°CICERO Shades of Green

Norsk Hydro ASA

Green Financing and Sustainability-Linked Financing Second Opinion

18 July 2022

Norsk Hydro ASA ("Hydro") is an integrated producer of aluminium that is active throughout the value chain, from energy production to bauxite mining and alumina refining, primary aluminium, extrusions, and recycling. The company is working to grow its renewable energy business and expand into battery production and energy storage. Hydro is headquartered in Oslo and listed on the Oslo Stock Exchange.

This is a second opinion on Hydro's green and sustainability-linked financing framework. Section 1 includes our assessment of Hydro's overall sustainability governance, including that of its green financing process. Section 2 contains our assessment of the green financing framework's use of proceeds. Section 3 covers our assessment of the sustainability-linked financing framework, including an assessment of the company's revenues and planned investments.

Hydro has a net zero by 2050 target for Scope 1 and 2 emissions and interim goals of reducing these emissions by 10% by 2025 and 30% by 2030 from a 2018 baseline. It is still in the process of setting a Scope 3 emissions reduction target. The company's decarbonization roadmap includes efficiency measures, piloting hydrogen use, developing its HalZero technology to eliminate hard-to-abate smelter emissions, and deploying carbon capture and storage (CCS). The company conducted an extensive assessment of transition and physical risks in 2017 that informs the integration of climate change into its corporate strategy. Hydro has robust policies and processes for managing climate and other sustainability risks in its own operations and supply chain. We give Hydro's governance procedures a score of **Excellent**.

Hydro's green financing framework

Project categories include manufacture of primary and secondary aluminium, renewable energy (hydropower, wind, solar), manufacture and recycling of batteries, manufacture of hydrogen, and energy storage (hydrogen, thermal, electricity). Capex and opex are eligible, as well as equity investments in companies that derive at least 90% of revenues from eligible project categories, with the remaining 10% of revenues subject to the framework's exclusion criteria. The framework excludes, i.a. projects that support fossil energy production.

Natural gas-powered aluminium recycling equipment is eligible under the framework and may entail emissions lock-in. It is also a pitfall that proceeds may be used to make minority equity investments, over which Hydro may have limited influence. Final project selection requires a consensus decision by Hydro's Green Finance Committee. Reporting will be aggregated across all outstanding green finance instruments, and impact reporting will distinguish between ex-ante and ex-post impacts but may not be externally verified.

The framework's criteria are likely aligned[1] with the technical screening criteria for corresponding activities in the EU Taxonomy. We have not assessed alignment with the specific DNSH criteria or minimum social safeguards but note that Hydro's extensive environmental and social safeguards aim at limiting harm to the other environmental objectives of the Taxonomy and focal risks of the minimum social safeguards.

We rate the green financing framework **CICERO Medium Green**. As Hydro has not determined the initial allocation of proceeds, the shading assumes equal allocation across all project categories.

SHADES OF GREEN

°CICERO Medium Green

GOVERNANCE ASSESSMENT

GREEN BOND AND LOAN PRINCIPLES

Based on this review, this Framework is found in alignment with the principles.

SUSTAINABILITY LINKED BOND AND LOAN PRINCIPLES

Based on this review, this Framework is found in alignment with the principles.

[1] We use the terminology *likely* aligned/partially aligned/not aligned to indicate the extent to which gaps have been identified with the eligibility criteria in the framework. The issuer will need to follow up in their annual reporting to confirm that only projects aligned with the criteria have received funding under the green finance framework.

Hydro's sustainability-linked financing framework

A Shade of Green was assigned to 39% of Hydro's 2021 revenues, with the remainder receiving a Yellow shading. Dark Green revenues (1.4%) came from the sale of hydropower to the grid. Medium Green revenues (37%) came from sales of primary aluminium that is aligned with the EU Taxonomy technical screening criteria for climate change mitigation, as well as sales of products made with secondary aluminium. Yellow revenues included non-Taxonomy aligned aluminium, as well as external sales of alumina. Note that aluminium revenues may qualify for different Shades of Green depending on the end use. For instance, Hydro shared that some of its aluminium is likely to be used in 2050 solutions such as battery electric vehicles and renewable energy components but was unable to provide sufficiently granular details for this to be reflected. Conversely, Hydro's aluminium could also be used in activities/technologies that have no role to play in a low-carbon future, e.g. internal combustion engine vehicles or fossil fuel production.

A Shade of Green was assigned to 61% of Hydro's 2022-2024 planned capex, with the remainder receiving a Yellow shading. Dark Green capex (14%) includes Hydro's investments in its HalZero technology, CCS and remelters for aluminium recycling. Medium Green capex (34%) includes planned investments in Taxonomy-aligned aluminium smelters, renewable energy and hydrogen. Light Green capex (13%) includes boiler electrification and the fuel switch project at the Alunorte alumina refinery and planned investments in the new business area of battery production and recycling. Yellow capex covers the opening of a new section of its Paragominas bauxite mine, investments in smelters producing non-Taxonomy aligned aluminium, and other sustaining capex. Based on this analysis, approximately 55% of planned capex may be eligible under Hydro's green finance framework. The analysis excludes capex for Hydro's announced offer to acquire Alumetal.[2]

Together, KPIs 1 and 2 (see table on next page) are material in terms of addressing Hydro's climate risks/impacts from its Scope 1 and 2 and Scope 3 emissions, respectively. Hydro shared that KPI 2 was selected as a proxy for Scope 3 emissions while it works on a Scope 3 emissions reduction target, as the large majority comes from cold metal and scrap aluminium sourcing. Investors should note that there will be Scope 3 emissions that remain unaddressed by KPI 2, particularly as Hydro increases natural gas use and expands into the areas of renewable energy, battery production, and other forms of energy storage. Hydro has not disclosed its considerations for possible Scope 3 emissions from natural gas production and transportion.

SPTs 1a and 1b are assessed as ambitious in relation to the Paris Agreement, although there are risks of emissions lock-in. Hydro's strategy to achieve SPTs 1a and 1b hinges on planned emissions reductions at its Alunorte refinery from the switch from fuel oil to natural gas and the electrification of steam boilers. It is a major pitfall that the former not only entails emissions lock-in at the refinery, but could also lock surrounding communities into natural gas use and delay investment in renewable energy. Hydro does not expect to achieve SPTs 1a and 1b by addressing smelter emissions; these are part of its post-2030 decarbonization pathway. Note that the carbon intensity of Hydro's aluminium production is already the lowest in the sector. It is a pitfall that changes to the baseline for SPTs 1a/1b can be made if they exceed 5%, but that there is no requirement to adjust the SPTs and/or seek external review.

SPT 2 is assessed as ambitious in relation to the Paris Agreement on the basis of the growth in post-consumer scrap (PCS) recycling capacity and the share of PCS in Hydro's total secondary aluminium production that the target would entail, provided Hydro's pre-consumer scrap capacity does not increase. Hydro has announced PCS recycling capacity additions that would achieve SPT 2, but could not disclose the projects' status and risks. Note that the acquisition of Alumetal would add ~150,000 tonnes of PCS recycling capacity—46% of the amount required by SPT 2. It is a pitfall that Hydro uses natural gas to melt aluminium scrap. Reductions to Hydro's emissions from increased recycling depend upon the displacement of primary aluminium production or pre-consumer scrap aluminium, and in the longer term, Hydro's plan to pilot hydrogen remelters in 2030.

[2] See https://www.hydro.com/en/media/news/2022/norsk-hydro-announces-tender-offer-for-100-of-the-shares-of-the-polish-recycler-alumetal-s.a/ and https://www.hydro.com/en/media/news/2022/hydro-is-extending-the-subscription-period-for-proposed-acquisition-of-alumetal-s.a/

Summary of KPI / SPT Assessment

Assessment of KPIs	KPI 1: Scope 1 & 2 absolute GHG emissions (million tonnes CO2e)	KPI 2: Post Consumer Scrap (PCS) Aluminium Recycling Capacity (tonnes)
Materiality	KPI 1 is material in terms of addressing Hydro's climate risks and impacts, but only if used together with KPI 2.	The KPI is material in terms of Hydro's intent to address Scope 3 emissions.
Strategic significance	The KPI is strategically significant.	The KPI is strategically significant.
Methodology	The methodology is robust and transparent.	The methodology is mostly robust and transparent; since KPI 2 is defined as the amount of PCS aluminium processed by Hydro's recycling plants, the extent to which it addresses Hydro's Scope 3 emissions depends on how much recycled aluminium is sold externally versus being used to substitute Hydro's own aluminium inputs.
Assessment of SPTs	**SPT 1a: Reduce KPI 1 by 30 percent by 2030 compared to 2018 baseline** **SPT 1b: Reduce KPI 1 by 10 percent by 2025 compared to 2018 baseline**	**SPT 2: Increase KPI 2 to 660,000 tonnes by 2025**
Own past performance	Ambitious vs own performance.	Ambitious vs own past performance in requiring technological innovation.
Peers	Ambitious vs immediate peers by requiring absolute emissions reductions.	Scope of ambition is beyond peers.
Science-based scenarios or international targets	Aligned with the Paris Agreement, although there is risk of emissions lock-in from Hydro's planned investments to achieve SPTs 1a/1b.	Aligned with the Paris Agreement on the basis of PCS recycling capacity growth and the share of PCS in Hydro's total secondary aluminium production that SPT 2 would entail, provided its pre-consumer scrap capacity does not increase.

CICERO Green has not reviewed the degree to which the variation in the financial characteristics is commensurate and meaningful. Investors are encouraged to review the term sheets in detail and conduct their own assessment of the financial characteristics of the SLBs.

°CICERO Shades of Green

Contents

1 Assessment of Hydro's sustainability governance

Company description

Hydro is an aluminium and energy company headquartered in Oslo, Norway. The company operates in more than 140 locations in more than 40 countries and is active across the aluminium value chain, from energy to bauxite mining and alumina refining, primary aluminium extrusions, and aluminium recycling. The company's five business areas include:

- Hydro Bauxite & Alumina: bauxite mining and alumina refining in Brazil
- Hydro Aluminium Metal: production of primary aluminium and value-added casthouse products
- Hydro Metal Markets: recycling of aluminium and sales, marketing and distribution of products from Hydro's primary metal and recycling plants
- Hydro Extrusions: recycling of aluminium and provider of extrusion-based aluminium solutions
- Hydro Energy: power production, operations, trading and consumption

Hydro was founded in 1905 and employs over 30,000 people. In 2021, the company had revenues of around NOK 150 billion and is listed on the Oslo Stock Exchange. As of Q1 2022, the company was 34% owned by the Norwegian Ministry of Trade, Industry and Fisheries, and 7% owned by the Government Pension Fund Norway (Folketrygdfondet).

Sector risk exposure

Physical climate risks:

- ✓ Increased frequency and severity of extreme weather events, e.g. floods, droughts, landslides, fires, storms, etc., will lead to increased damage to physical assets. Insurance coverage may become more expensive or unobtainable for the most exposed assets. Such events could increase disruptions to operations and supply chains, as well as impact companies' management of solid and hazardous waste, e.g. mine tailings and bauxite residues.

Transition risks:

- ✓ Due to the emissions and energy-intensive nature of mining, alumina refining, and aluminium smelting, companies in the sector are substantially exposed to carbon pricing and other climate regulation. Ongoing efforts to decarbonize among the wide range of aluminium end users increases market pressure to decarbonize, and failure to meet expectations could lead to declining market share and revenues.

Environmental risks:

- ✓ Bauxite mining and alumina refining are sources of multiple environmental impacts, including ecosystem conversion and biodiversity loss, emissions to air (e.g. particulate matter, nitrogen oxides, sulphur dioxide) and water/soil (metal oxides, sulphuric acid, cyanide, mercury, arsenic). Storage facilities for tailings and bauxite residues (red mud) must be carefully managed to avoid failure or leakage of toxic chemicals. Alumininum production also generates multiple hazardous wastes, e.g. spent electrolysis cell potlinings and caustic soda. Mining and production processes are also dependent on substantial water inputs. The wide range of these impacts and dependencies exposes companies in the sector to regulatory, reputational and physical risks.

Social risks:

- ✓ Adverse environmental impacts described above may negatively impact local communities' health and livelihoods, while conflicts over land can arise if principles of free, prior and informed consent (FPIC) are not observed. Illicit labour practices and hazardous working conditions are risks, especially for mining activities.

Environmental strategies and policies

Sustainability is integrated primarily into Hydro's 2025 strategy through a focus on strengthening its position in low-carbon aluminium, which the company believes is part of the solution to climate change due to its applications in sustainable transportation, green buildings, and circular economy. The company also recognizes it has other substantial environmental impacts and accordingly has goals focused on addressing biodiversity and waste. As a founding member of the Aluminium Stewardship Initiative (ASI), Hydro also certifies its production sites along the aluminium value chain according to the ASI standard. The company also employs life cycle assessment for its major product groups to identify areas for improvement.

Hydro's sustainability reporting is primarily based on reporting frameworks and principles including the UN Global Compact and GRI, as well as sector-specific disclosure standards including those developed by the International Council on Mining and Metals, and the Aluminium Stewardship Initiative (ASI).

