Review of OB 29/30/35 Greenhouse Gas Management Plan

BHP Iron Ore Pty Ltd

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Executive summary

Under the Western Australian Environmental Act, “significant proposals” are to be assessed for their environmental impact by the Western Australian Environmental Protection Authority (EPA). This assessment is to include the greenhouse gas emissions impact of the proposal as part of the Environmental Impact Assessment.

The EPA requires that project proponents develop a Greenhouse Gas Environmental Management Plan (GHGMP) which outlines the forecast of emissions over the life of the proposal and how greenhouse gas emissions will be mitigated through the adoption of best practice technology and the use of carbon offsets.

The OB29/30/35 proposal (Combined Proposal) is subject to the EPA requirements. BHP Iron Ore Pty Ltd (BHPIO) engaged KPMG to review the GHGMP for the Combined Proposal. The scope of the review covered:

- Alignment of the emissions reduction measures set out in the GHGMP, with industry best practice (a requirement of the EPA Guidelines for preparing a GHGMP).
- The forecast for Scope 1, 2 and 3 emissions and the overall emissions intensity of the Combined Proposal.
- Integrity of the carbon offsets strategy for the Combined Proposal.

Best Practice

KPMG compared the emissions reduction initiatives outlined in the GHGMP with our understanding of best practice in large scale mining. It was acknowledged that the Combined Proposal is part of BHP’s integrated iron ore operation in the Pilbara, and that the initiatives in the Combined Proposal were subject to the wider decarbonisation strategy of BHP. The following initiatives in the GHGMP were consistent with best practice emissions reduction:

- BHPIO has identified that electrification of mining vehicles and other equipment offers the best prospects for significant decarbonisation and is working with vehicle manufactures to trial and introduce battery electric haul trucks over a staged implementation period in order to optimise the technology and minimise operational risk.
- In the short term, power for electrification will be provided by the Yarnima power station which is a combined cycle gas-fired electricity generation plant. This technology is considered best practice in terms of current fossil fuel electricity generation.
- Specific decarbonisation initiatives incorporated into the Combined Proposal include the use of high efficiency materials and pumping equipment in dewatering, location of the Overburden Storage Area to reduce haul cycle times, and connection of some dewatering equipment to the BHP Iron Ore Inland Power Grid.

Under amendments to the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule, the Combined Proposal is required to transition to zero net Scope 1 greenhouse gas emissions by 2050 by way of being part of the Newman facility.

Emissions Forecasts

KPMG assessed the calculations, assumptions and factors supporting the forecasts of Scope 1, 2 and 3 emissions in the GHGMP, for consistency with the National Greenhouse and Energy Reporting (Measurement) Determination and the Greenhouse Gas Protocol. KPMG benchmarked BHPIO’s emissions reporting for the Combined Proposal against peers and international industry standards and determined that the coverage of Scope 1, 2 and 3 emissions sources are consistent with peers and use accepted methodologies.

Offsets

KPMG assessed whether carbon offsets that satisfy the integrity principles are likely to be reasonably practicable and available as and when required by the Combined Proposal. The type of carbon offsets being considered for use by the Combined Proposal, which satisfy the integrity principles, are considered to be reasonably practicable. Further, the number of carbon offsets that may conservatively be required for the Combined Proposal is not material relative to what is projected to be available in the carbon market. Whilst there is a risk of the Safeguard compliance offsets market becoming tight between the FY2028 to FY2032 period, securing the relatively small volume of carbon offsets that may be required for the Combined Proposal does not appear to be a material risk. Whilst the emission reductions for the Combined Proposal in the FY2038 to FY2045 period is projected to further increase from the FY2028 to FY2032 levels, the ACCU market is anticipated to be well supplied post 2032 and expected to meet the assumed conservative Combined Proposal’s carbon offset requirement.

Notwithstanding the low risk, BHP is considering procurement options which reduce reliance on securing carbon offsets from the spot market in a compliance period.

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Disclaimers

This report has been prepared as outlined with BHP Iron Ore Pty Ltd in the Scope Section of the engagement contract dated 28 March 2024. The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently no opinions or conclusions intended to convey assurance have been expressed.

A reference to the term "review" contained in this report refers to the scope of review required under the Western Australian EPA guidance on environmental factors and as outlined in the "Expert review" section of the Introduction of this document. Similarly, a reference to "best practice" contained in this report refers to the context of the term as it is applied in the Western Australian EPA guidance on environmental factors and as outlined in the "Best practice measures" section of the Introduction of this document.

No warranty of completeness, accuracy or reliability is given in relation to the statements and representations made by, and the information and documentation provided by, BHP Iron Ore Pty Ltd management consulted as part of the process.

KPMG have indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the report.

KPMG is under no obligation in any circumstance to update this report, in either oral or written form, for events occurring after the report has been issued in final form.

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This report has been prepared at the request of BHP Iron Ore Pty Ltd in accordance with the terms of KPMGs engagement contract dated 28 March 2024. Other than our responsibility to BHP Iron Ore Pty Ltd, neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on this report. Any reliance placed is that party's sole responsibility.

Introduction

Project description

BHP Iron Ore (BHPIO) operates the Newman iron ore mining area which is located approximately 6 km west of the town of Newman in the Pilbara region of Western Australia. Under an existing Approved Proposal, BHPIO has approval to develop orebodies 29, 30 and 35 (OB29/30/35) within the Newman mining area. The current amended proposal (Combined Proposal) incorporates expansion of some operations that are part of the Approved Proposal.

BHPIO proposes to expand the operations at OB29/30/35 as follows:

- An increase in the rate of dewatering, which decreases the period over which ore is being mined below the water table; and
- Establishment of a new overburden storage area (OSA) close to the existing OB29 mining activity.

The Combined Proposal will use existing facilities at the Whaleback mine including processing facilities, machinery fleet, support services and facilities, and overburden storage areas for waste rock.

The Combined Proposal incorporates the previous Approved Proposal as well as the new and expanded activities listed above. Both proposals are forecast to produce the same quantity of iron ore over the project life.

Western Australian EPA guidance on environmental factors

Under Part IV of the Western Australian Environmental Act 1986 (the EP Act), “significant proposals” are assessed for their environmental impact by the Western Australian Environmental Protection Authority (EPA) as part of the project approval process. A “significant proposal” is one that is defined as having a “significant impact on the environment” and includes expansions of existing operations.

The Western Australian Government has acknowledged the impact of greenhouse gas emissions on the environment. Under Section 15 of the EP Act which requires the EPA to act to “protect the environment” and to “prevent, control and abate pollution and environmental harm”, an assessment of the greenhouse gas impacts of a new proposal is required as part of the overall Environmental Impact Assessment (‘EIA’). The EPA has published Guidelines outlining how this is to be carried out (WA Environmental Protection Authority 2023).

The Guidelines apply to a proposal where the Scope 1 or Scope 2 emissions are reasonably likely to exceed 100,000 tCO_2-e on an annual basis.

The Guidelines require proposal proponents to develop and submit:

(i) An estimate (forecast) of annual Scope 1, 2 and 3 emissions over the lifecycle of the project, disaggregated by emissions source (e.g. rail operations, mining); and the emissions intensity per production unit; and

(ii) A Greenhouse Gas Environmental Management Plan (GHGMP) outlining how they will mitigate the GHG impact of the proposal through the implementation of best practice technology.

Estimate of emissions

For the estimate of emissions over the lifecycle of the project, the EPA requires:

- Credible estimates of annual and total Scope 1, 2 and 3 emissions over the expected life of the proposal (including the maximum emissions).
- This should include estimates based on throughput at maximum nameplate/nominal capacity, annual average operational design capacity (including applicable rates and assumptions), actual expected operational throughput (if significantly different from the nameplate or design capacity), and history of actual emissions (for proposals already in the operations phase).
- Scope 1 emissions estimates must include all emissions caused as a direct result of the proposal, including emissions associated with the clearing of vegetation and loss of sequestration potential.
- A breakdown of GHG emissions by source over the life of a proposal inclusive of, but not limited to, stationary energy, fugitives, transport, and emissions associated with changes to land use.
- Projected emissions intensity (emissions per unit of production) for the proposal and international benchmarking against other comparable projects, best practice, industry standards and/or milestones and sector pathways, benchmarks and/or milestones.

Greenhouse Gas Environmental Management Plan (GHGMP)

As well as providing a summary of emissions estimates, the GHGMP should outline:

- A clear pathway for reducing Scope 1 and/or Scope 2 emissions over the life of the proposal. This should usually be consistent with, or exceed, the EPA's minimum expectations for emissions reductions.
- Transparent emission estimates and clear targets for commitments for short term reductions, and targets for medium to long term reductions (noting a minimum expectation of 5-year targets).
- Strategies that demonstrate how best practice measures have been adopted to avoid or reduce a proposal's Scope 1 emissions at commencement, and throughout the life of the proposal.
- Strategies that demonstrate reasonably practicable measures and alternatives have been considered to avoid or reduce Scope 2 emissions at commencement, and throughout the life of the proposal.
- Show that consideration has been given to reducing Scope 3 emissions (where reasonably practicable) throughout the life of the proposal through regular reviews.
- Justification for the emissions baseline used and the alternative approaches that were considered for calculating baselines (including an explanation why these were not adopted).
- A demonstrated commitment to continuous improvement to ensure emissions reductions over the life of the project. This should include a consideration of measures to improve performance or setting targets for emissions intensity improvement over time.
- Implementation of a GHG emissions offset package to offset residual emissions for unavoidable Scope 1 and 2 emission sources, to achieve proposed commitments and targets. In some cases, it may also be reasonably practicable to offset all residual Scope 1 and 2 emissions.
- Whether there are other legal and policy instruments that can regulate GHG emissions from the proposal to meet the EPA's objectives.
- Demonstrate how the Scope 1, 2 and 3 emissions from project operation beyond 2050 is consistent with a global low-carbon transition to net zero by 2050 scenario.

