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Betreft Energiediplomatie en import van waterstof

Geachte Voorzitter,

De energiemarkten zijn mondiaal sterk in beweging, met een krappe gasmarkt en een snelle ontwikkeling van hernieuwbare energie. Dit verandert het geopolitieke speelveld en vraagt om een actievere rol van de overheid in het borgen van leveringszekerheid van energie en daarvoor benodigde grondstoffen. Waterstof speelt hierin een belangrijke rol, als alternatief voor olie en gas, en als energiedrager waarmee hernieuwbare energie wereldwijd grootschalig kan worden opgeslagen en getransporteerd. Naast eigen productie van waterstof zal Nederland import nodig hebben. Het kabinet wil ervoor zorgen dat deze import tijdig, duurzaam, veilig en grootschalig van de grond komt.

Over waterstofimport werd uw Kamer eind vorig jaar geïnformeerd in de brief over Voortgang waterstofbeleid[1]. Deze brief is een vervolg hierop en komt tegemoet aan de toezegging aan uw Kamer van 9 december jl.[2] om u dit voorjaar te informeren over een versterkte energiediplomatie-strategie voor met name LNG en waterstof, met aandacht voor de rol van staatsdeelnemingen.

De brief gaat achtereenvolgens in op: 1) de beleidsinzet voor leveringszekerheid van energie; 2) het huidige beleid voor de import van waterstof; en 3) het versterken van dit beleid via instrumenten en energiediplomatie, met aandacht voor internationaal maatschappelijk verantwoord ondernemen (IMVO).

1. De beleidsinzet voor leveringszekerheid van energie

Het kabinetsdoel van het energiebeleid is het realiseren van een betaalbaar, veilig, betrouwbaar en duurzaam energiesysteem. Nederland heeft hierbij een heldere ambitie: klimaatneutraal in 2050. Dit betekent dat de komende decennia een omschakeling moet plaatsvinden van een energiesysteem dat grotendeels is gebaseerd op fossiele bronnen naar een systeem van hernieuwbare en andere CO_2--vrije bronnen[3]. Waterstof zal een onmisbare schakel zijn in deze transitie.

[1] Kamerstuk 32813, nr. 1143
[2] Kamerstuk 29023, nr. 384
[3] Kamerstuk 32813, nr. 1053

Met de Russische militaire agressie in Oekraïne, is hier voor de EU het doel (in het kader van REPowerEU[4]) bijgekomen om zo snel mogelijk onafhankelijk te worden van Russische fossiele energie-importen. Uw Kamer is uitgebreid geïnformeerd over de maatregelen die het kabinet heeft genomen, en nog gaat nemen, ten behoeve van de leveringszekerheid van olie[5] en gas, energiebesparing en de versnelling van de energietransitie. Het is positief dat Nederland dankzij deze maatregelen niet meer direct afhankelijk is van Russische fossiele energie, maar tegelijk benadrukt het kabinet dat het energiebeleid ten aanzien van leveringszekerheid de volle aandacht behoudt.

De transitie naar een hernieuwbare energievoorziening zal de komende decennia geopolitieke risico's veranderen en ongewenste afhankelijkheden gerelateerd aan olie- en gasmarkten geleidelijk afbouwen. Energierelaties met buurlanden worden belangrijker door verdere integratie van onze elektriciteits- en gasnetwerken. Hier komen handelsrelaties bij met andere landen die een goede uitgangspositie hebben om hernieuwbare waterstof (en waterstofdragers) te produceren en exporteren.

Het gaat hier naar verwachting om een brede groep landen, verspreid over de continenten. Op termijn vermindert dit onze afhankelijkheid van een relatief kleine groep van landen (zoals nu met olie en gas). Een gediversifieerd aanbod zal bijdragen aan de leveringszekerheid. Daarom acht het kabinet het van belang om juist in de ontwikkelingsfase van importketens voor waterstof in te zetten op het opbouwen van relaties met deze landen en regio's. Actieve energiediplomatie helpt daarbij om op een verstandige wijze met de risico's en afhankelijkheden van energiebronnen en grondstoffen om te gaan.

Het is grotendeels aan bedrijven om de internationale markt voor waterstof verder te ontwikkelen. Op dit moment staan we echter pas aan het begin van deze ontwikkeling. Het op gang brengen van waterstofimport vereist in deze fase een aanjagende en ondersteunende rol van de overheid vanwege de geopolitieke en strategische belangen en het tijdig kunnen behalen van de klimaatdoelen. Hiermee wil het kabinet de basis leggen voor de toekomstige leveringszekerheid van waterstof.

Uiteraard blijft het kabinet ook goed oog houden voor het belang van inzet op leveringszekerheid van de andere energiedragers en bronnen:

<u>Gas</u>
In de Kamerbrief over gasleveringszekerheid van 14 april jl.[6] is het kabinet ingegaan op de internationale inzet met betrekking tot aardgas en LNG. Hierin is onder meer genoemd dat Nederland, vooral in EU-verband, ten behoeve van de gasleveringszekerheid inzet op versterking van de relaties met gas-producerende landen. Ook staat in die brief dat we, samen met andere lidstaten en de Europese Commissie, inzetten op het gezamenlijk inkopen van gas door het opzetten van een Europees inkoopplatform conform de Noodverordening gas van 19 december

[4] Kamerstuk 22112, nr. 3438
[5] Kamerstuk 36045, nr. 119
[6] Kamerstuk 29023, nr. 417

jl. (Verordening (EU) 2022/2576). Het ambassadenetwerk kan, in het licht van leveringszekerheidsuitdagingen waar Nederland en de EU voor worden gesteld, via contacten en inzet in specifieke gevallen een rol spelen gericht op de toelevering van fossiele energie. Zoals beschreven in de Kamerbrief van 28 september jl.[7] blijven de handelsbevorderende activiteiten van het ambassadenetwerk gericht op de prioriteiten van de BHOS-nota[8], waaronder het ontwikkelen van kansen op het terrein van verduurzaming en digitalisering.

Olie
Wat betreft import van olie ziet het kabinet, naast het eerder uit voorzorg verhoogde dieseldeel van de strategische nationale voorraad, de lopende update van het Landelijk Crisisplan Olie (LCP-O), en het opstellen van een dieseldistributieplan in geval van een dieselschaarste, op dit moment geen noodzaak voor een additionele overheidsinzet. Wel blijft het kabinet ook deze markt nauwlettend volgen.

Elektriciteit
Elektriciteit speelt al een cruciale functie in onze samenleving, en die zal met de energietransitie nog verder toenemen. Het kabinet meent dat de energiediplomatie op elektriciteit op dit moment voldoende is afgedekt door de samenwerking met onze buurlanden, o.a. in het kader van het Pentalaterale Energieforum, en de samenwerking met de acht andere landen in het kader van de Noordzee Energiecoöperatie (NSEC).

Grondstoffen
Grondstoffen spelen een belangrijke rol in de energietransitie. Hernieuwbare energietechnologie leidt tot een grotere behoefte aan mineralen en metalen zoals lithium, kobalt en zeldzame aardmetalen. Om te voorkomen dat afhankelijkheid op het gebied van gas wordt ingeruild voor afhankelijkheid van voor de energietransitie benodigde grondstoffen ziet het kabinet het belang van extra overheidsinzet, zowel nationaal als in EU-verband, op leveringszekerheid van deze kritieke grondstoffen. Afgelopen december heeft het kabinet de nationale grondstoffenstrategie[9] gepubliceerd. Deze strategie heeft tot doel om de leveringszekerheid van grondstoffen op middellange termijn te vergroten.

Het kabinet verwijst verder naar de in de strategie aangekondigde programmatische aanpak, die uw Kamer rond de zomer zal ontvangen, en naar de recent gepubliceerde *Critical Raw Materials Act* van de EU, waarover uw Kamer een BNC-fiche[10] heeft ontvangen. In het kader van de aanpak zal het kabinet bepalen welke acties Nederland onderneemt binnen en aanvullend op de Europese grondstoffenpartnerschappen, onder andere door het sluiten en verdiepen van bilaterale partnerschappen. Aangezien veel van de kritieke grondstoffen en mineralen worden geïmporteerd uit landen waarmee Nederland en de EU ook de relaties op het gebied van waterstof willen versterken, zullen deze onderwerpen waar mogelijk worden gecombineerd in bredere energiediplomatie.

[7] Kamerstuk 36180, nr. 23
[8] Kamerstuk 36180, nr. 1
[9] Kamerstuk 32852, nr. 224
[10] Kamerstuk 2023Z08738

2. Huidig beleid voor de import van waterstof

Nederland heeft met het windpotentieel op de Noordzee het voordeel dat in een deel van de hernieuwbare waterstofvraag kan worden voorzien met nationale productie. Dit draagt bij aan de strategische autonomie. Over hoe het kabinet de Nederlandse productie en verbruik van waterstof met financieel instrumentarium verder gaat ondersteunen, wordt uw Kamer voor de zomer in een aparte brief geinformeerd. Naast eigen productie zal import onmisbaar zijn, zoals wordt onderstreept in de op 4 april jl. gepubliceerde scenario's in de II3050 systeemstudie van Netbeheer Nederland. Deze gaan uit van 40% tot 60% import voor 2035 en 40% tot 70% import in 2040 (inclusief doorvoer). Ook de Europese Commissie benadrukt in haar RepowerEU plan dat de Europese Unie naast de opschaling van de EU-productie van hernieuwbare en koolstofarme waterstof moet inzetten op import[11].