The remainder of this section summarizes Hydro's approach to managing its climate change and environment-related risks and impacts, as well as its approach to supply chain sustainability. See "Selection" for a discussion of Hydro's approach to project-level environmental and social risk management.

Climate change

Climate change and renewable energy transition alongside it, are two focal topics within Hydro's sustainability strategy, and the company has an ambition to achieve net zero emissions by 2050 that is accompanied by two interim targets:

- 10% reduction in Scope 1 and 2 emissions by 2025
- 30% reduction in Scope 1 and 2 emissions by 2030

According to Hydro, it is currently in the process of setting a target for its Scope 3 emissions.

The company is exploring three pathways for decarbonizing its aluminium production, including 1) carbon capture and storage and direct air capture for existing facilities, 2) developing its proprietary HalZero technology to eliminate process emissions from aluminium smelting, and 3) utilizing more post-consumer aluminium scrap.

Alongside these initiatives, the company also aims to substitute fuel oil with natural gas and increase the amount of renewable electricity used in its operations at its alumina refinery Alunorte in Brazil. Currently, 70% of the electricity used for Hydro's primary aluminium production comes from renewable sources. This includes the annual use of around 9 TWh of hydropower energy, operation of a wind farm, and 9 TWh of renewable electricity purchased via long-term contracts in the Nordic market. The company is also investing in technologies required for the renewable energy transition, including batteries and green hydrogen production.

Hydro is implementing the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). This includes conducting physical climate risk assessments and assessing scenarios for climate transition risks. According to the company, this included hiring an external consultant in 2017 to conduct physical risk modelling and hazard identification and evaluation under the RCP 4.5 and RCP 8.5 climate scenarios. The company also conducted internal discussions on transition risks arising from 1.5-degree and below 2-degree scenarios that identified climate-related risks and opportunities. Hydro further shared that the outcome of this exercise has and continues to inform its climate and technology strategies. According to the company, climate change and other sustainability risks, are factored into its annual strategic planning and capital allocation processes. The company is already using carbon prices in its assumptions.

The company has also collaborated with the International Aluminium Institute to develop greenhouse gas reduction pathways that are consistent with the Paris Agreement and the International Energy Agency's 1.5-degree scenario, which it has integrated into its strategy.

Other environmental issues

Besides climate change and renewable energy transition, Hydro has also identified biodiversity; water; waste, effluents and other emissions; bauxite residues and tailings; and closure planning and legacy impacts as material environmentally relevant focal topics within its sustainability strategy. It has identified several long-term targets to address its environmental impacts, including:

- No net loss of biodiversity in new projects
- 1:1 rehabilitation of available mined areas within two hydrological cycles
- Eliminate landfilling of all recoverable waste by 2040
- Eliminate the need for new permanent bauxite residue storage from 2050

These ambitions pertain primarily to Hydro's sole operated bauxite mine Brazil and associated alumina refinery, and its hydropower operations in Norway, while its solid waste target is relevant to all stages of its value chain.

Hydro is a member of the International Council on Metals and Mining (ICMM) and has committed to implementing the Global Industry Standard on Tailings Management (GISTM) for its bauxite tailings and bauxite residue tailings facilities.

Hydro has assessed water stress as a non-material risk to Hydro's operations, and that it considers its impacts from management and discharge of excess water to be its principal water-related risk. In this respect, the company discloses in line with the ICMM's minimum water disclosure standard and plans to adopt the new ICMM disclosure requirements by 2023.

Responsible supply chain

Hydro's approach to supply chain sustainability is based on the OECD Due Diligence Guidance for Responsible Business Conduct. The company's Supplier Code of Conduct outlines minimum requirements for all suppliers, based on the Universal Declaration of Human Rights, UN Global Compact, and ILO Core Conventions.

Besides requiring compliance with all relevant environmental laws and regulations, the code expects suppliers to minimize their adverse environmental and climate impacts and implement environmentally friendly technologies and processes in their activities, and if applicable, to demonstrate an established methodology for identifying and mitigating material environmental risks. According to Hydro, it implements these expectations by setting requirements for suppliers. The principles are made binding through contractual clauses, and standard supply contracts also include clauses on auditing rights and the supplier's responsibility to promote the principles with its own suppliers. Suppliers deemed high-risk are subject to regular reviews and audits prior to and regularly during the period of the contract. Suppliers found in non-compliance are required to developing mitigating action plans and may face termination if they do not make satisfactory progress towards addressing the issue.

Hydro screens potential suppliers for sustainability risks. Depending on their risk categorization, potential suppliers are subject to additional internal and/or third-party screening and on-site audits and may be required to develop corrective action plans before being accepted by Hydro. According to Hydro, the company is in the process of rolling out company-wide an online tool for supplier screening and risk evaluation, which suppliers use to fill out a questionnaire and upload documentation regarding sustainability risks. The system facilitates follow-ups with suppliers on sustainability issues and allows information sharing across business areas.

Hydro's emissions

In 2021, Hydro had total Scope 1, 2 and 3 emissions of around 28 million tCO_2eq, of which 27% was Scope 1, 13% was Scope 2, and 60% were Scope 3.

Emissions intensity of alumnina refining and primary aluminium production (electrolysis) in 2021 was 0.63 and 1.61 tCO2eq per tonne of alumina and aluminium, respectively; these figures have largely remained stable over the past five years. According to Hydro, this is because the company is approaching the theoretical minimum for primary aluminium production that is achievable with current technology.

Historical performance and baseline figures - Greenhouse gas emissions[3]

Million tons CO_2e	2021	2020	2019	2018 strategy baseline[4]
Direct GHG emissions (Scope 1)	7.74	7.13	6.76	7.705
Indirect GHG emissions (Scope 2)	3.54	3.46	3.81	3.57
Total GHG emissions	11.31	10.59	10.57	11.28

Within Hydro's Scope 1 emissions, 50% was from bauxite and alumina production, 42% from primary aluminium production, 2% from remelters, and 7% from extrusions. The main sources of Scope 1 emissions were fuel combustion in furnaces and boilers, alumina calcination, anode production, anode consumption, and perfluorocarbon (PFC) emissions. Hydro's Scope 2 emissions originate from the purchase and consumption of electricity, heat or steam. Scope 1 and 2 emissions increased by 6.7% from 2020, which Hydro attributes to increased production volumes and the restart of a production line in Norway that had been idle since the financial crisis.[5]

[3] Data presented here benefits from an external assurance as part of Hydro's annual reporting.
[4] 2017 for Paragominas, Alunorte and Albras due to the production embargo at Alunorte and curtailment at Albras and Paragominas)
[5] https://www.hydro.com/en-NO/media/news/2020/production-restarts-at-the-hydro-husnes-b-line/

80-90% of Hydro's Scope 3 emissions were from purchased goods and services, primarily cold metal and alumininum scrap, with the remainder coming from external transportation. Hydro does not assign zero emissions to pre-consumer scrap aluminium emissions to reflect the fact that such aluminium has not yet fulfilled its end purposes. According to the company, this approach leads to Scope 3 emissions 70% higher than if it assigned zero emissions to pre-consumer scrap aluminium. Hydro reports that its Scope 3 emissions have declined by 18% since 2018 as a result of its efforts to source metal with a lower carbon footprint.

Governance assessment

Overall, Hydro has well-defined strategies on climate and other environmental sustainability issues, including a 2050 net zero target and interim targets, and relevant targets for other key environmental issues such as waste management and biodiversity loss. Hydro is implementing the TCFD recommendations, and the company's efforts so far on scenario analysis for physical and transition climate risks have been impressive. Further, the company has drawn on the findings from this analysis to integrate climate and sustainability issues into its overall strategy, as well as its strategic planning and capital allocation processes (see "Climate change").

The company also has a comprehensive approach to sustainability risk management that address its emissions, physical climate risks, and biodiversity loss, among other issues (see "Selection"). This is complemented with a robust approach to supply chain sustainability ("see Responsible supply chain") and supplier engagement that can lead to terminations in the case of continued non-compliance. It is also notable that the company has formalized the use of life-cycle thinking in its operations, supply chains and products via its sustainability directive.

The company demonstrates awareness of social risks, and its sustainability policies and safeguards are aligned with, i.a., the UN Guiding Principles on Business and Human Rights.

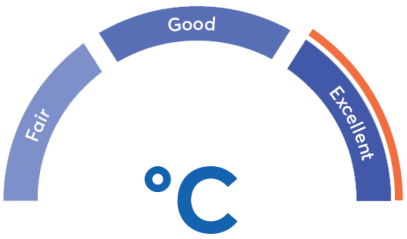
According to Hydro, its CEO and corporate management board (CMB) are responsible for delivering on Hydro's sustainability strategy. Hydro's Group Sustainability team is led by its Head of Sustainability, who reports to the Executive Vice President of Corporate Development, a member of the CMB. Hydro's CEO and CMB members' variable remuneration is linked to, i.a., Hydro's 2025 targets, which include the aforementioned targets pertaining to emissions, waste and biodiversity loss.[6]

Hydro has extensive sustainability reporting on multiple sustainability KPIs that aligns with various reporting frameworks, including the TCFD Recommendations, the EU Taxonomy, the GRI, and the requirements of the International Council on Mining and Metals.

The selection process for projects under the green financing framework is robust and benefits from Hydro's extensive environmental and social safeguards (described above); note that these align with the Equator Principles and IFC Performance Standards, among others, and that ESIAs will be conducted for projects categorized as medium and high risk in Hydro's risk screening process. In addition, medium and high risk projects are subject to minimum sustainability requirements throughout the project life-cycle, i.e. from inception through execution/implementation. The selection of projects requires a consensus decision by the Green Finance Committee, which includes environmental and sustainability competence.

[6] See 2021 Remuneration Report https://ml-eu.globenewswire.com/Resource/Download/d3457da3-fba8-4d26-8f5b-c13d9bcab1d9

Hydro's intended approach to reporting on green finance allocation and impacts is strong, and it is positive that reporting will include transparency on baselines and methodologies. However, it should be noted that reporting will only take place on a project category level and in aggregate across all outstanding green finance instruments. Further, Hydro may not seek external verification on its impact reporting.



The overall assessment of Hydro's governance structure and processes gives it a rating of **Excellent.**

2 Hydro's green financing framework

Brief description of Hydro's green financing framework and related policies

Use of proceeds

Proceeds can be used to finance both existing and new projects financed by Hydro or its subsidiaries. Hydro defines new financing as occurring in and after the reporting year when a green financing instrument is issued, and refinancing as that occurring prior to the reporting year of when a green financing instrument is issued. Hydro has defined a lookback period of three years as well as a look-forward period of three years. Both capex and opex are eligible, although Hydro expects the majority of proceeds to be capex. Examples of opex shared by Hydro that would potentially be financed include procurement of post-consumer scrap or other input materials with a sustainability profile.

Hydro's framework allows for eligible investments to take the form of joint ventures or other equity investments, where at least 90% of the revenues in the invested entity can be attributed to one or more of the eligible project categories. Hydro has emphasized that the exclusions identified in the framework (see below) will also apply to the activities from which invested entities derive the remaining 10% of revenues.

Project categories included in the framework include:

- Manufacture of aluminium
- Electricity generation from hydropower
- Wind power
- Solar power
- Manufacture of batteries
- Manufacture of hydrogen
- Storage

Hydro has not yet determined how the proceeds from its first issuance will be allocated across the project categories.

Under Hydro's framework, projects with the purpose(s) of fossil energy production, nuclear energy generation, weapons and defence, potentially environmentally harmful resource extraction (such as rare-earth elements or fossil fuels), gambling or tobacco are excluded from financing with the use of proceeds. Hydro has clarified that capex for natural gas-powered equipment, e.g. for use in aluminium recyclers, will be eligible.

Hydro's framework further specifies that proceeds will not be used to finance solar, wind and hydropower projects that are directly connected to fossil fuel production assets.

Selection

The selection process is a key governance factor to consider in CICERO Green's assessment. CICERO Green typically looks at how climate and environmental considerations are considered when evaluating whether projects can qualify for green finance funding. The broader the project categories, the more importance CICERO Green places on the governance process.

Under Hydro's evaluation and selection process, representatives from its different business segments will propose potential projects to Hydro's Green Finance Committee (GFC), supported from time to time by sustainability

experts. The GFC, which comprises senior representatives from Group Performance, Planning & Control, Group Accounting and Reporting, Group Treasury and Tax, Group Sustainability, and Portfolio development, has sole responsibility for evaluating the proposed projects' alignment with the framework criteria. The GFC may involve representatives from other business segments where relevant. A consensus decision is required before proceeds are allocated to a project. Decisions made by the GFC will be documented and filed.

All projects under the framework will be subject to Hydro's corporate-level environmental and social safeguards, policies and processes. These include a global sustainability directive that mandates the incorporation of life cycle sustainability risks and opportunities into operations, supply chains, and product stewardship, as well as specific minimum environmental management requirements. All new projects and major changes to existing facilities are screened and classified into high, medium or low sustainability risk categories.

