TECHNICAL ADVISORY REPORT

IN SUPPORT OF THE JOINT LETTER OF INTENT FOR TATA STEEL NETHERLANDS

Abstract

The Netherlands has committed to a 55% reduction in CO_2 emissions by 2030 relative to 1990 as described in the Climate Act ("Klimaatwet") [1]. Given that approximately one third of the national CO_2 emissions originate from the industrial sector [2], the Dutch government is in the process of developing tailor-made agreements with the major industrial emitters to accelerate decarbonisation.

Tata Steel Netherlands (TSN), currently the largest CO_2 emitter in the country [3], initiated the tailor-made agreement process in 2022 by signing the Expression of Principles. The subsequent step towards the binding tailor-made agreements is signing a Joint Letter of Intent (JLoI) [4].

As part of TSN's path towards net-zero before 2045 and the tailor-made agreement, TSN has developed a comprehensive Transition Plan built on four pillars. Two of these pillars, Green Steel Phase 1 and the Additional Environmental and Health Measures, are part of the tailor-made agreement and are in scope of this report. The remaining pillars, Roadmap+ (already being implemented) and Green Steel Phase 2 (required for achieving net-zero before 2045), are outside the current review scope.

TSN's Transition Plan aims to significantly reduce CO_2 emissions and the overall environmental impact of TSN's operations. The emission reductions targets from TSN Ijmuiden site are specified as key performance indicators (KPIs) in the JLoI. The funding is twofold: CO_2 reduction measures and environmental impact reduction measures. A monitoring system will be agreed upon to monitor actual achieved reductions after implementation of TSN's Transition Plan.

Since November 2022, Mott MacDonald has supported the Dutch government in reviewing the technical aspects of TSN's Transition Plan that fall within the scope of the tailor-made agreement. The objective of this independent technical review is to provide key insights into the project's technical maturity, associated uncertainties, and potential opportunities. This technical advisory report sets out the findings of a technical review conducted to support government decision making towards the JLoI.

Mott MacDonald is an employee-owned engineering and advisory company with no financial interest in the project or its stakeholders, allowing the company to perform an independent review of the technical documents. Mott MacDonald solely provides the technical project insights and does not advise on whether government support should be granted.

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Executive Summary

Introduction

Mott MacDonald has engaged with the Ministry of Climate Policy and Green Growth ("Klimaat en Groene Groei") since 2022 to act as key technical advisor in support of the tailor-made agreements with Tata Steel Netherlands (TSN). This report presents the findings of a technical review conducted by Mott MacDonald up to signing of the Joint Letter of Intent (JLoI). The objective of this review was to assess whether the environmental impact reduction targets, defined as Key Performance Indicators (KPIs), outlined in the JLoI are:

- Modelled following an appropriate methodology.
- Supported by appropriate documentation (in line with industrial standards).
- Realistically achievable within the proposed project scope.

Methodology

This review focused on the engineering documentation and models related to the projects included in the JLoI. This includes Green Steel Phase 1 and the Additional Environmental and Health Measures. The review is categorised into three main categories:

1. Environmental Review
2. Engineering and Technology Review
3. Cost review.

The aim of this review is to identify the key uncertainties for achieving the KPIs within the JLoI, without evaluating or commenting on the appropriateness of the target value itself.

Conclusions

Overall, it was found that TSN follows an engineering and modelling approach that is in line with industrial best-practice and expectation. The level of maturity varies across the subprojects, resulting in varying accuracies in environmental modelling, technical risks and cost accuracies. Although uncertainties were observed, no critical technical barriers ("showstoppers") were identified that would prevent the implementation of Green Steel Phase 1 or the Additional Environmental and Health Measures.

More details on identified uncertainties and conclusions are detailed below and in the subsequent report sections.

Environmental Review

The methodology for calculating scope 1 CO_2 emissions is considered appropriate, and it is therefore likely the targeted reductions can be achieved within the 0.6 Mtpa margin agreed in the JLoI. The targeted reductions in fine dust emissions and immission contribution in Wijk aan Zee appears achievable, though it carries a higher uncertainty due to assumptions in emission factors, source definitions and meteorological influences. A monitoring strategy will be implemented to ensure compliance with the agreed PM_{10} targets. The methodology applied to calculate channelled emissions of other air pollutants specified in the JLoI is considered appropriate and targeted reductions are likely to be achieved with the proposed projects. Noise nuisance is mainly attributed to peak and tonal noise. Additional monitoring will be developed to identify noise sources. No noticeable changes are expected in average noise levels after implementation of Green Steel Phase 1. The tailor-made agreement will be developed in such way that TSN will have full responsibility for achieving the targets, allocating the risks to TSN.

Engineering and Technology Review

TSN is still advancing the engineering documentation required to reach a final investment decision. The maturity level varies across the subprojects, resulting in higher uncertainties in projects in an earlier stage. Earlier reviews did not identify major technical barriers ("showstoppers"). The engineering approach taken by TSN aligns with industry best practice and TSN showed awareness and appropriate mitigation of key risks. The most significant uncertainty lies in the slag processing and application plan, as this plan is in early stages of development. The current plan (water granulation) relies on a technology and application pathway that is not yet proven at the required industrial scale. Significant challenges and uncertainties remain regarding technical feasibility, certification, and environmental compliance. A clear and detailed development roadmap, supported by equipment manufacturers' commitments and independent testing, will be essential to reduce these uncertainties. Slag quenching is developed in parallel as fallback option. Although quenching is considered a proven technology, application challenges remain.

Cost Review

TSN has developed CapEx estimates for both Green Steel Phase 1 and the Additional Environmental and Health Measures. The methodology is in line with industry practice, and the design maturity of the individual projects. Green Steel Phase 1 is estimated by TSN at approximately €4.5 billion with an estimated accuracy of -20% to +30%. The estimate is based on vendor input and is considered appropriate, though cost contingency is considered optimistic. The Additional Environmental and Health Measures are estimated at approximately €740 million with an estimated accuracy of ±30-50%. The lower accuracy compared to Green Steel Phase 1 is a result of lower level of development in EO2 and Slag Processing and Storage. As described in the JLoI, any overrun in project cost will be the risk for TSN as the funding is capped. To avoid overcompensation due to higher profitability of the DRP-EAF subproject, a clawback mechanism will be introduced and agreed upon in the tailor-made agreement.

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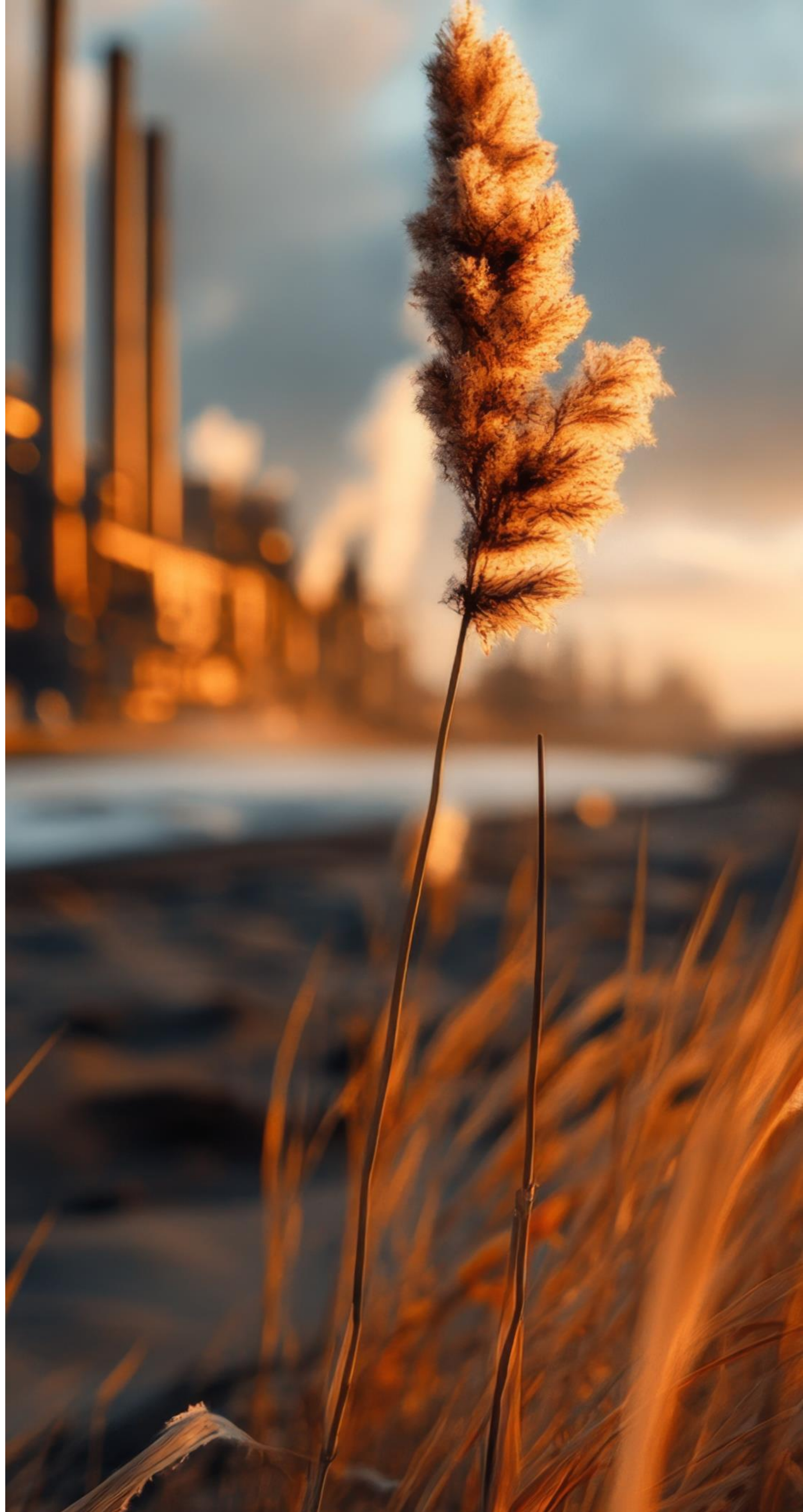


1. INTRODUCTION

1.1

Introduction – Tailor-Made Agreement

The Dutch government intends to support Tata Steel Netherlands' Transition Plan to achieve specified environmental impact reductions.

The Dutch government, represented by the Ministry of Climate Policy and Green Growth ("Klimaat en Groene Groei") and the Ministry of Infrastructure and Water Management ("Infrastructuur en Waterstaat"), is developing tailor-made agreements with the top 20 largest emitters in the Netherlands. The aim is to achieve additional and accelerated CO_2 reductions, supporting a sustainable future for The Netherlands and improving the living environment through targeted financial support. One of the agreements under discussion is with Tata Steel Netherlands (TSN).

Tailor-made agreement for Tata Steel Netherlands

TSN is the single largest emitter of CO_2 in The Netherlands, contributing to ~7.6% of the total Dutch annual CO_2 emissions [3]. In addition to its climate impact, TSN contributes significantly to local environmental concerns. It is the largest individual emitter of nitrous oxides (NO_x) in the Netherlands [5]. Furthermore, TSN emits (fine) dust, SO_2, Substances of Very High Concern (SVHC), and odorous compounds. The primary ambition of the government with the tailor-made agreement is therefore two-fold:

- Significantly reduce the CO_2 emissions, both in the short term and on the pathway to climate neutrality.
- Accelerate the reduction of TSN's impact on the local environment.

Tata Steel Netherlands' Transition Plan

To meet these objectives, TSN has developed its Transition Plan, a comprehensive strategy to transform its steelmaking operations and achieve climate neutrality by 2045. Four distinct pillars form the core of TSN's Transition Plan of which two are out of the scope of the Tailor-made agreements and two are within the scope (Figure 1):

1. **Roadmap+:** Environmental measures which are already being implemented by TSN. The roadmap+ is being/has been executed without government support.
2. **Green Steel Phase 1:** Activities are primarily focussed on reducing CO_2 emissions. Activities include replacing Blast Furnace 7 (BF7) and Coke and Gas Plant 2 (CGP2) by a Direct Reduction Plant (DRP) and an Electric Arc Furnace (EAF). The DRP can incorporate Carbon Capture and Storage (CCS) and use biomethane and/or hydrogen to further reduce CO_2 emissions.
3. **Additional Environmental and Health Measures:** A set of measures primarily focussing on reducing fine dust emissions, such as covering raw material stockpiles and nearby scrapyard, and implementing measures at slag processing partners Harsco and Pelt & Hooykaas (PHY).
4. **Green Steel Phase 2:** Future replacement of Blast Furnace 6 and Coke and Gas Plant 1 (CGP1) with a second DRP and two smelters. Exact plan is to be defined at a later stage.