The GHGMP should usually be accompanied by:

- An expert review that has been undertaken to demonstrate how best practice measures have been adopted. The EPA usually requires independent expert review of best practice measures.
- An expert review undertaken of whether offsets that satisfy integrity principles are likely to be reasonably practicable and available at the time of proposed future surrender.
- Any reviews that demonstrate that the proposal is consistent with, or outperforming, relevant sector pathways and, benchmarks and/or milestones.
- A summary of whether Scope 2 emissions are subject to emissions reduction regulation.
- A summary of where Scope 3 emissions will be emitted (domestic or international) and whether they are or are reasonably likely to be subject to similar emissions reduction regulation as Scope 1 or 2 emissions.

The EPA's expectations for "best practice measures" include:

- Avoiding or minimising emissions through best practice design.
- Avoiding or minimising emissions through demonstration of best practice operations.
- Adoption of renewable and low-carbon emissions.
- Identification of best practice for the sector that is appropriate to the scale of the relevant proposals at the time best practice is being considered.
- Evidence that the proposed best practices are capable of achieving stated emissions reductions.
- Identification of local conditions and current circumstances of the relevant proposal that might influence the choice of technologies or procedures to mitigate GHG emissions.
- Comparison of GHG emissions and energy intensity performance metrics with comparable facilities both domestically and internationally.

Approach

Review of best practice measures

KPMG compared the emissions reduction initiatives outlined in the Greenhouse Gas Environmental Management Plan (GHGMP) for BHPIO's Orebody 29/30/35 proposal (Combined Proposal), with our understanding of best practice measures, and of the feasibility and implementation timeline of decarbonisation initiatives.

We have developed an understanding of best practice measures for emissions reduction in mining and electricity generation, from our own engagement with the sectors on decarbonisation over more than 10 years, and from reviewing authoritative reports on the status of decarbonisation in the iron and steel supply chain. A description of the references used for this report is provided in Appendix 1.

We also considered the wider decarbonisation strategy of BHP Group noting that the Combined Proposal is part of an integrated iron ore and energy supply operation, and that BHP has publicly stated its own decarbonisation targets and objectives.

Where required, discussions were held with BHPIO mine decarbonisation planning and dewatering engineering specialists to clarify our understanding of BHPIO's GHGMP and the plans to implement best practice design and operation.

Emissions forecast

With respect to the greenhouse gas emissions forecast for the Combined Proposal, KPMG:

- Assessed the emissions sources (Scope 1, 2 and 3) coverage based on KPMG's experience of developing end-to-end carbon lifecycle assessments for different mining operations,
- Checked the calculations, assumptions and factors used for deriving Scope 1, 2 and 3 emissions, and the emissions intensity factor, and
- Assessed the approach taken by BHPIO to develop the emissions baseline for the Combined Proposal including key assumptions and use of methodologies (e.g. the NGER (Measurement) Determination and the Greenhouse Gas Protocol for Scope 3 emissions).

Offsets proposal

KPMG assessed what carbon offsets (carbon credit standards and schemes) would best satisfy integrity principles including:

- The carbon credit standards and schemes which BHP is more likely to rely on for compliance and voluntary purposes;
- Consideration of BHP's position with respect to perceived offsets integrity; and
- The methodologies within such carbon credit schemes that either have or are perceived to have higher levels of integrity.

The future supply availability of credits was also assessed by considering BHP's demand window for the Combined Proposal and the likely market demand for credits of suitable integrity.

Other

Consideration was given to:

- BHP's position on the development and implementation of emissions reduction initiatives relative to its peer organisation of large-scale iron ore mining companies;
- Recent amendments to the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Safeguard Rule); and
- The impact of the Renewable Energy Target.

Best practice measures

KPMG reviewed BHPIO's GHGMP and supporting information for the Combined Proposal, against each of the criteria for Best Practice measures set out in the EPA Guidelines. Sections 1, 2 and 3 outline BHPIO's initiatives in the Combined Proposal for emissions minimisation in design and operation, and adoption of renewable energy. Section 4 compares these initiatives with KPMG's understanding of best practice for comparable operations.

The feasibility of the initiatives is discussed in section 5, and the impact of local factors in section 6. Benchmarking of the emissions intensity of the Combined Proposal is discussed in section 7.

1. Avoiding or minimising emissions through best practice design
BHP has adopted a "Sustainability in Design" standard that requires new projects to identify and evaluate opportunities for incorporation of energy conservation, fuel reduction and renewable energy in design. An opportunity that is successfully evaluated at one asset has the potential to be applied to other iron ore projects. BHP's operational decarbonisation strategy requires assets such as BHPIO to annually identify and evaluate opportunities to further reduce greenhouse gas emissions, to quantify the emissions reductions achieved and to monitor and review the effectiveness of initiatives that have been implemented. Opportunities for minimising emissions in design are limited by the need for OB29/30/35 to operate within the existing Newman mining and processing infrastructure. The following are examples of where Sustainability in Design is being applied to the Combined Proposal: <u>Improved dewatering efficiency</u> Energy consumption for dewatering is expected to become increasingly significant for BHPIO as further mining plans will require exploitation of deposits below the water table. Innovations that are underway to reduce the energy requirements of dewatering include: (i) Trialling of higher efficiency pumps including pumps with Variable Speed Drives (currently in operation) and permanent magnet motors (under evaluation); (ii) Maximisation of pipe diameter and use of High Density Polyethylene for pipe construction. This reduces total dynamic head (friction losses); (iii) Where feasible, connecting transfer pumps to the BHP Iron Ore Inland Power Grid as an alternative to diesel power. This creates a further opportunity for decarbonisation as the grid transitions to high efficiency and low emissions gas power generation, and ultimately to renewable generation; (iv) Optimisation of bore locations and piping layout to minimise pumping distances and to avoid high elevation points; (v) Development of safe electrical systems that can be used to replace diesel powered pumps (including submersible pumps) that are currently required for safe operation below the level of the water table; (vi) Changing the design of the dewatering systems to enable pumps to feed a buffer storage tank from which aquifers are replenished by gravity feed. This design enables the pumps to operate at a higher efficiency; (vii) Where pumps have to be operated off the grid, construction of diesel and solar (with battery storage) hybrid power stations at dewatering bores. Specific dewatering design innovations that have been incorporated into the design of OB29/30/35 include; • Use of Variable Speed Generators (VSGs) for pumps that have to operate off the grid. VSGs enable pumps to work across a wider operating range enabling pumping of different water levels and without the need to "throttle" output at high rates. VSGs are also more fuel efficient then Variable Speed Drives; • Trialling of high efficiency pumps to replace the current pump technology that has been widely used across BHPIO. BHP expect to achieve improvements in energy efficiency of between 5% and 8%; • Connection of OB30 bores to main power. This will enable replacement of diesel powered pumps with electric powered pumps incorporating Variable Speed Drives to further improve efficiency. <u>Overburden storage location</u>

By establishing the Overburden Storage Area (OSA) for the Combined Proposal close to OB29, the cycle time for movement of waste loads is reduced from 31 minutes to 21 minutes. The corresponding reduction in diesel emissions offsets the increased emissions from dewatering and from land clearing for the Combined Proposal.

2. Avoiding or minimising emissions through demonstration of best practice operations

BHP has identified that the largest opportunity to reduce direct emissions is through electrification of mining haul vehicles and rail locomotives, and the uptake of renewable energy for electricity. Combustion of diesel fuel for haul vehicles is the largest source of emissions for BHPIO's operations. BHP has entered into partnerships with two original equipment manufacturers (OEMs) to develop electric haul trucks and other machinery. This initiative will apply across the development envelope and will have a significant decarbonising impact, especially when renewable electricity supply becomes more available.

Initial trials of electrified haul trucks have been carried out in the US, and preparation is being made for "early learning" trials at BHPIO and BMA (coal joint venture in Queensland). The focus of these trials will be to assess charging rates, maintenance, battery safety, integration with existing operations and the impact on production efficiency compared with the current diesel fleet. Trials of the CAT 793 battery electric haul truck are to commence in 2024 and the KOM 930 is to be trialled from 2026. Subject to the outcome of the trials, all trucks are planned to be electric by the mid-2030s.

An electrically powered excavator is being trialled at the Yandi mine. Trials of prototype battery electric locomotives from two vendors are planned to commence in 2025. Energy management systems are being trialled in preparation for trials of electric locomotives.

Electrification will require development of additional infrastructure such as charging stations and will increase the demand for electricity in the BHP Iron Ore Inland Power Grid. Charging infrastructure is being constructed at Orebody 25 to support early trials of battery electric locomotives. BHP is participating in the following industry-wide initiatives to support the introduction of charging infrastructure:

- BHP is part of the "Charge on Challenge" to develop charging technology solutions for electric haul trucks;
- BHP is a founding member of the CHARIN initiative which is promoting interoperability of charging systems across the mining industry, and is a member of the "Charging Interface Initiative Mining Taskforce" which is developing a standard for connections between mining equipment and charging infrastructure;
- Through the "Charge on Innovation Challenge", BHP is supporting the development of side-mounted charging systems which have the potential to enable "trolley assist" technology;
- BHPIO is undertaking extensive modelling of alternative supply and demand scenarios to identify the most practical and economically sustainable electrification technologies;
- A trial of battery electric Toyota Hilux vehicles, which follows on from a trial of a battery electric Toyota Land Cruiser at BHP's Nickel West assets. The Hilux trial will be the first time that a purpose-designed electric vehicle (as opposed to a converted diesel engine vehicle) will undergo trials.