Risk screening follows a standardized checklist that addresses and requires mitigating actions on social risks and environmental risks including, i.a. emissions, physical climate risk exposure, water withdrawals, and biodiversity impacts. Environmental and social impact assessments (ESIAs) are required for all high-risk projects, and the need for ESIAs is to be assessed for all medium-risk projects. In addition, medium and high-risk projects are subject to minimum sustainability requirements across the entire project life-cycle that aim to ensure project alignment with Hydro's sustainability strategy, identify risks and opportunities, and develop mitigating actions. According to Hydro, these minimum requirements reference international and sector-specific standards, including the UN Guiding Principles on Business and Human Rights, the Equator Principles, IFC Performance Standards and ASI Performance Standards.

Management of proceeds

CICERO Green finds the management of proceeds of Hydro to be in alignment with the Green Bond Principles and Green Loan Principles.

Hydro will use a green project register to track the allocation of proceeds to eligible projects. The company informs that this can be done on an individual project or portfolio basis depending on the size and materiality of financed projects. The management of proceeds will be reviewed by an independent external party appointed by Hydro. According to Hydro, the GFC's mandate includes monitoring of projects for compliance with the framework criteria; projects that no longer comply will be removed from the green project register by the GFC and substituted as soon as practicable.

Unallocated proceeds will be held in temporary investments such as cash, cash equivalents, and/or other liquid marketable investments in line with Hydro's treasury management policies. These temporary investments will not be invested in entities that have business plans focused on fossil energy generation, nuclear energy generation, research and/or development within weapons and defence, environmentally negative resource extraction, gambling or tobacco.

Reporting

Transparency, reporting, and verification of impacts are key to enable investors to follow the implementation of green finance programs. Procedures for reporting and disclosure of green finance investments are also vital to build confidence that green finance is contributing towards a sustainable and climate-friendly future, both among investors and in society.

Hydro is committed to annually publishing an allocation and impact report until the full allocation of proceeds and in the event of any material changes, until the maturity date of the relevant green finance instrument, via a green

financing report. According to Hydro, both allocation and impact reporting will be aggregated across all green financing instruments issued in a reporting year.

Allocation reporting will include the outstanding amount of green finance instruments issued, proceeds allocated to each project category, relative share of new versus refinancing, descriptions of selected projects, and the balance of any unallocated proceeds. Hydro shared that its allocation reporting will also provide information on the proportion of projects financed with green proceeds versus other Hydro capital.

Impact reporting will be aggregated at the project category level and will include transparency around methodologies, baselines and assumptions used, as well as distinguish between actual and estimated impact metrics. Hydro intends for its impact reporting approach to follow the approach outlined in the International Capital Markets Association's Handbook—Harmonised Framework for Impact Reporting (June 2021). Additionally, Hydro shared that when reporting upon impacts from equity investments, it will follow the GHG Protocol's principles for both ownership equity and consolidated reporting.

The GFC is responsible for preparing and verifying annual reporting on the allocation and impact of proceeds. Hydro will seek external review on the allocation of proceeds but not for impact reporting. According to Hydro, impact reporting may be part of the scope of external assurance of its annual report. The report will be published on Hydro's website.

Assessment of Hydro's green financing framework and policies

The framework and procedures for Hydro's green finance investments are assessed and their strengths and weaknesses are discussed in this section. The strengths of an investment framework with respect to environmental impact are areas where it clearly supports low-carbon projects; weaknesses are typically areas that are unclear or too general. Pitfalls are also raised in this section to note areas where Hydro should be aware of potential macro-level impacts of investment projects.

Overall shading

Based on the project category shadings detailed below, and consideration of environmental ambitions and governance structure reflected in Hydro's green financing framework, we rate the framework **CICERO Medium Green.**

Eligible projects under Hydro's green financing framework

At the basic level, the selection of eligible project categories is the primary mechanism to ensure that projects deliver environmental benefits. Through selection of project categories with clear environmental benefits, green bonds aim to provide investors with certainty that their investments deliver environmental returns as well as financial returns. The Green Bond Principles (GBP) state that the "overall environmental profile" of a project should be assessed and that the selection process should be "well defined".

Category	Eligibility criteria	Assessment of alignment with the EU Taxonomy technical screening criteria (TSC) for substantial contribution to climate change mitigation[7]	Green Shading and some concerns
Manufacture of aluminium Manufacture of aluminium through primary alumina (bauxite) process or secondary aluminium recycling.	The activity manufactures one of the following: (a) primary aluminium where the economic activity complies with two of the following criteria until 2025 and with all of the following criteria[8] after 2025: (i) the GHG emissions do not exceed 1,484 tCO2e per ton of aluminium manufactured: (ii) the average carbon intensity for the indirect GHG emissions does not exceed 100g CO_2e/kWh; (iii) the electricity consumption for the manufacturing process does not exceed 15.5 MWh/t Al. (b) secondary aluminium.	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 3.8 Manufacture of aluminium. ✓ Hydro has confirmed that the aluminium to be manufactured in this project category confirms with the EU Taxonomy definition of aluminium. ✓ According to Hydro, all 10 of its existing plants comply with criterion (iii); of these, seven plants further meet criterion (ii)—all five in Norway, Alouette in Canada, and Albras in Brazil. ✓ Hydro has confirmed that it does not currently and will not rely on renewable energy guarantees of origin or offsets to meet criterion (ii).	**Medium to Dark Green** ✓ Dark Green solutions for primary aluminium manufacturing are currently not commercially available due to unavoidable process emissions during electrolysis. Alumininum recycling is part of a 2050 solution as secondary aluminium is 95% less emission intensive than primary aluminium production[9] and receives a Dark Green shading. Note however that remelting of scrap aluminium for recycling is currently reliant on natural gas. ✓ According to Hydro, investments in this category will most likely refinance existing primary production sites and Hydro's announced recycling capacity expansion projects. Hydro further

[7] This does not include an assessment of alignment with Do No Significant Harm criteria or minimum social safeguards. We use the terminology *likely* aligned/partially aligned/not aligned to indicate the extent to which gaps have been identified with the eligibility criteria in the framework. The issuer will need to follow up in their annual reporting to confirm that only projects aligned with the criteria have received funding under the green finance framework.
[8] Combined to a single threshold resulting in the sum of direct and indirect emissions, calculated as the average value of the top 10% of installations based on the data collected in the context of establishing the EU ETS industrial benchmarks for the period of 2021-2026 and calculated in accordance with the methodology for setting the benchmarks set out in Directive 2003/87/EC plus the substantial contribution to climate change mitigation criterion for electricity generation (100gCO2e/kWh) multiplied by the average energy efficiency of aluminium manufacturing (15.5 MWh/t Al)
[9] https://aluminium.org.au/wp-content/uploads/2020/10/IAI-Recycling-Factsheet.pdf

clarified that supply chain activities for aluminium manufacturing, i.e. bauxite mining and alumina refining, are ineligible activities.

- ✓ In addition to its own mining operations, Hydro sources bauxite from Vale and Mineração Rio do Norte (MRN), the bauxite mine in which it has a 5% ownership stake. Hydro noted that bauxite from its Paragominas mine is transported 250 km by pipeline to its Alunorte refinery, and alumina is transported by ship to Norway. The company shared that it is looking into "Green Corridors" with Klaveness to decarbonize the transport of alumina.
- ✓ Note that Hydro and MRN have been associated with controversies regarding the impact of bauxite mining and alumina refining on local community health and the environment in Brazil, and Hydro faced a class-action lawsuit in February 2021 communities seeking damages from toxic waste pollution, of which the outcome is pending. According to Hydro, a new consultation is planned this summer.
- ✓ Hydro has shared that the main end use sectors for its aluminium include transportation and automotive, buildings,

HVAC-R, and electrical applications (specifically transmission lines). Note that several of these sectors are exposed to climate transition risks that could be transmitted to Hydro depending on the extent to which end customers are effectively managing climate risk. The company has not ruled out the possibility that its aluminium is used by customers in the fossil fuel or other high emissions sectors.

- ✓ According to Hydro, investments in natural gas-powered equipment are eligible due to their use in melting down scrap aluminium. According to Hydro, lock-in risk is mitigated as it does not source natural gas for remelters through long-term contracts. The company aims to pilot the use of hydrogen for this process by 2030.
- ✓ Note the risk of economy-level rebound effects from increase demand and supply for secondary aluminium—there is evidence that increased secondary aluminium production may not displace 100% of its mass in primary aluminium, and may actually stimulate primary aluminium production.[10]

[10] https://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1043&context=management_fac

			✓ Provided that improvements in recycling do not lead to systemic rebound effects that increase overall aluminium production, emissions benefits from increased aluminium recycling should outweigh the risks of lock-in from use of natural gas in remelters. ✓ Note that aluminium recycling generates emission to air that can have adverse health and environmental impacts, including dust from shredding, as well as volatile organic compounds and polychlorinated dibenzodioxins and furans (PCDD/Fs). Refer to "Selection" for information on Hydro's management of such risks. ✓ Eligible sites for secondary aluminium recycling are in Brazil, France, Germany, Luxembourg, Spain, the UK and the US.
Hydropower Construction or operation of electricity generation facilities that produce electricity from hydropower.	The activity complies with either of the following criteria: (a) the electricity generation facility is a run-of-river plant and does not have an artificial reservoir; (b) the power density of the electricity generation facility is above 5 W/m^2;	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 4.5 Electricity generation from hydropower. ✓ Hydro has shared that it has one run-of-river plant without an artificial reservoir, and that it expects the remainder to comply	**Medium to Dark Green** ✓ According to Hydro, hydropower sites that are eligible for financing are only located in Norway. Financed hydropower generation is used internally for aluminium production, sold to the grid, or sold directly to third parties. Proceeds cannot be used to finance

	(c) the life-cycle GHG emissions from the generation of electricity from hydropower, are lower than 100gCO_2e/kWh.[11] For new hydropower projects, necessary environmental and social impact assessments will be undertaken and there should be no significant controversies identified.	with the Taxonomy's power density criterion.	renewable energy generation that is directly connected to fossil fuel production assets. The shading reflects these possible end uses alongside the importance of hydropower to a 2050 solution. ✓ Hydropower is a clean and renewable energy source overall, but large hydropower facilities and associated construction/renovation projects can have impacts on the local environment, hydrology, biodiversity and communities. Methane emissions from reservoirs are also a risk factor, especially in warmer climates. Hydropower is also exposed to physical climate risks such as drought. Refer to "Selection" for information on Hydro's management of these risks.
Wind power Construction or operation of electricity generation facilities that produce electricity from wind power.	Onshore and offshore wind energy generation facilities	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 4.3 Generation of electricity from wind power.	**Medium to Dark Green** ✓ According to Hydro, wind power development will be used internally for aluminium production, sold to the grid, or sold directly to third parties. Proceeds cannot be used to finance renewable energy generation that is directly

[11] Calculated using Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018, ISO 14064-1:2018 or the G-res tool. Quantified life-cycle GHG emissions are verified by an independent third party.

connected to fossil fuel production assets. The shading reflects these possible end uses alongside the importance of wind power to a 2050 solution.

- ✓ This project category has inherent risks of deforestation and other impacts on terrestrial and marine biodiversity and ecosystems, and on local communities, as well as emissions, pollution and waste, especially during manufacturing and decommissioning. Refer to "Selection" for information on Hydro's management of these risks.
- ✓ According to Hydro, its renewable energy subsidiary, Hydro REIN, will develop projects in collaboration with partners that serve both Hydro and external customers. Hydro recently announced a PPA for wind power with Telenor Infra.
- ✓ The company currently does not have visibility on possible future locations of wind power projects. Hydro currently operates one wind farm in near Sundsvall, Sweden. Note that Hydro's existing wind farm impacts a neighbouring Sami community. According to Hydro's 2021 annual report, legal agreements on cooperation

			with the community have been signed and mitigative actions proposed by the community have been agreed.
Solar power Construction or operation of electricity generation facilities that produce electricity using solar photovoltaic (PV) technology or concentrated solar power technology.  	Solar energy technologies, such as Photovoltaic systems (PV) and Concentrated Solar Power (CSP).	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 4.1 Electricity generation using solar photovoltaic technology and 4.2 Electricity generation from concentrated solar power (CSP) technology.	**Medium to Dark Green** ✓ According to Hydro, solar power development will be used internally for aluminium production, sold to the grid, or sold directly to third parties. Proceeds cannot be used to finance renewable energy generation that is directly connected to fossil fuel production assets. The shading reflects these possible end uses alongside the importance of wind power to a 2050 solution.This project category has inherent risks of deforestation and other impacts on terrestrial and marine biodiversity and ecosystems, and on local communities, as well as emissions, pollution and waste, especially during manufacturing and decommissioning. Refer to "Selection" for information on Hydro's management of these risks. ✓ The company recently announced partnerships to build two solar projects with nearly 1 GWp capacity in Brazil.[12]

[12] See https://www.hydro.com/en-NO/media/news/2022/hydro-rein-atlas-renewable-energy-and-albras-to-develop-solar-energy-project-in-brazil/ and https://renewablesnow.com/news/scatec-to-build-532-mw-solar-plant-in-brazil-760432/

			✓ Risks discussed under "Wind power" pertaining to environmental and community impacts are applicable here.
Manufacture of batteries Recycling of end-of-life batteries Manufacture of rechargeable batteries, battery packs and accumulators for transport, stationary and off-grid energy storage and other industrial applications. Manufacture of respective components (battery active materials, battery cells, casings and electronic components) 	The economic activity manufactures rechargeable batteries, battery packs and accumulators (and their respective components), including from secondary raw materials, that result in substantial GHG emission reductions in transport, stationary and off-grid energy storage and other industrial applications. Recycling of end-of-life batteries.	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 3.4 Manufacture of batteries.	**Light to Medium Green** ✓ Lithium-ion batteries are crucial for 2050 solutions such as electrified transportation and renewable energy storage. The shading reflects lack of transparency around specific sourcing criteria for battery raw materials and the possibility for end uses to include solutions that are not part of a 2050 vision. ✓ Hydro does not yet manufacture any batteries and is unable to provide details of its specific production processes and energy sources. ✓ Investments in battery recycling are crucial for mitigating the wider environmental impacts of battery material demands. According to the company, its battery raw material requirements will be stricter than those in the proposed EU battery regulation,

which includes requirements for recycled metal content and traceability.[13]

- ✓ However, the regulation does not set requirements for critical anode materials such as graphite and silicon, which can be carbon-intensive to produce and currently depend on fossil fuel inputs.
- ✓ Mining of lithium, cobalt and other battery raw materials can have substantial adverse environmental and social impacts; development and disclosure of specific sourcing requirements and alignment with third-party standards is recommended.
- ✓ Hydro has partnerships with and investments in battery production and recycling companies, as well as a producer of battery anode materials.[14] Of note is its investment in Hydrovolt, which is building a battery recycling plant in Norway that extracts aluminium, nickel, lithium, manganese and cobalt from batteries. Aluminium will be recycled by Hydro, with other metals used for battery manufacturing.