Door nieuw Europees beleid breekt er nu een belangrijke fase aan voor de ontwikkeling van de markt voor hernieuwbare waterstof en daarmee het belang van import. Op 29 maart jl. besloten het Europees Parlement en de EU-lidstaten om in de herziene hernieuwbare-energierichtlijn van de EU (Renewable Energy Directive / RED) vast te leggen dat in 2030 voor het waterstofgebruik in de industrie 42% met hernieuwbare energie geproduceerde waterstof moet worden gebruikt op lidstaatniveau. Eerder dit jaar heeft de Europese Commissie middels de gedelegeerde handelingen van de RED II al voorgesteld welke duurzaamheidscriteria moeten gelden voor deze waterstof (wil deze meetellen, ook voor de transportsector, als *Renewable Fuel of Non-Biological Origin*, RFNBO). Deze criteria gaan ook gelden voor te importeren waterstof.

Met het oog op de EU-verplichtingen ligt voor het kabinet, naast het stimuleren van binnenlandse productie, de nadruk op het bevorderen van import van hernieuwbare waterstof. Alle vormen van koolstofarme en hernieuwbare waterstofdragers kunnen evenwel bijdragen aan het bereiken van CO_2-reductie. De verwachting is dat door prijsprikkels via het Emissions Trading System (ETS), de nationale CO_2-heffing en het toekomstige grenscorrectiemechanisme (Carbon Border Adjustment Mechanism, CBAM) de markt voor CO_2-reducerende waterstofdragers ook op gang zal komen.

Naast ons nationaal belang bij waterstof wil het kabinet ook het mondiale perspectief benadrukken. Waterstof gaat het mogelijk maken dat hernieuwbare energie een mondiale markt wordt ("verschepen van zon en wind") en daarmee ook grootschalig kan bijdragen aan de aanpak van de mondiale klimaatcrisis. Voorwaarde hiervoor is dat de benodigde ketens met duurzame lokale impact worden ontwikkeld. Daarom moet Nederland inzetten op samenwerking met inachtneming van de belangen van de exporterende landen, waarbij we streven naar gelijkwaardige energierelaties.

[11] De EU heeft recent ook samenwerkingsovereenkomsten gesloten met Egypte, Marokko, Chili, Japan, Kazachstan, Namibië en Oekraïne, gericht op de transitie naar hernieuwbare energie, kennisuitwisseling over technologie en het versterken van het regelgevend kader om investeringen in waterstofproductie te faciliteren.

Huidige aanpak: randvoorwaarden, diversificatie en internationale samenwerking
De huidige voorbereidingen voor import van waterstof zijn vooral gericht op het creëren, in nationaal en EU verband, van de **randvoorwaarden** om de markt te ontwikkelen: **infrastructuur voor transport en opslag, importterminals, certificering, veiligheid en regulering.** Dit is de eerste en belangrijkste pijler van de Nederlandse importstrategie. Het gegeven dat Nederland als eerste Europese land de infrastructuur op orde zal hebben, is een sterk signaal richting de markt dat internationale importketens voor de Noordwest-Europese markt op korte termijn al kunnen worden gerealiseerd. Deze infrastructuur wordt op basis van *open access* (met gereguleerde of onderhandelde toegang voor derden) ontwikkeld, een model dat ook voor de bestaande energiemarkt goed heeft gewerkt. De uitkomst van de onderhandeling met het Europees Parlement en de Europese Commissie over het decarbonisatiepakket zal dit jaar duidelijkheid bieden over de marktordening rond de voor import benodigde infrastructuur. De verwachting is dat de markt voor waterstof op termijn een open en goed functionerende markt wordt en dat Nederland hierin een leidende positie kan innemen.

Diversificatie van routes en stromen is de tweede pijler. Nederland zet in op het versterken van de banden met een brede groep landen voor het faciliteren van contacten tussen bedrijven en overheden ten behoeve van import-export ketens. Met Portugal, Chili, Uruguay, Namibië, Canada, Verenigde Arabische Emiraten, Oman, Australië, Spanje en Saudi Arabië zijn inmiddels overeenkomsten ondertekend, meer landen zullen volgen. Met sommige landen, zoals Noorwegen, hebben we een bredere energie-samenwerking, waarvan waterstof onderdeel is.

Internationale samenwerking op het gebied van beleid is de derde pijler. Het is belangrijk om Noordwest-Europa als afzetmarkt te positioneren en daarmee ook standaarden te zetten. Dat vergt dat we in deze beginfase nauw moeten samenwerken met vooral onze buurlanden België en Duitsland, en via het Pentalaterale Energieforum ook met andere landen in de regio. Omdat we idealiter beschikken over mondiale standaarden en afspraken, trekken we in bilateraal en multilateraal verband op met andere importlanden, zoals Japan en Zuid-Korea.

Stand van zaken op het terrein van import van waterstof
De internationale ontwikkelingen gaan snel. Vele energiebedrijven zijn zich aan het positioneren. Er zijn wereldwijd circa 680 grootschalige waterstofprojecten in ontwikkeling waarvan bij circa 10% een definitief investeringsbesluit is genomen[12]. Overheidsbeleid in andere landen zorgt voor nieuwe prikkels. Zo is de verwachting dat stimulering van de waterstofproductie via de *Inflation Reduction Act* er toe zal leiden dat de Verenigde Staten een waterstof-exporteur wordt.

Nederland is voor veel internationale bedrijven en exporterende landen al een belangrijke potentiële schakel in toekomstige import-export ketens. Er zijn door meerdere private partijen aankondigingen gedaan van investeringen in Nederland in importterminals, variërend van uitbreidingen van bestaande terminals tot

[12] Hydrogen Council en McKinsey and Company. *Hydrogen Insights 2022*. Voor een goed overzicht zie ook de *Global Hydrogen Review 2022* van het IEA.

aanleg van nieuwe terminals. Een aantal terminalprojecten wordt al meegenomen in het Meerjarenprogramma Infrastructuur Energie en Klimaat (MIEK). Private partijen zullen dit jaar met importpilots starten, in 2025/26 worden de eerste importen verwacht en waarschijnlijk zal rond 2030 grootschalige import plaatsvinden.

Belang van monitoring
In deze fase van marktopbouw is nog veel onzeker en is niet goed te voorzien hoe de markt zich precies zal ontwikkelen. Achter het begrip "waterstofimport" schuilt een complexe wereld van internationale handel in op waterstof gebaseerde grondstoffen en brandstoffen voor vele verschillende toepassingen. Het zal daarbij gaan om waterstof in verschillende vormen, zoals vloeibare en gasvormige waterstof, ammoniak en methanol. Nu wordt er voor waterstofbeleid vooral naar de gasmarkt gekeken, voor de verdere beleidsontwikkeling moet rekening worden gehouden met de Noordwest-Europese marktsystemen en infrastructuur voor zowel gasvormige als vloeibare moleculen[13]. Om deze ontwikkelingen in onze regio goed te kunnen volgen heeft Nederland daarom het initiatief genomen voor de Northwest European Hydrogen Monitor, in samenwerking met het Internationaal Energieagentschap (IEA)[14].

Nieuw internationaal speelveld
De import van waterstof en waterstofdragers valt samen met keuzes die in de industrie en in de transportsector worden gemaakt. Die keuzes gaan ook over de inrichting van nieuwe ketens. De energietransitie leidt tot een nieuw internationaal speelveld voor industriële productie. Industriële partijen kunnen overwegen om hun productieproces (deels) te verplaatsen naar regio's waar hernieuwbare energie en grondstoffen goedkoper zijn. Nederland wordt met het potentieel voor hernieuwbare energie uit de Noordzee hierin ook een speler, maar zal om deze partijen te bedienen ook import nodig hebben. Het gaat hier niet alleen om de bestaande waterstofmarkt, maar ook om nieuwe ketens, zoals groene staal en synthetische brandstoffen, die van strategisch belang zijn. In de Routekaart Verduurzaming Industrie, onderdeel van het nationale programma verduurzaming industrie (NPVI), zal daarom ook aandacht zijn voor welke rol import gaat spelen[15].

3. Aanvullend beleid voor import van waterstof

Met de hiervoor geschetste inzet op randvoorwaarden, diversificatie, internationale samenwerking, monitoring van de markt en koppeling aan verduurzamingsbeleid voor industrie en transport legt het kabinet de basis voor de waterstof-importstrategie van Nederland.

[13] Clingendael International Energy Programme, Managing future security of low carbon hydrogen supply, juli 2022.
[14] Deze jaarlijkse publicatie komt tot stand in het kader van de waterstofwerkgroep van de *Clean Energy Ministerial*. Verder behelst het Nationaal Waterstofprogramma een meerjarig kennisprogramma: *Sustainable Hydrogen Import Programme for the Netherlands* (SHIP-NL), zie het thema import op de website www.nationaalwaterstofprogramma.nl.
[15] Kamerstuk 29826, nr. 176

Om ervoor te zorgen dat de import tijdig, duurzaam, veilig en grootschalig van de grond komt, stelt het kabinet de volgende prioriteiten: 1) het adresseren van markt- en coördinatie-falen in de beginfase van de ontwikkeling van import; 2) het realiseren van de eerste import-exportketens, met aandacht voor diversificatie van waterstofdragers; en 3) het agenderen van internationaal maatschappelijk verantwoord ondernemen (IMVO) bij het opzetten van deze ketens.

3.1: Rol van de overheid in de beginfase van de ontwikkeling van import

De komende jaren speelt de overheid een belangrijke rol in het op gang brengen van de import: de mondiale markt bevindt zich in de opstartfase en wordt geconfronteerd met uitdagingen en onzekerheden in elk onderdeel van de keten. Wereldwijd moet er worden geïnvesteerd in productiecapaciteit, waarvan maar een gedeelte beschikbaar zal zijn voor export naar Europa. Infrastructuur moet worden opgeschaald en aangepast. Eindverbruikers moeten investeren in procesaanpassingen om waterstof te kunnen gebruiken, zoals bijvoorbeeld in de staalindustrie. Aangezien private investeringsbeslissingen in de gehele keten van elkaar afhankelijk zijn, is er sprake van een coördinatie-uitdaging. De overheid heeft de verantwoordelijkheid om in die coördinatie waar nodig een rol te spelen. Dit kan middels een helder lange-termijnkader dat zekerheid biedt, waar nodig aangevuld met gericht financieel instrumentarium en een actieve inzet op energiediplomatie. Beide laatste sporen worden hieronder toegelicht.