All BHP assets are required to have a decarbonisation plan that supports BHP's interim and long term decarbonisation targets. Examples of emissions reduction opportunities identified by BHPIO include:

- Fuel efficiency gains through improvement to fuel cleanliness by filtration and the use of additivities.
- Trialling hydrogenated vegetable oil (HVO) for use in hard to abate equipment such as dozers and graders.

3. Adoption of renewable and low emissions technology

BHPIO operates the Yarnima power station at Newman. Whilst the power station is separate to the Combined Proposal, Scope 1 emissions from power generated for the OB29/30/35 operation contribute to the emissions forecast of the Combined Proposal. In addition, Yarnima is critical to the electrification of mining equipment at BHPIO operations in the Pilbara by providing a stable and low emissions intensity interim power source.

Yarnima is a Combined Cycle Gas Turbine power plant (CCGT) providing electricity to the BHP Iron Ore Inland Power Grid, which includes the Newman operations. CCGT utilises waste heat from the first stage of gas combustion, to generate steam which is used to drive a second turbine to generate additional electricity. Combined cycle plants are recognised as best practice design in gas-fired electricity generation and produce less emissions than alternative gas-fired power generation designs (and significantly less than coal-fired power stations or diesel-powered generation).

BHPIO is planning to add 500MW of renewable power and storage to the BHP Iron Ore Inland Power Grid by 2030. This will comprise approximately 200 MW of wind power, 200 MW of solar PV and 150 MW of battery storage. Discussions with potential vendors of renewables technology are at an advanced stage.

In order to provide a stable source of power that is responsive to demand fluctuations and that will support safe and stable operation during the transition to electrification, BHPIO intends to install up to 120 MW of gas reciprocating engines (GRE) generation to provide additional capacity at Yarnima. GREs are close to CCGTs in terms of efficiency but can respond much more quickly to demand variability.

Assessment of sites to identify opportunities for additional renewables generation is ongoing. This includes locations on or close to existing BHPIO operations as well as connections to more remote generating facilities where transmission infrastructure needs to be developed.

BHP is a participant in the Pilbara Industry Roundtable, which is evaluating options for the interconnectivity of independent grids serving the Pilbara. A grid with a larger capacity, larger energy storage and multiple renewable energy supplies that are geographically dispersed, will be more stable and require less thermal power to back up renewable energy supplies. The Clean Energy Finance Corporation (CEFC) has recently announced $3 billion in funding to support interconnectivity and renewable energy in the Pilbara (DCCEW 2023e). As part of the CEFC initiative, the Western Australian Government is conducting an Expression of Interest in the construction of transmission corridors in the Pilbara.

4. Identification of best practice for the sector that is appropriate to the scale of the relevant proposals at the time best practice is being considered

KPMG has identified the following best practice measures as being applicable to the Combined Proposal under the WA EPA Guidelines:

- Electrification of mining equipment including battery electric vehicles, excavators and rail locomotives
- Generation and use of renewable power in mining operations
- Fuel switching (to hydrogen or biofuels)
- In pit crushing and conveying.

These measures are also being considered by BHP's peer organisations in the Pilbara and overseas.

<u>Electrification of mining equipment including battery electric vehicles</u>

BHP has identified that electrification of mining equipment, especially haul trucks, presents the greatest opportunity for significant decarbonisation of its operations. Currently, emissions from combustion of diesel account for approximately 75% of the total Scope 1 emissions from BHP's Pilbara assets (55% from trucks and other heavy equipment; 20% from rail).

Internal and external studies completed by BHP have identified that conversion to battery electric vehicles (BEVs) is the best pathway to decarbonise the vehicle fleet. BHP is working closely with vehicle manufacturers to introduce commercially viable battery powered haul trucks.

The challenges that need to be addressed in the Proof-of-Concept stage include:

- Delivery of power (overall capacity and demand profile)
- Changes to operational and workforce practices
- Interoperability with existing equipment
- Development of charging infrastructure (including interoperability of charging systems)
- Additional development lead time for autonomous vehicles
- Safety of high voltage supply
- Battery management and safety
- Regulatory changes
- Availability of suitably trained personnel to operate and maintain the technology.

The current trajectory is for operational trials of battery electric haul trucks to commence in 2024. Depending on the success of the trials, BHP anticipates that the first vehicles will be operational on selected BHPIO mining sites in 2027. The fleet will be progressively electrified by the mid-2030s. Electric excavators are being trialled at Yandi with the target of being operational from 2027.

BHPIO has undertaken detailed modelling and continues to evaluate electricity demand and infrastructure requirements in order to plan for the investment necessary to support the progressive electrification of mining operations in the Pilbara.

An additional program is underway to replace diesel electric locomotives with battery electric technology. This will reduce Scope 1 emissions within the Regional GHGMP Boundary including for the Combined Proposal.

The equipment electrification program is run at the BHPIO level and not at the asset or site level. This is normal practice for major technology development programs and ensures that the technology that is developed is applicable across all the operations. The Combined Proposal will benefit from technology that is proven at other BHP mining operations in the Pilbara.

Generation and use of renewable power in mining operations

Electrification of mining operations will require significant investment in the BHP Iron Ore Inland Power Grid to meet the additional capacity required and to decarbonise power generation. BHP’s approach is to trial the emerging technologies and subject to the success of trials, to progressively introduce electrification of mining equipment. A staged approach will be taken to understand and optimise the demand profile, and to introduce the necessary supporting infrastructure and work practices.

If BHP were to not adopt this staged approach (e.g. by bringing forward introduction of additional renewable capacity generation capacity), the grid may not be able to support the electrification plan and may fail to achieve synergies with other renewable power initiatives. In the interim, electrification will be supported by best practice combined cycle gas generation at the Yarnima power station.

This approach will also help to realise synergies that can be obtained should interconnection between the BHP Iron Ore Inland Power Grid with other grids in the Pilbara and Port Hedland occur in future. However, in order to meet its stated commitment to decarbonisation, it is necessary for BHPIO to commence to decarbonise the BHP Iron Ore Inland Power Grid ahead of the timeline for interconnectivity with other grids.

Electrification of other equipment such as excavators, is also being investigated. For these applications, consideration needs to be given to how high voltage cables can be laid to this type of equipment without introducing a safety risk to the operations.

Fuel switching (to hydrogen or biofuels)

BHP has considered a range of electrification and alternative fuel solutions.

Hydrogen-powered vehicles are being considered by other mining companies. BHP’s assessment is that hydrogen fuel whilst being potentially high impact, has a lower probability of success compared with vehicle electrification due to the quantity of electricity that would be required to produce green hydrogen, and the complex generation and distribution infrastructure that would be required. There are also safety risks that would need to be considered for storage of hydrogen on operating sites and in vehicles.

Hydrogen fuel cells have also been considered. However, BHP considers that well-to-wheel efficiency for fuel cell electric vehicles is much lower than for battery electric vehicles (36% compared to 80%). Hydrogen is expected to be a more viable energy carrier for hard-to-abate sectors including steelmaking and shipping.

BHP has trialled hydrotreated vegetable oil (HVO) as a potential “drop in” substitute for diesel as a low emissions fuel or as a blended fuel with diesel. Proof of Concept trials have shown that blends of up to 50% HVO are feasible in a wide range of equipment including diesel locomotives.

HVO is not seen as a long-term solution but may be suitable for equipment that is difficult or uneconomic to electrify (e.g. power generation in remote locations), and as a transitional solution between diesel and BEVs. Biofuels may be subject to supply limitations and can have an unfavourable carbon and overall environmental profile when the entire production lifecycle is considered.

BHP has prioritised development of BEVs but maintains a watching brief over other technologies.

In pit crushing and conveying

In pit crushing and conveying (IPCC) involves construction of crushing equipment at the bottom of the open cut pit and transporting the crushed ore to the loading point by a conveyor. It can reduce the requirement for large haul trucks by replacing diesel consumption with electrification of the conveyor and crusher and is suitable for mining of wide and homogeneous deposits such as coal.

OB29/30/35 exists within a well-established ore processing and transport infrastructure, so there is little opportunity to re-design the infrastructure. The Combined Proposal to increase the rate of mining includes location of the Overburden Storage Area in closer proximity to the mining operation. The reduction in transport-related emissions that results from the shorter haul distances and cycle times largely offsets the increase in emissions from higher dewatering rates.

By making use of existing processing infrastructure, the amount of vegetation that would otherwise have to be cleared, is reduced.

5. Evidence that proposed best practices are capable of achieving stated emissions reductions

BHP has an objective to reduce emissions by 30% (below 2020 levels) by 2030 and to achieve net zero emissions by 2050 (BHP 2024d). BHPIO supports these goals by focusing on emissions reduction in power generation and purchased electricity, and by undertaking projects to replace combustion of diesel in rail locomotives and mining equipment.

These strategies are consistent with best practice in relation to current and emerging decarbonisation technologies for large scale iron ore mining operations.

When considering whether the proposed best practices are capable of achieving the stated emissions reductions, it is necessary to consider the overarching decarbonisation strategies across BHP's integrated iron ore supply chain.

The Clean Energy Finance Corporation and the Minerals Research Institute of Western Australia (CEFC 2022) have carried out a detailed review of the decarbonisation options available to the mining industry in Australia. Each technology was given a "decarbonisation score" of between 0 and 10 based on decarbonisation impact, technological and commercial readiness and social and environmental factors (CEFC 2022).