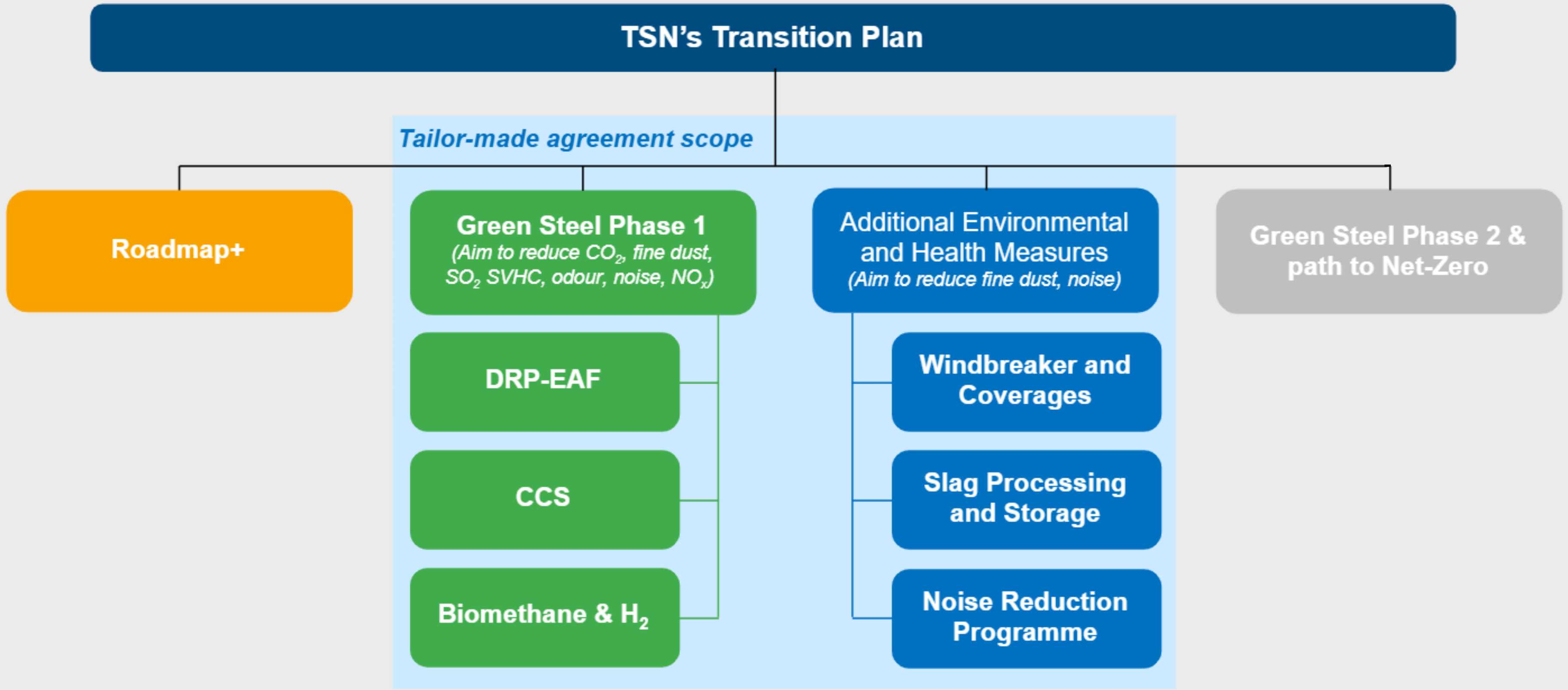
Joint Letter of Intent

The tailor-made agreement will be designed to ensure TSN aims to achieve a set of environmental and climate-related emission reductions objectives, enabling the government to provide targeted support for the transition. Within the scope of the tailor-made agreement, TSN will be aiming to achieve the following objectives:

- Reducing CO_2 emissions by 5.4 million tonnes per annum (Mtpa) by 2030 (~43% reduction), up to 7.2 Mtpa by 2037 (~57% reduction) relative to the representative baseline emissions of 12.6 Mtpa.
- Reducing fine dust (PM_{10}) emissions to a maximum of 467 tpa, and immission contribution in Wijk aan Zee (WaZ) by a minimum of 35% relative to 2019.
- Reducing NO_X by 40%, SO_2 by 37% and Odour by 40% relative to the Environmental Impact Assessment (EIA) baseline.
- Reduce SVHC emissions (for more details on exact emission reduction targets see page 20 or the JLoI publication [4]).
- Reduce noise nuisance.
- Increase circularity by using ~30% of scrap input.

Discussions on the tailor-made agreement with TSN have resulted in the JLoI which further details the mutual objectives to support the transition to low-carbon, green and clean steelmaking[4].

Figure 1. The four pillars in TSN's Transition Plan [4]



Introduction – Project Green Steel Phase 1

Green Steel Phase 1 is designed to reduce CO_2 emissions, while increasing circularity and reducing the environmental impact.

TSN's Green Steel Phase 1 is a major shift away from coal-based steel production. The plan is designed to significantly cut CO_2 emissions, reduce environmental impact, and increase the use of recycled materials.

TSN will start Green Steel Phase 1 with building the DRP-EAF combination, and will subsequently retire the existing BF7 and CGP2. Other assets, such as the Basic Oxygen Furnace, will remain. This transition is visually depicted in Figure 2. The new DRP-EAF setup will operate primarily on natural gas and electricity, with a higher intake of steel scrap to reduce the need for raw materials. Over time, TSN plans to switch to renewable energy sources like biomethane and/or hydrogen, further reducing CO_2 emissions.

The reported CO_2 emissions for TSN represent a combined total of emissions from two distinct sources:

- TSN's own industrial operations, including steel production and related processes.
- The adjacent Vattenfall power plant, which supplies electricity and steam to the TSN Ijmuiden site using process gases generated in the steel making process.

Green Steel Phase 1

Green Steel Phase 1 consist of the following three subprojects:

1. DRP-EAF – 5.4 million tonnes CO_2 reduction: A DRP produces iron by removing oxygen from iron ore using gases like natural gas or hydrogen, rather than coke (a coal product). This process emits significantly less CO_2 than a traditional blast furnace, which relies on coal combustion and generates significant amounts of greenhouse gases and other pollutants. The DRP is paired with an EAF, which melts the iron and steel scrap using electricity, forming the liquid steel product. The DRP-EAF project will replace approximately 60% of TSN's current steelmaking capacity and is expected to reduce CO_2 emissions by 5.4 Mtpa (−43%), assuming natural gas is used in the DRP.

In addition to replacing BF7 and CGP2, TSN will implement a range of environmental upgrades in the DRP-EAF project, including:

- Dust extraction systems on conveyor belts.
- Covered scrapyards to reduce particulate emissions.
- Use of brackish water for cooling to conserve freshwater.
- Installation of $DeNO_X$ technology to reduce NO_X emissions.

The DRP-EAF project, including the environmental upgrades, aim to reduce emissions in CO_2, fine dust (PM_{10}), NO_X, SO_2, heavy metals, and other pollutants affecting local communities.

2. Carbon Capture and Storage – 0.6 million tonnes CO_2 reduction: A CCS system captures CO_2 emissions from industrial processes before they reach the atmosphere. The captured CO_2 is then transported and stored in geological formations such as depleted gas fields or saline aquifers. TSN plans to install CCS technology to capture up to 0.6 Mtpa of CO_2. CCS is compatible with DRP technology and is considered an important bridge solution by TSN until renewable fuels become widely available or combine with biomethane to result in negative CO_2 emissions.

3. Biomethane and/or hydrogen – maximum 1.2 million tonnes CO_2 reduction: The DRP can operate on varying blends of natural gas, biomethane, and hydrogen. This allows TSN to gradually transition to renewable energy sources as markets and infrastructure develop.

While the use of biomethane does generate CO_2 emissions, these are considered carbon-neutral as they originate from the short carbon cycle [7]. When combined with CCS, the process can achieve net-negative CO_2 emissions.

Operating the DRP with hydrogen significantly reduces CO_2 emissions, as iron ore reduction occurs without the use of carbon. However, this also results in a lower availability of CO_2 for capture, potentially limiting the effectiveness of CCS.

The replacement of natural gas with biomethane and/or hydrogen can offset a maximum additional 1.2 Mtpa of CO_2. This phased approach enables TSN to continue reducing its carbon footprint while maintaining operational stability and preparing for net-zero by 2045.

Figure 2. Transition from the current situation to the Green Steel Phase 1 [6]

The Additional Environmental and Health Measures aim to reduce fine dust (PM_{10}) emissions, PM_{10} immission contribution in WaZ, and noise nuisance.

Beyond the Green Steel Phase 1 project, which reduces CO_2, NO_x, SO_2, fine dust (PM_{10}), heavy metals, and other pollutants, TSN will implement Additional Environmental and Health Measures to further reduce its impact on local communities. These measures focus on reducing PM_{10} emissions, PM_{10} immission contribution in WaZ and noise nuisance.

What is PM_{10}?

PM_{10} refers to particulate matter (fine dust particles) that are 10 micrometres or smaller in diameter. PM_{10} can be expressed in two ways:

- **Emissions:** the amount released to the atmosphere from a source, typically expressed in kilograms per hour (kg/hr).
- **Immissions:** Indicating the contribution from the source to the PM_{10} concentration in the surrounding air, typically expressed in micrograms per cubic meter (μg/m^3).

Additional Environmental and Health Measures to reduce PM_{10}

The Additional Environmental and Health Measures consist of three subprojects, that each consist of multiple measures to reduce TSN's environmental impact (see Table 1):

1. Windbreaker and Coverages: Raw materials used in steel production are stored and handled in open fields, releasing fine dust into the air. Large coverages over raw material storage areas (MV2, SOP3, EO2) and a windbreaker at MV1 will be constructed with the aim to limit dust emissions (Table 1, Figure 3).

2. Slag Processing and Storage: Steel slag, a by-product of steel production, is processed and stored at Harsco and PHY which are located on the TSN terrain. The steel slag is transported to Harsco, where it is processed through steps like metal recovery, crushing, and screening. The processed slag is then temporarily stored at PHY, where it undergoes further refinement into a final product suitable for use in construction and other industries. These operations involve multiple handling stages that can release fine dust. Measures at Harsco and PHY aim to reduce dust during slag handling and storage, which are PM_{10} sources near WaZ.

3. Noise reduction measures: Residents near the plant have reported significant noise nuisance. TSN will address noise nuisance by installing a monitoring system on-site and in the surrounding areas. Based on the new insights, additional technical and operational solutions will be developed to mitigate noise nuisance. Covering SOP3 also aims to reduce noise, alongside its primary role in fine dust reduction.

Focus on PM_{10} at Wijk aan Zee

TSN has set targets to reduce their contribution to PM_{10} concentrations (immissions) at the nearby community in WaZ. Research by Rijksinstituut voor Volksgezondheid en Milieu (RIVM) shows the likelihood of adverse effects from exposure to PM_{10} is highest at WaZ and decreases with distance from the plant [8]. Therefore, the Dutch government and TSN are prioritizing measures to reduce PM_{10} immissions in this area (although other areas are targeted as well). TSN will aim to achieve a minimum reduction of 35% in PM_{10} immission contribution in WaZ by 2030 relative to 2019. Furthermore, a maximum PM_{10} emission target of 467 tpa is agreed upon in the JLoI.

Coarse dust emissions

While TSN targets reductions in PM_{10}, it expects that emissions and immissions of course dust will follow a similar reduction as predicted for PM_{10}. Mott MacDonald considers this expectation as technically reasonable and supports the projected correlation.

Table 1. Description of the proposed measures in the Additional Environmental and Health measures [6]

Location	Description	Subproject	Proposed measure	Aim to reduce
MV1	Ore blending field 1	Windbreaker and Coverages	Windbreaker	PM_{10}, coarse dust
MV2	Ore blending field 2	Windbreaker and Coverages	Shed	PM_{10}, coarse dust
EO2	Ore storage field 2	Windbreaker and Coverages	Domes	PM_{10}, coarse dust
SOP3	Scrapyard 3	Windbreaker and Coverages	Shed	PM_{10}, coarse dust, noise
Harsco	Slag processing	Slag Processing and Storage	Water granulation in an enclosed building	PM_{10}, coarse dust
Harsco	Slag processing	Slag Processing and Storage	Dedusting Metal Recovery Plant	PM_{10}, coarse dust
PHY	Slag processing	Slag Processing and Storage	Windbreaker	PM_{10}, coarse dust
PHY/Harsco	Slag processing	Slag Processing and Storage	Dedusting open storages and roads	PM_{10}, coarse dust
PHY	Slag processing	Slag Processing and Storage	Dedusting Break sieve installations	PM_{10}, coarse dust
TSN site & surrounding	Monitoring system	Noise reduction measures	Sensors both on-site and in surrounding areas to identify the sources of noise	Noise

Figure 3. Locations of the assets that will be affected by the Additional Environmental and Health Measures [6]

1.4

Introduction – Design Maturity

Tata Steel Netherlands' transition to green steel is a complex programme of interconnected projects with varying levels of maturity and phased implementation.

To manage the complexity and scale of its transition, TSN is applying a structured project development approach known as Front-End Loading (FEL).

The concept of Front-End Loading

FEL is widely used in engineering projects to reduce risks and improve decision-making by gradually increasing the level of detail and certainty at each stage. FEL breaks down project development into five distinct phases which is visualised in Figure 4 and described below:

- FEL0: The opportunity is identified, and the business case is outlined (not depicted).
- FEL1: Multiple technical options are explored. Initial cost estimates and timelines are developed to assess feasibility.
- FEL2: The preferred option is further engineered. Cost and schedule estimates are refined to support decision-making.
- FEL3: Basic engineering is completed before the final investment decision (FID) is made.
- FEL4/Execute: The project is implemented with detailed designs and a finalised execution plan.

In short, a higher FEL stage means more detailed planning, better cost certainty, and a higher readiness for execution[8]. This phased approach ensures that each decision is backed by progressively more reliable data. Each subproject has been reviewed, with consideration of the maturity level, more detail and accuracy is expected for subprojects with a higher maturity level.

Front-End Loading by Tata Steel Netherlands

TSN's Transition Plan includes several (sub)projects, each at a different stage of maturity. Their position within the FEL framework reflects how much is known about their design, cost, and timeline. The maturity level/FEL stages of the subprojects are identified by TSN and verified by Mott MacDonald. The FEL stages are visually depicted in Figure 5 and described below:

- DRP-EAF: This project has reached FEL3. The new assets will have completed basic engineering stage in Q3 2025.
- Windbreaker and Coverages: Part of the scope (MV1, MV2, SOP3) is at FEL3, while EO2 is between FEL1 and FEL2.
- Slag Processing and Storage: This project is at FEL1, with the scope defined in July 2025 and early engineering in development.