Financieel instrumentarium
De Nederlandse beslissing om te investeren in een publieke transportinfrastructuur voor waterstof is een goed voorbeeld van het nemen van die verantwoordelijkheid. Een ander voorbeeld is het opnemen van een aantal projecten in de op import en opslag gerichte subsidieronde van het waterstofinitiatief in het kader van *Important Projects of Common European Interest (*IPCEI). Daarnaast ondersteunt Nederland ook meerdere importprojecten bij EU trajecten voor financiële steun, zoals de Connecting Energy Facility (CEF) en het Innovation Fund. Dit onderstreept dat de overheid deze projecten van strategisch belang vindt.

De grootste uitdaging op dit moment is dat investeerders in productie- en exportcapaciteit zekerheid nodig hebben voor langjarige afzet, bij voorkeur in de vorm van langdurige afnamecontracten. Aan de vraagzijde willen inkopende partijen hun prijsrisico's (met name in relatie tot het prijsverschil met fossiele brandstoffen) echter kunnen afdekken. Ook zijn er veel potentiële afnemers die nog keuzes moeten maken omtrent de rol van waterstof in hun strategie.

Om de markt in de beginfase op dit vlak te steunen zal Nederland, zoals gemeld in de brief aan uw Kamer van 2 december 2022, financieel gaan deelnemen aan het Duitse in publiek-privaat verband opgezette H2Global[16]. H2Global ondersteunt via subsidieveilingen marktpartijen bij import uit derde landen. Het voornemen is om met een bedrag van € 300 miljoen in de tweede helft van 2023 te starten met de opzet van een tender. Momenteel wordt uitgewerkt wat de insteek van de tender

[16] Zie www.h2-global.de

zal zijn en hoe deze in samenwerking met Duitsland wordt uitgevoerd. Daarbij zal ook gebruik worden gemaakt van de ervaringen van de eerste tender die momenteel plaatsvindt.

Op 16 maart jl. heeft de Europese Commissie een mededeling over een op te richten Europese waterstofbank gepubliceerd. Eén van de hoofdactiviteiten van deze bank moet de ondersteuning van hernieuwbare waterstofproductie in derde landen ten behoeve van Europese eindafnemers worden. Nederland verwelkomt de focus van de Europese waterstofbank op import en mogelijke samenwerking met H2Global en wacht de voorstellen voor de verdere vormgeving af.

Het kabinet wil een compleet beeld krijgen van de uitdagingen in de keten die niet of moeizaam door de markt zelf kunnen worden opgelost. Daarom wordt een onderzoek uitgezet naar de noodzaak van maatregelen of instrumenten die de overheid aanvullend op bestaande instrumenten kan ontwikkelen.

Inzet op energiediplomatie
Naast het inzetten van financieel instrumentarium vergroten we onze inzet op energiediplomatie om de import te stimuleren. Dit behelst o.a. het organiseren van matchmaking voor bedrijven, consortiumvorming, projectontwikkeling en gerichte missies, waarmee tevens wordt bijgedragen aan het verzilveren van exportkansen voor het Nederlandse bedrijfsleven. Daarnaast zetten we in op een grotere rol van staatsdeelnemingen, nauwe samenwerking met Duitsland, aansluiting bij EU-initiatieven, en het initiëren van de dialoog tussen importerende en exporterende landen.

De eerste specifieke waterstofhandelsmissies hebben inmiddels plaatsgevonden, o.a. naar Chili, Oman, Verenigde Arabische Emiraten en Spanje. Waterstof is voor het ambassadenetwerk een belangrijk aandachtsgebied geworden. In opdracht van Buitenlandse Zaken biedt RVO met het International Clean Energy Partnership ondersteuning aan het Nederlandse bedrijfsleven op kansrijke markten voor waterstof. Met de vergroening van het verzekeringsinstrumentarium is Atradius Dutch State Business gepositioneerd om risico’s voor bedrijven op het terrein voor waterstof te mitigeren.

Staatsdeelnemingen
Om de gunstige Nederlandse uitgangspositie te verzilveren moeten we deze positie internationaal uitdragen. Mede omdat we in deze fase regelmatig aan tafel zitten met overheden en staatsbedrijven in de landen waar we een samenwerkingsrelatie mee opbouwen, is het gepast om aan Nederlandse zijde de staatsdeelnemingen hierbij te betrekken, in ieder geval Havenbedrijf Rotterdam, Gasunie en Invest International. Deze deelnemingen spelen ieder vanuit de door hen te borgen publieke belangen een rol in het op gang brengen van importketens. De andere Nederlandse havens zijn eveneens actief in het buitenland en worden uiteraard ook betrokken bij de inzet op energiediplomatie.

Havenbedrijf Rotterdam heeft een grote rol gespeeld in het tot stand brengen van het huidige netwerk van internationale contacten en het op de kaart zetten van Nederland als toekomstige waterstofhub. Het havenbedrijf zal deze rol

voortzetten, en kan ook worden ingezet om vraag en aanbod bij elkaar te brengen. Daarin kan het havenbedrijf de basis leggen voor geïntegreerde (op Nederland gerichte) ontwikkeling van logistieke ketens door consortiumvorming en projectontwikkeling met publieke en private partijen. Naast het faciliteren van importterminals in de eigen haven kan het havenbedrijf in bepaalde landen ook helpen met het ontwikkelen van exporthavens (zoals nu al in bijvoorbeeld Oman). Ook voor de andere Nederlandse havens geldt dat een aanpak met consortiumvorming in deze fase nuttig is. Een goed voorbeeld hiervan is de *Memorandum of Understanding* over levering van waterstof die begin dit jaar is ondertekend door het havenbedrijf van Amsterdam en partijen uit de Amsterdamse regio met het bedrijf Masdar uit de Verenigde Arabische Emiraten.

Gasunie werkt in Nederland al nauw samen met het Havenbedrijf Rotterdam op het gebied van infrastructuur. Hun belangrijkste taak is het realiseren van de landelijke *open access* infrastructuur voor waterstoftransport en -opslag. Deze infrastructuur verbindt de Nederlandse industrieclusters met elkaar en moet in een volgende fase tevens de verbinding met Duitsland en België realiseren, en is daarmee ook cruciaal voor import. Gasunie is voorts betrokken bij de ontwikkeling van importterminals voor ammoniak en andere waterstofdragers, en is ook actief in Duitsland als netbeheerder.

Infrastructuur staat centraal in hoe Nederland zich positioneert als toegang tot de Europese markt. Gasunie kan dit helpen uitdragen, in combinatie met het onderhouden van contacten met relevante marktpartijen. Daarnaast speelt Gasunie een rol in de totstandkoming van marktmechanismen en instrumenten voor de importwaardeketen (zoals H2Global, certificering, opzetten waterstofbeurs). Zo nodig kan Gasunie kennis en expertise op het gebied van infrastructuur delen met exporterende landen.

Ook voor staatsdeelneming Invest International (joint venture van de Nederlandse staat en ontwikkelingsbank FMO) is hernieuwbare waterstof een belangrijk aandachtsgebied. Het stimuleren van hernieuwbare waterstofproductie in ontwikkelingslanden en opkomende markten kan op meerdere manieren bijdragen aan de *Sustainable Development Goals* (SDG's), inclusief aan duurzame economische groei ter plekke. De daarvoor benodigde ketens bieden kansen voor Nederlandse bedrijven. Een goed voorbeeld is de inzet van Invest International in Namibië: financiering van een masterplan voor een waterstofhaven, €3 miljoen voor capaciteitsopbouw bij de Namibische overheid en €40 miljoen uit het BHOS-budget als startkapitaal voor een publiek investeringsfonds. Invest International is inmiddels actief in o.a. Marokko, Zuid-Afrika, Egypte en Australië. Met hun expertise op het gebied van financiering kan Invest International een belangrijke partner worden in het opzetten van internationale ketens.

<u>Buurlanden</u>
Het kabinet zal de samenwerking met de buurlanden intensiveren. Een aanzienlijk deel van de Duitse import zal via Nederland kunnen verlopen. Nederlandse en Duitse marktpartijen zijn actief in dezelfde landen met potentieel voor export. H2Global, interconnecties van de waterstofbackbone met de Duitse markt en de plannen voor Delta Rijn Corridor vergen gezamenlijke inzet. Om te zorgen dat al

deze initiatieven elkaar versterken is tijdens de bilaterale politieke consultaties van 27 maart jl. afgesproken dat Nederland en Duitsland de ontwikkeling van de grensoverschrijdende infrastructuur gaan versnellen en een gezamenlijke routekaart voor import gaan opstellen. Deze routekaart wordt eind dit jaar gepresenteerd. Daarnaast heeft Nederland ook in de recente consultaties met België en Frankrijk aangegeven dat grensoverschrijdende infrastructuur een prioriteit is met oog op een geïntegreerde (Noordwest-Europese) waterstofmarkt.