[13] The proposed regulation includes, i.a. carbon footprint rules, minimum requirements for recycled raw materials like cobalt, copper, lead, nickel and lithium, as well as requirements for manufacturers to introduce chain of custody/traceability systems for raw materials, and end-of-life management. See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020PC0798

[14] Other partnerships include that with Vianode, an anode material producer. Part-ownerships include Corvus, a provider of maritime battery solutions, and Hydrovolt, a battery recycling business.

			✓ Hydro does not have any offtake agreements in place for batteries but notes its part-ownership in Corvus. Hydro does not yet have visibility on end uses for its batteries; it is thus possible that they could be used to support fossil fuel production, e.g. coal mining trucks and in oil tankers, or in hybrid vehicles, which are not part of a 2050 solution.
Manufacture of hydrogen Manufacture of hydrogen and hydrogen-based synthetic fuels  	Life-cycle GHG emissions savings requirement of 73.4% for hydrogen[15] and 70% for hydrogen based synthetic fuels relative to fossil fuel comparator of 94g CO2e/MJ	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 3.10 Manufacture of hydrogen. ✓ Hydro has confirmed that it does not currently and will not rely on renewable energy guarantees of origin or offsets to meet the emissions-saving requirement. ✓ Hydro has also confirmed that the life-cycle emissions savings will be calculated as stipulated by the EU Taxonomy. ✓ According to Hydro, it is currently only looking into green hydrogen production and so Taxonomy requirements around transportation and storage of sequestered CO2 are not applicable.	**Medium to Dark Green** ✓ According to the company, it is currently only looking into green and not blue hydrogen production. Hydro shared that it expects to use green hydrogen to eventually replace natural gas in its production processes. ✓ Green hydrogen, i.e. produced from water and renewable electricity, is part of a 2050 solution due to applications in industrial processes, transportation, and energy storage, but comes with risks associated with leakage (see "storage of hydrogen"). ✓ Hydro does not yet manufacture any hydrogen or hydrogen-based synthetic

[15] Resulting in life-cycle GHG emissions lower than 3tCO2e/tH2

fuels and is unable to provide details of its specific processes.

- ✓ The company confirms it will produce hydrogen for external as well as internal industrial applications but does not have visibility on whether it will produce hydrogen-based synthetic fuels as well as hydrogen, the likely feedstock for the former, or the anticipated end uses. Note that green hydrogen could have emissions-intensive end uses, e.g. if used to produce green ammonia for fertilizers, which could generate substantial on-field emissions.
- ✓ Except for green ammonia, synthetic hydrogen-based fuels require inputs of CO_2; in order to avoid transition risks, such CO_2 should be non-fossil, i.e. either biogenic or from direct air capture. Biogenic CO_2 may be associated with direct and indirect land use change if sourced from biomass/biofuel combustion (depending on feedstock), as well as substitution effects and valorization of potentially unsustainable economic activities if derived from waste and byproducts.
- ✓

Storage Construction and operation of facilities that store electricity and return it at a later time in the form of electricity  	<u>Storage of hydrogen</u> The activity is one of the following: (a) construction of hydrogen storage facilities; (b) conversion of existing underground gas storage facilities into storage facilities dedicated to hydrogen-storage; (c) operation of hydrogen storage facilities where the hydrogen stored in the facility meets the criteria for manufacture of hydrogen <u>Storage of thermal energy</u> The activity stores thermal energy, including Underground Thermal Energy Storage (UTES) or Aquifer Thermal Energy Storage (ATES) <u>Storage of electricity</u> The activity is the construction and operation of electricity storage including pumped hydropower storage[16].	**Likely aligned** ✓ The criteria for this project category are identical to the Taxonomy TSC for 4.10 Storage of electricity, 4.11 Storage of thermal energy, and 4.12 Storage of hydrogen.	**Medium to Dark Green** ✓ According to Hydro, its energy storage investments will be used to ensure a stable supply of electricity for alumnium production. ✓ Energy storage is crucial for facilitating greater integration of renewables and part of a 2050 solution. However, certain technologies in this category may entail risks to climate warming and climate resilience (in terms of possible water-related impacts) that are not yet fully understood, which are reflected in the shading. *Storage of hydrogen* ✓ Leakage of stored hydrogen is difficult to avoid due to small molecule size and low density. Impacts from leakage of stored hydrogen to the atmosphere are not yet well-understood but emerging research indicates it increases the atmospheric lifetime of methane and its climate impacts, partially offsetting its emissions reduction benefits, and may contribute to Antarctic ozone

[16] Where the activity includes chemical energy storage, the medium of storage (such as hydrogen or ammonia) complies with the criteria for manufacturing of the corresponding product specified in Sections 3.7 to 3.17 of the EU Taxonomy regulation Delegated act annex 1 for climate change mitigation. In case of using hydrogen as electricity storage, where hydrogen meets the technical screening criteria specified in Section 3.10 of the same Annex, re-electrification of hydrogen is also considered part of the activity

depletion.[17] High flammability also entails a hazard.

- ✓ Conversion of underground gas storage facilities to hydrogen will require measures to avoid venting residual methane into the atmosphere.

Storage of thermal energy

- ✓ UTES and ATES systems involve storing heat underground; the main difference is the use of coolants in closed loops in UTES versus the use of groundwater in open loops in ATES.
- ✓ Such systems may have adverse impacts on subsurface hydrology, groundwater chemistry and thermal balance, and microbiology. Drilling may also entail adverse impacts on the local environment and biodiversity.[18]

Storage of electricity

- ✓ In addition to pumped hydropower, electricity storage can entail the use of batteries, compressed air, flywheels, thermal energy conversion, and power-to-gas technology. Hydro is unable to provide visibility on the type of electricity storage in which it will invest.

[17] https://www.gov.uk/government/publications/atmospheric-implications-of-increased-hydrogen-use
[18] For instance, see https://link.springer.com/article/10.1007/s42108-021-00150-4 and https://www.heatstore.eu/documents/HEATSTORE_WP6_D6.6_Rev.%20Final_2021.10.25.pdf

	✓ Pumped storage hydropower (PSH) is either open-loop (continuously connected to a naturally flowing water feature) or closed-loop (not continuously connected to a naturally flowing water feature). Closed loop systems generally have lower environmental impacts due to avoided impacts on freshwater systems, although closed loop systems that use groundwater may still adversely impact groundwater quality.[19] ✓ Concerns highlighted under "Electricity generation from hydropower" and "Manufacture of batteries" are applicable to pumped hydropower storage and electricity storage with batteries, respectively. ✓ Concerns highlighted above for UTES and ATES may be relevant here.

Table 1. Eligible project categories

[19] https://www.energy.gov/sites/default/files/2020/04/f73/comparison-of-environmental-effects-open-loop-closed-loop-psh-1.pdf

EU Taxonomy Assessment

The EU taxonomy is a classification system establishing a list of environmentally sustainable economic activities. The regulation defines six environmental objectives. To be considered sustainable, an activity must substantially contribute to at least one of the six environmental objectives without harming the other objectives ("Do No Significant Harm"), while complying with minimum social safeguards. So far, the EU has adopted delegated acts under the regulation that set out the technical screening criteria for the climate mitigation and adaptation objectives, respectively. The DNSH-criteria are developed to make sure that progress against some objectives is not made at the expense of others and recognizes the relationships between different environmental objectives.

Relevant EU Taxonomy activities for Hydro are:

- Manufacture of aluminium
- Electricity generation from hydropower
- Electricity generation from wind power
- Electricity generation from solar photovoltaic technology power
- Electricity generation from concentrated solar power (CSP) technology
- Manufacture of batteries
- Manufacture of hydrogen
- Storage of electricity
- Storage of thermal energy
- Storage of hydrogen

CICERO Green assesses that all the financed taxonomy activities in the framework's project categories are likely aligned with the mitigation criteria in the EU Taxonomy.

Alignment with specific DNSH criteria has not been assessed or minimum social safeguards. We note that Hydro's extensive environmental and social safeguards aim at limiting harm to the other environmental objectives of the Taxonomy and social risks. See "Environmental strategies and policies," "Selection," and "Eligible projects under Hydro's green financing framework" for relevant information.

Strengths

The "Excellent" governance score reflects the strength of Hydro's corporate climate and sustainability governance. The company has undertaken substantive efforts to understand its exposure to physical and transition climate-related risks and opportunities, and it is clear that the findings from climate scenario analysis have been integrated into the company's climate strategy. Based on documentation shared by Hydro, the company has very well-established risk management policies and procedures for managing risks and opportunities related to climate change and other environmental and social risks. We however note that the company's climate scenario analysis exercise was conducted in 2017, and its plans to update the assessment and introduce adaptive management are unclear. This will be important to consider in light of updated findings from the IPCC's Sixth Assessment Report regarding physical climate impacts and mitigation pathways.

The identified project categories in the framework align strongly with Hydro's sustainability strategy and objectives, namely its decarbonization targets and intentions to expand its business into the areas of renewable energy and energy storage.

Hydro has used the EU Taxonomy technical screening criteria (TSC) for substantial contributions to climate change mitigation as the eligibility criteria for its green financing framework, which facilitates investors' understanding of the framework's contribution to climate change mitigation.The framework explicitly excludes the financing of renewable energy projects that will be directly connected to fossil fuel production assets, in

addition to projects for which the purpose is fossil energy production, nuclear energy generation, weapons and defence, potentially environmentally harmful resource extraction (such as rare-earth elements or fossil fuels), gambling or tobacco..

Weaknesses

Although the criticality of increased aluminium recycling for a 2050 solution and the magnitude of emissions reduction potential supports a Dark Green shading, it is nevertheless a weakness that the framework allows for investment in natural gas-fired remelters for aluminium recycling. Although Hydro expects to eventually pilot the use of hydrogen for this purpose, this is only expected by 2030. According to Hydro, the natural gas-fired remelters are the main investments in fossil fuel-powered equipment expected under the framework, although the company has not explicitly excluded financing other fossil fuel-powered equipment. Further, Hydro has not ruled out using proceeds to procure natural gas or other fossil fuels for such equipment.

Pitfalls

Further, Hydro's framework allows for equity investments in companies that derive at least 90% of revenues from one or more of the eligible project categories, and Hydro has clarified that the remaining 10% of revenues will be subject to the exclusions in its framework. It is possible that in some cases, Hydro will be minority owners in invested projects. In such cases, Hydro shared that it will assert its influence on projects to comply with its internal sustainability principles. Hydro's Code of Governance requires its board/committee representatives in the partly owned entities to endeavour to implement Hydro's ambitions and principles, including those pertaining to the environment and corporate social responsibility. Hydro also has guidelines for board members in such entities to consider the entity's environmental impacts. Nonetheless, this is a pitfall as there is no guarantee that such efforts will be successful, and there are consequently risks that proceeds are invested in projects that have adverse environmental and social impacts.

Hydro has not yet identified the investments it will likely make with proceeds from its initial green financing issuance. The company has low visibility on the nature and location of likely investments under the framework, especially for project categories associated with its expansion into new business areas, which makes it challenging to fully assess the associated climate and environmental risks. Hydro's strong climate and sustainability governance provides some reassurance that such risks will be avoided and mitigated. However, investors should take note of prior and ongoing controversies, such as those related to Hydro's bauxite mining and alumina refining operations,[20] in light of the potential impacts of certain investments under the framework on land use, biodiversity and water resources, e.g. solar power, wind power, hydropower, and underground energy storage. Note also that Hydro's sustainability and climate governance would not address the risks that some products/services resulting from investments under the framework, e.g. batteries, other energy storage, and hydrogen, will be used by the fossil fuel sector or other industries with high climate impacts and/or transition risk exposure.

