negative emissions in line with the accounting methodology in the *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cwth) and the United Nations Framework Convention on Climate Change, 2019, *International Financial Institutions Technical Working Group on GHG Accounting: GHG Accounting for Grid Connected Renewable Energy Projects* (International Financial Institutions Technical Working Group on GHG Accounting, 2019).

The emissions estimate contains a certain level of residual uncertainty that will be refined as the design, construction and operations of the Project progresses. Notwithstanding, the NT avoided emissions are projected to be 1.8 million T CO₂e/y or 115 million T CO₂e over the Project's life. The forecasted total GHG emissions generated in the NT (4.2 million T CO₂e) represents approximately 4 % of the total NT avoided emissions. Refinement of the disturbance footprint of the Powell Creek Solar Precinct and AI, OHTL Corridor, Electrodes and Cable Transition Facilities will not materially change the net emissions profile of AAPowerLink, including the Project's ability to achieve carbon neutrality early in the life span of the asset.

³ The clearance footprint for operations is within the construction clearance footprint (Chapter 2).

⁴ The Draft EIS proposes 15,035 ha total clearance area for construction; this SEIS proposes,15 238 ha.



Figure 11-1: AAPowerLink cumulative GHG emissions within Australia (Xodus, 2022)

11.6 Avoidance, Mitigation, and Monitoring

The Project is aligned with the NTG's objective of achieving net zero emissions by 2050. The intent is to maximise the carbon abatement opportunity from AAPowerLink and deliver a net zero infrastructure project.

The Proponent is actively pursuing the identification of opportunities for avoiding and mitigating GHG emissions from the construction, operation and decommissioning stages of the Project. Consistent with Section 26 of the *EP Act*, the identification of opportunities focuses on applying the environmental decision-making hierarchy as follows:

- Avoid ensure that actions are designed to avoid adverse impacts on the environment
- Mitigate identify management options to mitigate adverse impacts on the environment to the greatest extent practicable
- Offset if appropriate, provide for environmental offsets for residual adverse impacts on the environment that cannot be avoided or mitigated.

The avoidance, mitigation, monitoring, and reporting commitments in the Draft EIS extend to, and are appropriate for, the refined footprint of the Powell Creek AI, OHTL Corridor, Electrodes, and Cable Transition Facilities. Therefore, no changes to the mitigation measures previously committed to within the Draft EIS are required.

11.7 Residual Impact

The residual impacts of the Project to atmospheric processes result in minor adverse residual impacts and major positive residual impacts due to an overall carbon positive net emission profile.

Each impact to atmospheric processes was assigned a residual impact rating taking into consideration the scale, magnitude and duration of the impact, the presence/absence of environmental values and/or sensitive receptors and the level of certainty concerning the intensity of the impact and effectiveness of the mitigation measures.

The residual impact of land clearing, GHG emissions from fuel combustion, and decomposition of organic matter and loss of soil carbon all have a minor residual impact. While there are some short to medium term impacts of GHG emissions associated with the Project relating to land clearing and construction, AAPowerLink includes GHG mitigations to avoid and reduce GHG emissions ALARP.

As stated in Section 11.5.3, changes to the disturbance footprint of the Powell Creek AI, OHTL, Electrodes and Cable Transition Facilities do not substantiate a change to previous conclusions, as the assessment rating of the newly assessed residual impacts are consistent with the Draft EIS. Furthermore, the avoidance, mitigation, monitoring, and reporting commitments extend to the refined footprint.

The residual impacts of AAPowerLink will be predominantly positive locally, domestically and internationally, supporting the NTG in their goal of achieving net zero GHG emissions by 2050. The impact of an overall reduction in GHG emissions remains a major positive residual impact. As discussed in Section 11.5.5, the Project refinements since the Draft EIS will not materially impact the net carbon positive emission profile from the avoidance of fossil fuel power generation.

11.8 Cumulative Impact Assessment

Cumulative impacts were considered by assessing potential residual GHG emissions impacts of AAPowerLink with residual impacts from other past, present and reasonably foreseeable future projects. The framework used to assess the cumulative impacts of the Project is described in Chapter 3 of the Draft EIS.

While the magnitude and type of development are difficult to predict, it is reasonably foreseeable that the Project will stimulate economic activity by delivering renewable electricity at scale and at a potentially lower wholesale price without exacerbating the existing GHG emissions footprint from power demands in the NT. Reasonably foreseeable future development activities which could contribute to potential cumulative impacts are anticipated in the Barkly Region where the Powell Creek AI and Electrodes are located, and in the Darwin Region where the OHTL Corridor and Cable Transition Facilities are located.

As no material changes to potential impacts or residual impacts due to the Project's refinement are proposed, there is limited potential for change to the cumulative impacts assessed in the Draft EIS.

11.9 Conclusion

The Project will notably contribute to decarbonising the NT's electricity generation system by making 800 MW of low-carbon solar renewable energy available to the Darwin Region. In total, within the Draft EIS assessed GHG boundary, an avoidance of 115 million T CO₂e emissions is anticipated over the project life. AAPowerLink's avoidance of GHG emission directly supports the NT EPA's objective for the atmospheric processes factor and the NT's aspirational carbon target to:

Minimise GHG emissions so as to contribute to the NT Government's aspirational target of achieving net zero GHG emissions by 2050 and adapt to a changing climate to protect ecological integrity and maintain the welfare and amenity of people.