Mondiale dialoog

Het kabinet ziet het belang van een mondiale dialoog tussen exporterende en importerende landen: wat is er nodig om deze mondiale markt van de grond te krijgen, en hoe kan de internationale waterstofhandel ten gunste komen van zowel producerende (exporterende) als consumerende (importerende) landen. Daarom heeft Nederland in het kader van het Hydrogen Initiative van de Clean Energy Ministerial, in samenwerking met het IEA, het initiatief genomen om het Global Hydrogen Trade Forum te organiseren. De bevindingen hiervan worden door het IEA verwerkt in de *Global Hydrogen Review 2023*. In samenwerking met de Verenigde Arabische Emiraten zal de eerste bijeenkomst van dit Forum ook op de agenda worden gezet voor de COP28.

3.2: Strategische corridors binnen en buiten Europa

Voor het bewerkstelligen van import zijn transportroutes nodig die importerende en exporterende landen en regio's met elkaar verbinden. Op termijn kunnen pijpleidingen een belangrijke rol spelen, maar voorlopig zal de meeste internationale aanvoer van waterstofdragers per schip plaatsvinden. Het is van belang om Nederland onderdeel te laten uitmaken van deze corridors. Dit vergt een nauwe samenwerking met de betrokken marktpartijen en overheden.

Nederland zal deze inspanningen concentreren op strategische corridors met landen en regio's binnen en buiten Europa. Hiervoor geldt dat er niet alleen moet worden gekeken naar de potentiële omvang van de productie, maar ook naar de verwachtingen omtrent hoeveel daarvan beschikbaar zal komen voor export richting Noordwest-Europa, waarbij landen die eenvoudiger aan de EU duurzaamheidscriteria kunnen voldoen in het voordeel zullen zijn.

Alhoewel de grote volumes op termijn waarschijnlijk van buiten Europa zullen komen, is het belangrijk om nu te werken aan importrelaties met landen binnen Europa, met name Spanje, Portugal, Noorwegen en de andere Scandinavische landen. Het is van strategisch en geopolitiek belang om te verzekeren dat de EU beschikt over eigen productie. Ook zijn ketens in EU-verband sneller in te richten door de gelijkheid in regelgeving, kortere afstanden en mogelijkheden voor EU-ondersteuning.

Buiten Europa is er een aantal landen in staat om al voor 2030 grootschalig waterstofdragers te exporteren. Dit zijn met name de landen met een geschikt investeringsklimaat en met bestaande netwerken met marktpartijen, vaak al met ervaring op het gebied van fossiele brandstoffen en grondstoffen. Dit betreft

landen in de Golf-regio (Verenigde Arabische Emiraten, Oman, Saudi-Arabië) en Noord-Amerika (Verenigde Staten en Canada).

Daarnaast zijn er landen in Afrika en Zuid-Amerika, die ambitie en een groot potentieel hebben om waterstof te produceren en een deel ervan te exporteren naar Europa, waaronder Marokko, Egypte, Namibië, Zuid-Afrika, Brazilië, Chili en Uruguay. Australië verdient speciale vermelding als land met wellicht het grootste exportpotentieel. Hoewel de eerst exporten waarschijnlijk richting landen in Oost-Azië zullen gaan, kan het land op termijn een relevante partner worden op het gebied van waterstof.

Het is waarschijnlijk dat in deze fase ammoniak de dominante drager wordt voor het internationale transport van waterstof. Tijdige realisatie van infrastructuur geschikt voor verwerking van de verwachte volumes aan import is van groot belang. Diverse partijen onderzoeken of het mogelijk is om deze ammoniak grootschalig te kraken in Nederlandse havens, zodat de waterstof direct kan worden ingezet.

Waterstof zal ook in andere vormen worden geïmporteerd en deze dragers zullen naast elkaar worden gebruikt, in verschillende ketens. Al deze waterstofdragers hebben voor- en nadelen als het gaat om ruimtelijke impact, veiligheid, energiegebruik, hergebruik van bestaande infrastructuur en toepasbaarheid. Het is belangrijk dat het transport en de doorvoer van geimporteerde waterstof veilig kan worden ingepast. Zoals aangekondigd in de brief aan uw Kamer van 17 maart jl. over "Omgevingsveiligheid toekomstige stromen waterstofrijke energiedragers" komt het kabinet met een visie op de afweging van deze belangen[17]. Ook komt het kabinet voor het eind van 2023 met een eerste versie van een richtsnoer voor waterstofrijke energiedragers dat duidelijkheid biedt voor het omgaan met de risico's van waterstofrijke energiedragers.

Het is gewenst dat naast ammoniak ook andere waterstofdragers beschikbaar komen. Bij het bewerkstelligen van corridors wordt hiervoor ruimte geboden, zodat ontwikkeling, opschaling en internationale standaardisering van deze waterstofdragers versneld tot stand komen. Via het Nationaal Groeifondsprogramma GroenvermogenNL en het topsectorenbeleid kan innovatie op het vlak van waterstofdragers in samenwerking met andere landen worden aangejaagd.

3.3: Internationaal maatschappelijk verantwoord ondernemen (IMVO) en de internationale klimaatstrategie

Het opzetten van importketens is niet het enige internationale doel van Nederland ten aanzien van hernieuwbare waterstof: klimaatinzet (waterstof voor klimaatmitigatie) en handelsbevordering (het aanbieden van Nederlandse technologie, expertise en producten) spelen eveneens een rol. Nederland werkt op het gebied van klimaat en energie samen met veel landen die een belangrijke rol

[17] Kamerstuk 32813, nr. 1192

toekennen aan waterstof bij de verduurzaming van hun energiesystemen, zeker ook buiten de EU. In onze eind vorig jaar gepubliceerde Internationale Klimaatstrategie[18] geeft het kabinet voor hernieuwbare waterstof aan dat Nederland zal bijdragen aan de ontwikkeling van een aantal waterstofhubs in prioritaire productielanden voor de Europese en Nederlandse energievraag, die ter plekke leiden tot duurzame economische groei.

Van alle bedrijven in Nederland wordt verwacht dat ze handelen volgens de internationale kaders voor IMVO, te weten de OESO-richtlijnen voor Multinationale Ondernemingen en de *UN Guiding Principles on Business and Human Rights* (UNGP's). Zeker in de ontwikkeling van het upstream gedeelte van de waardeketen is grote aandacht voor IMVO gepast, gezien de grootschaligheid van de faciliteiten die hiervoor nodig zijn: wind- en zonneparken voor het produceren van elektriciteit, kabels en pijpleidingen voor transport van energie, water voor elektrolyse, ruimte voor productie en opslag, terminals voor export etc. Het is belangrijk dat de opbouw van deze ketens en de productie en toepassing van waterstof plaatsvinden met aandacht voor mens en milieu, en dat de betrokken bedrijven gepaste zorgvuldigheid toepassen in lijn met de OESO-richtlijnen voor multinationale ondernemingen en de UNGP's.

Naar aanleiding van de motie[19] van de leden Kröger en Boucke, die de regering verzoekt om een sectorspecifieke IMVO-risicoanalyse te laten uitvoeren voor waterstofimport, is in opdracht van het ministerie van Economische Zaken en Klimaat (EZK) door het bureau Arcadis een risico- analyse uitgevoerd van waterstofimport. Dit rapport ontvangt u als bijlage bij deze brief. De analyse bestaat uit drie delen. Eerst wordt er ingegaan op de potentiële risico's op het gebied van IMVO van de verschillende onderdelen van de waardeketen (opwek, productie, conversie, transport en opslag). In het tweede deel wordt een aantal landen nader geanalyseerd. Bestaande en aanstaande IMVO-wetgeving komt aan de orde in het derde deel.

Arcadis geeft aan dat in het algemeen het risico's zijn die opgaan voor alle grote infrastructurele en industriële activiteiten, waarbij de omvang van de risico's afhangt van de locatie en schaal van het project. Voorbeelden van risico's die meer specifiek zijn voor waterstofprojecten hebben betrekking op in hoeverre de hernieuwbare energie ook beschikbaar komt voor de plaatselijke gemeenschap, gebruik van water en bepaalde grondstoffen en mineralen, landgebruik dichtbij woongemeenschappen en gebrek aan specifieke regulering en regelgeving op het gebied van milieu en veiligheid.

Naast het onderzoek naar de IMVO-risico's heeft Arcadis ook gekeken naar de potentiële kansen. Deze potentiële kansen zijn: bredere beschikbaarheid van hernieuwbare energie, opschaling van technologieën die bijdragen aan beschikbaarheid van water (bijvoorbeeld door ontzilting), werkgelegenheid en nieuwe duurzame economische ontwikkelingen.

[18] Kamerstuk 2022D40616
[19] Kamerstuk 32813, nr. 1025

Het rapport geeft een goed overzicht van risico's die zich kunnen voordoen in de ontwikkeling van import-exportketens. Het is aan Nederland, als handelsland en toekomstig importeur van waterstof, en aan Nederlandse bedrijven om hier rekening mee te houden. Bedrijven die waterstof produceren en importeren kunnen binnen de reikwijdte van de bestaande en aanstaande IMVO regelgeving vallen. De *Corporate Sustainability Reporting Directive* (CSRD), gericht op verplichte duurzaamheids-rapportage, is onlangs in werking getreden. Over de *Corporate Sustainability Due Dilligence Directive* (CSDDD), gericht op verplichte zorgvuldigheid, wordt nu onderhandeld; uw Kamer is hierover geïnformeerd op 16 december 2022[20].

In het coalitieakkoord heeft het kabinet afgesproken dat Nederland in de EU IMVO-wetgeving bevordert en nationale IMVO-wetgeving invoert die rekening houdt met een gelijk speelveld met de omringende landen en implementatie van mogelijke EU-regelgeving. Het kabinet moedigt de Nederlandse waterstofsector aan om samen te werken om voor waterstofimport gepaste zorgvuldigheid te bevorderen. Een goed voorbeeld is het IMVO-convenant van de hernieuwbare energiesector dat op 6 maart jl. is ondertekend[21].