Figure 4. The concept of Front-End Loading and the various stages [9]

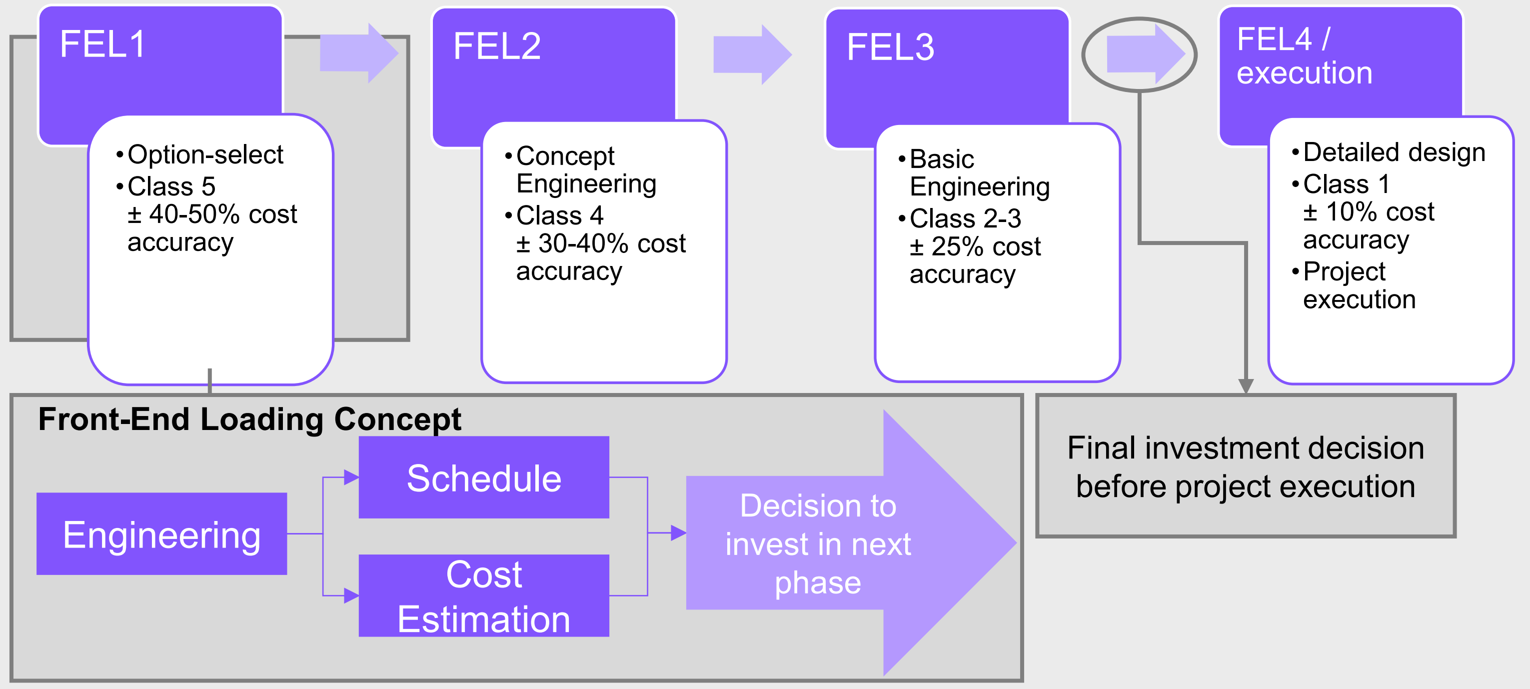
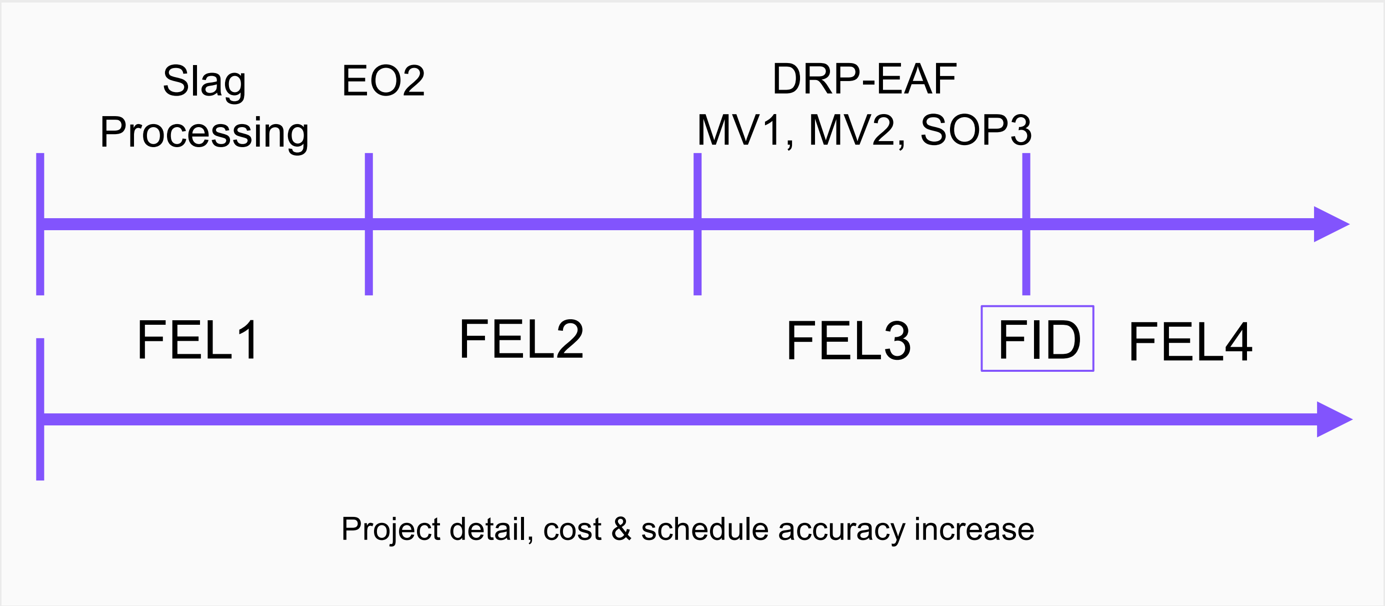


Figure 5. The FEL stages of the various projects relative to the final investment decision



2. SCOPE AND METHODOLOGY

Mott MacDonald has performed a technical review of Tata Steel Netherlands' Transition Plan, focussing on environmental impact reduction, engineering, technology and project cost.

Since November 2022, Mott MacDonald has supported the Dutch government by providing independent technical advise on TSN's Green Steel Phase 1 and the Additional Environmental and Health Measures on technical aspects.

Independent technical review

Mott MacDonald is an employee-owned engineering and advisory firm with no financial interest in TSN or its stakeholders. This independence enables an unbiased review of technical documentation. The objective is to identify uncertainties that could affect TSN's ability to meet its design specifications and reduction targets as defined in the JLoI. The review assesses the feasibility of achieving the KPIs but does not evaluate the target values themselves. Mott MacDonald does not initiate its own research or advise on financial support decisions; its role is limited to the agreed scope.

By reviewing the maturity and quality of the technical work and highlighting any key uncertainties, Mott MacDonald enables the government to make an informed decision on whether to financially support TSN's transition. This intends to provide confidence that public resources are allocated to well-defined, feasible projects with a clear environmental impact reduction.

Review process

The review process follows a structured workflow, including a three-step validation (see Figure 7). Reviews are conducted at multiple stages of project development, based on a scope defined by the Ministry of Climate Policy and Green Growth. TSN was requested by Mott MacDonald to provide relevant documentation and additional evidence to support any assumption and/or methodology.

As described, multiple reviews have been conducted overtime. An overview of when the most recent review was conducted for each project is shown in Figure 6.

Over the course of the engagement, more than 1,000 documents have been reviewed, supplemented by workshops and clarification sessions with TSN where necessary.

Figure 6. Timeline of when the most recent reviews were conducted

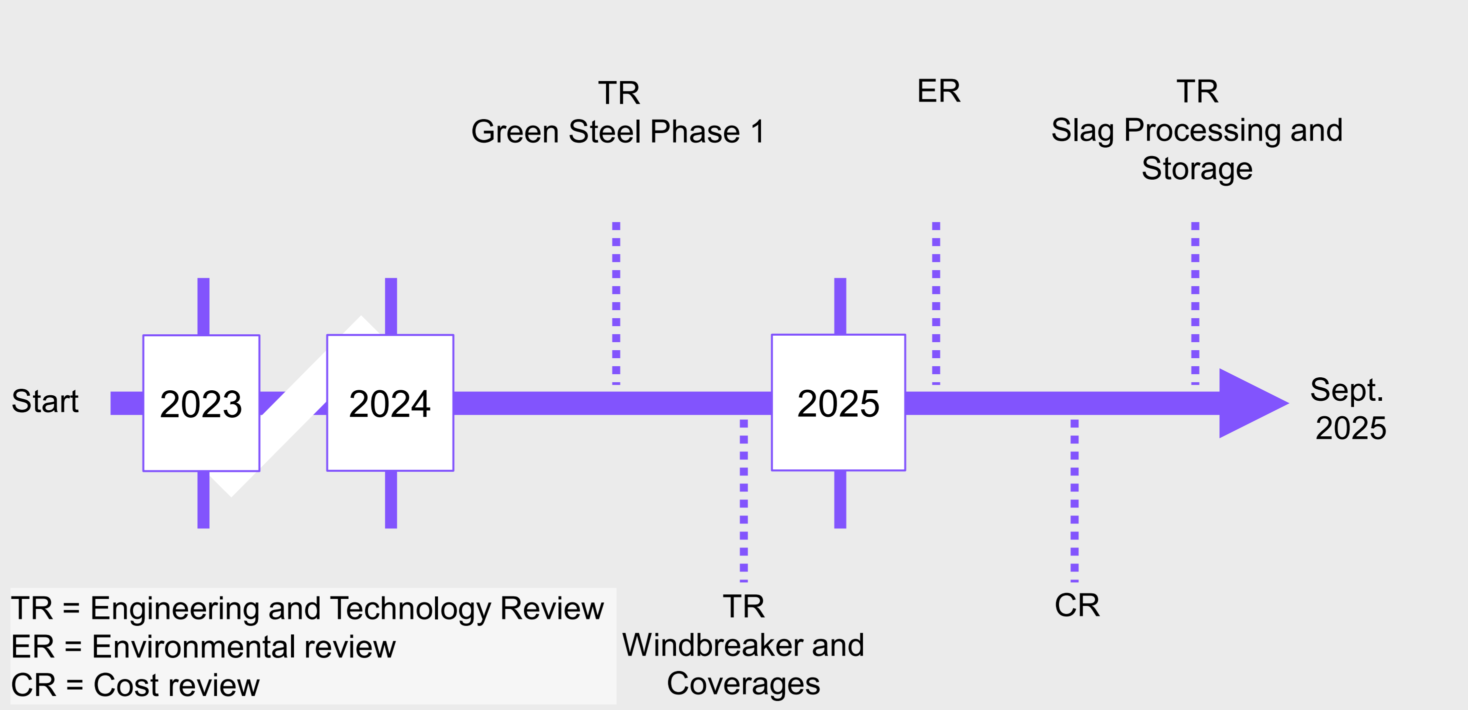
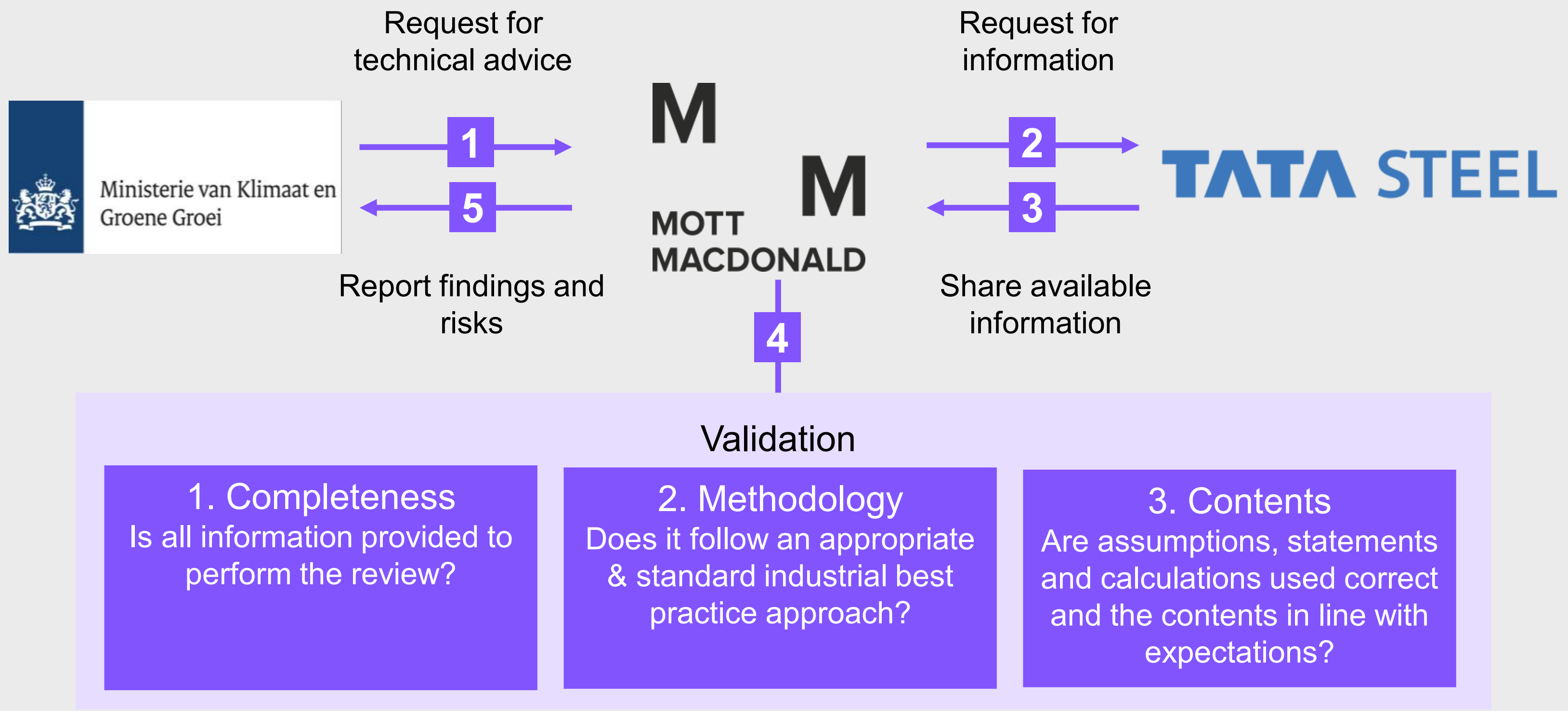


Figure 7. The review process workflow and three-step validation process



2.2 Scope and Methodology – Defining Uncertainties

Mott MacDonald has provided the Dutch government with key insights into the uncertainties that could affect Tata Steel Netherlands' achieving the agreed reduction targets.