Solar PV and wind power assisted by lithium-ion battery technology achieves a high decarbonation score based on technology maturity, ease of implementation and commercial uptake rate. Based on this assessment, decarbonisation of the BHP Iron Ore Inland Power Grid would be considered as low to medium risk.

BEVs were assessed as being in the technology "demonstration" phase but with the potential for significant decarbonisation impact. Additional benefits of BEV technology include:

- Elimination of fumes and reduced workplace noise;
- Support for the grid by being able to discharge to – as well as charge from – the grid;
- Economies of scale and reduced maintenance costs; and
- Ability to use regenerative braking to charge batteries.

The main direct challenges with BEVs are the limited range before the batteries need to be recharged, and the time taken for charging. In addition, large scale deployment of BEVs is likely to require significant investment in renewables generation and distribution capacity as well as in charging infrastructure. This is an important consideration for BHPIO because the BHP Iron Ore Inland Power Grid is currently operating at capacity and demand is anticipated to more than triple by the end of the decade.

CEFC noted that BHP and other mining companies have entered into partnerships with OEMs to develop BEVs for open cut iron ore mining, and that Roy Hill Mining had announced the purchase of the first battery powered locomotive for iron ore haulage. BEVs have had a higher rate of uptake in underground mining where elimination of diesel fumes is important and range limitations are not as much of a disadvantage.

BHP has adopted the following approach to minimising the risks to its decarbonisation program:

- Development is coordinated at the enterprise (i.e. BHPIO) level to maximise efficiency and ensure that solutions can be adopted across the assets. This is "best practice" for major technology programs that are capital intensive and have application across a wide asset base;
- By entering into partnerships with major OEMs and other stakeholders, BHP will benefit from the latest technological knowledge and advancements, and from the global experience of OEMs in developing and implementing BEVs and the supporting infrastructure for charging;
- By adopting a staged approach commencing with initial trials, introduction of the first BEV in 2027, and full conversion of the fleet by the mid-2030s; BHP will be able to develop the skills and infrastructure to support the new technology, and continuously improve the technology in partnership with the OEMs;
- As the BEVs are introduced and their operation is optimised, the future requirements of the electricity infrastructure will become better defined, which will assist in planning for decarbonisation and interconnectivity of the grid. BHP continues to be involved in discussions with other stakeholders in relation to the future of electricity supply in the Pilbara;
- BHP uses an Adaptive Management framework to continually improve its operations, including by identifying opportunities for development and implementation of emissions reduction technologies. The framework operates on a cycle of monitoring, reporting and implementing emissions reduction initiatives and is responsive to changes in operational, environmental and regulatory conditions. Under this framework, the regional GHGMP which includes OB29/30/35, is reviewed and updated every three years;

- BHPIO is accredited under AS/NZS ISO:14001 (Environmental Management Systems). Under this standard, organisations are required to maintain a continuous improvement to identify, address, monitor and review environmental risk mitigation including climate risk;
- Under its publicly documented "Environment and Climate Change: Our Requirements" document (BHP 2020), BHP sets out the expectation for its assets to reduce greenhouse gas emissions on an annual basis, and to monitor, review and quantify the impact of opportunities that have been implemented;
- BHPIO maintains close contact with wider initiatives promoted by Government to achieve a decarbonised and interconnected Pilbara grid. This includes the 2023 announcement by the Clean Energy Finance Corporation to make available $3 billion in funds to support this initiative.

6. Identification of local conditions and current circumstances of the relevant proposal that might influence the choice of technologies or procedures to mitigate GHG emissions

The local conditions and current circumstances and how they affect the emissions reduction approach in the Combined Proposal, have been covered in the preceding discussion. In summary, these are:

- The isolation of the BHP Iron Ore Inland Power Grid from the Northwest Interconnected System (NWIS), and the current lack of an existing electricity grid in the Eastern Pilbara that could support electric vehicles;
- The lack of "green" hydrogen (i.e. produced from renewable sources) and other alternative fuels on a commercial scale including a distribution and supply infrastructure, as well as safety considerations from storage and handling of hydrogen and other compressed flammable gases;
- Changes in the production profile (e.g. as a result of market fluctuations) affecting demand for power;
- Supply chain limitations on the availability of battery technology, and competition for human resources and expertise to operate and maintain the emerging technologies in a remote location;
- The need to take a staged approach to introduction of new technology, in order to maintain operational effectiveness and safe working conditions, and to overcome technological and supply chain challenges.

7. Comparison of GHG emissions and energy intensity performance metrics with comparable facilities both domestically and internationally

The emissions intensity of iron ore mining depends on the geology of the resource, whether it is above or below the water table, the topography and distance from infrastructure. As existing iron ore deposits are exhausted, BHPIO and other mine operators in the Pilbara must increasingly access deposits at deeper levels often below the water table which necessitates the need for dewatering.

In Table 12 of the GHGMP, BHPIO has benchmarked the emission intensity forecasted for the Combined Proposal, with other Pilbara iron ore mining operations based on publicly available data. This information is shown below along with the Industry Average baseline for iron ore mining (Schedule 2 of the Safeguard Rule).

Table 1: Combined Proposal emission intensity comparison with BHP's peers (from Table 12 of the GHGMP for the Proposal)

Proposal / Data Source	Emissions intensity (tCO_2 (Scope 1) per tonne of ore)
Orebody 29/30/35 Combined Proposal (Mining only)	0.0071
Jimblebar Hub (Mining only)	0.00463
Rio Tinto Greater Paraburdoo	0.0053
West Pilbara Iron Ore Project	0.0054
McPhee Creek Iron Ore Project	0.0057
BHP Strategic Proposal (Mining only)	0.0063
Roy Hill Revised Proposal	0.0076

FMG Iron Bridge North Star Magnetite Extension	0.0106
Safeguard Mechanism default baseline	0.00476

KPMG sought additional information on the emissions intensity of iron ore mining, to further benchmark the intensity forecast in the Combined Proposal. This information is shown in Table 2.

Refer to Appendix 1 for the data source descriptions.

Table 2: Additional benchmarking data

Information source	Emissions intensity (tCO_{2}-e per tonne of ore)	Comment
CSIRO 2015	0.0098 (Port operations of 0.8 kg CO_{2}-e/t ore have been deducted from the source emissions intensity of 11.9 kg CO_{2}-e/t ore)	This Life cycle assessment of iron ore mining considered material and energy use during extraction and processing of iron ore. CSIRO's analysis of iron ore mining and processing estimated total lifecycle GHG emissions of 11.9 kg CO_{2}-e per tonne of ore. For this report, emissions associated with port operations have been excluded. The study itemised emissions from unit processes including drilling, blasting, loading and hauling, crushing and screening, stacking and reclaiming, rail transport and port operations. Deducting emissions intensity of rail and port operations, equal to 2.1 kg CO_{2}-e/t ore, yields an emissions intensity benchmark of 0.0098 t CO_{2}-e per tonne of iron ore.
IEA 2022	0.03 (0.018 based on iron ore being 60% by weight iron)	The International Energy Agency provides global data and analysis of energy markets, trends and technologies. In "The Role of Critical Minerals in Clean Energy Transition", the IEA analysed the emissions intensities for commodities including iron ore. Iron ore emissions intensity was assessed to be 0.03 t CO_{2}-e per tonne of metal content which includes Scope 1 and 2 emissions. The IEA report does not include sufficient information on the source of emissions. The higher emissions intensity may be as a result of emissions from rail and port operations, being included. The IEA figure also covers global operations that may be more emissions intensive that operations in the Pilbara (e.g. mining in developing countries, and smaller scale mining).
World Steel Association 2022	0.037	The World Steel Organisation (WSA) represents 85% of global steel production. The WSA provide benchmarking analysis for the industry, including environmental analysis. The CO2 Data Collection collates energy data from participating mines to develop an overall emissions intensity of 0.037 t CO_{2}-e per dry tonne of ore. The figure is for Scope 1 emissions, although the individual emissions sources are not specified.
ICMM 2013	0.008 - 0.021 (Scope 1) 0 – 0.0017 (Scope 2)	The ICMM is the international body for the mining industry. The data is from an assessment of carbon pricing policies from ICMM member companies. The range represents data provided for the Carbon Disclosure Project by ICMM member companies. The emissions intensity ranges are per tonne of iron ore produced. The sources of emissions are not specified.
Ferreira and Praca Leite. 2015	0.01332	The figure of 13.32 kg CO_{2}-e per tonne of iron ore concentrate produced is from a Life Cycle Assessment published in the Journal of Cleaner Production. The data point was calculated from production reports from the operator of an open pit mine in the Iron Quadrangle in Brazil and includes a breakdown of emissions by source within the mine

		operations. The emissions data profile is consistent with the Combined Proposal although some minor sources may not be relevant.

Emissions intensity of iron ore mining depends on multiple factors such as the grade of the ore, strip ratio, proximity to processing infrastructure, and the depth of the ore relative to the water table. OB29/30/35 makes use of existing infrastructure but requires mining below the water table and hence additional energy is required to operate dewatering infrastructure such as pumps and generators.

The emissions intensity that has been estimated for the Combined Proposal is at the upper end of figures for comparable Pilbara operations referenced by BHPIO (table 12 of the GHGMP) but is within the range of the benchmark data sourced independently by KPMG including the CSIRO assessment.