Nederland zal in de aanstaande deelname aan H2Global ook voorwaarden kunnen stellen aan marktpartijen die gebruik gaan maken van H2Global tenders. H2Global heeft IMVO-criteria verwerkt in de voorwaarden voor de recente tenders. Het gegeven dat in de RED II aan te importeren waterstof dezelfde eisen worden opgelegd als aan productie in de EU, zal ook bijdragen aan de duurzame lokale impact van import.

Import van waterstof en andere energievormen zal ons ook in de toekomst voor dilemma's blijven stellen. In de bredere dialoog met exporterende landen, zowel bilateraal als via multilaterale kanalen, zullen, waar nodig, mensenrechten en IMVO een plaats blijven houden. Zoals eerder toegezegd aan uw Kamer, zal Nederland in toekomstige waterstof-overeenkomsten met overheden (Memorandums of Understanding), ook voorstellen om in de tekst te verwijzen naar de SDG's en het belang benadrukken van lokale duurzame impact van waterstofprojecten[22].

Uitvoering en vervolg

Energiediplomatie is met oog op de internationale energietransitie en onze importafhankelijkheid van groter belang dan ooit. Waterstof is hierbij in korte tijd een belangrijk thema geworden, ook in mondiaal verband en in relatie tot onze klimaatdoelen. In het licht van het belang van de strategische waterstofcorridors en de actieve rol van de Nederlandse overheid bij de totstandkoming daarvan, zullen de ministeries van EZK en Buitenlandse Zaken organisatie en capaciteit daarop afstemmen en inrichten. Daarbij wordt ingezet op maatwerk (in de voor waterstofcorridors relevante landen) en zal zoveel mogelijk gebruik gemaakt

[20] Kamerstuk 26485, nr. 405.
[21] Zie www.imvoconvenanten.nl Sectoren kunnen bij RVO hiervoor een subsidievraag indienen via de Subsidieregeling Sectorale samenwerking.
[22] Kamerstuk 2022Z22598

worden van de beschikbare capaciteit, zoals op de economische afdelingen van posten.

Voor het kabinet is energiediplomatie en aandacht voor waterstofimport een speerpunt, dat ook zijn weerslag heeft op de reisagenda van het kabinet. In veel bilaterale contacten staat het onderwerp op de agenda, zoals bij de recente bezoeken aan Duitsland, Spanje en Saudi-Arabië, het komende bezoek van de Minister-President aan een aantal landen in Afrika en bij komende werkbezoeken van Z.M. de Koning aan het buitenland. Het is cruciaal dat hierbij Nederlandse bedrijven en kennisinstellingen worden betrokken en waar nodig ondersteund bij het leggen van contacten. Ook zet Nederland zich in om tijdens de aanstaande G20 en COP28-bijeenkomsten de internationale samenwerking op het gebied van waterstof en andere vormen van hernieuwbare energie verder te versterken.

R.A.A. Jetten
Minister voor Klimaat en Energie

M.A.M. Adriaansens
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E.N.A.J. Schreinemacher
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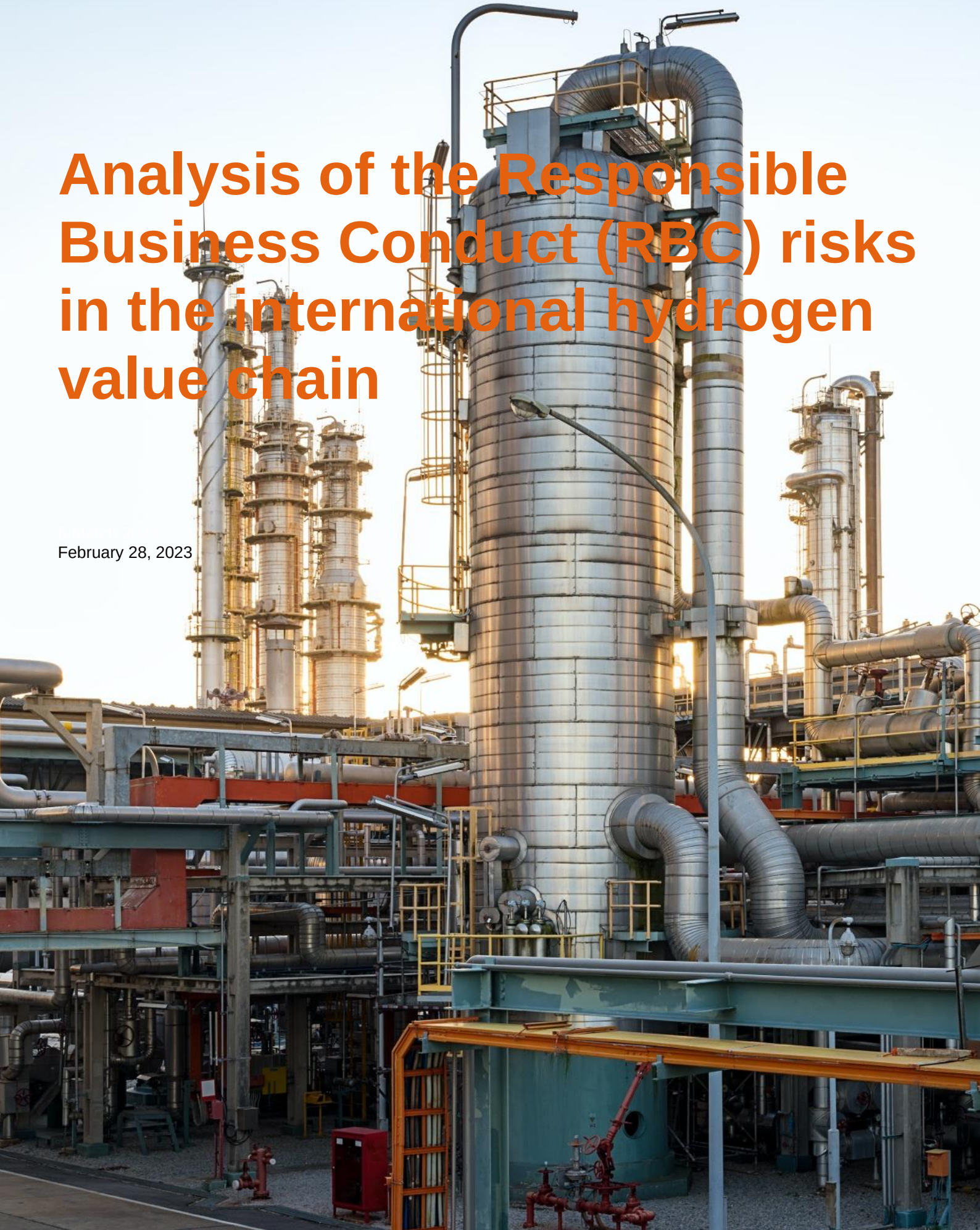
W.B. Hoekstra
Minister van Buitenlandse Zaken

Analysis of the Responsible Business Conduct (RBC) risks in the international hydrogen value chain

February 28, 2023



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Appendices

1 Introduction

The government of The Netherlands expects that, while doing business, Dutch companies conduct due diligence in line with the OECD Guidelines for Multinational Enterprises, 2011 (hereafter: OECD Guidelines), which means identifying, preventing, mitigating and accounting for actual and potential adverse impacts in their own operations, their supply chain and other business relationships. Companies are expected to carry out due diligence process by implementing the six due diligence steps[1] outlined in the OECD Due Diligence Guidance for Responsible Business Conduct[2], 2018 (hereafter: OECD RBC Guidance).

In this context, Arcadis B.V. has been hired by RVO and Ministry of Economische Zaken en Klimaat (EZK) to perform a preliminary RBC risk analysis for hydrogen import to the Netherlands. This request has originated from a request by the Dutch Parliament (April 2022) to identify Responsible Business Conduct (hereafter: RBC) risks associated with the import of hydrogen to meet the increasing hydrogen demand in the Netherlands.

Specifically, the request is aimed at gaining insight into the risks and opportunities for the sustainable hydrogen trade by analyzing:

1. The potential RBC risks and opportunities in the hydrogen import chain, per step in the supply chain.
2. The potential RBC risks in the hydrogen import chain at the country (of origin) level, focusing the analysis on selected countries; and
3. The extent to which the proposed European legislation (specifically Corporate Sustainability Reporting Directive CSRD and Corporate Sustainability Due Diligence Directive CSDDD) provides sufficient safeguards for managing RBC risks.

[1] The six due diligence steps include:
1. Embed Responsible Business Conduct into policies and management systems;
2. Identify and assess adverse impacts in operations, supply chains & business relationships;
3. Cease, prevent or mitigate adverse impacts;
4. Track implementation and results;
5. Communicate how impacts are addressed; and
6. Provide for or cooperate in remediation when appropriate.

[2] The OECD RBC Guidance takes the high-level principles embodied in the international frameworks, such as UNGPs and OECD Guidelines for Multinational Enterprises, and proposes a multi- step process to support supply chain due diligence.

2 Approach and Scope of the Assessment

The OECD Guidelines encourage the positive contributions that business can make to economic, environmental and social progress (opportunities), but also recognize that business activities may result in actual or potential adverse impacts (risks). To that end, Responsible Business Conduct (hereafter: RBC) risks refer to the risks associated with the environmental and social impact/risk that can be caused by an activity, considering its significance and likelihood. These risks are distinct from risks that are financially material[3] for the activity itself; financially material risks relate to the impact that environmental and social risks may have on the business itself. It should, however, be noted that an overlap between these two types of risks is possible.

One of the steps recommended in the OECD RBC Guidance is for businesses to carry out a scoping exercise, including in its supply chain, where RBC risks are most likely to be present and most significant. This exercise should consider, amongst other, sectoral and geographic factors, and enable business to prioritize the most significant risk areas for further assessment.