Large-scale industrial transformation projects, such as TSN's Green Steel Phase 1, involve complex technical, financial, and environmental challenges. While contractual arrangements place the responsibility for delivery with TSN, the Dutch government seeks insight into the uncertainties that could affect the achievement of the agreed reduction targets. This understanding is essential for assessing how plausible it is that TSN can meet its objectives.

Risk allocation

The JLoI assigns clear responsibility to TSN for achieving the agreed environmental improvements by means of quantified reductions in emissions. Government funding is capped, meaning that any capital expenditure (CapEx) overruns must be absorbed by TSN. Where risks arise from novel technologies or incomplete engineering definition, TSN is expected to manage these. To avoid overcompensation due to higher profitability of the DRP-EAF subproject, a clawback mechanism will be introduced and agreed upon in the tailor-made agreement [4].

As a result, the contractual framework will likely ensure that the primary financial and performance uncertainties identified in this review rest with TSN.

Focus on uncertainties

Because the responsibilities rest with TSN to achieve the reduction targets, the review evaluates the plausibility of TSN achieving its cost, schedule, and environmental targets under the current plan. To do this, Mott MacDonald examined the key uncertainties that could influence TSN's ability to meet these objectives.

Scope

This report presents the most recent findings and identified uncertainties in three areas: environmental, engineering & technology, and cost. Each topic was reviewed against defined evaluation criteria to determine the robustness of TSN's approach and the credibility of its projections. The review has been conducted against objectives defined in the concept JLoI. Although any changes in the final JLOI should be incorporated in this report, some minor deviation can occur.

Environmental Review

Covered the DRP-EAF and Additional Environmental and Health Measures, and generally considered:

- **Modelling approach**: Assessment of the methodology used to calculate emissions and immissions.
- **Assumptions and data sources:** Review of emission factors, reduction factors, and meteorological assumptions.
- **Mathematical and logical consistency:** Validation of calculations for emission reductions.

Engineering and Technology Review

Covered the DRP-EAF, coverages, and slag processing technology, and generally considered:

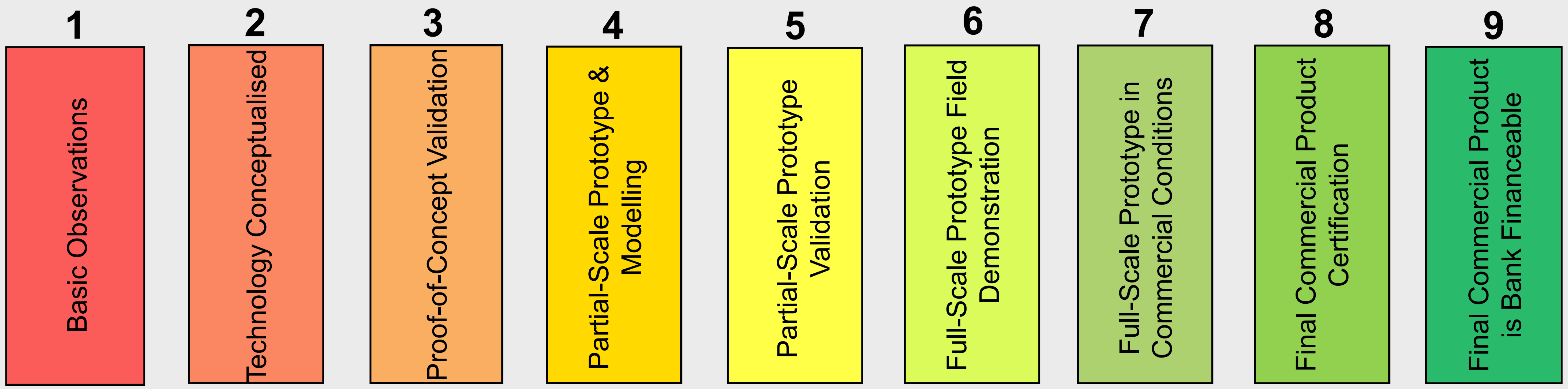
- **Engineering approach:** Assessment of the robustness and reliability of TSN's engineering methodology, including alignment with industrial standards and best practices.
- **Technology selection:** Review of the rationale for chosen technologies, consideration of alternatives, and the selection methodology and evaluation criteria.
- **Technology Readiness Level (TRL):** Evaluation of the maturity of the technology and its suitability for deployment at the intended industrial scale. A TRL scale is depicted in Figure 8. For technologies still under development, the review considered development roadmaps, timelines, and contractual arrangements.
- **Risk identification and mitigation:** Analysis of TSN's awareness of technical risks and adequacy of proposed mitigation measures.

Cost Review

Review of the CapEx for both the Green Steel Phase 1 and Additional Environmental and Health Measures. Operational expenditures are excluded from this review. The cost review generally covered:

- **Methodology:** Review of the overall cost estimation approach, including structure, breakdown, clarity, and alignment with industry standards.
- **Assumptions:** Benchmarking of key assumptions (e.g., labour rates, material costs, equipment prices) against Mott MacDonald's internal databases and evaluation of their reliability and relevance.
- **Mathematical review:** Validation of cost calculation spreadsheets to identify mathematical errors or inconsistencies.
- **Contingency analysis:** Assessment of contingency provisions and TSN's adequacy in managing cost uncertainty.

Figure 8. The Technology Readiness Levels from 1 to 9 [10]



3. ENVIRONMENTAL REVIEW

The modelling approach to calculating scope 1 CO_2 emissions is considered appropriate and it is likely that the reduction target can be achieved with implementation of Green Steel Phase 1.

TSN aims to achieve a 5.4 Mtpa reduction in CO_2 emissions through the Green Steel Phase 1, by replacing BF7 and CGP2 with the DRP-EAF combination. Additional CO_2 reduction is proposed through introduction of CCS, and/or natural gas replacement with biomethane and/or hydrogen.

Predicted CO_2 emissions

The following scope 1 CO_2 emission scenarios for the TSN site and Vattenfall power plant are predicted and illustrated in Figure 9:

- Baseline: Financial year 2018 adjusted to an agreed & representative production volume of 7.23 Mtpa of LS, resulting in 12.6 Mtpa CO_2.
- Green Steel Phase 1: Commissioning the DRP-EAF and closing BF7 and CGP2 reduces CO_2 emissions to 7.2 Mtpa (a 5.4 Mtpa reduction).
- CCS: Applying CCS to the DRP reactor further reduces CO_2 emissions to 6.6 Mtpa (additional 0.6 Mtpa reduction).
- Biomethane: Operating the DRP with 100% biomethane and CCS, further reduces CO_2 emissions to 5.4 Mtpa (additional 1.2 Mtpa reduction).
- Hydrogen: Operating the DRP with 13% hydrogen, 87% biomethane and CCS results in 5.5 Mtpa of CO_2 emissions. Considered as alternative for biomethane, if green hydrogen becomes commercially viable. Final hydrogen percentage is to be defined.

Uncertainties

To calculate CO_2 emissions, TSN uses its in-house Carbon (reduction) Selection Model (CSM) which is based on carbon mass-balance principles and historical data for the existing assets. The material flows for the new assets (DRP-EAF) are sourced from databooks provided by the Original Equipment Manufacturers (OEMs). Overall, the methodology is considered appropriate and in line with industrial best practice. However, some uncertainties are identified:

- Only the major assets onsite are included.
- Minor carbon flows (e.g. scrap and steel products) are excluded.
- Only CO_2 is included; other greenhouse gasses are omitted.
- The coking time of CGP1 will increase once Green Steel Phase 1 is implemented. This operational change can impact the material balance over CGP1, but is not completely reflected in the calculations.
- Some consumption factors in the CSM differ from source documents.

A margin of 0.6 Mtpa has been agreed upon in the JLoI. This margin is considered sufficient to allow for any of the above-mentioned uncertainties to materialise. Therefore, it is likely the stated CO_2 objectives in the JLoI can be achieved with Green Steel Phase 1. The scope of this review only covers scope 1 emissions, scope 2 and 3 emissions are specifically not part of this review.

Carbon Capture and Storage

The calculations for the CCS system are supported with key information from the OEMs and appropriate data.

Biomethane

The approach to calculating emissions after replacement of natural gas in the DRP by biomethane are found to be robust. CO_2 emitted from the DRP, when operating on biomethane, is part of the short carbon cycle and therefore considered as zero carbon. Addition of the CCS systems results in negative CO_2 emissions.

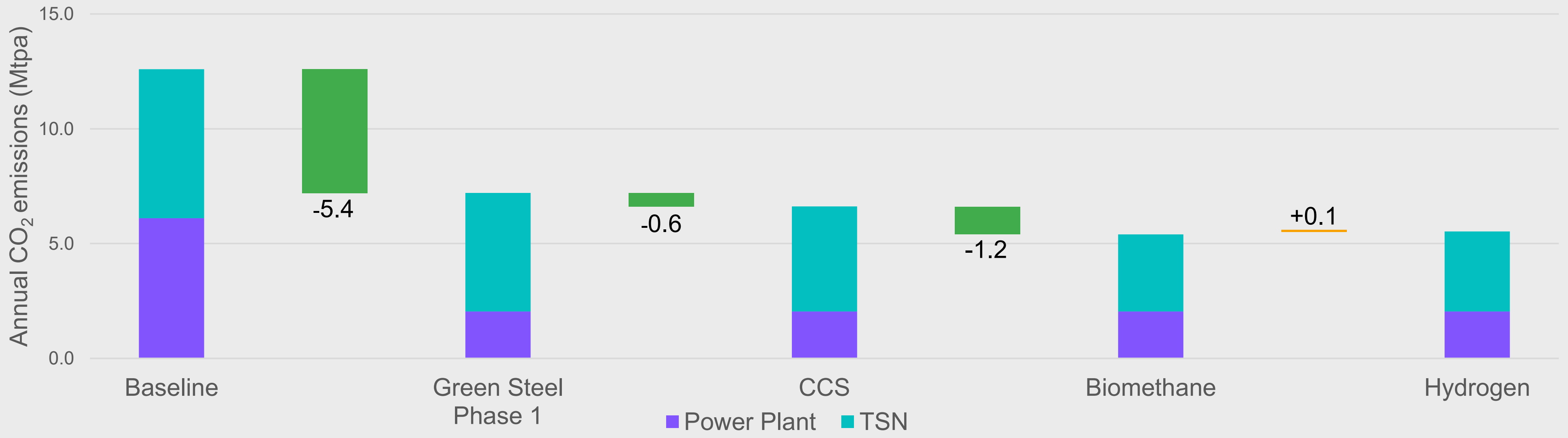
Hydrogen

The introduction of hydrogen is predicted to increase the energy efficiency of the DRP, which is in line with expectations and literature [11]. The CO_2 emissions are higher compared to the biomethane scenario, as less CO_2 is available in the DRP for the CCS system and no negative CO_2 emissions can be generated.

Lower production rate

It should be noted that with the implementation of Green Steel Phase 1, TSN will reduce its liquid steel production with approximately 15-20%. As a result, steel slabs will be imported to maintain a constant steel product output.

Figure 9. Predicted CO_2 emissions per (sub)project [6]



Conclusion

The greenhouse gas emissions calculations are well supported, and the applied methodology is considered appropriate and in line with industrial best practice. Some uncertainties and simplification in the calculations have been observed, however considering the agreed margin of 0.6 Mtpa it is likely the target scope 1 CO_2 emissions can be achieved with the proposed Green Steel Phase 1.

Tata Steel Netherlands aims to reduce PM_{10} emissions to a maximum of 467 tpa, and immission contribution at Wijk aan Zee by at least 35%, which both are found to be achievable.

The Green Steel Phase 1, Roadmap+, and Additional Environmental and Health Measures aim to reduce TSN's PM_{10} emissions to a maximum of 467 tpa and immission contribution in WaZ by at least 35% compared to 2019 levels (Figure 10). WaZ, the nearest residential area to TSN, has been identified by RIVM as the most affected receptor[8]. This reduction target aligns with achieving the World Health Organisation guideline of 15 µg/m³ [12], which is stricter than the forthcoming EU legal limit of 20 µg/m³ [13]. TSN assumes that other regional PM_{10} sources will also reduce emissions proportionally, while natural sources remain unchanged.

PM_{10} emissions

While the focus of the Additional Environmental and Health Measures is reduction in immissions, TSN have set emission objectives for PM_{10} of 467 tpa by 2030. This is a 38% reduction relative to the 2019 baseline of 753 tpa. These total emission values include contributions from TSN's material stockyards and slag processing chain partners, which are the largest sources. In addition, point source emissions from steelmaking installations, and mobile sources are also included.

The methodology applied to the calculations supporting the predicted reductions is appropriate and encompasses all key sources. However, due to the scale and complexity of material stockyards and slag processing, calculations rely heavily on assumptions such as the application of emission factors for different materials and expected reduction factors associated with the measures and stockpile management practices. While these assumptions are reasonable and supported by best practice guidance or TSN's own investigations, the precise annual emissions objectives do not reflect this significant level of uncertainty inherent to the calculations. Given the underlying uncertainties, actual PM_{10} emissions could vary substantially from the projected target of 467 tpa, potentially falling either above or below the target.