Legislative impacts

The Safeguard Mechanism

Under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (the Safeguard Rule), facilities with annual Scope 1 emissions greater than 100,000 tonnes CO_2 must adopt a site-specific emissions intensity factor based on the middle three years (as emissions intensity) of the last five years of production (FY2018 to FY2022). This factor transitions to the Industry Average factor in the Safeguard Rule, by 2030. An annual decline rate of 4.9% is applied to this “hybrid” factor up to 2030, beyond which the decline rate is set to achieve net zero emissions by 2050.

From 1 July 2023, a facility must “make good” on emissions above its baseline by surrendering Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs). Facilities that operate below their baseline can generate credits that can be banked or traded with other liable facilities.

The Combined Proposal will form part of the existing Newman facility under the Safeguard Rule. This will drive the Combined Proposal to support the emissions reduction trajectory.

BHP has stated that its emissions reduction trajectory will be determined by the Safeguard Mechanism. The emissions reduction initiatives outlined in the Combined Proposal are consistent with this objective.

The Yarnima power station is a covered facility under the Renewable Energy Target (RET) and as such will be subject to Commonwealth initiatives to decarbonise electricity generation.

Emissions forecast

This section presents the findings of the review of whether BHPIO has met the requirements to “Provide estimated proposal Scope 1, 2 and 3 emissions, as tonnes of CO_2-e for all project phases” and “Provide trajectory of estimated proposal Scope 1, 2 and 3 emissions, as tonnes of CO_2-e for all project phases” for the Combined Proposal.

The assessment has been split into the following elements:

1 Assessment of the emissions source’s coverage,

2 Checking of calculations, assumptions and factors used for deriving Scope 1, 2 and 3 emissions and the emissions intensity factor, and

3 Assessment of the approach taken by BHP to develop the emissions baseline.

The findings for each of the above elements are presented below.

1. Assessment of the emissions sources (Scope 1, 2 and 3) coverage based on KPMG’s experience of developing end-to-end carbon lifecycle assessments for different mining operations

BHPIO has estimated the average annual Scope 1 emissions of the Combined Proposal for the construction of the Orebody 29/30/35 mine, located in the Shire of East Pilbara, to be 71,538 t CO_2-e and approximately 1,849,597 t CO_2-e over the life of the Combined Proposal. For the Orebody 29/39/35 mine, Scope 2 emissions are not relevant to the Combined Proposal. All emissions linked to the Yarnima Power Station and rail operations are factored into Scope 1 emissions.

The average annual Scope 3 emissions for the Combined Proposal (inclusive of the previously approved activities) are estimated at 9,787,488 t CO_2-e and 242,387,401 t CO_2-e for the life of the Combined Proposal. See the table below for the emissions estimates for the Combined Proposal:

Emissions (t CO_2-e)	Annual average	Life of Orebody 29/30/35 Combined Proposal
Scope 1	71,538	1,849,597
Scope 2	-	-
Scope 3	9,787,488	242,387,401

Reference: *BHP Pilbara Regional GHGMP-V1-(OB29-30-35); Section “Schedule 4: Orebody 29/30/35.”*

<u>Scope 1:</u>

Sources of Scope 1 emissions include diesel consumption in heavy haulage, ancillary equipment and equipment for dewatering; and land clearing.

Forecast diesel consumption is based on the estimated equipment hours and work to support iron ore and waste movement, and the Original Equipment Manufacturer (OEM) fuel consumption rate estimates. The factors are regularly compared to business records through a BHPIO managed review process by relevant subject matter experts (SMEs).

Diesel consumption for dewatering has been derived from estimates used in BHPIO’s Business Plans and the project specific assumptions from relevant SMEs.

Emissions associated with clearing of vegetation is aligned with the Full Carbon Accounting Model (FullCAM) methodology, which is used by DCCEEW (Department of Climate Change, Energy, the Environment and Water) for modelling Australia’s GHG emissions from the land sector, as well as for reporting Australia’s emissions including state and territory greenhouse gas inventories.

Scope 1 emissions sources (mining) is inclusive of:

- The use of land clearing for the purpose of construction and mine operation.
- Diesel used for construction and mine use.
- Use of electricity, which is supplied by the Yarnima Power Station (scope 1 emissions).
- Rail transport of iron ore to Port Hedland.

Scope 2: (Inclusive of electricity supply)

There are no Scope 2 emissions associated with the Orebody 29/30/35 mine. All emissions related to the Yarnima Power Station (electricity generation) and emissions associated with BHPIO's rail operations are factored into the Scope 1 emissions.

BHPIO Downstream Emissions

Rail transport emissions are based on data reported for BHPIO's rail facilities in accordance with the NGER Act. BHPIO has calculated the average emissions per net tonne kilometer to transport iron ore from BHPIO mines to Port Hedland. The emissions attributed to the Combined Proposal are further based on the quantity of saleable iron ore from the Orebody mine 29/30/35, and the average emissions per net tonne kilometre.

Scope 3 Emissions

Scope 3 emissions are made up of BHP's downstream emissions associated with ship loading at Port Hedland, downstream shipping of products and the use of products for steelmaking. Scope 3 emissions associated with the downstream processing of the Combined Proposal iron ore products into iron and steel have been estimated from industry-average emissions factors used at BHP Group level for reporting of Scope 3 Category "Processing of Sold Products" emissions in FY2021 (BHP 2022).

BHP's Scope 3 emissions relating to steelmaking are based on global average emissions intensity factor (tonnes of CO_2 per tonne of crude steel) for the blast furnace and basic oxygen furnace (BF-BOF) process route, sourced from the International Energy Agency (IEA 2023). This emissions intensity factor for crude steel is assumed to be based on iron ore as the only raw material and so excludes scrap steel. The factor is applied to an equivalent crude steel production volume assuming 100% of the Combined Proposal iron ore product is processed using this route (BHP 2022). The crude steel equivalent is calculated assuming the average annual rate of output for the orebodies at the Combined Proposal and the average percentage iron (Fe) content across BHP's product portfolio in FY2022, converted to equivalent crude steel quantity assuming the global industry average iron content of crude steel (99.1% Fe) from the IEA Iron and Steel CCS Study (April 2013).

This estimate does not consider site-specific production grades or fluctuations in production volumes and grades anticipated over the life of the Combined Proposal. This estimate is a straight-line extrapolation of the potential indirect emissions associated with the downstream processing of BHP iron ore products, assuming all FY2022 assumptions are constant. Shipping emissions have been estimated assuming 100% of production from the Combined Proposal will be shipped over a distance representative of a North Asia dispatch region and using an industry average factor for emissions intensity per voyage. BHP has assumed that the emissions intensity factor and distance travelled hold constant across the life of the Combined Proposal.

Scope 3 emissions estimates do not contain any forward-looking views or offsetting by third parties that may occur in the value-chain that may impact future Scope 3 emissions.

2. Checking of calculations, assumptions and factors used for deriving Scope 1, 2 and 3 emissions, and the emissions intensity factor

Emissions estimated in the GHGMP have been calculated in accordance with the NGER Act and with the Greenhouse Gas Protocol (for Scope 3), with exception of land clearing emissions, for which the NGER Act does not include a calculation methodology. The FullCAM methodology was utilised for calculation of emissions due to land use. FullCAM was developed as part of the National Carbon Accounting System (NCAS) and is used in Australia's National Greenhouse Accounts for land use and land use change and forestry sectors.

The GHG emissions attributed to land clearing were estimated using FullCAM by calculating the difference in the GHG emissions from a baseline case wherein no anthropogenic clearing was assumed and a progressive clearing scenario which follows BHPIO's proposed clearing schedule for the Combined Proposal as above.

KPMG performed additional benchmarking and research to compare the emissions forecasting and estimates. Based on the summary of emissions calculations below, the Combined Proposal estimates appear to be consistent with relevant frameworks and methodologies, and existing BHP projects.

Table 4: Emission Forecasting

Emission Source (Unit)	Emission Scope	Orebody 29/30/25's Emission Factor	Source	KPMG Notes	Emissions Factor Benchmarks
Diesel – Heavy Haulage (kg CO_{2-e}/ GJ)	Scope 1	70.2	NGER (Measurement) Determination 2008,	Confirmed emissions factor is consistent with the most recent Australian National Greenhouse	GHG Protocol 74.11

			Compilation #11 (1 Jul 2019)	Accounts Factors (DCCEEW 2023c)	
Diesel – Dewatering **(kg CO_{2-e}/ GJ)**	Scope 1	70.2	NGER (Measurement) Determination 2008, Compilation #11 (1 Jul 2019)	Confirmed emissions factor is consistent with the most recent Australian National Greenhouse Accounts Factors (DCCEEW 2023c)	GHG Protocol 74.11
Vegetation Clearing **(tCO_{2-e}/ha)**	Scope 1	Combined Proposal – 68.0	Greenhouse Gas Forecast – OB29 30 35_V 0.5_JR (BHPIO 2024)	The emissions factor for land clearing is location specific. The benchmark emission factors for land clearing assumes a total loss of the carbon sink associated with the vegetation. In contrast the land clearing emission calculation for the Combined Proposal considers the emissions associated with land clearing based on the land clearing schedule and with the cleared vegetation and topsoil being stockpiled on the project site which results in a lower land clearing emission estimate.	FMG Iron Bridge 49.12
Other – Oils and Greases **(tCO_{2-e}/GJ)**	Scope 1	0.3% of Heavy Haulage and Ancillary (Diesel)	FY19 BHP Billiton Iron Ore -– NGER 22X Report -– Yandi Mine (2020)	Based on the NGER report and Australian National Greenhouse factor. The estimate is considered to be conservative. Peers do not report these emissions due to their small quantity.	N/A
Shipping **(tCO_{2-e}/** **t iron ore)**	Scope 3	0.013088 (t CO_2-e/ DMT)	Internal – Historical WAIO Shipping Emissions Intensity	The emissions factor was sourced from BHP's historical iron ore shipping data.	FMG Iron Bridge 0.011 $CO2\text{-}_e$/WMT Roy Hill 0.08
Steelmaking **(tCO_{2-e}/** **t iron ore)**	Scope 3	1.34 (t CO_2-e/ DMT)	Iron and Steel Technology Roadmap, IEA 2020 Iron and Steel CCS Study, IEA 2013	This emissions factor was derived from the crude steel emissions intensity factor (IEA 2020) adjusted for the Fe content of crude steel (IEA 2013).	FMG Iron Bridge: 1.85CO_2-e/WMT Rio Tinto: 2.17 t CO_2-e/t attributable liquid steel Roy Hill: 0.88-1.35 t CO_2-e/t

Diesel Consumption

Diesel consumption includes use for heavy haulage, ancillary equipment and equipment used in land clearing, and for dewatering. In these cases, a diesel consumption emissions factor is applied, sourced from the National Greenhouse Account factors. Consumption forecasts are based on estimated equipment hours and work required to support the iron ore and waste movements, as well as the Original Equipment Manufacturer (OEM) fuel consumption rate estimates. These factors are regularly reviewed against the business records by BHP SMEs.