11.10 Submission Response

During the Draft EIS Public Submissions period, the ECNT provided a submission which raised various concerns relating to GHG emissions. The Proponent's responses to ECNT's submission are provided in Section 11.10.1.

Two anonymous community submissions were also received regarding atmospheric processes, responses to which are provided in Section 11.10.2.

11.10.1 ECNT Submission

11.10.1.1 Fossil Fuels and GHG Calculations

ECNT welcomes Sun Cable's objective to "minimise GHG emissions so as to contribute to the NT Government's target of achieving net zero GHG emissions by 2050". The estimation that the project will result in net emissions of -110 million CO2e is positive.

However, ECNT retains major concerns regarding the foreshadowed supply of electricity to fossil fuel power generators. Chapter 12 raises the following possibility: "The AAPowerLink proposes to supply electricity to users in the Darwin-Katherine region, and although activities to support this are currently out of scope for the project, this could potentially include customers on the DKES as well as industrial customers, who typically utilise behind the meter power generation from non-renewable sources."

In particular, ECNT is concerned by the objective of "Pursuing power purchase agreements with large fossil fuel power generators in the NT." The provision of power to the fossil fuel export industry may reduce emissions of the operations of those activities, but this emissions reduction is far outweighed by the continuation of those industries to export vast quantities of fossil fuels overseas and to the east coast of Australia. ECNT recognises that "GHG emissions outside of the scope of this estimate are those generated from activities outside of Australia" (12-5), however we submit that this should not preclude a consideration of the potential emissions profile of exporting industries that may be enabled by the provision of power, i.e., the LNG export industry.

The exclusion of emissions generated outside of Australia from the project's estimations will distort the actual climate impacts of the provision of power to the fossil fuel industry, occluding the genuine damage that would occur should the proponent, for example, electrify the LNG export industry at Middle Arm.

As such, Sun Cable should not pursue any power purchase agreements that enable new fossil fuel projects or the expansion of existing fossil fuel projects. As it stands, a declaration that the proponent intends to seek pursue "power purchase agreements with large fossil fuel power generators in the NT" considerably undermines the proponent's social license. There are many scenarios under which Sun Cable pursuing power purchase agreements with fossil fuel projects will substantially increase overall emissions in the long term, all of which must be categorically avoided. If, for example, Sun Cable was to provide power to the Middle Arm Sustainable Development Precinct (MASDP) and electrify the production of petrochemicals using offshore and fracked gas as a feedstock, this could secure the demand for gas into the future and legitimise the further development of offshore gas reserves in the Timor Sea. Sun Cable must provide an early guarantee that it will not pursue agreements of this kind that serve to enable the continuation of fossil fuel developments.

Whilst ECNT recognises that commercial decisions around the supply of power to industrial customers are "currently out of scope for the project", ECNT believes these decisions are of such fundamental importance to the project's stated objective to "minimise GHG emissions" that it would be remiss to not discuss them at this stage of the project. In short, if power from the AAPowerLink Project is provided to the gas industry to electrify gas processing, gas export, and the production of petrochemicals using fracked gas as a feedstock, this would constitute such an egregious departure from the original intent and objective of the project that it would undermine the proponent's stated intentions to meet the net zero target, and indeed scupper the Territory's possibility of meeting this target at all. The intended positive impact of the project, stated in Table 12.3 as being an "Overall reduction in GHG emissions from generation of renewable energy", requires the imposition at an early stage of a clearly defined framework establishing the nature of industries to which power will and will not be provided.

11.10.1.2 Response

The Proponent acknowledges the stated position on the supply of renewable power to fossil fuel projects and the concerns raised with respect to the GHG emissions generated by the fossil fuel industry.

AAPowerLink's GHG emissions profile complies with the requirements of the GHG Emissions Management for New and Expanding Large Emitters Policy (NTG, 2021). Furthermore, the scope and boundary of the Project's GHG emissions estimate conforms with the requirements of the Draft EIS TOR, issued by the NT EPA. The Proponent is developing a full lifecycle assessment for the Project. However, this is not a legislative requirement of the NT or CWTH and is therefore outside the scope of the SEIS.

While offtake discussions are understandably commercial in confidence, the Project is aligned with the NTG's objective of achieving net zero emissions by 2050 and has set the following long-term targets for AAPowerLink:

- Maximise the carbon abatement opportunity from AAPowerLink
- Be a net zero infrastructure project
- Be a carbon positive exporter of electricity.

11.10.1.3 Mitigation Hierarchy and Offsetting

The mitigation hierarchy – avoid, mitigate, offset. ECNT is concerned that the EIS does not apply the mitigation hierarchy appropriately, particularly with respect to the offsetting of residual impacts. This is the case for biodiversity impacts and GHG emissions.