$PM_{2.5}$ emissions

The total $PM_{2.5}$ emissions after Green Steel Phase 1 and the Additional Environmental and Health Measures is calculated to be 306 tpa, which is a 34% reduction relative to the 2019 baseline of 466 tpa. TSN has assumed a standard ratio of 0.625 tons $PM_{2.5}$ per ton PM_{10} for material stockpile emissions which is derived from recognised guidance. PM_{10} and $PM_{2.5}$ emissions from channelled sources are derived from monitoring and can vary independently. This calculation approach is considered appropriate; however, the uncertainties associated with emissions from material stockpiles are also applicable to $PM_{2.5}$.

PM_{10} immissions

TSN estimates its 2019 baseline immission contribution in WaZ at 5.6 µg/m³, including chain partners Harsco and PHY. To meet the 35% target, a reduction of approximately 2.0 µg/m³ is required (Figure 11). TSN predicts a 38% reduction (2.1 µg/m³) through combined measures (reduction percentages and totals may differ due to rounding):

- Roadmap+: ~0.8 µg/m³.
- Green Steel Phase 1: ~0.5 µg/m³.
- Windbreaker and Coverages: ~0.5 µg/m³.
- Slag Processing and Storage measures: ~0.2 µg/m³.

Dispersion modelling uncertainties

The PM_{10} immissions have been calculated using TSN's emissions data and dispersion industry-standard dispersion modelling software. While this approach aligns with industry best practice, and dispersion modelling is the appropriate tool for predicting future immissions, this introduces additional uncertainty such as not being able to predict future meteorological conditions and how the model calculates pollutant dispersion. Independent baseline immissions estimates by RIVM, derived from alternative modelling and monitoring data analyses, range from 4.6 to 7.4 µg/m³. TSN's baseline immission estimate of 5.6 µg/m³ falls within this range. However, the spread of values highlight the inherent uncertainty in immission modelling.

Figure 10. TSN's 35% PM_{10} Reduction Target at WaZ (µg/m³) [6]

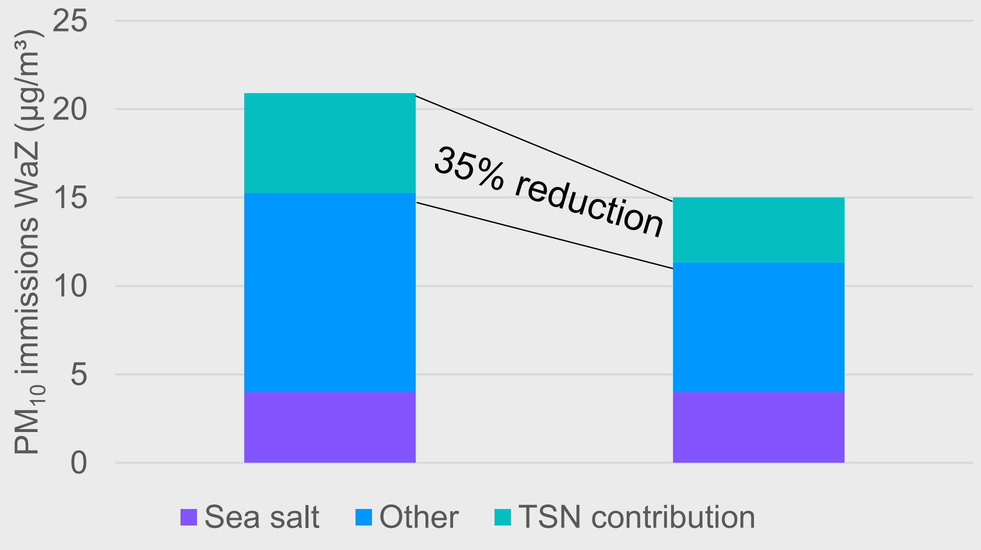
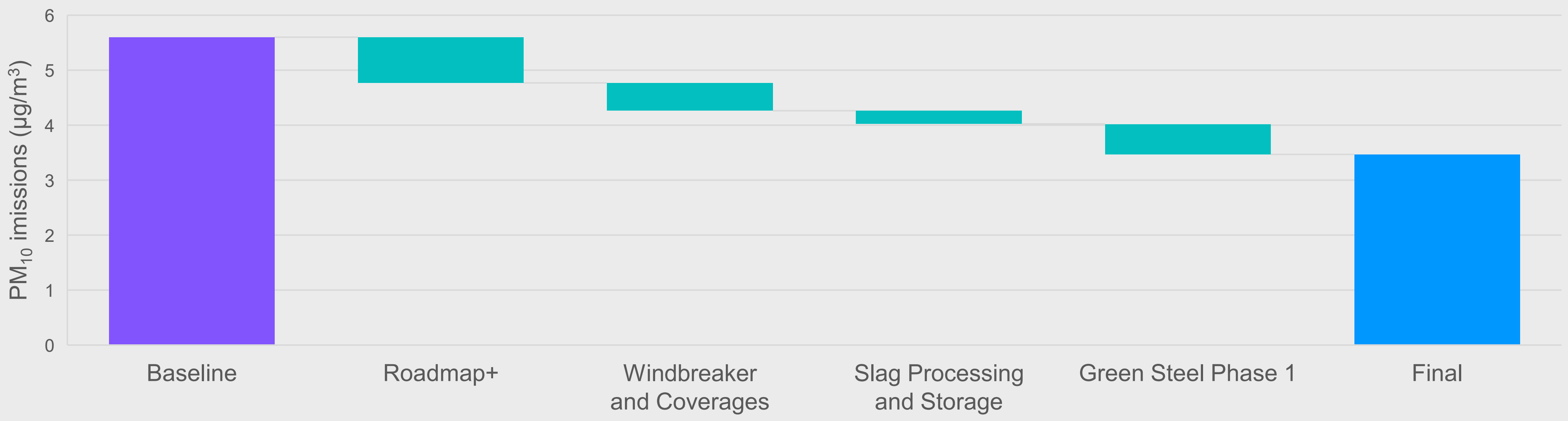


Figure 11. TSN's predicted PM_{10} immission contribution reductions in WaZ [6]



Uncertainties were identified, that are partly inherent to PM_{10} calculation, however this may result in falling short of the reduction target.

Impact on the nearby area

Although the analysis focuses on WaZ, other nearby areas such as IJmuiden will also experience improvements, though the magnitude will vary depending on proximity, wind direction, and dispersion patterns.

Roadmap+ (~15% reduction)

Roadmap+ measures, already being implemented and not part of the tailor-made agreement funding and this review, are expected to reduce PM_{10} immissions by ~0.8 µg/m³ (~15%). This reduction is included in the total reduction target of 35%, as agreed upon in the JLoI.

Green Steel Phase 1 (~10% reduction)

Green Steel Phase 1 is predicted to reduce PM_{10} immissions by ~0.5 µg/m³ (~10%). This reduction results from:

- Lower channelled emissions from new DRP and EAF assets.
- Decommissioning of assets.
- Reduced stockyard activity due to process changes.

Baseline emissions were derived from monitored data reported to authorities, while future emissions incorporate guaranteed limits from equipment suppliers. TSN has refined these calculations as design details evolved, ensuring the use of the most accurate available data.

Windbreaker and Coverages (~9% reduction)

Measures include a windbreaker at MV1 and coverages at MV2, EO2, and SOP3. These are predicted to reduce PM_{10} immissions by ~0.5 µg/m³ (~9%) (see Figure 12). As detailed on page 15, TSN's calculations have used emission factors from national guidance and dispersion modelling by an independent consultant. Reduction factors applied (90% for full coverages and 50% for the windbreaker) are supported by published literature and wind simulation data. This methodology aligns with industry best practice, however the predicted reductions are subject to uncertainty due to the cumulative effects of:

- Emission factor assumptions.
- Dispersion modelling outputs.
- Application of reduction factors.

TSN has not undertaken a formal uncertainty analysis to quantify the range and likelihood of potential immissions reductions.

While some monitoring data has been incorporated into TSN's analysis, there is scope to expand this further. In particular, future reporting could benefit from targeted monitoring that isolates immissions contributions from individual stockpiles, thereby refining the methodology and improving accuracy.

Slag Processing and Storage (~4% reduction)

Slag processing at chain partners Harsco and PHY is projected to increase emissions due to higher slag volumes. Proposed measures at TSN chain partners are included in the tailor-made agreement, to offset this. Proposed Slag Processing and Storage subproject is expected to achieve a net reduction of ~0.2 µg/m³, after adjusting for the predicted increase. These measures are essential to meet the 35% target. Calculations have been provided which support this claimed reduction; however, they are subject to notable uncertainties concerning suitability of emissions factors, dispersion modelling and the expected effectiveness of measures within the Slag Processing and Storage subproject.

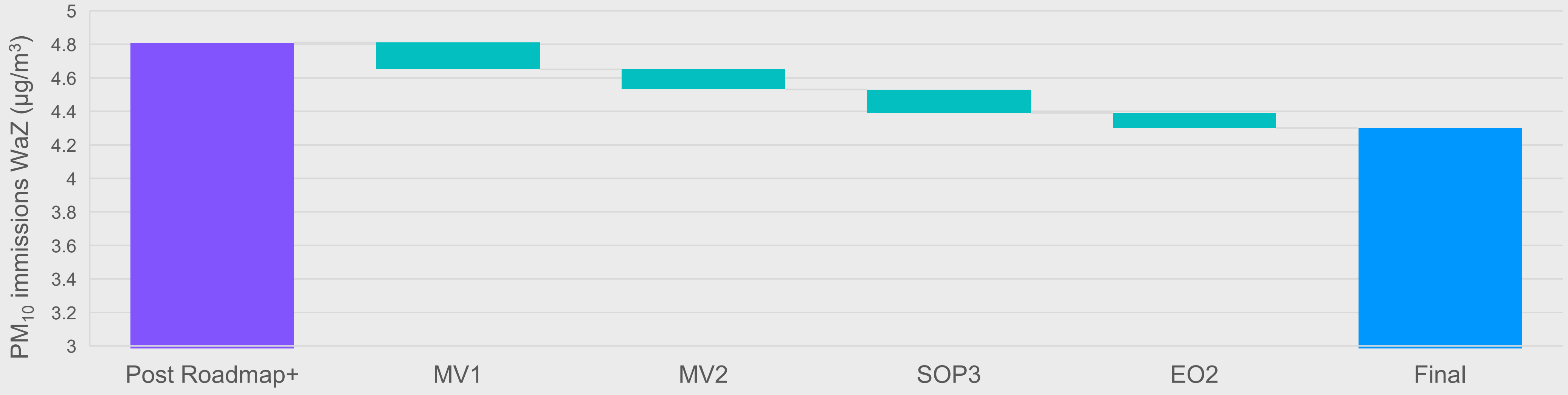
Monitoring strategy

To ensure the predicted reductions are achieved by TSN, a comprehensive monitoring strategy is required and to be agreed with relevant stakeholders. This strategy should include:

- Define pollutants to be monitored.
- Establish review frequency.
- Identify data sources and monitoring sites.
- Specify analytical methods, including statistical approaches.
- Address limitations and mitigation measures.

Monitoring will provide transparency, verify performance, and allow adjustments if actual reductions differ from predictions.

Figure 12. PM_{10} immission reduction in WaZ from the Windbreaker and Coverages [6]



Conclusion

TSN has undertaken a comprehensive assessment of PM_{10} emissions and their immission contribution at WaZ. The methodology adopted uses national guidance documents, published values and industry standard dispersion modelling software to calculate the predicted improvements. Considering the information provided, the targeted maximum of 467 tpa in PM_{10} emissions and a minimum of 35% reduction in PM_{10} immissions contribution at WaZ is achievable. However, uncertainties remain which could result in falling short of these targets. Nevertheless, the tailor-made agreement will make TSN fully responsible for achieving these targets. A monitoring strategy will be developed, as part of the tailor-made agreements, and agreed with relevant stakeholders to monitor ongoing performance of the measures.

Tata Steel Netherlands is targeting to reduce channelled emissions (e.g. emissions from chimneys) and it is likely that the reduction target can be achieved with the proposed projects.

Mott MacDonald reviewed TSN's calculations for emissions from channelled sources (pollutants released through chimneys) for the baseline and predicted emission reductions under Green Steel Phase 1. The review assessed the methodology, assumptions, and data sources used to estimate baseline and future emissions, as well as the approach to odour impact review.

Methodology and data sources

TSN's emissions calculations for existing assets are based on actual monitoring data collected between 2019 and 2023 at multiple emission points, which are reported to the authorities. Emissions for baseline and post-Roadmap+ scenarios were adjusted to reflect the representative and agreed production volume of 7.23 Mtpa of LS, while post-Green Steel Phase 1 emissions account for reduced production capacity for the new processes (6.8 Mtpa LS). Calculated emissions likely represent higher production volumes than will occur in practice, meaning emissions after implementation of Green Steel Phase 1 are potentially overstated, creating headroom for any uncertainties. Additional sources associated with TSN such as chain partners and mobile sources have also been included in TSN's calculations.

For the calculation of emissions from new assets associated with the Green Steel Phase 1 project, including the DRP and EAF, TSN has incorporated design emissions limits from equipment suppliers, and TSN has refined its approach as new data became available, reducing uncertainty over time. The methodology underpinning these predictions is robust and aligns with best practice.