The overall ***objective*** of the analysis is to provide a method of scoping the RBC risks and opportunities associated withactivities that are part of, or related to, the international hydrogen value chain. The analysis and its results aim tosupport the decision-making process of business organizations (promoters) with regards to the import of sustainable hydrogen. The analysis furthermore aims to help said organizations in prioritizing the most significant topics for further assessment.. The results of this assessment provide an overview of potential (high-level) risks considering:

1. Activity-specific contextual risks and opportunities; and
2. Country-specific contextual risks.

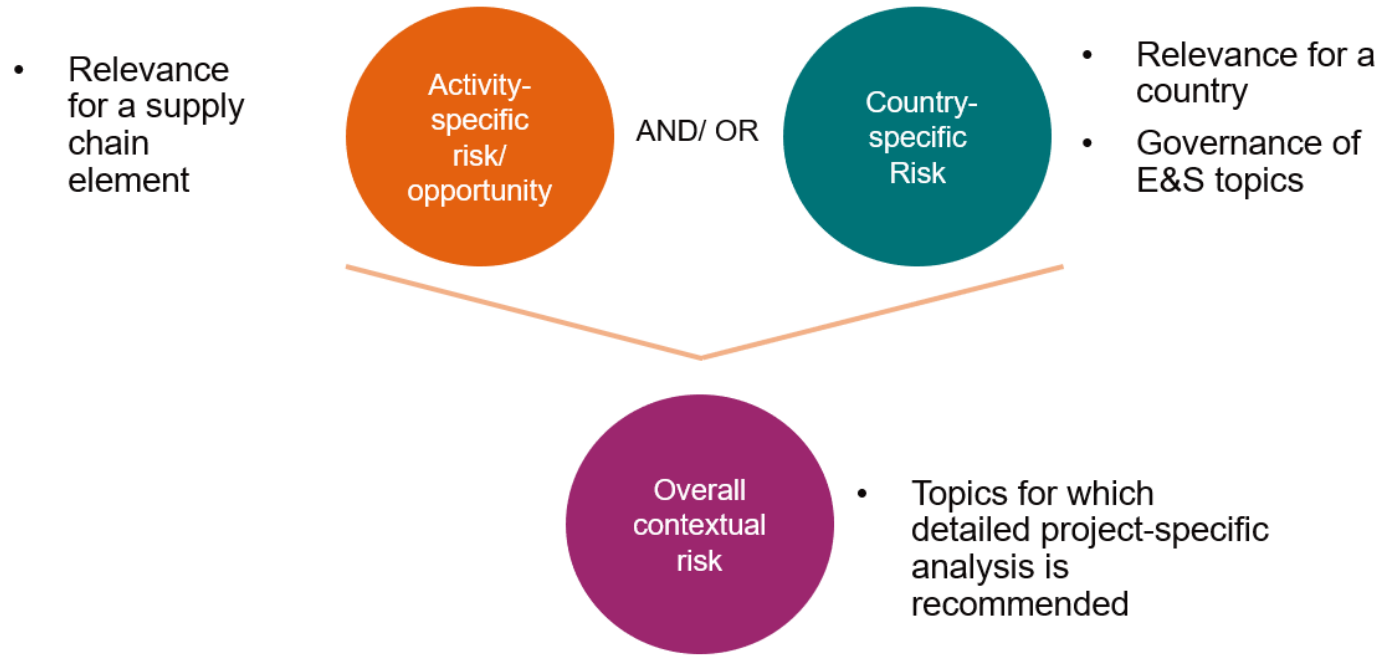

Figure 2-1 Approach

[3] As outlined in the OECD RBC Guidance: "*For many enterprises, the term "risk" means primarily risks to the enterprise – financial risk, market risk, operational risk, reputational risk, etc.* […]. *The Guidelines however refer to the likelihood of adverse impacts on people, the environment and society that enterprises cause, contribute to, or to which they are directly linked. In other words, it is an outward-facing approach to risk."*

The overall contextual risk can be relevant for further analysis, when either or both activity-specific and country-specific contextual risk/opportunity is significant and/or likely. For these risks detailed project-specific analysis is recommended.

The service includes three steps (Figure 2-2), which are described in the sub-sections below.

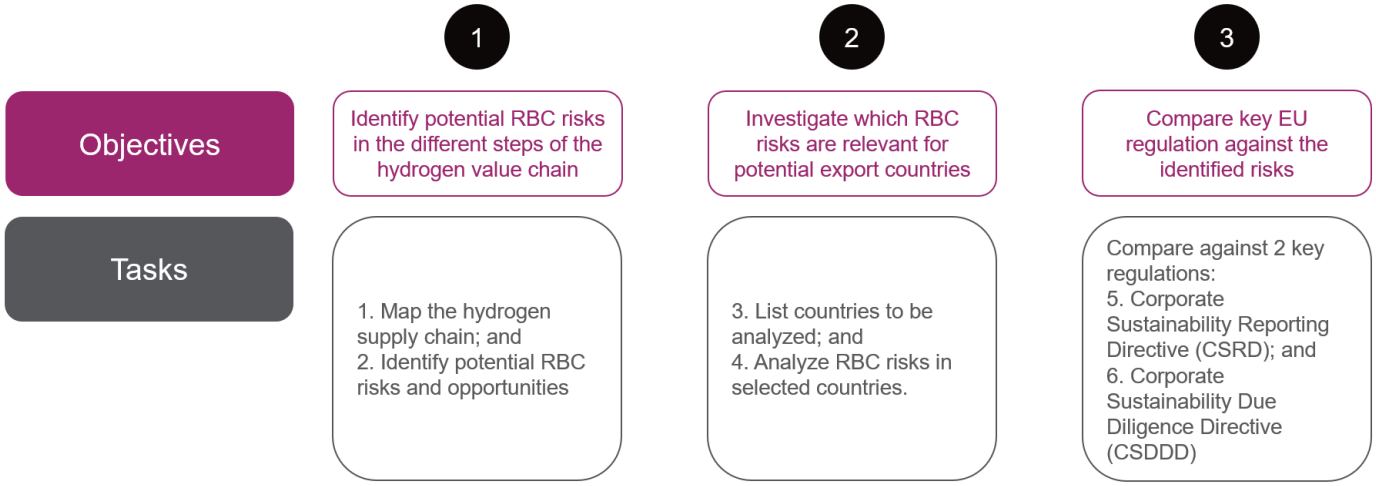

Figure 2-2 Steps and tasks

It is important to highlight that the initial scoping proposed in this report can only provide contextual information in early stages of the development of an international hydrogen value chain. Importing companies should be aware that this initial scoping must be followed by due diligence processes in accordance with the “OECD Due Diligence Guidance for Responsible Business Conduct”. As recommended in the latter, the due diligence process should be integrated into the risk and impact management system of the promoter, and should allow the identification, prevention and management of environmental, social and governance risks associated to the hydrogen supply chain.

2.1 Map the hydrogen value chain

As an initial step in the assessment, a generic hydrogen value chain has been outlined (Figure 2-3). The figure below combines the two types of hydrogen (“green”, and “blue”), which only differ in production method and source of inputs needed for production. The “grey” hydrogen is not considered in the analysis as it is not planned to import such hydrogen to the Netherlands. In terms of “green’ hydrogen, electrolysis is considered. “Blue” hydrogen production refers to steam methane reforming or gasification of coal and CCS. In the conversion & transformation phase, the assessment also considers hydrogen carriers such as synthetic fuel, ammonia, and H-LOHC.

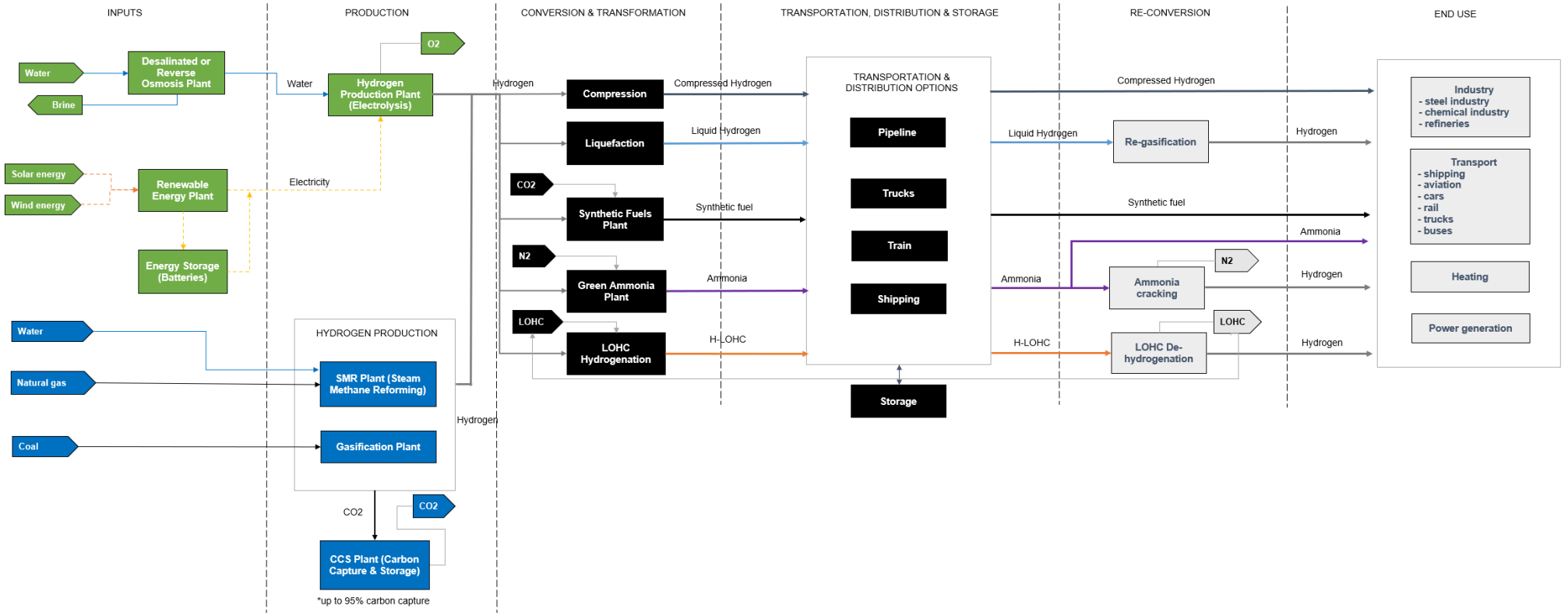

Figure 2-3 Hydrogen value chain

2.2 Identify potential international RBC risks and opportunities at the supply chain level

A comprehensive list of potential risks and impacts that are typical for hydrogen-related projects has been identified. As references for potential RBC topics, the following publications and frameworks were used:

1. MVO Nederland (October 14, 2022). CSR themes & SDGs. https://www.mvorisicochecker.nl/.
2. PtX Hub Berlin. PtX. Sustainability Dimensions and Concerns. https://ptx-hub.org/wp-content/uploads/2022/05/PtX-Hub-PtX.Sustainability-Dimensions-and-Concerns-Scoping-Paper.pdf.
3. Oeko-Institut Working Paper (2021). Working Paper Sustainability dimensions of imported hydrogen. Working Paper 8/2021. https://www.oeko.de/en/publications/p-details/sustainability-dimensions-of-imported-hydrogen.
4. Proposal for a Directive of The European Parliament and of The Council on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937 and annex (February 23, 2022); and https://ec.europa.eu/info/publications/proposal-directive-corporate-sustainable-due-diligence-and-annex_en
5. OECD Due Diligence Guidance for Responsible Business Conduct (2018).

Arcadis internal experts, who have experience in hydrogen-related projects, have been involved in shortlisting the risks that can be potentially relevant for the activities performed in the different phases of the hydrogen value chain.

As a next step, Arcadis experts assessed which risks are relevant (in terms of severity and probability) for each step of the identified value chain. The results are provided in a table format (Table 2-1).

Table 2-1 Supply chain level risk and opportunity presentation format

Topic	Risk/ opportunity	Potential supply chain element risks and opportunities	Inputs		Hydrogen production		Conversion & transformation	Transportation & distribution	Storage
			Green	Blue	Green	Blue			

For each of the risks and opportunities from the pre-defined list it is indicated in which element of the value chain it is potentially relevant.

The summarized results are provided in Chapter 3.1 of this report. The detailed analysis is provided in **Annex A.**

2.3 List countries to be analyzed

A sample of countries has been selected to be analyzed in the study. Given that the actual hydrogen supply chains are not yet existing and the hydrogen market is still in early stages of development the countries were selected based on the following criteria:

a. Geographical distribution (one country per region).
b. Biggest planned amount of hydrogen export by 2030 within the countries from the same region (based on the study published by International Energy Agency[4]).
c. The country has a hydrogen strategy with a focus on hydrogen export; and
d. Whether or not there are MoUs[5] with the Netherlands, or Dutch harbors.

Based on these criteria, countries with highest priority to be included in this analysis were determined (Table 2-2). For each case, a comment with a rationale has been also provided.

[4] Global Hydrogen Review 2022 (windows.net)

[5] Whether or not there is an existing MoU does not indicate which country will export hydrogen to The Netherlands first

Table 2-2 List of countries selected for further assessment

Country	Region/continent	Hydrogen strategy with focus on export	Bilateral trade agreement or signed MoU's/SOIs
Chile	Latin America	Hydrogen strategy that focusses on both domestic deployment and export of hydrogen. Very recently there was also a trade mission between the Netherlands and Chile to promote the export of green Hydrogen to the Netherlands (November 2022).	MoU with the Port of Rotterdam and the Netherlands
Oman	Middle East	Ambition to export 1Mt in 2030.	MoU with the Netherlands
Australia	Australia	Australia's National Hydrogen Strategy (2019) targets clean hydrogen (blue and green) production and becoming an export hub in renewable and low-carbon hydrogen and ammonia. Feasibility study to import green hydrogen to Rotterdam	MoU with the Port of Rotterdam.
Denmark	Europe	National strategy promotes export of green hydrogen and e-fuels. The Power-to-x strategy is accompanied by plans to expand renewable energy production. Belgium, Denmark, Germany and Netherlands signed an agreement to co-operate on offshore wind power and hydrogen production.	MoU between Denmark and Netherlands for joint cooperation on green tech (including hydrogen) and trade to meet 2030 climate targets.
South Africa	Africa	Hydrogen roadmap which considers hydrogen export.	MoU with the Netherlands in progress
USA	North America	The U.S. Department of Energy has published the National Hydrogen Strategy and Roadmap (September 2022). One of the key strategies is to target strategic, high-impact uses for clean hydrogen, which includes long-term opportunities for exporting clean hydrogen or hydrogen carriers.	SOI between USA and Netherlands to collaborate on collecting, analyzing, and sharing information on hydrogen production and infrastructure tech. No information on trade agreement available
Kazakhstan	Asia	Kazakhstan aims to become a leading producer and exporter of renewable hydrogen. Ambition is to build a Green Hydrogen Production and Distribution Hub in Kazakhstan in collaboration with EU.	Strategic partnership between Kazakhstan and EU signed.

2.4 Analysis of RBC risks in selected countries

Following the risk-based approach recommended by the OECD Guidelines for Multinational Enterprises, Arcadis proposes that with regards to the development of a hydrogen value chain, importing companies should conduct a country-specific contextual risk analysis, which should include:

1. Review of applicable policies, standards and procedures (Environmental and Social Management System) set by the promoter in order to initiate a project or opportunity.
2. Review of applicable local regulatory and policy requirements for the hydrogen supply chain.
3. Review of applicable Dutch regulatory and policy requirements for importation; and
4. Risk assessment by the importing company, for which the scope will depend on the level of Environmental, Social and Governance risks associated with the hydrogen supply chain in the country(s) of origin. Arcadis is proposing a categorization that considers:
    a. The existence of local regulation that addresses the environmental, social and governance risks associated to the hydrogen supply chain;
    b. The performance of the country on global indexes that include Environmental, Social and Governance topics.

In the case of this report, which includes a selection of seven countries, the list of external data sources includes the following[6]:

- Corruption Perceptions Index (CPI) The ABCs of the CPI: How the Corruption… - Transparency.org;
- Environmental Performance Index (EPI) About the EPI | Environmental Performance Index (yale.edu);
- Equator Principles List of Designated and Non-designated Countries Home Page - Equator Principles Association (equator-principles.com)
- Global Peace Index (GPI) Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org);
- Global Slavery Index The Index | Global Slavery Index;
- World Bank Open Data database World Bank Open Data | Data;
- Regulatory quality index Regulatory quality by country, around the world | TheGlobalEconomy.com;
- World Governance Indicators (WGI) WGI 2022 Interactive > Documentation (worldbank.org); and
- Women Peace and Security Index (WPS) WPS-Index-2021-Summary.pdf (georgetown.edu).

c. The relevance of the Environmental, Social or Governance topic, on the basis of an inherent feature, its value or its status. In this report, the assessment has considered, among others, if:
   - A resource is scarce;
   - A resource accommodates a high rate of threatened or unique species;
   - A resource provides ecosystem services that are essential for the wider ecosystem;
   - A resource or social group is subject to a special regulatory regime;
   - A resource is highly significant in terms of use by human groups/species and which cannot be replaced by an alternative;
   - Aspect is highly significant for the well-being of human groups.

Depending on the applicability of one or more of these criteria (a, b and/or c above), an overall risk category is assigned to the topic for each country. The categories are presented in Table 2-3.

Table 2-3 Explanation of risk categories

Categories	
Triggers contextual project level analysis	Besides the review of the promoter's E&S management system, and the local and Dutch regulatory and policy frameworks, it is recommended to execute a contextual analysis of this topic at the project level, prior to engaging in the activity.
Does not trigger contextual project level analysis	At the country level, this topic is not a contextual risk for the project. The initial scanning can focus on the review of the promoter's E&S management system, and the local and Dutch regulatory and policy frameworks that are applicable to the project.
Insufficient information available	Available information[7] is not sufficient for the risk assessment.

The approach described above was taken to assess RBC risks at the country level for the selected countries. The summarized results of the categorization per risks, for each of the selected countries, are provided in Chapter 3.2 of this report. The detailed analysis is provided in **Annex B.**

[6] For detailed description of the indexes please refer to **Annex C**

[7] Publicly available information in English language

3 Results

In this section both results per step of the value chain and country level are presented.

3.1 Potential RBC risks and opportunities at the supply chain level

The table below provides an overview of the risks[8] and opportunities that are potentially relevant for each element of the hydrogen value chain. The analysis considers 'green' and 'blue' hydrogen only. 'Grey' hydrogen is not assessed as it is not planned to be imported into to the Netherlands. When a particular risk is relevant for a component of the value chain, the corresponding box is marked with an x. A bold **x** indicates a higher risk, while a regular x indicates a lower risk. The detailed analysis is provided in **Annex A.**

[8] Note: The risk allocation for each step of the value chain considered a conservative scenario. The risks were assessed having in mind large-scale projects.