While it is positive that the company has set a new ambition as of 2021 to have no net loss of biodiversity for all new projects, note that this allows for the use of biodiversity offsets to compensate for adverse and unavoidable project impacts. Offsets should only be used as a last resort when higher priority aspects of the mitigation hierarchy (avoid, reduce, restore, offset) have been applied. Given the highly location-specific nature of biodiversity, i.e. no two areas have identical habitat and species populations, the use of offsets does not guarantee that there is no biodiversity loss. The effectiveness and credibility of offsets also depends on robust governance, including monitoring and enforcement, as well as implementation of social safeguards to avoid adverse local community impacts.

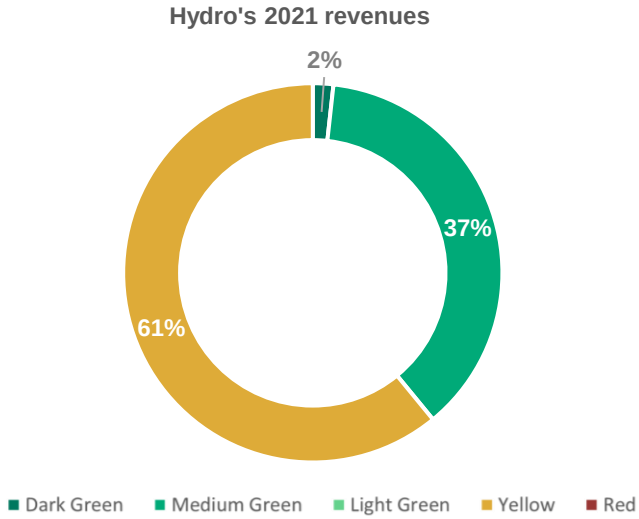
[20] For instance, see https://www.ft.com/content/78566e6b-f280-438e-9465-40105693504d and https://www.reuters.com/article/us-norsk-hydro-brazil-idUSKBN2A923Q

3 Hydro's Sustainability-Linked Financing Framework

According to CICERO Green's methodology for sustainability-linked financing frameworks, a Shade of Green should be allocated to the issuer's revenue and planned investment streams. The shadings provide additional context around the issuer's business model and strategy and reflect alignment of the underlying activities towards a low carbon and climate resilient future, while taking into account governance issues. (See "Terms and methodology" for further details).

Assessment of Hydro's revenues

A Shade of Green was assigned to 39% of Hydro's 2021 revenues, with the remainder receiving a Yellow shading.



The 2% of revenues that received a Dark Green shading came from Hydro's sale of hydropower electricity to the grid. The shading reflected the importance of renewable energy for a 2050 solution, as well as the fact that the electricity was sold to the grid and not directly to specific end users.

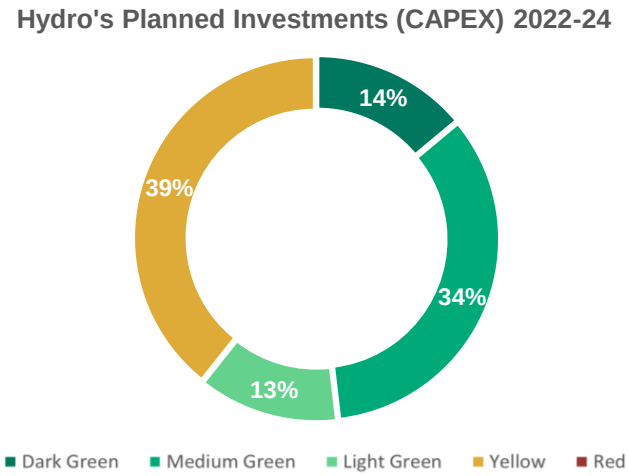
A Medium Green shading was assigned to the 12% and 25% of revenues, respectively, that Hydro generated from sales of primary and secondary aluminium under Hydro's Aluminium Metal, Metal Markets, and Extrusion business segments that complied with the EU Taxonomy's technical screening criteria for a significant contribution to climate change mitigation. This shading reflects Hydro's highly efficient aluminium production, but a Dark Green shading is currently not possible due to remaining hard-to-abate emissions from the aluminium smelting process, which Hydro eventually aims to address with its HalZero technology and CCS. Medium Green revenues from secondary aluminium extrusions included the value-added from the extrusions process in addition to the value of secondary aluminium used.

Note that revenues from aluminium may vary in shading depending on end use. According to Hydro, these include applications in automotive and transportation, buildings, distribution, industrial, and HVAC-R. According to the company, revenues from Aluminium Metal and Metal Markets are higher up the value chain, making it difficult to distinguish the end use, but a portion of its production actively supports the low-carbon transition. For example, the company shared that revenue in these segments is from the automotive and building and construction industries, which use the aluminium for applications including light-weighting and building refurbishment,

respectively, as well as in the production of wires/cables that support electrification. As such, it is possible that such revenues include Dark Green elements, e.g. if used in battery electric vehicles, or Yellow/Red elements, e.g. if used in internal combustion engine vehicles. Revenues from Extrusions also were from sales for use in automotive/transportation and buildings, but also industrial and HVAC-R solutions and distribution; the company noted that end uses of its extrusions actively supporting the low-carbon transition include Dark Green activities, e.g. manufacturing of components used in renewable energy production. However, Hydro was unable to provide the necessary data to refine the shading accordingly.

A Yellow shading was assigned to revenues from non-Taxonomy aligned aluminium (49%). Yellow-shaded revenue also included Hydro's external sales of alumina to external parties (11%); according to Hydro, the majority of this alumina is used in the production of aluminium metal. The Yellow shading reflects the continued dependence of alumina refining on fossil fuels, as well as the lack of information about the ultimate end use of the alumimium it is used to produce. As above, these revenues may include various Shades of Green depending on the ultimate end use of the sold product, but Hydro was unable to provide the necessary data to refine the shading accordingly.

Assessment of Hydro's investment plans



A Shade of Green was assigned to 61% of Hydro's planned investments for the three years over 2022-2024, with the remaining 39% receiving a Yellow shading. Note that the shadings have benefited from Hydro's "Excellent" governance rating where there are climate and environmental risks or other uncertainties pertaining to the planned investments.

The following discussion of Hydro's investment plans should be considered as part of the assessment of Hydro's strategy to achieve the SPTs outlined in its sustainability-linked financing framework (See "Initiatives and strategy to achieve SPTs 1a and 1b" and Initiatives and strategy to achieve SPT 2"). The analysis does not include capex for Hydro's announced offer to acquire Alumetal, as the data required to assign a shading was unavailable at the time of this second opinion's publication.

A Dark Green shading was assigned to the 14% of Hydro's planned investments in its HalZero technology, carbon capture and storage (CCS), and aluminium remelters for recycling. According to Hydro, the investments in HalZero technology and CCS are required to eliminate the remaining process emissions from aluminium smelting and are integral parts of its roadmap to producing net-zero emissions aluminium by 2050—the capex shaded here is thus part of its efforts to test and bring these technologies to industrial pilots by 2030, to enable subsequent full-scale investments.

Hydro shared that its HalZero technology requires the same alumina inputs as the existing Hall-Héroult process. According to Hydro, the technology is not suitable for existing aluminium plants as it requires a complete reconstruction of aluminium smelters. The company therefore aims to rely on CCS to eliminate process emissions, first targeting its newer and more energy efficient plants for which further emissions reductions are more challenging. Although the HalZero process might have a slightly higher energy requirement than the current best Hall-Héroult cells, Hydro noted that this would be compensated for by the inherent management of CO_2 emissions via the closed loop process. According to Hydro, there are minor solid byproducts, and emissions to air and water include oxygen and cooling water, respectively. Note that the process still relies on anodes produced from graphite. This may constitute possible transition risks in terms of dependency on fossil materials, i.e. calcined pet coke and coal tar pitch, although this is mitigated by the fact that the anodes are not consumed in the HalZero process. Despite this risk, investments in the HalZero technology were assigned a Dark Green shading given its potential to be a breakthrough technology in a hard-to-abate sector. Planned investments in CCS also received a Dark Green shading given its criticality to a 2050 solution.

The Dark Green shading for planned investments in aluminium remelters aligns with the shading allocated to aluminium recycling Eligible projects under Hydro's green financing framework. See "Initiatives and strategy to achieve SPT 2" for additional discussion of Hydro's planned investments in aluminium recycling in the context of its target to reach 660,000 tonnes of post-consumer scrap recycling capacity by 2025 (SPT 2).

A Medium Green shading was assigned to 34% of Hydro's planned investments. This includes the planned investments in hydropower and aluminium smelters that comply with the EU Taxonomy's technical screening criteria for primary aluminium production. Planned investments by Hydro REIN in wind and solar power and by Hydro Havrand in hydrogen manufacture and storage also received a Medium Green shading. These shadings respectively align with the shadings assigned to the following project (sub)categories inEligible projects under Hydro's green financing framework: electricity generation from hydropower, manufacture of aluminium, wind power, solar power, manufacturing of hydrogen, and hydrogen storage.[22]

A Light Green shading was assigned to 13% of Hydro's planned investments. These include planned investments in battery production, in accordance with the corresponding shading under Eligible projects under Hydro's green financing framework. Light Green investments also include those planned at Hydro's Alunorte alumina refinery to 1) pilot boiler electrification and 2) support the fuel switch from heavy fuel oil to natural gas.

Boiler electrification will support the initial step of replacing coal-fired boilers, thereby reducing emissions by around 400,000 tCO_2eq per year, as well as eventual electrification of gas-fired boilers. This investment is a clear step towards to Hydro's vision of delivering net-zero aluminium by 2050; in the interim, the investment will support the Yellow and Medium Green revenues from conventional and Taxonomy-aligned aluminium, respectively. The remaining emissions from the boilers will depend on the carbon intensity of the grid to which the Alunorte refinery is connected (see "Initiatives and strategy to achieve SPTs 1a and 1b").

The Light Green shading for investments supporting the Alunorte refinery fuel switch considers the emissions reductions that the investment will deliver within the context of Hydro's Excellent governance score, its interim and long-term emissions reduction targets, and the wider suite of initiatives the company has outlined in its decarbonization roadmap. The shading weighs considerations against the clear pitfall that the investment nonetheless represents emissions lock-in risks—both for Hydro and the region of Barcarena in Brazil's northern state of Pará, in which the Alunorte refinery is located. While we consider the investment to be Light Green and a

[22] Note that where a range of shadings are indicated for project categories, the lower end of the range has been used for the purposes of shading corresponding planned investments.

clear aspect of Hydro's longer-term decarbonization strategy, in the interim it supports both Yellow and Medium Green revenues from conventional and Taxonomy-aligned aluminium, respectively. Hydro expects the Alunorte fuel switch to reduce emissions by around 700,000 tCO_2eq, corresponding to a 19% decrease in fossil fuel combustion emissions at the refinery from 2018 levels by 2025. In connection with the project, Hydro finalized a 15-year natural gas supply agreement in December 2021.[23] Hydro also announced in April 2022 a USD 200 million sustainability-linked loan that will be used to finance part of the fuel switch project. Hydro aims for natural gas to be used in the calcination process and in some steam boilers. Whereas Hydro expects its boilers to transition to renewable electricity by 2030, the replacement of natural gas with green hydrogen is only expected by 2050. According to Hydro there are currently no other commercially available technologies that can provide the high temperatures required for calcination; while green hydrogen could be an alternative, limited local access to renewable energy currently prevents its production.

The Alunorte fuel switch project entails investments in natural gas infrastructure that increase access to natural gas for other industries and consumers in the area, which according to the company is a key aspect of a tax deferral agreement with the Pará state government.[24] The project could contribute to emissions lock-in in the region and potentially delay investments in renewable energy. Hydro acknowledges these risks but believes that the increased natural gas supply to the Barcarena region will enable local communities to shift away from heavy fuel oil for power generation, delivering short-term emissions reduction and local air pollution benefits. According to the company, the region lacks the infrastructure needed to support short-term renewable energy projects, and environmental conditions in the region do not support the economic development of renewable energy. Hydro further noted that its plans for boiler electrification by 2030 will necessitate leadership on the development of renewable infrastructure in the region moving forwards. We strongly encourage Hydro to continually reassess local conditions and report on its efforts to promote renewable energy development and minimize the lock-in effects of the Alunorte fuel switch.

Hydro has not disclosed its considerations for possible Scope 3 emissions from natural gas production and transportation, e.g. methane leakage, venting and flaring, or the possibility that natural gas comes from unconventional sources. Supporting infrastructure, e.g. road or pipeline expansions, may also contribute to habitat fragmentation and biodiversity loss.

Remaining planned investments are associated Hydro's business-as-usual activities and received a Yellow shading (39%); these include:

- Opening a new section (M5) of its Paragominas bauxite mine;
- Maintenance of a pipeline connecting it to the Alunorte alumina refinery;
- Other sustaining capex for bauxite and alumina production;
- Capex related to anode production;
- Investments in Hydro's Tomago and Slovalco smelting plants in Australia and Slovakia, respectively, which currently produce aluminium that does not comply with the EU Taxonomy's technical screening criteria;
- Extrusion presses and sustaining capex for extrusions.