With respect to GHG emissions, ECNT notes that the Project footprint is vast, at approximately 13800 ha. Sun Cable's GHG Management Plan states that 3 million tonnes of GHG emissions will be generated in the first four years of the project, and half a million tonnes over the life of the project."

However, Chapter 12 of the EIS states that "Offsets pertaining to atmospheric processes are not required as there are no overall residual negative impacts relating to GHG emissions from the AAPowerLink project when emissions over the Project's life cycle are contemplated."

ECNT believes that the emitting activities of the Project, such as land-clearing, should be independently and directly offset, and that it is inadequate for the proponent to rely on "avoided emissions". ECNT rejects 'avoided emissions' as a category of offset. To achieve the goal of being a "net zero infrastructure project" the proponent must develop and implement a GHG offset strategy that proposes genuine offsetting of emissions from e.g., land clearing.

11.10.1.4 Response

The Proponent acknowledges the issues raised with respect to environmental offsets of residual adverse impacts. Consistent with Section 26 of the NT *EP Act*, the Proponent has adopted the environmental decision-making hierarchy described in Section 12.5 of the Draft EIS. The Proponent is actively pursuing the identification of opportunities to avoid GHG emissions and where avoidance is impracticable, mitigate GHG emissions throughout the construction, operation and decommissioning of the Project. Avoidance, mitigation, monitoring, and reporting commitments for atmospheric processes are summarised in Table 12-5 of the Draft EIS.

The residual impact assessment outlined in Section 12.4.2 of the Draft EIS concludes only minor adverse residual impacts and major positive residual impacts to atmospheric processes are associated with the construction and operation of the Project.

The residual impact rating process adopted for the Project's EIA considers the scale, magnitude and duration of the impacts, the presence/absence of environmental values and/or sensitive receptors and the level of certainty with respect to the intensity of the impacts and the effectiveness of the avoidance and mitigation measures.

As described in the NT Offsets Principles (Department of Environment and Natural Resources, Flora and Fauna Division, 2020), offsetting may be required for significant residual impacts and is subject to determination from the Minister responsible for the *EP Act*. The significant residual impact of an overall reduction in GHG emissions from the generation of renewable energy is considered positive and supports the objective of the NTG achieving net zero GHG emissions by 2050.

The Proponent intends to be a carbon positive exporter of electricity and has set the long-term target for AAPowerLink to be a net zero infrastructure project. Accounting for carbon abatement in the net emissions profile associated with the avoidance of GHG emissions through the generation of solar renewable energy is consistent with both national and international standards (Section 11.5.5).

11.10.1.5 Climate Change Risk

ECNT is concerned that the Appendix E – Impact Assessment Register does not contain the phrase "climate change" even once. Given the 70-year project span, contingency planning for various climate scenarios must be integral to impact assessment and risk planning and mitigation processes of the proponent. Sites that are mentioned as being potential customers for electrification, such as Middle Arm's industrial hub, will be underwater due to climate change before the conclusion of the project's lifespan. ECNT urges the proponent to more thoroughly embed an awareness of escalating and severe climate impacts into the project plan and the Supplementary EIS.

11.10.1.6 Response

The Proponent acknowledges concerns relating to climate change adaptation and associated project activities. The Proponent has committed to locating, designing, and engineering the Project's infrastructure to withstand impacts from climate change ALARP.

The impacts of climate change have been considered as described in Section 2.9 of the Draft EIS. Material climate change impacts to the Project, outlined in Climate change in the NT: State of the science and climate change impacts (CSIRO, 2020) are discussed throughout the Draft EIS. An increase in the intensity and frequency of heavy rainfall events, sea level rise as incorporated in NTG's storm surge modelling for 2100, changes in fire frequency and weather conditions and changes in wind speed from severe storms are among the material climate change impacts referenced throughout various chapters as well as within Appendix E of the Draft EIS.

Chapter 12 of the Draft EIS considers climate change mitigation by assessing the impact of GHG emission production and abatement from the Project throughout construction, operation and decommissioning. Mitigating GHG emission is essential to avoid adverse impacts of climate change, and rapid emissions reductions are required to stay below 2 degrees of warming (IPCC, 2022, 18). The Project has been identified as a key contributor to the NTG's target of achieving net zero emissions by 2050 (Section 11.5.5).

11.10.2 Anonymous Submission

11.10.2.1 NT Net Zero Target

In addition, how will this project help to achieve the NTG net zero target if the majority of the generated power is sent to Singapore and not the NT?

11.10.2.2 Response

Refer to the response provided in Section 11.10.1.2 and Section 11.5.5 for further detail.

11.10.2.3 Supply Chain Embodied Emissions

How could the Project claim to be carbon positive by Year 4 when factoring in the mining of critical minerals in the materials needed such as cables and solar panels?

11.10.2.4 Response

Scope 3 embodied emission associated with the manufacture and supply of goods and services to construct and operate AAPowerLink is outside the scope of the EIS. This will be addressed in the international Environment SIA Report and AAPowerLink lifecycle assessment.

11.11 NT EPA Direction Responses

The NT EPA Direction Response (Appendix 1.1) did not nominate any comments or additional information requirements for the SEIS associated with Chapter 12 Atmospheric Processes of the Draft EIS.



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