Other sources of diesel consumption including for dewatering have been compared to estimates used in BHPIO Business Plans in conjunction with project specific assumptions from relevant SMEs.

Land Usage

BHP proposes to operate within the existing 1,346 hectares (ha) of land and requests to clear an additional 116 ha of native vegetation for the Combined Proposal. The emissions associated with land clearing have been estimated using FullCAM which includes carbon pools within forest and agricultural systems.

The estimation of GHG emissions associated with land use (clearing of vegetation) aligned with the FullCAM methodology, the model utilised by the DCCEEW for modelling Australia's GHG emissions from the land sector, and for reporting Australia's GHG emissions including State and Territory GHG Inventories.

Emissions Intensity

Emissions intensity of the Combined Proposal was calculated by dividing the total forecasted Scope 1 emissions by the total forecasted production of the Combined Proposal, defined as "Ore For Rail" which is the quantity of the production variable shipped by rail from the development envelope.

3. The approach taken by BHP to develop the emissions baseline for the proposal including key assumptions and use of methodologies (e.g. the NGER (Measurement) Determination and the Greenhouse Gas Protocol for Scope 3 emissions).

The emissions forecast for the Combined Proposal is based on activities that are reportable under the NGER Act and are within the project's development envelope. GHG emissions estimates have been calculated in accordance with the NGER Act, aside from emissions due to land clearing, for which the NGER Act does not detail a calculation methodology. For these emissions, BHPIO has calculated land-use-change emissions by using the Full Carbon Accounting Model (FullCAM), which is consistent with estimation methods adopted by the Australian Government and the National Inventory reporting used by DCCEEW to determine LULUCF (Land Use, Land-use Change and Forestry) emissions in both National and State emission inventory reporting.

The Combined Proposal is covered by the NGER Act and by the Safeguard Mechanism. Scope 3 emissions are not reportable under the NGER Act as they occur outside of the facility boundary. However, downstream Scope 3 emissions relating to processing of iron ore and shipping associated with production are included in the GHGMP. Upstream Scope 3 emissions (such as those relating to the purchase of goods and services) have been excluded in the GHGMP as BHPIO has estimated that such Scope 3 emissions are not material emissions. Further, as downstream Scope 3 emission are associated with activities with a limited number of parties, BHP is also in a better position to influence such emissions relative to upstream emissions. BHP has set specific downstream Scope 3 emission reduction targets and initiatives to support decarbonisation of these activities (BHP 2024c). BHPIO's downstream Scope 3 emission calculations for the Combined Proposal appear to be consistent with the GHG Protocol as defined in BHP's GHG and emissions calculation methodology.

Offsets proposal

This section presents the findings of KPMG's assessment of "whether the offsets that satisfy integrity principles are likely to be reasonably practicable and available at the time of proposed future surrender" as articulated in the EPA Guidelines.

The assessment has been split into the following five elements:

1. Examination of the offset integrity principles that BHP applies for offset investments;
2. Extent to which such offsets are practicable;
3. Assessment of the offset demand required to meet the stated emission reduction targets under the GHGMP, with respect to offset type, volume and timing;
4. Market review on the availability for the required carbon offsets; and
5. Examination of the strategies considered by BHP to reduce the offset supply risk.

The findings for each of the above elements is presented below.

Combined Proposal's Offsets Integrity Principles

BHP has publicly set seven quality standards or integrity standards that it looks to apply when investing in carbon offsets (BHP 2024a). These quality standards are identical to the set BHP will adopt for offset investments required to support BHP's GHGMP (section 2.8 of the GHGMP). BHP's carbon offsets integrity standards have been designed to align to global best practice for high-integrity carbon credits which include the International Carbon Reduction and Offsetting Alliance's accreditation Code of Best Practice (ICROA 2024) and the Integrity Council for the Voluntary Carbon Market's Core Carbon Principles (IC 2024).

BHP's integrity standards for carbon offsets include the offset integrity standards set under the Carbon Credit Act 2011 (Australian Government 2011) and the offsets integrity principles outlined in the Climate Active Carbon Neutral Standard (Climate Active 2022). Moreover, BHP's offset integrity principles further require that carbon offset projects should not result in any social or environmental adverse impact and that offset vintages are limited to the last five years.

BHP undertakes due diligence of offset investments on a case-by-case basis, a process which includes a risk assessment of the extent to which an offset investment meets the stated minimum quality standards. Where the integrity standards of carbon offsets are set and monitored by government agencies and the principles underpinning the offset integrity standards are broadly aligned with BHP's, then BHP does not apply a review process (BHP 2024a).

BHP has also stated in section 2.8 of the GHGMP that it would look to regularly review its minimum offsets sourcing standards and sourcing strategy to ensure alignment with global best practice.

Extent to which Offsets are Practicable

The Environmental Protection Act 1986 defines "reasonably practicable" as "having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge" (GoWA 2020).

Section 2.8 of the GHGMP states that any offset units that may be required to meet emission targets for BHPIO's GHGMP are to be sourced from either internationally recognised voluntary carbon standards such as the Verified Carbon Standard and the Gold Standard, or from the ACCU scheme. The offsets from these two voluntary standards and the ACCU compliance scheme can be considered as being practicable in the sense that such carbon offset schemes are capable of delivering offsets which meet the above stated minimum quality principles and are capable of being put into practice.

Projected Offset Demand for Combined Proposal

Section 2.8 of the GHGMP sets out that GHG emission reductions are to be prioritised over investment in carbon offsets. Figure 8 of section 2.3 in Schedule 4 outlines the proposed GHGMP emission reduction targets and the projected offset requirements to meet the targets. The carbon offset required to meet the GHGMP reduction targets are also outlined in Table 10 of Section 2.3 in Schedule 4 of the GHGMP. However, the GHGMP does not delineate the relative proportion of the emission reductions that are to be achieved through structural abatement versus offsets.

To review whether offsets that satisfy integrity principles are likely to be available at the time of proposed future surrender and given that there is no estimated proportion of emission reductions to be achieved through structural abatement, for the purpose of this assessment it has been assumed that all emission reductions required for the Combined Proposal will be achieved via offsets.

Further, as the project will be required to comply with the Safeguard Mechanism, this assessment will assume that all offsets will be in the form of ACCUs. The basis for this assumption is as follows:

1 ACCUs are more versatile units as the offsets can be used to meet Safeguard compliance and emission reduction targets under BHPIO's GHGMP, whilst offsets from voluntary carbon standards are not eligible to be used for Safeguard compliance, and
2 The Safeguard compliance requirement for this development coincide with the GHGMP's emission targets as set out on Table 10 of the GHGMP.

Whilst SMCs can also be used for Safeguard compliance and BHP may consider using SMCs for compliance purposes for the Combined Proposal, it is unclear whether SMCs meet the requirements of the WA EPA Environmental Factor Guideline. DCCEEW notes that SMCs do not meet the additionality principle under the CFI Act and that therefore the units are not regarded as offsets (DCCEEW 2023a). The EPA Environmental Factor Guideline requires the use of domestic "offsets" under the Safeguard Mechanism which meet the offset integrity principles. Given that DCCEEW deems SMCs as not being additional or offsets, the eligibility of SMCs for use against the GHGMP at this point is unclear.

Assuming that on a conservative basis, all emission reductions for the GHGMP (as set out in Table 10 of the GHGMP) will be achieved via offsets, then the yearly average ACCU offset demand for the GHGMP is as per Table 3.

Table 3 Assumed ACCU Demand for the Combined Proposal

Compliance Period	Annual ACCU Demand Average Assumed (rounded)	Peak Annual ACCU Demand Within Period Assumed (rounded)
FY25 to FY27	14,000	16,000
FY28 to FY32	33,000	47,000
FY33 to FY37	28,000	40,000
FY38 to FY45	53,000	72,000
Post FY45	< 27,000	27,000

Market Projections of Offsets Availability

Safeguard facilities have the option of meeting their Safeguard Baselines by either reducing their emission intensities or through carbon offsets. The proportion of emission reductions achieved through structural abatement will depend on the availability of technological solutions and their relative costs to carbon offsets. To the extent that Safeguard facilities seek to use carbon offsets to meet part or all of their Safeguard baseline exceedances in a compliance year, at present they can either use ACCUs or SMCs.