Risks related to anode raw materials that were highlighted in the above discussion of Hydro's HalZero technology are applicable here.

[23] https://ir.newfortressenergy.com/news-releases/news-release-details/nfe-signs-gas-supply-agreement-hydro-alunorte-alumina-refinery
[24] https://www.hydro.com/en-NO/media/news/2015/norsk-hydro-long-term-icms-tax-framework-established-for-hydros-brazil-operations/

Description of Hydro's sustainability-linked financing framework

Key performance indicators (KPIs)

Hydro has selected two KPIs as the basis for its sustainability-linked financing framework.

- ✓ KPI 1: Scope 1 & 2 absolute GHG emissions (million tCO_2eq)
- ✓ KPI 2: Post Consumer Scrap (PCS) Aluminium Recycling Capacity (tonnes)

Sustainability performance targets (SPTs)

Hydro has identified two SPTs that correspond to KPI 1 and one SPT that corresponds to KPI 2, which are summarized below.

	KPI 1: Scope 1 & 2 absolute GHG emissions (million tCO_2eq)		**KPI 2:** Post Consumer Scrap (PCS) Aluminium Recycling Capacity (tonnes)
SPT	1a. Reduce GHG emissions, direct and indirect emissions (Scope 1 and 2), by 30 percent by 2030	1b. Reduce GHG emissions, direct and indirect emissions (Scope 1 and 2), by 10 percent by 2025	2. Increase the post-consumer scrap recycling capacity to 660,000 tonnes by 2025
Baseline/ reference value	2018	2018	335,000 tonnes (2021)

The company has shared that at least one of the KPIs will be used for sustainability-linked loans issued under the framework, and both KPIs will be used for sustainability-linked bonds. Hydro will choose between SPT 1a or 1b depending on the maturity of the financing instrument.

On the target observation date (TOD) specified for each sustainability-linked instrument, the company's performance on the KPI(s) will be compared against the corresponding SPT(s). Should the company fail to achieve any of the SPTs, a trigger event will occur, leading to a change in the characteristics of the instrument (see Financial Characteristics section).

Fallback mechanisms and exceptional events

The KPIs and SPTs set out in this Framework will remain applicable throughout the tenor of any security issued under the Framework, regardless of any changes to Hydro' sustainability strategy.

Under the framework, changes that would lead to a five percent change in the baseline for SPT 1 will result in a change in the baseline. This could be the result of changes to Hydro's organizational structure, KPI calculation methodology, or significant changes in data due to better data accessibility. According to Hydro, the updated baseline will be externally verified, but there will be no reconsideration of the SPT or update to this second party opinion. Because such modifications could greatly alter the ambition of the SPTs, we would recommend third-party reassessment accordingly.

Financial characteristics

The financial characteristic for each sustainability-linked financing instrument will be specified in the transaction-specific documentation. Possible adjustments to the financial characteristics include coupon step-ups and/or increased redemption price of bonds. Hydro aims for the size of the change to be meaningful and commensurate. According to Hydro, both SPTs will be weighted equally when calculating the size of the adjustment to reflect the equal materiality of the KPIs.

Reporting

Transparency, reporting, and verification of impacts are key to enable investors to follow the performance of the KPIs selected. Procedures for reporting and disclosure are also vital to build confidence that SLB is contributing towards a sustainable and climate-friendly future, both among investors and in society.

Hydro will report on KPI performance and progress towards the SPTs via Hydro's publicly available annual report, which will be published on its website, and/or in a separate sustainability-linked progress report. Reporting will include:

- Performance on the KPIs and related SPTs, including calculation methodology and baselines
- Information about potential recalculation of baselines
- Information on relevant updates to Hydro's sustainability strategy and/or governance with an impact on the KPIs and SPTs
- A list of outstanding sustainability-linked financing instruments

Reporting will also include explanation of the main factors behind changes in KPI performance, positive sustainability impacts from improved KPI performance, and updates on relevant regulatory changes.

Verification

Hydro's reporting on its performance on the KPI(s) against the SPT(s) will be verified by an external reviewer. According to Hydro, the verification report will be published and will be part of the external assurance for Hydro's annual report.

Assessment of Hydro's sustainability-linked financing framework

In this section we comment on Hydro's sustainability-linked financing framework alignment with the Sustainability Linked Bond Principles (SLBP) and Sustainability Linked Loan Principles (SLLP). According to the SLBP and SLLP, the KPIs should be relevant, core and material to the issuer's overall business, and of high strategic significance to the issuer's current and/ or future operations. The SLBP and SLLP further recommend that three benchmarking approaches are considered during the target-setting exercise, the below table summarizes the conclusions of our review of Hydro's target-setting process. We also include some comments on methodology choices including benchmarks and baselines, as well as comments on bond characteristics, reporting and verification.

CICERO Green finds Hydro's sustainability-linked financing framework to be in alignment with the SLBP and SLLP.

Assessment of KPI 1: Scope 1 & 2 absolute GHG emissions (million tonnes CO2e)

Detailed comments on KPI selection

Aspect	CICERO Green Comments
Materiality	**KPI 1 is material in terms of addressing climate risks and impacts, but only if used together with KPI 2** ✓ KPI 1 covers Scope 1 and 2 emissions, which are substantial and a material issue for Hydro due to large process emissions and the highly energy-intensive nature of aluminium production. Note that Hydro is vertically integrated, and so KPI 1 also covers substantial emissions from Hydro's own bauxite mining and alumina refining activities. ✓ Scope 1 and 2 emissions only comprised 40% of Hydro's Scope 1, 2 and 3 emissions in 2021. As such, KPI 1 might not be considered material to Hydro's climate risks and impacts in isolation, and it is positive that Hydro will always use both KPI 1 and KPI 2 in sustainability-linked financing instruments, since the latter indirectly addresses Scope 3 emissions. There are however some limitations with KPI 2 in this respect (see "Assessment of KPI 2: Post Consumer Scrap (PCS) Aluminium Recycling Capacity (tonnes)"). ✓ KPI 1 includes Scope 1 and 2 emissions from all of Hydro's operating segments.
Strategic Significance	**The KPI is strategically significant** ✓ KPI 1 aligns with the corporate-level KPIs and targets that Hydro has set on emissions reductions and can be considered fully aligned with Hydro's sustainability strategy. KPI 1 also aligns strongly with Hydro's broader corporate strategy, of which production of low-carbon aluminium is clearly a pillar. ✓ Short-term remuneration incentives for Hydro's CEO and CMB include delivering on Hydro's 2025 strategic targets, thereby partially aligning with the timeframe covered by KPI 1's associated SPT.
Methodology	**The methodology is robust and transparent** ✓ KPI 1 is clearly defined, its scope is clear, and it can be consistently calculated due to the use of the GHG Protocol. ✓ We understand the KPI as referring to Hydro's Scope 1 and 2 emissions, calculated using the GHG Protocol's equity share approach, thereby reflecting emissions from all of Hydro's operations, including non-consolidated operations where Hydro has a minority interest. ✓ Hydro calculates its Scope 2 emissions using the GHG Protocol's location-based accounting method, which may more accurately reflect emissions from purchased electricity than the market-based approach. Using a location-based accounting method also means that purchases of renewable electricity guarantees of origin would not drive performance on KPI 1.

- ✓ As an absolute measure of emissions, KPI 1 may be affected by economic activity, impacting comparability from year to year. Note that Hydro reports on emissions intensity of aluminium production in its annual reporting, which should be considered as important complementary data to KPI 1 in order to distinguish between the effects of economic activity and its own efforts to decarbonize.
- ✓ Hydro's framework indicates that the 2018 baseline is the same as the baseline for Hydro's corporate-level emissions reduction targets, which were introduced in 2019. The 2018 baseline does not give Hydro any advantage with regards to achieving the associated SPT, as Hydro's Scope 1 and 2 emissions in 2021 remain essentially unchanged from 2018.
- ✓ Hydro has identified the International Aluminium Institute's (IAI) decarbonization pathways, published in September 2021, as the external benchmark for KPI 1. The pathways were developed by the IAI's Greenhouse Gas Pathways Working Group, whose members include IAI member companies and regional associations. Whereas there is some transparency around the underlying methodology and data, it does not appear that the pathways were subject to peer reviews or other forms of input external to the IAI.[25]

Assessment of SPTs 1a and 1b

- SPT 1a: Reduce KPI 1 by 30 percent by 2030 compared to 2018 baseline
- SPT 1b: Reduce KPI 1 by 10 percent by 2025 compared to 2018 baseline

Detailed comments on SPT ambitiousness

Benchmark	CICERO Green Comments
Own performance	**Ambitious vs own performance** ✓ The required emissions reductions under SPTs 1a and 1b exceed Hydro's historical performance over 2018-2021. Over 2018-2021, Hydro's Scope 1 and 2 emissions have declined by 0.3%, or an average of 0.1% each year. By contrast, SPTs 1a and 1b independently entail annual average declines of 1.4% and 2.5%, respectively. Achieving SPT 1a after Hydro has already achieved SPT 1b would entail an annual average decline of 4% between 2025-2030. ✓ According to Hydro, it is already approaching the theoretical minimum emissions intensity for primary aluminium production that is likely the lowest in the sector. Further emissions reductions will require substantial investments in new technologies (see "Initiatives and strategy to achieve SPTs 1a and 1b").

[25] The pathways are based on the IEA's Net-Zero by 2050 Scenario (NZE) and Beyond 2°C Scenario (B2DS) and the IAI's emissions data and production forecasts. See https://international-aluminium.org/resource/aluminium-sector-greenhouse-gas-pathways-to-2050-2021/

Peers	**More ambitious than immediate peers by requiring absolute emissions reductions** ✓ Peer benchmarking is challenging due to the limited number of companies that can be considered immediate peers to Hydro in terms of being pureplay, vertically integrated aluminium producers. Among the group of aluminium sector peers identified by the Transition Pathway Initiative (TPI), the most relevant appear to be Alcoa, China Hongqiao, Rusal, and Vedanta. Among these, Alcoa[26] and Vedanta[27] have set company-wide Scope 1 and 2 emissions intensity reduction targets, but these are not accompanied by commitments on absolute emissions reductions. ✓ Comparability of Scope 1 and 2 targets set by diversified and more specialized companies from the TPI peer group include, i.a. Rio Tinto's (15% absolute reduction by 2025 and 50% by 2030 from a 2018 baseline)[28] and Press Metal's (15% absolute reduction by 2025 and 30% by 2030 from a 2020 baseline).[29] However, comparability is limited due to differences in their activities, place in the value chain, and baselines.
Science-based scenarios or international targets	**Aligned with the Paris Agreement, although there are risks of emissions lock-in** ✓ We assess SPTs 1a and 1b as Paris Agreement aligned. If SPTs 1a and 1b are achieved, Hydro's share of the global aluminium carbon budget remains roughly constant under the IAI's Beyond 2-Degree (B2DS) scenario. ✓ Hydro's share of the global aluminium carbon budget in 2025 and 2030 under SPTs 1a and 1b also remains roughly constant under the IAI's 1.5-degree scenario[30] but increases when compared with the One Earth Climate Model's (OECM) 1.5-degree aligned aluminium sector pathway.[31] ✓ A third reference point is the IEA Net Zero by 2050 (NZE) scenario, under which the emissions intensity of global aluminium production declines by 3% annually between 2020 and 2030. By comparison, Hydro expects the emissions intensity of Reduxa, its low-carbon aluminium product, to decline from 3.4-4.0 to 2 $kgCO_2eq$ / kgAl between 2020 and 2030, which corresponds to a 3% decline per year. While this compares favourably with the NZE, it should be noted that overall emissions intensity reductions implied by SPTs 1a and 1b are likely to be lower, as Reduxa is not fully representative of overall production. ✓ According to Hydro, scenarios and pathways for the aluminium sector other than the IAI's may not incorporate the same level of insight into the characteristics of the aluminium industry.

[26] https://www.alcoa.com/sustainability/en/sustainability-at-alcoa/strategic-long-term-goals
[27] https://d1rbiogke1jwo5.cloudfront.net/wp-content/uploads/2021/10/VEDANTA-ALUMINIUM-BUSINESS-SDR-2020-21-Final.pdf
[28] https://www.riotinto.com/en/sustainability/climate-change
[29] https://www.pressmetal.com/pdf/Sustainability%20Report%202021.pdf
[30] 1.2% in 2025 and and 1.0% in 2030, compared to 1.1% in 2018. The sectoral carbon budget for 2025 was estimated using linear interpolation between IAI figures for 2018 and 2030. See https://international-aluminium.org/resource/1-5-degrees-scenario-a-model-to-drive-emissions-reduction/
[31] 1.6% in 2025 and 1.7% in 2030, compared with 1.1% in 2019. The OECM sector pathways were commissioned by the Net Zero Asset Owner Alliance to support target-setting for its members and were developed by the Institute for Sustainable Futures at the University of Technology Sydney, with review by a multistakeholder expert panel. See https://link.springer.com/article/10.1007/s42452-022-05004-0 for underlying work on the aluminium sector.