Predicted emission reductions

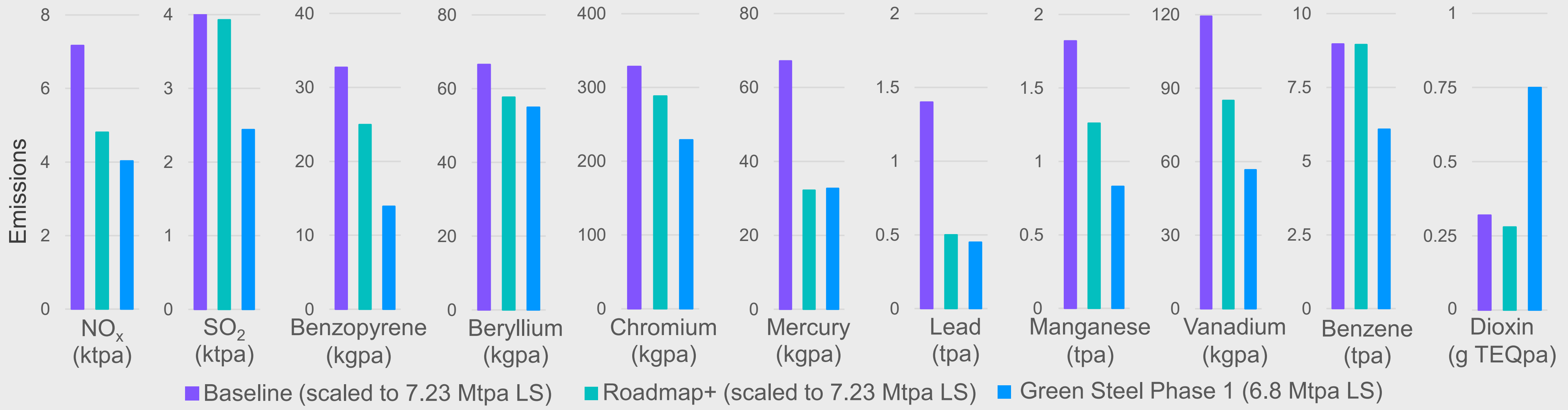
For each pollutant presented below except for dioxins, reductions in emissions are predicted after Roadmap+ and after Green Steel Phase 1 relative to the baseline. This reflects improvements in emissions after the implementation of changes to TSN's installations associated with these projects. For example, Roadmap+ measures at the pellet plant are predicted to reduce NO_X emissions by ~30%, while the DRP-EAF project is predicted to reduce NO_X emissions by a further ~10%.

The impact of changes to TSN's installations together with changing production levels across different pollutants is highly complex, resulting in varying levels of improvement. In the case of dioxins, the DRP and EAF are new sources which increase emissions with the Green Steel Phase 1 project relative to baseline. This calculation is based on provided emission levels from the equipment suppliers. Although this is an unwanted trade-off of Green Steel Phase 1, TSN's approach remains transparent, and calculations aligns with best practice.

Odour impact review

Odour impacts were reviewed independently as part of the EIA using best-practice dispersion modelling [14]. The closure of CGP2 and BF7 is expected to reduce odour emissions, while new sources from DRP and EAF will be introduced. Overall, Green Steel Phase 1 is predicted to result in a net reduction in odour emissions, consistent with the Provincial Odour Decision of 22 May 2022 [4].

Figure 13. Predicted channelled emissions [6]



Conclusion

The methodology behind TSN's calculations of channelled emissions is robust and uses monitoring data submitted to authorities and information provided by equipment suppliers. From the information reviewed the predicted reductions in emissions are likely to be achieved. Future emissions will continue to be monitored and reported to the authorities. The approach to assess odour is robust and predicted changes align with the Provincial Odour Decision dated 22 May 2022.

Environmental Review – Noise measures

Noise nuisance is mainly attributed to peak and tonal noise. Additional monitoring will be developed to identify noise sources. No noticeable changes are expected in average noise levels.

Environmental noise from the TSN site has been a concern for surrounding communities, particularly WaZ, Beverwijk, and IJmuiden. Reducing noise nuisance is included in the JLoI due to the history of complaints and the wide area affected. Noise is differentiated into average noise levels and peak and tonal noises, of which nuisance is mainly a result of peak and tonal noises.

Green Steel Phase 1 noise measures

A noise impact assessment was performed as part of the EIA [15]. The study evaluated noise during three phases: construction, transition (testing and commissioning alongside normal operations), and full operation of the DRP-EAF facilities. For the transition phase, two approaches were considered: Best Available Techniques (BAT) and measures beyond BAT (BAT+). TSN has selected BAT+ technology for the transition phase, as permit limits would be exceeded if BAT is selected. Furthermore, BAT+ measures are also selected for the operational phase after full implementation of Green Steel Phase 1.

Predicted changes in average noise levels

The assessment predicts that average noise levels in WaZ and IJmuiden will decrease slightly after implementation of the Green Steel Phase 1 (Figure 14). The reductions are less than 1 dB, which is generally considered imperceptible under normal conditions (a 1 dB change is the smallest detectable in controlled environments, while 3 dB is readily noticeable). Although these changes may not be perceptible individually, they are expected to contribute to an overall improvement in ambient noise perception. It should be noted that this study only considers the Green Steel Phase 1, Additional Environmental and Health Measures were not included.

Peak and tonal noise

Peak and tonal noises have historically been the main source of complaints, often linked to activities such as scrap handling, steel strip movement, railway operations, fans, transformers, and pumps. TSN monitors noise and complaints using modelling tools to identify risks and investigate reported issues. In 90% of cases, no direct correlation between complaints and noise source was found, as a result of complexity of multiple noise sources. Measures already implemented, such as a "traffic light" monitoring system for scrapyard operators and installation of a noise barrier, have significantly reduced complaints.

Measures agreed in the JLoI to address peak and tonal noise include:

- **Noise Monitoring System:** Current monitoring systems cannot reliably link peak and tonal noise nuisance to specific site activities. A new monitoring system is therefore proposed as part of the Additional Environmental and Health Measures to identify noise sources and subsequently being able to take specific measures to reduce nuisance.
- **Enclosure of SOP3:** TSN proposes enclosing SOP3 to further reduce noise emissions. Although, its effectiveness for noise nuisance mitigation has not been demonstrated, the measure will result in a reduction in PM_{10} immissions (as outlined on page 18).

Figure 14. Long-term average noise levels [15]

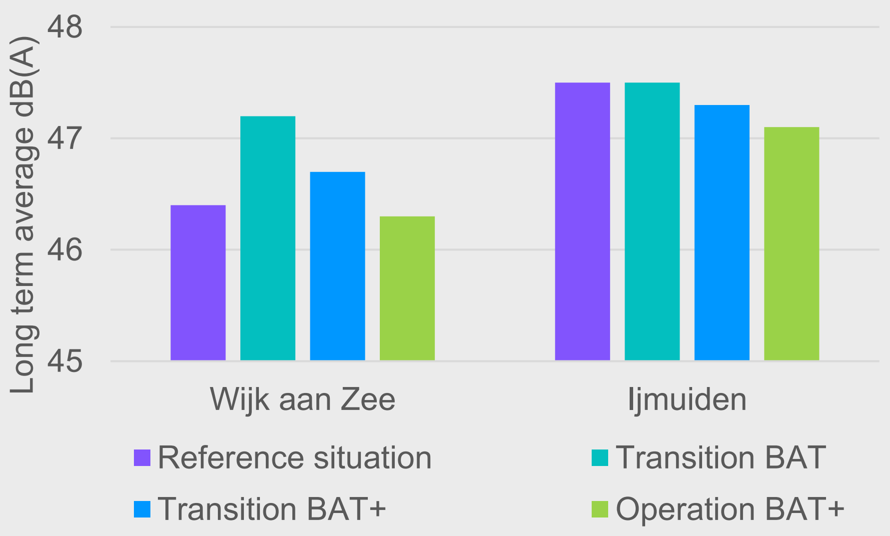


Figure 15. Concrete block noise barrier at the scrapyard [6]

Conclusion

Noise nuisance is mainly attributed to peak and tonal noises, however TSN has not been able to identify the sources of the complaints. As such, additional monitoring is proposed as part of the Additional Environmental and Health Measures to further understand peak and tonal noises. Subsequently, TSN will be able to take measures to reduce nuisance. Average noise levels have been assessed and are not expected to change noticeably after implementation of the Green Steel Phase 1. The approach to the assessment is robust and aligns with industry standards.

Lastly, although covering SOP3 will result in reduction in PM_{10} emissions and immisions, the effectiveness for noise nuisance has not been demonstrated.

4. ENGINEERING AND TECHNOLOGY REVIEW

4.1 Engineering and Technology Review – Engineering of subprojects DRP-EAF and Windbreaker and Coverages

The Engineering and Technology selection approach taken by Tata Steel Netherlands is considered appropriate and has further progressed since starting the review.

The Engineering and Technology Reviews of Green Steel Phase 1, and windbreaker and coverages, were conducted in 2024 and early 2025. These reviews are now known to be (partly) outdated, as TSN is still advancing the engineering documentation required to reach FID. Consequently, the current situation may differ from what is described below.

However, earlier reviews did not identify any major technical roadblocks for these topics from the government's perspective. Most of the technology-related uncertainties identified primarily affect cost and schedule. Under the JLoI, these risks remain with TSN, as the agreement specifies performance-based targets.

DRP-EAF

The DRP-EAF route was selected for its lower investment requirements, reduced technical uncertainties compared to alternatives, and ability to achieve significant CO_2 reductions through increased scrap recycling without relying heavily on green hydrogen.

An Engineering and Technology Review in Q2 2024 concluded that TSN's engineering approach for DRP-EAF development was generally appropriate. The most significant uncertainty identified related to the feasibility of processing EAF slag.

Following this risk, the technology readiness of EAF slag processing was assessed in more detail in Q2 2025, please refer to page 23.

Several other uncertainties were identified, including:

- Raw Material Supply: Securing sufficient high-grade iron ore.
- Steel Quality: Limitations in liquid steel quality and the steel grades that can be achieved.
- By-Product Management: Processing of slag and zinc-containing residues (see page 21).

TSN demonstrated awareness of these issues and provided appropriate roadmaps for mitigation.

Windbreaker and Coverages

- A review of the superseded coverage plan (Q2–Q3 2024) noted that TSN applied a structured selection process, considering technology readiness, robustness, and cost. Identified risks, such as ventilation system performance and emissions from uncovered ship unloading points, were not considered critical at that stage.
- TSN revised its plan in Q4 2024, but this updated design has not yet been reviewed. Given the lower complexity of sheds, domes, and windbreakers, no major technical concerns are expected.

Schedule Review

- A schedule review in Q2 2025 highlighted significant risks of delay due to permitting procedures. These risks have since materialised, and TSN has developed a new schedule, which has not yet been submitted for review.

Figure 16. 3D model Green Steel Phase 1 [6]

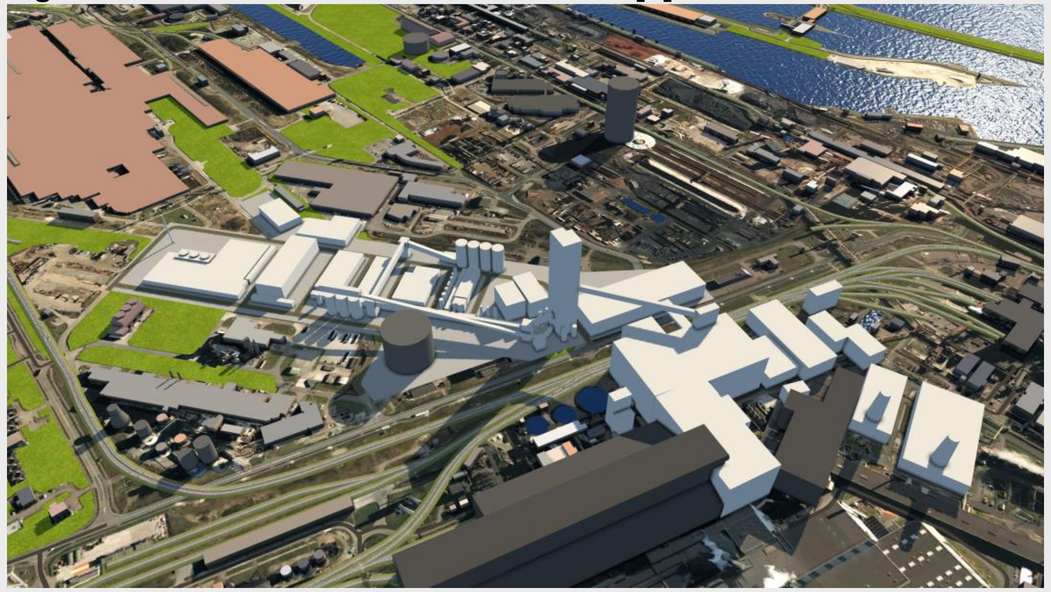


Figure 17. 3D models coverages [6]

Conclusion

TSN is still advancing the engineering documentation required to reach FID. Earlier reviews did not identify major technical barriers for DRP-EAF, Windbreaker and Coverages. The most significant uncertainty in Q2 2025 was the feasibility of EAF slag processing, which will be discussed in more detail on page 21.

Engineering and Technology Review – Slag Processing and Application

Significant uncertainties and challenges in EAF Slag Processing and Application were identified.

Slag is a by-product of steelmaking. With the transition from blast furnace to EAF technology, TSN expects to produce approximately 600 ktpa of EAF slag. TSN plans to process this material into a marketable product, primarily for use as a Supplementary Cementitious Material (SCM), a material added to cement to improve durability and reduce carbon footprint of the cement industry.

TSN has started developing its strategy for processing and applying EAF slag in Q4 2024 and the development was reviewed in Q2 2025 by Mott MacDonald. As the project is in an early stage, TSN has not provided a complete documented overview of the project, and significant uncertainties and challenges are identified.

Technology selection and readiness level

TSN has selected water granulation as the preferred processing method after evaluating alternatives. This process rapidly cools molten slag with water jets to form glass-like granules (Figure 18). TSN currently uses water granulation for blast furnace slag, which is widely used as SCM.