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) has targeted a cumulative abatement of 205Mt between FY24 and FY30 for Safeguard facilities over business-as-usual projections through the Safeguard Mechanism reforms (DCCEEW 2023a). The 4.9% annual decline set through the Safeguard Mechanism reforms through to FY30 is designed to achieve this level of abatement from existing Safeguard facilities and in addition, build up a reserve of emission abatement. This reserve is to factor in the uncertainty over emissions projections from Safeguard facilities as well as to allow some room for new facilities captured in the Safeguard Mechanism over the FY24 to FY30 period, such as BHPIO.

Analysis of the Australian compliance carbon market published by DCCEEW (DCCEEW 2023b) indicates that the carbon market will be well supplied to meet the projected demand to 2035 (refer to Figure 1). DCCEEW projects total ACCU and SMC (Unit) holdings to reach 38 million in 2024 which is four times greater than ACCU demand for the same year. As a result, Unit holdings are projected to increase until 2027 when demand for ACCUs is expected to accelerate and outpace the projected ACCU issuance. Total ACCU demand is a combination of cancellations of ACCUs for Safeguard compliance, delivery of ACCUs to the Commonwealth against carbon abatement contracts and the voluntary cancellation of ACCUs. The increase in ACCU demand is mainly driven by the increase in Safeguard compliance demand, which is projected to increase from less than 1 million in 2022 to 26 million ACCUs in 2030. DCCEEW projects deliveries of ACCUs under Government carbon abatement contracts and voluntary cancellation of ACCUs to be smaller sources of demand. The DCCEEW projects ACCU demand to decline post 2031 as industry pursues more on-site carbon abatement opportunities. DCCEEW projects ACCU issuance to grow steadily from 19 million ACCUs in 2024 to 30 million in 2035 driven by higher ACCU prices. Under the DCCEEW projections, the combination of an initially high Unit holdings and steady ACCU supply results is a domestic carbon compliance market that is projected to be well balanced to 2035.

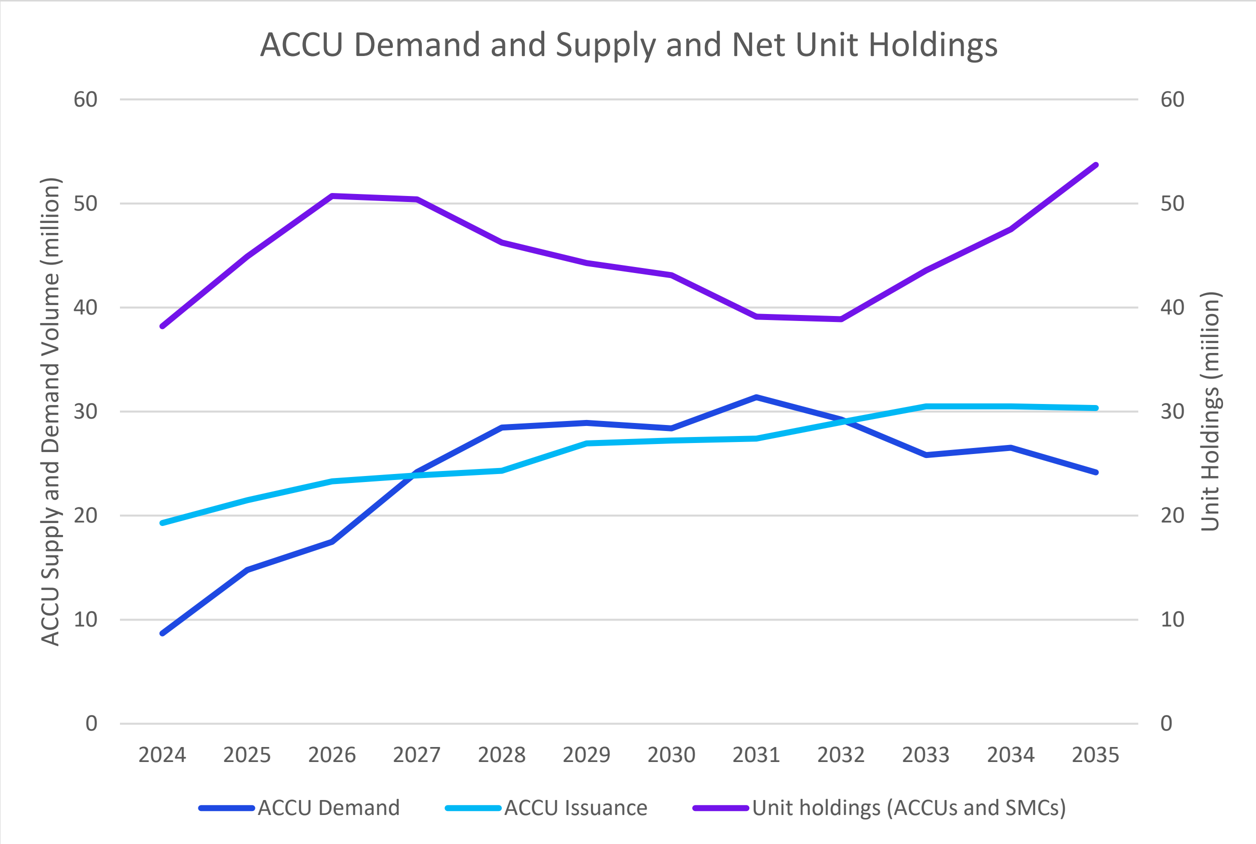

Figure 1: ACCU Demand and Supply and Net Unit (ACCU and SMC) holdings (Source DCCEEW 2023b)

The volume of ACCUs being conservatively assumed to be required for this Combined Proposal is modest. The 47,000 ACCUs assumed in the peak year for the FY28 to FY32 period for the Combined Proposal, coinciding with the period that the ACCU market is anticipated to tighten, represents less than 0.2% of the transacted volume in the first half of 2023, or around 2 average ACCU transactions. So even on a conservative basis, the ACCU volume required for this Combined Proposal for the FY28 to FY32 period is not material when compared to the ACCU market size as shown in *Table 4*.

Whilst the GHGMP emission reduction requirements post FY38 are set to increase to an annual peak of 72,000 tCO_2e, the ACCU market is anticipated to be well supplied post 2032 and can be expected to meet this demand volume.

Table 4 ACCU Market Transaction Volume

Year	Number of Transactions	ACCU Volume Transacted	Average ACCUs per Transaction
2019	261	4,248,631	16,278
2020	266	3,908,781	14,694
2021	524	7,498,816	14,310
2022	1,189	23,281,843	19,581
H1 2023	969	23,890,177	24,654

(Source: CER 2023)

Strategies Considered to De-risk Offset Supply for the Combined Proposal

Sourcing offsets on the spot market in a compliance period is considered a high-risk sourcing option. In its GHGMP BHPIO has outlined long-term sourcing approaches for securing offsets to help reduce reliance on sourcing offsets from the spot market in a compliance year. These include long term offtake agreements and carbon project origination.

Whilst BHP has not set a target for securing a proportion of offsets ahead of a compliance year, given that the conservative estimate for ACCU requirements for the GHGMP is relatively small compared to the ACCU market size, any residual ACCU volumes that may be required to be procured through the spot market is expected to be modest.

Section 2.8 of the GHGMP notes that BHP will use a portfolio approach in securing and using carbon offsets. Moreover, BHP is looking to use offsets not only for regulatory compliance but also for meeting its net zero emission voluntary targets and goals (BHB 2024b). Using a portfolio approach in sourcing and utilising offsets will reduce the risk of a supply shortfall for the Combined Proposal.

One complication for BHP to manage is the offset vintage restriction whereby BHP looks to retire (or sell) offsets within five years from the offset registration. This places limits on how long BHP can warehouse offsets before they are used or sold. However, BHP does not apply the vintage restriction to the purchase of ACCUs on the basis that the additionality of ACCU scheme projects are independently assessed.

Appendix 1 – References

The following references were used for this report:

Australian Government 2011, ***Carbon Credits (Carbon Farming Initiative) Act 2011 Section 133 Offsets integrity standard**,* Available at: http://www.austlii.edu.au/cgi-bin/viewdoc/au/legis/cth/consol_act/ccfia2011355/s133.html

Australian Government 2023, ***National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015*** (as amended 2023*).* Published October 2023.

BHP 2020, Environment and Climate Change – Our Requirements (online), Available at: 191127_environmentandclimatechange.pdf (bhp.com)

BHP 2024a, BHP website: *Sustainability/ Climate Change/ Carbon offsetting*, Available at: https://www.bhp.com/sustainability/climate-change/carbon-offsetting[last accessed September 2024]

BHP 2024b, Climate Transition Action Plan 2024, Available at: https://www.bhp.com/-/media/documents/investors/annual-reports/2024/240827_bhpclimatetransitionactionplan2024

BHP 2024c, BHP website: *Sustainability/ Climate Change/ Value chain GHG emissions (Scope 3 emissions)*, Available at: Value chain GHG emission reductions | BHP [last accessed September 2024]

BHP 2024d, BHP website: BHP's Climate Transition Action Plan (CTAP) 2024, Available at: Climate Transition Action Plan | BHP [last accessed September 2024]

BHP 2024e, BHP Website: BHP's GHG Emissions Calculation Methodology 2024, Available at: BHP GHG Emissions Calculation Methodology 2024 [last accessed October 2024]

BHP Group Ltd (BHP) (2022) Annual Report 2022 [online] Available at: https://www.bhp.com/-/media/documents/investors/annual-reports/2022/220906_bhpannualreport2022.pdf

BHPIO 2024, *Greenhouse Gas Forecast – OB29 30 25_V 0.5_JR,* unpublished internal spreadsheet.