- ✓ Note that the above analysis does not account for Hydro's substantial historical emissions reduction efforts. Hydro's 2018 baseline places it at a lower starting point than peers, who will have to achieve greater emission reductions over a similar timeline to decarbonize in line with the Paris Agreement.
- ✓ Note also that the above conclusions may be different if Hydro's loses market share over 2018-2030 and its growth fails to match the projected growth of the wider aluminium sector under the referenced climate scenarios.
- ✓ Assessment of SPTs 1a and 1b should also consider the wider context of Hydro's current revenues and planned investments, including possible emissions lock-in from Hydro's planned switch to natural gas at its Alunorte refinery (see "Assessment of Hydro's revenues" and "Assessment of Hydro's investment plans").

Initiatives and strategy to achieve SPTs 1a and 1b

Hydro has specified a pathway to achieving SPTs 1a and 1b that involves initiatives focused on reducing emissions from fossil fuel combustion at its alumina refinery at Alunorte. Up till 2025, the main contributor to emissions reductions will be the ongoing switch at the refinery from fuel oil to natural gas, which will be used in the calcination process and in some steam boilers. Hydro expects that this step will reduce emissions by around 700,000 tCO_2eq. The initiatives also include the electrification of currently coal-fired boilers at the Alunorte refinery, which will deliver emissions reductions of 400,000 tCO_2eq. Together, these investments will account for nearly all of the emissions reductions required to achieve SPT 1b. Hydro aims to achieve most of the remaining emissions reductions required to achieve SPT 1a with electrification of the remaining boilers, including those running on natural gas. Refer to "Assessment of Hydro's investment plans" for a discussion of pitfalls associated with these investments. The remaining emissions reductions will depend on the decarbonization of Brazil's electricity grid and smelter process improvements. The different rates of decarbonization entailed by SPT 1a and 1b are linked to the timing of the expected emissions reductions—emissions reductions from the fuel switch and boiler electrification will be realized over 2024-2030, with other emissions reductions achieved more evenly across the entire period.

Note that, according to Hydro's provided emissions reduction pathway, SPTs 1a and 1b can be achieved entirely without addressing process emissions from aluminium smelting, which are the hardest emissions to abate in the aluminium production process. In this regard, it is a strength that the company has already developed a roadmap towards net zero emissions in 2050 that entails addressing these and remaining emissions sources, and is already allocating capital towards the development of the necessary technologies (see "Assessment of Hydro's investment plans"). Consideration of Hydro's SPTs should therefore take into account the broader context of Hydro's overall 2050 climate strategy.

Summary of key factors beyond the issuers' direct control that may affect the achievement of SPTs 1a and 1b:

According to Hydro, the main external factor affecting its achievement of SPTs 1a and 1b is the decarbonization of the electricity grid in Brazil and other countries. Hydropower supplied 66% of Brazil'electricity demand in 2020, with solar and wind, biomass and fossil fuels accounting for 11%, 12% and 8%, respectively. Note that in addition to expanding renewable energy capacity, the Brazilian government has since begun incentivizing natural gas production and gas-fired power plant development. This is motivated by the goal of tapping its offshore gas reserves, in addition to diversifying its power mix in the face of drought and deforestation, which may threaten the

future stability of hydropower-based electricity.[32] According to Hydro, it intends to enter into power purchase agreements for renewable electricity only.

Assessment of KPI 2: Post Consumer Scrap (PCS) Aluminium Recycling Capacity (tonnes)

Detailed comments on KPI selection

Aspect	CICERO Green Comments
Materiality	**The KPI is material in terms of Hydro's intent to address Scope 3 emissions** ✓ According to Hydro, KPI 2 was selected to address emissions from Scope 3, a large majority of which come from its sourcing of scrap aluminium. Hydro does not assign zero emissions to pre-consumer scrap aluminium but considers PCS aluminium to have zero emissions as it has already fulfilled its originally intended purpose. KPI 2 can be considered material with regards to reducing its Scope 3 emissions. ✓ However, we note that there are some Scope 3 emissions that remain unaddressed by KPI 2, including those associated with external transportation of raw materials and sold products, as well as embedded emissions in capital equipment. Further, as Hydro intends to expand into businesses such as batteries and renewable energy between now and 2030, the share of Scope 3 emissions associated with raw material extraction and manufacturing of components, as well as waste management, could increase.
Strategic Significance	**The KPI is of strategic significance** ✓ KPI 2 matches Hydro's corporate ambition to recycle 660,000 tonnes of PCS aluminium by 2025. Further, delivering recycled aluminium products is a clear aspect of the company's sustainability and corporate strategies, and the company expects recycled aluminium to be a driver of EBITDA growth moving forward. The company has also invested in aluminium scrap sorting technology as early as 2015 that is relevant to achieving SPT 2.[33] ✓ KPI 2 aligns with the corporate-level KPIs and targets that Hydro has set on emissions reductions and can be considered fully aligned with Hydro's sustainability strategy. KPI 2 also aligns strongly with Hydro's broader corporate strategy, of which production of low-carbon aluminium is clearly a pillar. ✓ Short-term remuneration incentives for Hydro's CEO and CMB include delivering on Hydro's 2025 strategic targets, which include targets on recycling capacity and profitability (EBITDA potential).
Methodology	**The methodology is mostly robust and transparent** ✓ We understand the KPI as being the total tonnage of post-consumer scrap aluminium taken in for recycling each year at Hydro's recycling plants. Hydro

[32] https://www.eia.gov/todayinenergy/detail.php?id=49436
[33] https://www.hydro.com/no-NO/media/news/2015/hydro-investing-in-sorting-technology-for-recycling/

	clearly defines PCS aluminium in the framework as aluminium scrap from products that have fulfilled the purpose for which they were produced. ✓ As noted earlier, Hydro's selection of KPI 2 was informed by a desire to address its Scope 3 emissions. According to Hydro, there is a strong business case for increasing recycling capacity given growing demand for decarbonized aluminium, and its intention is to use recycled PCS aluminium in its own production. However, since KPI 2 is defined as the amount of PCS aluminium processed by Hydro's recycling plants, the extent that achieving KPI 2 contributes to reductions in Hydro's own Scope 3 emissions depends on how much recycled aluminium is sold to external parties versus used to substitute Hydro's own aluminium inputs. ✓ Hydro has identified aluminium recycling figures in the IEA's Net Zero Emissions by 2050 (NZE) scenario as an external benchmark for SPT 2. This is a relevant and reliable benchmark.

Assessment of SPT 2: Increase KPI 2 to 660,000 tonnes by 2025

Detailed comments on SPT ambitiousness

Benchmark	CICERO Green Comments
Own performance	**Ambitious vs own past performance in requiring technological innovation** ✓ Historical data presented by Hydro show recycled PCS more than tripling between over 2018-2021 to 335,000 tonnes, or an average annual growth of 74% per year. By comparison, achieving SPT 2 entails nearly doubling recycling capacity by adding 325,000 tonnes over 2022-2025, or an average annual growth of 32%. ✓ Whereas the targeted growth under SPT 2 is less than historical growth in Hydro's PCS recycling, note that historical growth was attributable to Hydro's 2017 consolidation of its ownership in Sapa, which was previously already 50% owned by Hydro Extrusions. ✓ According to Hydro, easily recyclable scrap is expensive, and maintaining cost competitiveness requires Hydro to develop and deploy technology that can better sort post-consumer waste.
Peers	**Scope of ambition is beyond peers** ✓ Of the peers along the aluminium value chain identified in the Transition Pathway Initiative's assessment of the sector, none have set targets pertaining specifically to increasing the production or use of recycled aluminium. ✓ One (Sumitomo Chemicals) has set a target specifically to reduce Scope 3 emissions by 14% from 2020, although the company's large portfolio of specialty materials and chemicals beyond aluminium reduces the comparability of its target. Further, it is challenging to benchmark this target against SPT 2 given uncertainty

	around the scale of Scope 3 emissions reductions that would be associated with SPT 2.
Science-based scenarios or international targets	**Aligned with the Paris Agreement/1.5-degree goals on the basis of recycling capacity growth and the share of PCS in Hydro's total secondary aluminium production that the target would entail, provided Hydro's pre-consumer scrap capacity does not increase.** ✓ The near doubling of PCS recycling capacity entailed by SPT 2 between 2022-2025 exceeds the 43% growth in PCS recycling between 2018-2025 under the IAI's 1.5-degree scenario.[34] It also exceeds the 37% growth in PCS recycling between 2019-2025 under the One Earth Climate Model's (OECM) 1.5-degree aligned aluminium sector pathway.[35] ✓ In addition to the growth in PCS scrap, its share in secondary aluminium production is an important aspect of the NZE. Hydro's 2021 share of post-consumer scrap in its total recycling capacity was 25%. Note that Hydro has not disclosed how it expects the share of PCS recycling in its own use of recycled aluminium to change in the future. If it achieves SPT 2 while keeping pre-consumer scrap recycling capacity constant, its share of PCS in total recycled aluminium would increase to 39%. This compares favourably with the corresponding milestone of 36% in the IAI's 1.5-degree scenario.[36] ✓ According to Hydro, scenarios and pathways for the aluminium sector other than the IAI's may not incorporate the same level of insight into the characteristics of the aluminium industry. We note that IEA scenario data on required secondary aluminium recycling growth only include manufacturing and post-consumer scrap, but not internal/fabrication scrap and is thus less suitable for benchmarking SPT 2. ✓ Benchmarking SPT 2 in terms of Scope 3 emissions reductions achieved is not possible as this would depend on the emissions intensity of aluminium substituted; Hydro has not made any such estimates but believes that this would mostly be in Europe where aluminium production is already relatively efficient.

Initiatives and strategy to achieve SPT 2

Hydro's strategy to achieve SPT 2 involves investing in post-consumer scrap recycling capacity. In April 2022, Hydro announced an offer to acquire Alumetal. If finalized, the acquisition will add ~150,000 tonnes of capacity—46% of the amount required to achieve SPT 2.

Hydro has also announced the following planned greenfield projects and expansions to existing facilities that, if fully realized, will increase Hydro's PCS recycling capacity by 348,000 tonnes (see table below).

[34] Estimated using linear interpolation based on IAI figures for 2018 and 2030.
[35] See https://link.springer.com/article/10.1007/s42452-022-05004-0/tables/6
[36] The milestone for PCS share in secondary aluminium was estimated using linear interpolation, based on 2018 and 2030 data for pre-consumer scrap (manufacturing plus internal/fabrication scrap) and post-consumer scrap in IAI's 1.5-degree scenario.

Announced projects	Capacity increase (tonnes)
USA - Oregon	27,000
USA - Michigan	120,000
Norway	36,000
Germany	25,000
UK	7,000
Hungary	90,000
Sweden	20,000
Spain	23,000
Total	**348,000**

According to Hydro, work on its Michigan recycling plant has just begun. Hydro was otherwise unable to disclose the status of and risks of the announced projects.

As noted above, Hydro shared that easily recyclable scrap is expensive, and maintaining cost competitiveness requires Hydro to develop and deploy technology that can better sort post-consumer waste. As such, the company has been developing improved sorting technology to increase the available volumes of PCS aluminium. The technology, laser induced breakdown spectroscopy (LIBS), can distinguish between different aluminium alloys. According to Hydro, the application of LIBS sorting technology does not substantially change GHG emissions from the recycling process, but can contribute to reduced non-GHG emissions such as volatile organic compounds or polychlorinated dioxins and furans. Hydro also notes that emissions from increased transportation of PCS aluminium and secondary aluminium to and from its recycling plants are insignificant in this context. We nonetheless encourage Hydro to measure and address such emissions.

Note that Hydro will rely on natural gas as the fuel for powering aluminium remelters, and that it expects to start piloting the use of hydrogen by 2030. It is unclear how easily natural gas-powered remelters can be retrofitted to make use of hydrogen; even if the technological and financial barriers are minimal, there is no guarantee that Hydro will be successful in implementing this change. As such there is a risk of emissions lock-in associated with Hydro's investments in natural gas-powered remelters. That being said, at the company level, the impact of these emissions is unlikely to outweigh the overall benefits from the increased use of recycled aluminium in Hydro's aluminium production, provided that this displaces primary aluminium production or production of secondary aluminium from pre-consumer scrap.

However, at the economy-level, there is a risk of a rebound effect from increased demand and supply for secondary aluminium, namely that increased secondary aluminium production may lower the prices of both primary and secondary material, leading to increased overall demand. Further, the overall emissions savings and other environmental benefits from aluminium recycling may be eroded if it fails to displace primary aluminium production and instead displaces the use of other raw materials.[37]

Summary of key factors beyond the issuers' direct control that may affect the achievement of SPT 2:

According to Hydro, it may not be able to achieve the target if it is unable to secure sufficient quantities of PCS aluminium.