Water granulation for EAF slag is not yet proven at industrial scale. The most advanced project is at TRL7 (prototype stage) and is not expected to reach commercial readiness before 2027/2028. Water granulation is currently in an early stage of development and scaling up from a pilot facility to TSN's required capacity (600 ktpa) appears highly challenging given the required operation date in 2030. Safety and noise issues, caused by hydrogen formation and ignition, have previously halted similar projects. These risks have to be taken into account and mitigated by TSN in the next engineering phases.

Application as SCM

Unlike blast furnace slag, EAF slag is not yet standardised for use as SCM. TSN aims to obtain certification, but this may require additional testing and expert review, with no guarantee of approval. Performance testing of EAF slag for SCM application is incomplete, and for some tests that were performed, early strength development of cement mixes are below performance of SCM with BF slag but above SCM with limestone flower. Given the preference for replacing BF slag, due to a higher expected market volume, early-age performance remains a concern.

In addition, long-term durability data is not yet available, which is critical for certification and market acceptance. Without this data, the suitability of EAF slag for structural applications cannot be confirmed.

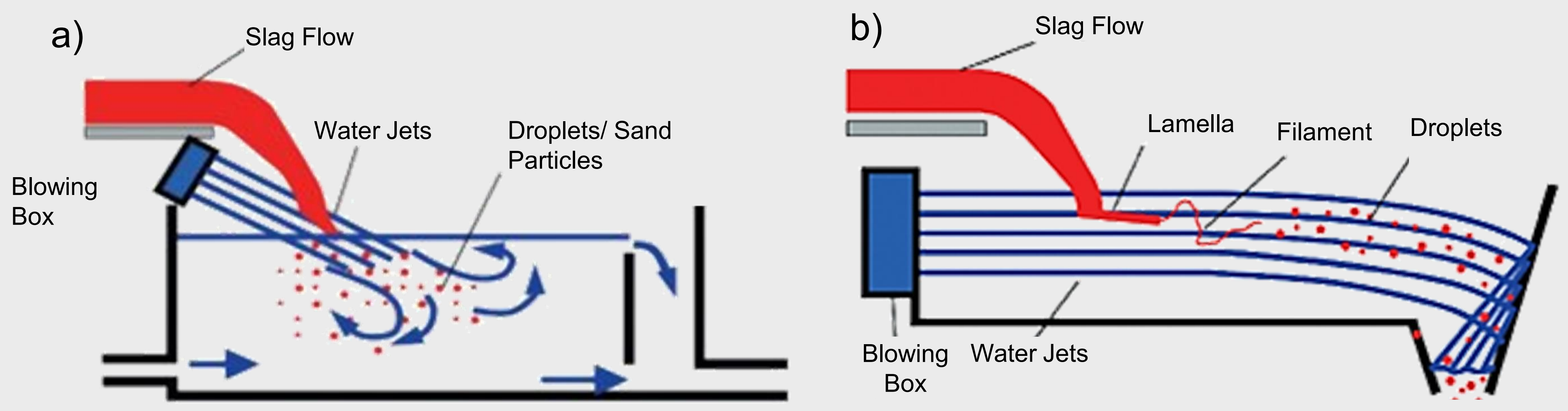
Leaching and environmental compliance

The leaching properties of SCM (bound application) from EAF slag appear to comply with the regulatory requirements. Limited leaching of Vanadium (V) and Chromium (Cr) was observed during the standardised leaching test. Results have not yet been independently verified and remain under non-disclosure agreement. Second-life leaching tests have not yet been performed. TSN expects to publish additional results later in Q3/4 2025.

Future regulatory changes on heavy metals could significantly impact the viability of slag applications. TSN has acknowledged that stricter limits on chromium and vanadium could pose a major challenge.

It should be noted the above-mentioned uncertainties do not affect TSN only but is a wider issue affecting the steel industry in Europe. Other companies like Ecocem & ArcelorMittal, are facing similar issues and progressing in development [17]. TSN is engineering quench cooling as a fallback option. This technology is proven and already applied by Harsco in other locations. This provides an alternative if water granulation cannot be implemented in time, however application of the formed product in SCM remains a challenge.

Figure 18. Two Water Granulation Concepts [16]



Conclusion

TSN's slag processing and application plan is in early stages of development. The current plan relies on a technology and application pathway that is not yet proven at the required scale. Significant challenges and uncertainties remain regarding technical feasibility, certification, and environmental compliance. A clear and detailed development roadmap, supported by OEM commitments and independent testing, will be essential to reduce these uncertainties. Due to the uncertainties with water granulation, TSN is engineering quench cooling as fallback option, which is considered a more proven technology, although challenges with SCM application remain.

5. COST REVIEW

The CapEx estimate for Green Steel Phase 1 is well developed, however the cost contingency is considered optimistic.

Mott MacDonald reviewed TSN's CapEx estimates for the Green Steel Phase 1. The review assessed the methodology, assumptions, and completeness of the estimates, as well as the adequacy of contingency and risk provisions. The findings reflect the project's current Front-End Loading (FEL3) stage and associated uncertainties.

CapEx overview

TSN's total CapEx allowance for Green Steel Phase 1 is approximately €3.6 billion, excluding contingency and risk provisions. When these are included, the total rises to around €4.5 billion. The estimate is structured across three phases (see Figure 19):

- **Definition Phase** – Engineering and planning prior to FID.
- **Execution Phase** – Procurement, construction, and commissioning.
- **Closure Phase** – Post-commissioning activities and demobilisation.

The estimate follows the AACE Class 3 methodology, widely used in the energy and construction sectors, and carries an indicative accuracy range of -20% to +30%, consistent with the current level of project definition [9].

Basis of Estimate

The estimate draws on multiple data sources, including:

- Material take-off lists and equipment lists.
- Vendor quotations and OEM budget estimates.
- Industry benchmarks and in-house cost databases (e.g., CESK [18]).

The base date for pricing is Q4 2024, with escalation and inflation applied at work-pack level based on procurement timelines.

Definition Phase

The allowance of €90 million is considered reasonable, given that a significant portion has already been incurred.

Execution Phase

This phase accounts for 97% of total CapEx. Key observations:

- **DRP and EAF:** Represent 65% of execution costs. Budgets are based on periodically updated vendor quotes, which are currently time-expired, but still considered broadly representative. TSN expects to receive updated quotes after completion of Basic Engineering end of September 2025.
- **Cost basis:** ~3% of costs are supported by vendor quotes, ~13% by budget estimates, ~70% by TSN in-house estimates, and ~14% by other sources.
- **Integrated project management team:** Represents 18% of CapEx, which is within the expected range (15–20%).
- **Other work packs:** Benchmarked against Mott MacDonald's cost database and considered reasonable overall.

Closure Phase

Represents 0.2% of total CapEx, covering post-commissioning and demobilisation. This is consistent with expectations for this stage of project development.

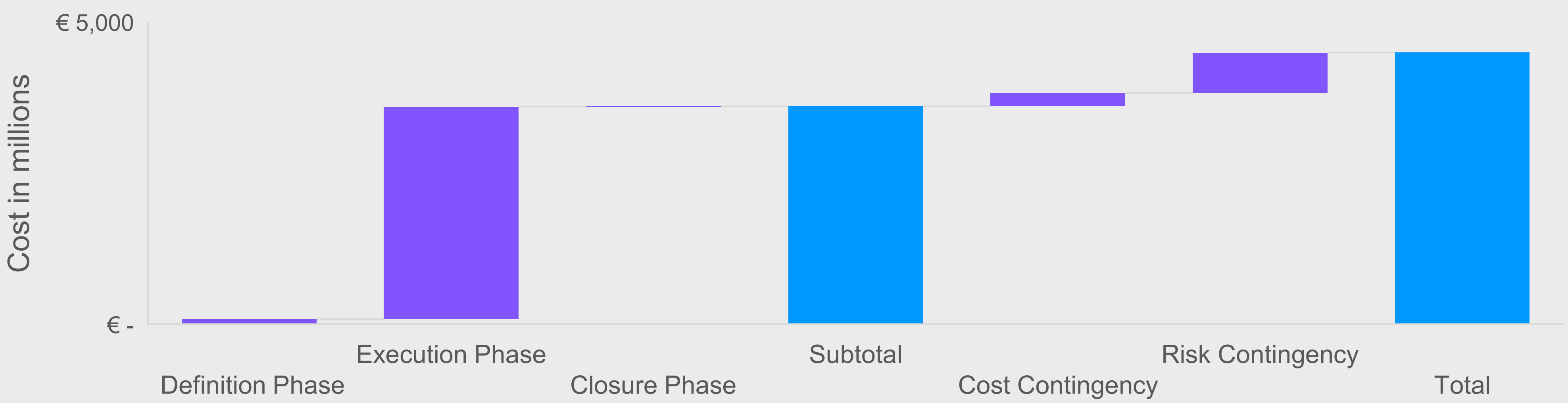
Contingency and risk provisions

In addition to the €3.6 billion base estimate:

- **Cost contingency:** TSN has included 6%, which is considered low given the level of definition. A contingency of ~10% would be more appropriate.
- **Risk contigency:** Currently 19%, based on an outdated risk assessment, but considered broadly reasonable.

Combined, these allowances increase the total estimated CapEx to ~€4.5 billion.

Figure 19. Phase-by-Phase and Total CapEx for Green Steel Phase 1 [6]



Conclusion

TSN estimates the CapEx for Green Steel Phase 1 at approximately €4.5 billion, including contingency. The estimate represents a FEL3 or AACE Class 3 estimate with an accuracy range of -20% to +30%. The methodology applied is following industrial standards and makes use of vendor quotes and in-house data. Mott MacDonald considers the cost contingency of 6% optimistic, considering the current level of development, a cost contingency of 10% is considered more appropriate.

5.2

Cost Review – Coverages and Windbreaker

The CapEx estimate for the Windbreaker and Coverages carries a higher uncertainty as coverage EO2 accounts for 60% of the cost and has the lowest accuracy level.

Mott MacDonald reviewed TSN's CapEx estimates for the Windbreaker and Coverages. The review assessed the methodology, assumptions, and completeness of the estimates, as well as the adequacy of contingency and risk provisions.

CapEx overview

TSN's total CapEx allowance for the Windbreaker and Coverages project is approximately €465 million, divided across four main storage areas (EO2, MV1, MV2, SOP3) and General Utilities (Figure 20). The estimate is structured as follows:

- **EO2 Domes:** ~€275 million.
- **MV1, MV2, SOP3 & General Utilities:** ~€190 million.

MV1, MV2, SOP3 and General Utilities – FEL3

The methodology for these estimates is appropriate and consistent with industry standards for FEL3 cost estimates.

- **MV1 and MV2:** Data accuracy is medium to high (Figure 21), supported by budget quotes and benchmarks.
- **SOP3 and General Utilities:** Data has a lower accuracy, with limited breakdowns and reliance on in-house estimates. No detailed breakdown was provided for project management office costs, which introduces uncertainty.
- **Contingency:** for general utilities is lower than for other areas, despite higher uncertainty.

EO2 – FEL1/2

EO2 accounts for 60% of total project costs (~€275 million) and is at FEL1/2 maturity. Current contingency is 17%, which is low given the early stage and identified issues. A contingency of 25% is considered more appropriate. As this estimate accounts for 60% of the total programme costs, this significantly affects the total integrity of the cost estimate.

Figure 20. CapEx estimate Windbreaker and Coverages [6]

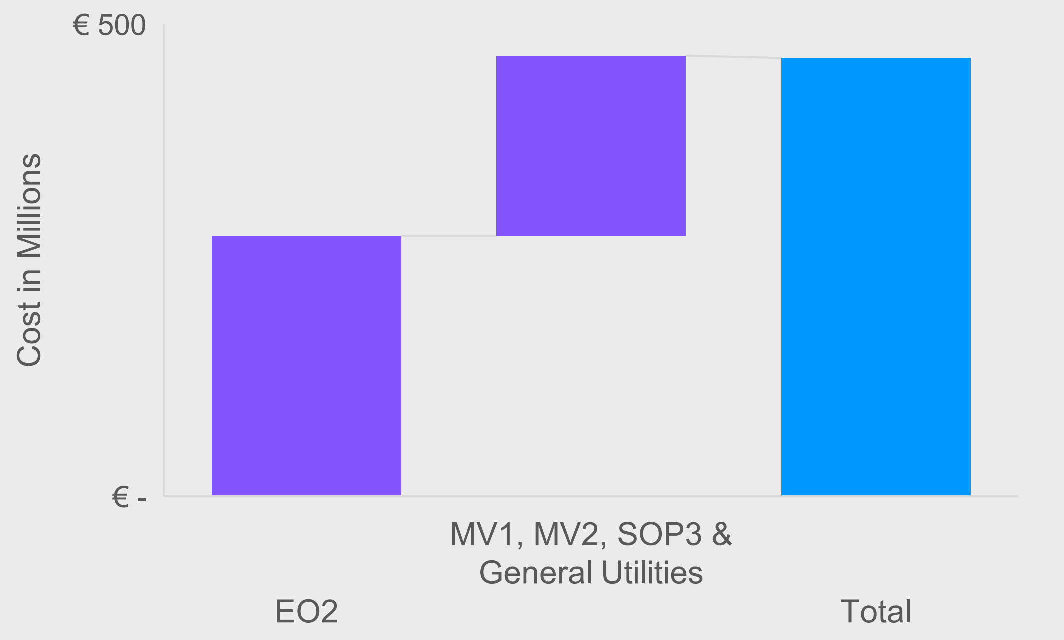
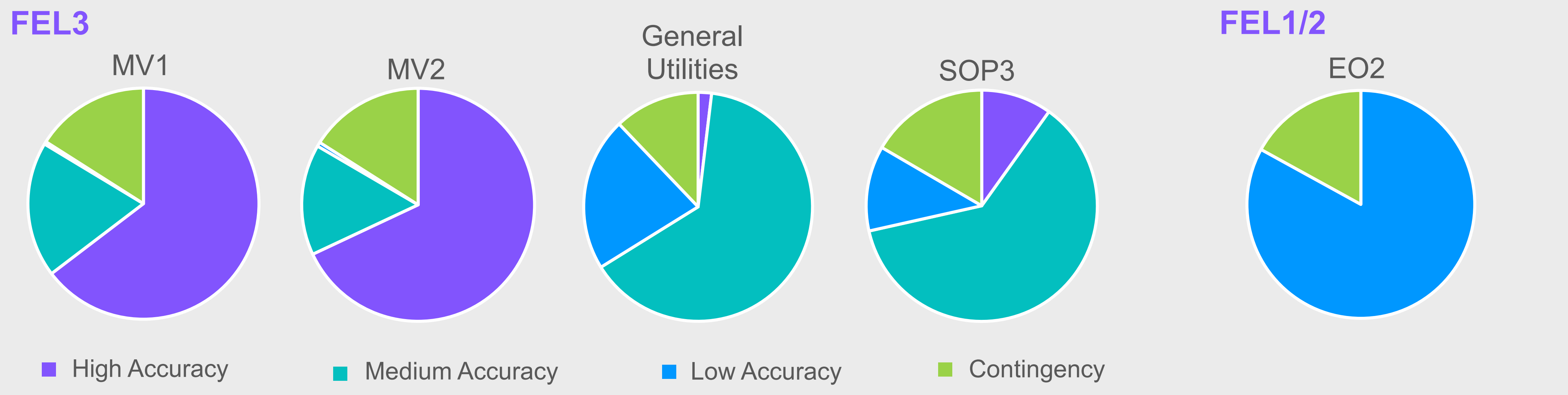