CEFC 2022, *Technology solutions for decarbonisation: Mining in a low-emissions economy*, Clean Energy Finance Corporation with the Minerals Research Institute of Western Australia, 2022

This is the second of three extensive reports by CEFC and MRIWA into decarbonisation of Australia's mining industry. The report identifies the current and emerging technology solutions for decarbonisation, discusses the opportunities and challenges of each, and assigns a rating based on technological readiness and commercial viability. Opportunities for decarbonisation are grouped by their position in the supply chain, i.e.:

- Energy carriers (fuels) including electricity, hydrogen and biofuels
- Stationery energy generation including green hydrogen, biofuels and renewables
- Material movement including haul vehicles, crushing and conveying
- "In mine" operation including blasting, excavation and dewatering.

Alternative fuels such as green hydrogen and ammonia were categorised as having an advanced level of technological readiness but were some way off being commercially viable due to the lack of large-scale chemical manufacturing including electrolysis to produce hydrogen, and supply chain infrastructure. Biofuels to replace diesel were closer to commercial viability due to lower substitution costs than other diesel alternatives, however large-scale production of biofuels may lead to undesirable sustainability outcomes due to competition for food crops and scarce water resources.

Grid electricity supply was at a high level of commercial readiness but was dependent on the development of. Battery electric vehicles for main haulage and other operations and was subject to the emissions intensity of the grid. Combined cycle gas turbines were efficient (relative to other forms of fossil-fuel power generation) when applied to supply base load electricity demand. Renewable power sources (solar PV and wind) and current lithium-ion battery storage had high levels of technical and commercial readiness. Alternative battery storage technologies such as vanadium flow and compressed hydrogen, required additional development but could be "drop in" technologies to replace older style batteries in the future.

Battery and fuel cell electric vehicles faced challenges in relation to energy storage, range and charging. Both technologies were assessed as being advanced in relation to technological readiness, but well short of commercial viability at the present time. Battery electric vehicles depend for their decarbonisation impact on the emissions intensity of the grid but are not dependent on development of a green hydrogen supply infrastructure.

The uptake of renewable power, battery storage and battery electric drive trains, offer solutions to the emissions intensity of crushing, excavation, loading and dewatering. These operations typically rely on diesel power or grid electricity, or electricity generated from diesel combustion.

The report gives an overall Decarbonisation Score to the various technology options based on the potential for emissions reduction, technological and commercial readiness, and environmental and social impact. On a scale of 0 to 10, the following technologies had a rating of 7 or higher:

- Renewable power generation (solar and wind) and grid electricity
- Lithium ion (current technology) and vanadium flow (emerging technology) batteries
- Battery electric vehicles (using green power)
- Trolley assist (overhead supply of electricity. Not viable for large scale open cut mining)
- In pit crushing and conveying.

Clean Energy Regulator (CER) 2023, Quarterly Carbon Market Report – March Quarter 202*3*, Available at: https://www.cleanenergyregulator.gov.au/Infohub/Markets/quarterly-carbon-market-reports/quarterly-carbon-market-report-march-2023, 15 June 2023. Note that the CER has not provided subsequent ACCU market transactions data in subsequent quarterly reports.

Climate Active 2022, *Climate Active Carbon Standard for Products and Services, Available* at: https://www.climateactive.org.au/sites/default/files/2023-04/Standards_Products%20%26%20Services.pdf

CSIRO 2015, *Life cycle assessment of iron ore mining and processing*, Mineralogy, Processing and Environmental Sustainability, 2015, Pages 615-630

This Life Cycle Assessment was carried out for a typical Australian iron ore mine. The emissions from rial transport and port operations were subtracted from the total emissions in Table 20.2 to give a figure that was comparable to the benchmark data in BHP's GHGMP.

Renewable fuel and electrification of mining equipment and optimisation of pit design and crushing equipment, were identified as current and emerging technologies for emissions reduction.

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023a, *Safeguard Mechanism Reforms Position Paper*, Available at: https://storage.googleapis.com/files-au-climate/climate-au/p/prj23cd662ff4387d8c254ae/public_assets/Safeguard%20Mechanism%20Reforms%20Position%20Paper.pdf, January 2023

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023b, Australian's emissions projections 2023, Available at: https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2023, November 2023

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023c, Australian National Greenhouse Accounts Factors, Available at:

https://www.dcceew.gov.au/sites/default/files/documents/national-greenhouse-accounts-factors-2022.pdf

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023d,

Australian National Greenhouse Accounts Factors**,** Available at:

https://www.dcceew.gov.au/sites/default/files/documents/national-greenhouse-account-factors-2023.pdf

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023e, Rewiring the Nation. Available at https://www.dcceew.gov.au/energy/renewable/rewiring-the-nation

H. Ferreira, & M.G. Praca Leite. 2015. *A Life Cycle Assessment study of iron ore mining*, Journal of Cleaner Production 108 (A): Pg. 1081-1091

The research article "A Life Cycle Assessment study of iron ore mining", published in the Journal of Cleaner Production, found an emissions intensity of 13.32 kg $CO_{2\text{-}e}$ per tonne of iron ore concentrate produced. This was calculated from data sourced in production reports from the operator of an open pit mine in the Iron Quadrangle in Brazil. A breakdown of emissions by source within the mine operations is provided in the study, with all items listed consistent with the Combined Proposal.

FMG 2020, *Pilbara Energy Generation Power Station*, Section 38 Referral Supporting Document, Available at: https://www.epa.wa.gov.au/sites/default/files/Referral_Documentation/Supporting%20Document_13.pdf, May 2020

FMG 2022*, FMG Ironbridge Greenhouse Gas Management Plan*, Available at: https://www.epa.wa.gov.au/sites/default/files/Referral_Documentation/Appendix%2015_NS%20GHGMP.pdf

Government of Western Australia 2020, *Environmental Protection Act 1986*, (2020) Available at: https://www.legislation.wa.gov.au/legislation/prod/filestore.nsf/FileURL/mrdoc_43482.pdf/$FILE/Environmental%20Protection%20Act%201986%20-%20%5B09-f0-00%5D.pdf?OpenElement (As of Nov 2020)

Integrity Council for the Voluntary Carbon Market (IC) 2024, *Core Carbon Principles version 1.1*, January 2024, Available At: https://icvcm.org/wp-content/uploads/2024/02/CCP-Section-2-V1.1-FINAL-15May24.pdf

ICMM 2013*. The cost of carbon pricing: competitiveness and implications for the mining and metals industry*, International Council of Mining and Metals, 2013

The ICMM is an industry body for mining and metals production, formed by mining CEO's to consult around and research sustainable development. The ICMM develops principles and standards for best practice mining and metal production. The source document is an assessment of carbon pricing policies to inform transition to a low carbon economy, reporting ICMM member company data related to emissions.

International Carbon Reduction and Offsetting Alliance (ICROA) 2023, *Code of Best Practice,* February 2024,, Available At: https://icroa.org/wp-content/uploads/2024/02/ICROA_Code_Best_Practice_v2.5.pdf

IEA 2023, *Breakthrough Agenda Report 2023: Steel, International Energy Agency,* 2022, Available At:https://www.iea.org/reports/breakthrough-agenda-report-2023/steel

IEA 2022, *The Role of Critical Minerals in Clean Energy Transitions*, International Energy Agency, 2022

This report focused on minerals that were essential for the clean energy transition including for metals used in renewable energy generation (e.g., solar PV) and battery technology. It is relevant to the iron ore industry because a number of the operations (e.g., lithium) involved large scale open cut mining in remote locations including Western Australia.

Whilst most of the report focused on the contribution of minerals to the energy transition, it was acknowledged that technology companies will come under pressure to reduce the emissions in their supply chain, including emissions from mining. Electricity consumption and fuel use were identified as the main sources of emissions.

Emissions from electricity use can be reduced through Power Purchase Agreements (PPAs), investment of battery storage to support electrification of operations, digitalisation and process improvement including energy management, however this was dependent rate of decarbonisation of the grid, which was not under the control of the mine operator. Switching materials movement operations to conveyors and to electric or hydrogen-fuelled track were seen as medium-term opportunities. Offsets were also acknowledged as a decarbonisation tool.

IEA 2020, *Iron and Steel Technology Roadmap - Global Avg Emissions Intensity for BF-BOF route (pg 43)*, International Energy Agency, 2020

IEA 2013, *Iron and Steel CCS Study*, International Energy Agency, 2013

World Steel Association 2022, *CO2 Data Collection,* Available at:https://worldsteel.org/wp-content/uploads/CO2_User_Guide_V11.pdf

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This report has been prepared as outlined with BHP Iron Ore Pty Ltd in the Scope Section of the engagement contract dated 28 March 2024. The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently no opinions or conclusions intended to convey assurance have been expressed.

No warranty of completeness, accuracy or reliability is given in relation to the statements and representations made by, and the information and documentation provided by, BHP Iron Ore Pty Ltd management consulted as part of the process.

KPMG have indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the report.

KPMG is under no obligation in any circumstance to update this report, in either oral or written form, for events occurring after the report has been issued in final form.

This report is solely for the purpose set out in the Scope Section of the engagement contract dated 28 March 2024 and for BHP Iron Ore Pty Ltd's information and is not to be used for any purpose not contemplated in the engagement contract or to be distributed to any third party without KPMG's prior written consent.

This report has been prepared at the request of BHP Iron Ore Pty Ltd in accordance with the terms of KPMGs engagement contract dated 28 March 2024. Other than our responsibility to BHP Iron Ore Pty Ltd, neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on this report. Any reliance placed is that party's sole responsibility.