Comments on financial characteristics, reporting and verification

[37] https://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1043&context=management_fac

Component	CICERO Green Comments
Financial Characteristics	✓ CICERO Green has not reviewed to what degree the variation in the financial characteristics of the SLB/SLLs is commensurate and meaningful. ✓ Investors are encouraged to review the terms sheets in detail and conduct their own assessment of the financial characteristics of the SLBs.
Reporting	✓ Transparency, reporting, and verification of impacts are key to enable investors to follow the performance of the KPIs selected. Procedures for reporting and disclosure are also vital to build confidence that the SLB/SLL is contributing towards a sustainable and climate-friendly future, both among investors and in society. ✓ Hydro is committed to transparent and regular reporting on its performance against the SPT that includes relevant contextual information. It is important that Hydro continues to disclose the emissions intensity of its aluminium production and Scope 3 emissions as complementary data to KPIs 1 and 2.
Verification	✓ Both KPIs are externally verifiable and Hydro has committed to obtaining external and independent verification on its performance against the KPIs. ✓ According to Hydro, the verification report will be published and will be part of the external assurance for Hydro's annual report.

4 Terms and methodology

This note provides CICERO Shades of Green's (CICERO Green) second opinion of the client's framework dated May 2022. This second opinion remains relevant to all green and sustainability-linked bonds and/or loans issued under this framework for the duration of three years from publication of this second opinion, as long as the framework remains unchanged. Any amendments or updates to the framework require a revised second opinion. CICERO Green encourages the client to make this second opinion publicly available. If any part of the second opinion is quoted, the full report must be made available.

The second opinion is based on a review of the framework and documentation of the client's policies and processes, as well as information gathered during meetings, teleconferences and email correspondence. In our review we have relied on the correctness and completeness of the information made available to us by the company.

Expressing concerns with 'Shades of Green'

CICERO Green second opinions are graded dark green, medium green or light green, reflecting a broad, qualitative review of the climate and environmental risks and ambitions. The shading methodology aims to provide transparency to investors that seek to understand and act upon potential exposure to climate risks and impacts. Investments in all shades of green projects are necessary in order to successfully implement the ambition of the Paris agreement. The shades are intended to communicate the following:

Shading	Examples
Dark Green is allocated to projects and solutions that correspond to the long-term vision of a low-carbon and climate resilient future.	Solar power plants
Medium Green is allocated to projects and solutions that represent significant steps towards the long-term vision but are not quite there yet.	Energy efficient buildings
Light Green is allocated to transition activities that do not lock in emissions. These projects reduce emissions or have other environmental benefits in the near term rather than representing low carbon and climate resilient long-term solutions.	Hybrid road vehicles

Approach to sustainability-linked financing

The structure of sustainability-linked financing instruments linking financial returns with environmental performance can provide security around environmental impacts. However, these can vary widely in terms of robustness depending on what KPIs are selected and how they are measured. We provide transparency on 1) the relevance, materiality and reliability of selected KPIs, 2) the rationale and level of ambition of the proposed Sustainability Performance Targets, 3) the relevance of selected benchmarks and baselines, as well as transparency on how well the strategy outlined to achieve them fits with a low carbon and climate resilient future. By considering these factors, we provide context to consider the ambition level of the sustainability-linked instruments. Please note that CICERO Green does not evaluate any financial aspects of transaction, including to what degree the variation in the financial characteristics is commensurate and meaningful.

Shading	Examples
Dark Green is allocated to projects and solutions that correspond to the long-term vision of a low-carbon and climate resilient future.	Solar power plants
Medium Green is allocated to projects and solutions that represent significant steps towards the long-term vision but are not quite there yet.	Energy efficient buildings
Light Green is allocated to transition activities that do not lock in emissions. These projects reduce emissions or have other environmental benefits in the near term rather than representing low carbon and climate resilient long-term solutions.	Hybrid road vehicles
Yellow is allocated to projects and solutions that do not explicitly contribute to the transition to a low carbon and climate resilient future. This category also includes activities with too little information to assess.	Healthcare services
Red is allocated to projects and solutions that have no role to play in a low-carbon and climate resilient future. These are the heaviest emitting assets, with the most potential for lock in of emissions and highest risk of stranded assets.	New oil exploration

Incorporated into the sustainability-linked bond assessment is our company climate risk assessment approach. We allocate a shade of green, yellow or red (see figure below) to revenues or portfolio value which reflect alignment of the underlying activities to a low carbon and climate resilient future and taking into account governance issues.

Governance assessment

When assessing the governance of the company, CICERO Green looks at five elements: 1) strategy, policies and governance structure; 2) lifecycle considerations including supply chain policies and environmental considerations towards customers; 3) the integration of climate considerations into their business and the handling of resilience issues; 4) the awareness of social risks and the management of these; and 5) reporting.

Further, sound governance and transparency processes facilitate delivery of the client's climate and environmental ambitions laid out in the framework. Hence, key governance aspects that can influence the implementation of the green finance are also carefully considered. In addition to the issuer-level elements considered above, CICERO Green considers: 6) the selection process used to identify and approve eligible projects under the framework, 7) the management of proceeds and 8) the reporting on the projects to investors.

Based on these factors, we assign an overall governance grade: Fair, Good or Excellent, which is also factored into the overall shading for green financing frameworks. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.

Appendix 1:
Referenced Documents List

Document Number	Document Name	Description
1	Green and Sustainability-Linked Financing Framework (May 2022)	
2	Annual report 2021	
3	Capital Markets Day 2021 Presentation	
4	Global Sustainability Directive (Mar 2022)	Presents the principles Hydro follows to address risks and opportunities from its impacts on society and the environment. Internal document.
5	Global Procedure - Sustainability in New Projects and Major Changes to Existing Facilities (Mar 2022)	Sets out the minimum requirements that Hydro's projects shall follow to consider their positive or negative contributions to sustainability topics. Internal document.
6	Global Procedure - Risk screening to determine projects sustainability risk category (Mar 2022)	Hydro's framework for preliminary screening of sustainability risks in all types of projects and for their categorization. Internal document.
7	Global Procedure - Plant Design, Construction and Decommissioning (Jan 2018)	Ensures that design, construction and decommissioning of Hydro's plants are performed to minimum standards. Internal document.
8	Global Procedure - Sustainability in the supply chain (Jun 2021)	Explains Hydro's commitment to sustainability principles in its supply chain and sets forth procedures for how to run a due diligence process based on guidance from external standards. Internal document.
9	Global Procedure - Environment Management (Nov 2020)	Provides Hydro's business areas, locations and units with minimum requirements on environmental management. Internal document.

10	Supplier Code of Conduct (Oct 2020)	
11	Human Rights Policy (Dec 2020)	
12	Global Supporting Document - Biodiversity and Ecosystem Services Risk Screening (not dated)	Outlines Hydro's recommended steps for conducting a biodiversity and ecosystem services (BES) risk and impact assessment. Internal document.
13	Global Supporting Document - Glossary of Terms for Biodiversity and Ecosystem Services	Internal document.
14	Code of Governance (Sept 2020)	Defines how Hydro creates value for all its stakeholders through the Hydro Way and sets out the basis for Hydro's Governance System. Internal document.
15	Global Supporting Document - Guideline for board members in subsidiaries and affiliated companies	Provides guidance on the rights, duties and obligations of Hydro employees and representatives appointed to serve on boards of subsidiary and affiliated companies. Internal document.

Appendix 2: Sector Background

Aluminium end products are used in a wide range of industries (e.g., manufacturing, transport equipment, vehicles and parts, construction, machinery, product packaging and many more). As of 2019, an estimated 36% of the global aluminium stock was in buildings, 25% in electrical cables and machinery, and 30% in transport applications. Global aluminium production grew annually by an average of 5.5% over 2010-2018, stayed flat in 2019 and 2020, but is expected to continue expanding as a result of continued population and GDP growth. In the IEA's Net Zero Emissions by 2050 (NZE) scenario, the sector is projected to grow by 0.8% annually on average until 2050, or a total 10% growth in total demand from present levels.

According to the International Aluminium Institute, around 1.1 billion, or 2% of annual greenhouse gas emissions, were attributable to the aluminium sector across Scopes 1, 2, and 3 in 2019. Around 90% of total sector emissions are from primary two stages of the production process—alumina refining and smelting by electrolysis. As is typical for production of many metals, aluminium production involves ore extraction, refining, and smelting before the metal itself can be further processed for specific end uses. Deposits of aluminium ore, or bauxite, tend to be concentrated in the top soils of tropical and subtropical regions, including parts of Africa, the Caribbean, South America and Australia. Bauxite is refined to produce alumina (aluminium hydroxide) via the Bayer process. High temperatures of around 1,000 degrees Celsius are needed in the calcination, the final stage of the Bayer process, rendering it highly energy-intensive as well as emissions-intensive due to current reliance on fossil fuel boilers. Alumina produced from the Bayer process is smelted to produce aluminium metal via the Hall-Héroult process. Smelting involves electrolysis of molten dissolved alumina, forming aluminium metal at the cathode and oxygen gas at the carbon anode. In addition to indirect emissions from high energy needs, resultant oxidation of the anode is a significant source of process emissions.

According to the IEA, energy intensity for alumina refining has declined on average by around 3% annually during 2010-2018, with the energy intensity of smelting having declined by around 0.6% annually during 2010-2017 before increasing by around 0.3% per year over 2018-2020. Energy efficiency improvements and use of renewable electricity have substantially reduced emissions from the Bayer and Hall-Héroult processes and are expected to continue playing critical roles in decarbonizing the sector.

However, hard-to-abate emissions remain due to the lack of available technologies that overcome 1) the high temperatures required during calcination, and 2) anode oxidation. Efforts to reduce emissions from calcination include piloting the use of renewable hydrogen[38] and electricity.[39] Research also suggests that concentrated solar thermal (CST) energy may be a viable energy source for calcination if hybridized with other low-carbon sources to address challenges from cloud cover and seasonality.[40] Major industry initiatives to address smelter emissions include the development of inert anode materials that do not oxidize.[41] Others, including Hydro, are focused on the chlorination of aluminium oxide prior to electrolysis to avoid oxidation of the carbon anodes, which avoids the release of carbon dioxide.[42] Carbon capture and sequestration also holds potential for reducing smelter emissions, although the low

[38] https://arena.gov.au/news/renewable-hydrogen-could-reduce-emissions-in-alumina-refining/
[39] https://www.alcoa.com/australia/en/news/releases?id=2022/05/alcoa-receives-funding-to-pilot-carbon-reduction-technology-for-alumina-refining-supporting-refinery&year=y2022
[40] http://www.cspfocus.cn/en/market/detail_3291.htm
[41] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/110921-alcoas-plans-for-new-aluminum-capacity-hinge-on-elysis-technology-executives
[42] https://blog.sintef.com/sintefenergy/energy-efficiency/could-the-chloride-process-replace-the-hall-heroult-process-in-aluminium-production/

concentration of CO_2 in exhaust gases from the smelting process poses a substantial challenge to developing capture technology.[43]

Given the hard-to-abate nature of primary aluminium production, decarbonization of the sector also necessitates increased production of secondary aluminium from recycled aluminium. Replacing primary aluminium production with secondary recycling has substantial emissions reduction potential as the production of secondary aluminium is 95% less emissions-intensive than primary production from bauxite.[44] Secondary aluminium can be produced from both pre-consumer scrap (new scrap) or post-consumer scrap (PCS or old scrap), where the former is scrap created during the production of finished aluminium products and the latter is scrap aluminium from products that have reached their end-of-life. According to the IEA, in 2019, the share of secondary aluminium in total aluminium production has stayed between 31-34% over 2000-2019. In 2019, 34% of total aluminium production utilized secondary aluminium, of which 58% came from PCS scrap. Under the NZE, 40% of aluminium production needs to come from secondary aluminium by 2030, with at least 70% of this amount coming from PCS scrap.[45] In order to achieve this, collection rates for PCS scrap need to increase from 70% in 2019, and improved sorting technology also needs to be deployed in order to increase recovery rates.

[43] https://www.iea.org/reports/aluminium
[44] https://aluminium.org.au/wp-content/uploads/2020/10/IAI-Recycling-Factsheet.pdf
[45] https://www.iea.org/reports/aluminium

°CICERO Shades of Green

Appendix 3:
About CICERO Shades of Green

CICERO Green is a subsidiary of the climate research institute CICERO. CICERO is Norway's foremost institute for interdisciplinary climate research. We deliver new insight that helps solve the climate challenge and strengthen international cooperation. CICERO has garnered attention for its work on the effects of manmade emissions on the climate and has played an active role in the UN's IPCC since 1995. CICERO staff provide quality control and methodological development for CICERO Green.

CICERO Green provides second opinions on institutions' frameworks and guidance for assessing and selecting eligible projects for green bond investments. CICERO Green is internationally recognized as a leading provider of independent reviews of green bonds, since the market's inception in 2008. CICERO Green is independent of the entity issuing the bond, its directors, senior management and advisers, and is remunerated in a way that prevents any conflicts of interests arising as a result of the fee structure. CICERO Green operates independently from the financial sector and other stakeholders to preserve the unbiased nature and high quality of second opinions.

We work with both international and domestic issuers, drawing on the global expertise of the Expert Network on Second Opinions (ENSO). Led by CICERO Green, ENSO contributes expertise to the second opinions, and is comprised of a network of trusted, independent research institutions and reputable experts on climate change and other environmental issues, including the Basque Center for Climate Change (BC3), the Stockholm Environment Institute, the Institute of Energy, Environment and Economy at Tsinghua University, the International Institute for Sustainable Development (IISD) and the School for Environment and Sustainability (SEAS) at the University of Michigan.