Figure 21. Accuracy of the CapEx estimates per asset [6]



Conclusion

TSN estimates the CapEx for the Windbreaker and Coverages subproject at approximately €465 million, including contingency. The estimate for MV1, MV2, SOP3 and General Utilities represent a FEL3 or AACE Class 3 and the estimate for EO2 represents a FEL1/2 or Class 4/5. A continency of 17% is applied to EO2, this is considered optimistic and a contingency of 25% is considered more appropriate. As EO2 accounts for approximately 60% of the total estimate, the total accuracy is estimated at -30% to +40%.

5.3 Cost Review – Slag Processing and Storage

The CapEx estimate for Slag Processing and Storage is in an early stage with a high level of uncertainty, but an appropriate level of contingency allocated.

Mott MacDonald reviewed TSN's CapEx estimate for the Slag Processing and Storage subproject, which is a critical component of Green Steel Phase 1. Given the early stage of definition, the estimate is classified as FEL1, carrying a high degree of uncertainty. The review assessed the methodology, assumptions, and adequacy of applied uplifts and contingencies.

CapEx Overview

TSN's total CapEx allowance for the Slag Processing and Storage subproject is approximately €275 million. The estimate is based on a conceptual design and is classified as FEL1, indicating a high level of uncertainty (±40-50%). The estimate comprises the following work packs:

- **Direct cost:** Estimated at approximately €145 million, includes buildings and gas cleaning, windbreaker PHY, metal recovery plant and humidification and sieve installation.
- **Indirect Costs**: ~30% uplift on direct costs.
- **Owner's Costs:** ~15% uplift on indirect costs.
- **Contingency:** ~30% uplift on total costs.

Buildings and gas cleaning

The largest cost component is the gas cleaning system. Estimate is based on a prior quotation from an equipment supplier. No detailed breakdown was provided, and it is unclear if the system meets current project requirements. Further specification is needed to validate scope and appropriateness of the estimate.

Windbreaker PHY

The estimate is derived using a parametric approach, referencing the MV1 windbreaker. The design is based on a desktop study and pro-rata scaling, which introduces uncertainty and potential for optimisation.

Metal recovery plant

The estimate uses historical data from similar systems. The proposed flow rate is 500,000 m³/h, with the estimate scaled down from larger reference plants. The approach is considered reasonable.

Humidification and sieve installation

Based on quotes and reference projects. Considering the stage of development and minor contribution to the overall estimate, this is considered appropriate.

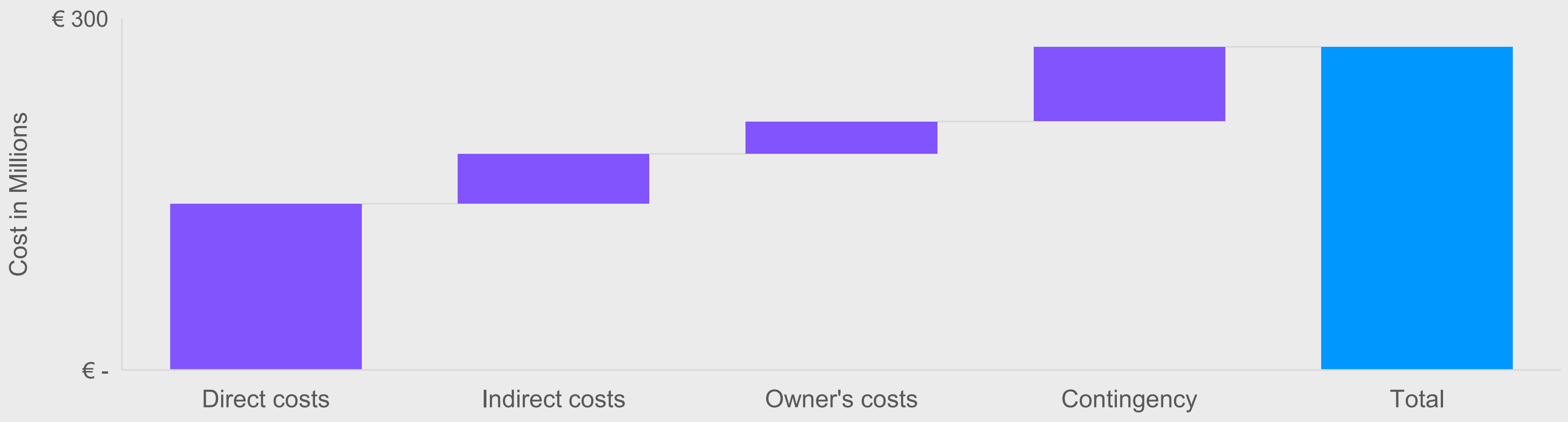
Contingency, indirect and owner's Costs

An indirect cost uplift of 30% is applied to the direct estimate, covering site setup, project management, health and safety, permitting, logistics, and administration. A further 15% uplift is applied to account for owner's costs. Both uplifts are appropriate for this stage of project development.

Contingency

A contingency of 30% is applied to the total estimate. This is in line with expectations for FEL1 maturity.

Figure 22. Total CapEx Slag Processing and Storage [6]



Conclusion

The CapEx estimate for subproject Slag Processing and Storage is estimated at approximately €275 million including contingency. The subproject is at an early stage of development, and representing a FEL1 estimate or AACE class 5, with an estimated accuracy of ±40-50%.

Several components are based on indicative or parametric methods. While the overall structure and uplift provisions are consistent with industry norms, the lack of detailed breakdowns and reliance on conceptual inputs introduce uncertainty.

6. EXCLUSIONS AND LITERATURE

Exclusions

- This study does not provide any insights into the health effects corresponding to the reviewed pollutants. This is part of the gezondheidseffectrapportage.
- The future scenario NO_X, SO_2, SVHC emissions are calculated using outputs from TSN's Carbon (reduction) Selection Model (CSM) at 6.8 Mtpa production of Liquid Steel production as in line with the EIA. The CSM outputs and other data inputs to TSN's emissions model for a scenario with 6.8 Mtpa of LS production have not been reviewed; however, scenarios for 7.23 Mtpa of LS and Green Steel Phase 1 have been reviewed in detail and accepted, confirming the methodology used is appropriate.
- TSN's modelled emissions are based on historical data and future scenarios are based on balanced situation, operating philosophies and modelling of most likely operating scenarios with average meteorological conditions to inform policy decisions. In reality, the exact values can differentiate and are subject to topics like disturbances, maintenance and market activities. Therefore, the values should not be considered as exact values rather an estimate of reductions that could be achieved. The numbers generated by TSN have been reviewed within this context.
- Green Steel phase 2 is not part of this review.
- Roadmap + is not reviewed as this is not part of the tailor-made agreement. The environmental effects, e.g. PM10 reduction, were taken 'as-is' and were not challenged by Mott MacDonald.
- This review only assessed the appropriateness of the applied methodology and applied assumptions in the predictions. The assessments does not provide any insights into the actual feasibility of the project details as these have not been part of this review.
- Technology selection & engineering approach of Green Steel phase 1 and the Additional Environmental and Health Measures have been evaluated in summer 2024, any updates after this date have not been included in this review.
- Received monitoring data have been accepted and verification of this data is not part of this review.

Literature

TSN company information is used throughout the report which has been received directly from TSN for execution of this review. The information has been included in this report with approval of TSN.

1. Klimaatwet. (2019, 2 juli). https://wetten.overheid.nl/BWBR0042394/2023-07-22
2. Centraal Bureau voor de Statistiek. (z.d.). Welke sectoren stoten broeikasgassen uit? https://www.cbs.nl/nl-nl/dossier/dossier-broeikasgassen/welke-sectoren-stoten-broeikasgassen-uit
3. Nederlandse Emissieautoriteit. (2025, 15 april). Emissiecijfers 2021–2024. https://www.emissieautoriteit.nl/documenten/2024/04/15/emissiecijfers-2021-2024
4. Ministerie van Klimaat en Groene Groei. (2025). Joint Letter of Intent.
5. Ministerie van Landbouw, Natuur en Voedselkwaliteit. (2025, februari). Top 100 bedrijven stikstofoxiden. https://stikstofinfo.net/wp-content/uploads/2025/02/top-100-bedrijven_-stikstofoxiden.pdf
6. TSN. (2025). Figure as part of TSN's company information that has been received as part of this review and has been included with TSN's approval.
7. European Commission. (2024). Commission Implementing Regulation (EU) 2024/2493. https://eur-lex.europa.eu/eli/reg_impl/2024/2493/oj
8. Rijksinstituut voor Volksgezondheid en Milieu (RIVM). (2023). De bijdrage van Tata Steel Nederland aan de gezondheidsrisico's van de omwonenden en de kwaliteit van hun leefomgeving (RIVM-rapport 2023-0171). https://www.rivm.nl/bibliotheek/rapporten/2023-0171.pdf
9. AACE International. (2020). Recommended Practice No. 18R-97: Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries.
10. Wind Harvest. (2023). Technology readiness levels: The path to commercialization. https://windharvest.com/blog/faq-items/what-are-technology-readiness-levels-and-where-is-wind-harvest-in-the-process/
11. Millennium Steel. (2019). Hydrogen-based steelmaking. https://www.millennium-steel.com/wp-content/uploads/2021/04/MS2019-22-MS19-16.pdf
12. World Health Organization. (2021). WHO global air quality guidelines: Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. https://www.who.int/publications/i/item/9789240034228
13. European Commission. (2024). Directive (EU) 2024/2881 of the European Parliament and of the Council of 23 October 2024 on ambient air quality and cleaner air for Europe (recast), PE/88/2024/REV/1. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024L2881
14. Royal HaskoningDHV. (2025). Detailstudie geur, MER Heracless – Groen Staal.
15. Royal HaskoningDHV. (2025). MER Groen Staal: Detailstudie geluid – Groen Staal.
16. Barati, M., & Jahanshahi, S. (2020). Granulation and heat recovery from metallurgical slags. Journal of Sustainable Metallurgy, 6, 191–206. https://doi.org/10.1007/s40831-020-00268-8
17. European Commission. (2025). *ENVIRONMENTALLY COMPATIBLE OPTIMIZATION OF EAF SLAG FOR LOW-CARBON ADVANCED GREEN CEMENT (ECO-SLAG-CEM)* (Project No. 101221259). CORDIS. https://cordis.europa.eu/project/id/101221259 https://doi.org/10.3030/101221259
18. Ceskdata. (2025). https://ceskdata.com/

Abbreviations

Abbreviation	Description	Abbreviation	Description
AACE	Association for the Advancement of Cost Engineering	LS	Liquid Steel
BAT	Best Available Techniques	Mtpa	Million tonnes per annum
BF	Blast Furnace	MV1	Mengveld 1
CapEx	Capital Expenditure	MV2	Mengveld 2
CCS	Carbon Capture & Storage	NO_x	Nitrogen Oxides
CESK	Cost Engineering Standard Knowledgebase	OEM	Original Equipment Manufacturer
CGP	Coke and Gas Plant	PHY	Pelt & Hooykaas
CO_2	Carbon Dioxide	PM_{10}	Particulate Matter (With Aerodynamic Diameter <10µm)
CSM	Carbon (reduction) Selection Model	RIVM	Rijksinstituut voor Volksgezondheid en Milieu (Dutch National Institute for Public Health and the Environment)
DRP	Direct Reduction Plant	SCM	Supplementary Cementitious Material
EAF	Electric Arc Furnace	SOP3	Scrap Storage 3
EIA	Environmental Impact Assesment	SO_2	Sulphur Dioxide
EO2	Erts Opslag 2	SVHC	Substance of very high concern
FEL0/1/2/3	Front-End Loading Phase 0/1/2/3	TRL	Technology Readiness Level
FID	Final Investment Decision	TSN	Tata Steel Netherlands
JLoI	Joint Letter of Intent	WaZ	Wijk aan Zee
KPI	Key Performance Indicator		

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Mott MacDonald BV, registered in the Netherlands under company number KVK 30199525, with its registered office located at Velperplein 23, 6811 AH Arnhem, has been contracted by the Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland – RVO), by order of the Ministry of Climate Policy and Green Growth, to prepare the Technical Advisory Report in support of the Joint Letter of Intent for Tata Steel Netherlands.

Mott MacDonald BV hereby grants consent for this report to be published on www.rijksoverheid.nl.

MOTT MACDONALD

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