*Table 3-1 Potential RBC risks and opportunities in the hydrogen supply chain (**x**- higher risk, x- lower risk)*

				Hydrogen value chain														
				Inputs		Production		Conversion & Transformation					Transportation & Distribution					
Theme	Topics	Risk/ Opportunity	Potential supply chain risk and opportunities	Green hydrogen	Blue hydrogen**	Green hydrogen	Blue hydrogen	Hydrogen compression	Hydrogen liquefaction	Synthetic fuels plant	Green ammonia plant	LOHC hydrogenation	Pipeline	Trucks	Train	Shipping	Storage
Environment	Biodiversity and deforestation	Risk	Activity can cause intervention, loss and/or fragmentation of ecosystems; alteration or disturbance of habitats	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**				**X**
	Biodiversity and deforestation	Risk	Activity can cause soil loss and/or erosion.	X	X	X	X	X	X	X	X	X	X				X
	Air pollution	Risk	Activity generates significant amounts of atmospheric emissions to air		**X**		**X**	X	X	**X**				**X**	**X**	**X**	
	Air pollution	Opportunity	The activity generates low amounts of atmospheric emissions to air	**X**		**X**											
	Waste & resources	Risk	Activity generates significant amounts of solid waste	X	X												
	Waste & resources	Risk	Activity generates significant amounts of hazardous waste	X	X												
	Waste & resources	Risk	Activity requires significant amounts of hazardous substances		X		X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	Waste & resources	Risk	Activity requires Critical Raw Materials (CRM), according to the EU list, such as iridium, platinum, tantalum, cobalt and nickel			**X**											
	Waste & resources	Risk	Activity requires carbon sources (as a raw material)		**X**		**X**			**X**		X		**X**	**X**	**X**	
	Climate and energy	Risk	Activity requires significant amounts of electricity		**X**	**X**	**X**	X	**X**	X	X	X			X		X
	Climate and energy	Opportunity	Activity requires significant amounts of electricity	**X**													
	Climate and energy	Risk	Activity requires significant amounts of heat energy or cooling			X	X		**X**	X	X	X		X	X	X	X
	Climate and energy	Risk	Activity requires significant amounts of fuel		**X**		**X**							**X**	**X**	**X**	
	Water use & water availability	Risk	Activity requires significant amounts of fresh water	**X**	**X**	**X**	X										
	Water use & water availability	Risk	Activity requires water desalination or other treatment	**X**	**X**												
	Water use & water availability	Opportunity	Activity requires water desalination or other treatment	**X**	**X**												
	Water use & water availability	Opportunity	Activity requires water desalination or other treatment	**X**	**X**												
	Water use & water availability	Risk	Activity generates significant amounts of wastewater (including brine from desalination)	**X**	**X**												
	Land restoration and regeneration	Risk	Activity requires cleaning up and restoring of mining sites after use		**X**	**X**											

*Table 3-2 Potential RBC risks and opportunities in the hydrogen supply chain (**x**- higher risk, x- lower risk) (cont.)*

				Hydrogen value chain													
				Inputs		Production		Conversion & Transformation					Transportation & Distribution				
Theme	Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green	Blue**	Green	Blue	Hydrogen compression	Hydrogen liquefaction	Synthetic fuels plant	Green ammonia plant	LOHC hydrogenation	Pipeline	Trucks	Train	Shipping	Storage
Social	Community health and safety (community impacts)	Risk	Activity generates significant noise and vibration emissions	X	X	X	X	X	X	X	X	X		X	X	X	X
	Community health and safety (community impacts)	Risk	Explosion risks of plants, storage tanks, pipelines, etc. and products toxicity.		X	X	X	X	X	X	X	X	X	X	X	X	X
	Community health and safety (community impacts)	Risk	Activity requires to develop additional infrastructure	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Land use & property rights	Risk	Activity requires relatively large areas of land and/or sea	X	X												
	Land use & property rights	Risk	Activity is typically related to engagement with indigenous peoples	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Child labor	Risk	Child labor is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Forced labor and human trafficking	Risk	Forced labor is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Forced labor and human trafficking	Risk	Presence of migrant workers is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Discrimination and gender	Risk	Discrimination and/or gender inequality is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Wage & renumeration	Risk	Not providing living wage is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Gender-based violence	Risk	Gender-based violence is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Freedom of association and collective bargaining	Risk	Freedom of association and/or collective bargaining is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Health and safety at work	Risk	Substantial occupational health and safety risks are typical for the activity	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Government influence	Risk	Activity requires political commitment	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Government influence	Risk	Government is typically participating in the companies in the value chain	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Government influence	Opportunity	Government is typically participating in the companies in the value chain	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Conflict and security	Risk	Activity typically requires security services	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Table 3-3 Potential RBC risks and opportunities in the hydrogen supply chain (**x**- higher risk, x- lower risk) (cont.)*

				Hydrogen value chain													
				Inputs		Production		Conversion & Transformation					Transportation & Distribution				
Theme	Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green	Blue**	Green	Blue	Hydrogen compression	Hydrogen liquefaction	Synthetic fuels plant	Green ammonia plant	LOHC hydrogenation	Pipeline	Trucks	Train	Shipping	Storage
Fair business	Market distortion and competition	Opportunity	Domestic consumption			X	X										
	Market distortion and competition	Opportunity	Use of national transport infrastructure			X	X										
	Market distortion and competition	Opportunity	Opening of new export markets			X	X										
	Market distortion and competition	Risk	Environmental and safety standards are not yet defined for the activity			X				X		X	X			X	
	Market distortion and competition	Risk	Third parties (investors) typically have a significant stake in the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Market distortion and competition	Opportunity	Third parties (investors) typically have a significant stake in the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Taxation	Risk	Taxation is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Corruption	Risk	Corruption is a contextual risk for the industry	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Many of the risks identified during the analysis are typical for large infrastructure and industrial projects, and handling of energy carriers. All of the assessed risks are relevant for at least one element of the hydrogen supply chain. The severity of these risks is largely dependent on the size and location of a specific project. Some of the evaluated risks and opportunities can be considered as more specific to the hydrogen supply chain.

Key risks:

- **Renewable energy availability and additionality:** green hydrogen requires renewable energy sources and this needs to be ensured throughout the supply chain**,** including energy used for production, conversion and transformation, transportation and storage. Additionality of green electricity is an important aspect to consider.
- **Water availability:** hydrogen production stage requires significant amounts of water. In the locations where fresh water is scarce, desalination and demineralization might be needed. Desalination is an energy-intensive process and significant amount of brine is generated.
- **Critical Raw Materials:** the so called critical raw materials[9] are required for the various technologies in the different stages of the supply chain. For example, for the production of wind turbines and solar panels, but also for the production of electrolyzers (metals such as platinum) needed for green hydrogen production. Mining of these minerals involves significant environmental and social risks and impacts.
- **Carbon capture, storage and utilization technologies**: blue hydrogen production requires fossil energy sources. The opportunities to decrease the associated environmental impact rely on the availability of carbon capture storage & utilization technologies. These technologies can be also relevant as a source for additional carbon needed for transformation to synthetic fuel.
- **Land use:** some activities, such as renewable energy generation, may require large areas of land. Like any other big industrial and infrastructure projects, if hydrogen production plants are close to communities there can be associated social risks. Especially if those communities include indigenous people and vulnerable groups.
- **Health and safety:** in terms of health and safety it is worth mentioning that hydrogen itself is an explosive substance. In addition, other hazardous substances can be used in production and conversion phases. To that end, occupational health and safety as well as community health and safety risks are relevant. Emergency preparedness and response is key.
- **Political commitment:** because of the scale of hydrogen projects government is often involved and, therefore, political commitment is needed in terms of policy and potentially also for infrastructure development.
- **Corruption:** government involvement in some countries can contribute to an increased risk of corruption.
- **Environmental and safety standards:** given that the hydrogen industry is in early stages of development, there is a lack of national and international regulations and standards that are specific for hydrogen production and transportation.

Key opportunities:

- **Renewable energy infrastructure development**: depending on a specific location of hydrogen project, there can be opportunities to develop (or to create a virtuous circle of) green energy infrastructure in the country.
- **Increasing water availability:** development of desalination plants can also provide opportunity to increase (or to create a virtuous circle of) fresh water supply in the country.
- **Infrastructure development:** local infrastructure improvement opportunities may exist thanks to potential government involvement.
- **Economic development:** thanks to new workplaces and taxation.

[9] Critical raw materials (europa.eu)

3.2 Analysis of RBC risks in the selected countries

The table below provides an overview of the risks that are potentially relevant for each analyzed country. The detailed analysis is provided in **Annex B.**

Table 3-4 Potential RBC risks in the selected hydrogen import countries

Topic	Potential supply chain element risk	Potential country-level assessment criteria	Chile	Oman	Australia	Denmark	South Africa	USA	Kazakhstan
Biodiversity and deforestation	Activity can cause intervention, loss and/or fragmentation of ecosystems; alteration or disturbance of habitats	Biodiversity and ecosystems	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Biodiversity and deforestation	Activity can cause soil loss and/or erosion.	Soil loss, erosion, deforestation	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Air pollution	Activity generates significant amounts of emissions to air	Air quality	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Waste & resources	Activity generates significant amounts of solid waste	Waste management	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Waste & resources	Activity generates significant amounts of hazardous waste	Hazardous waste management	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Waste & resources	Activity requires significant amounts of hazardous substances	Hazardous substances	Triggers project level analysis	Insufficient information available	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Waste & resources	Activity requires Critical Raw Materials (CRM), according to the EU list, such as iridium, platinum, tantalum, cobalt and nickel.	Critical Raw Materials	Does not trigger project level analysis.	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis
Waste & resources	Activity requires carbon sources (as a raw material)	Carbon sources: ambient air DAC, biogenic sources, industrial point sources CCU	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis

Topic	Potential supply chain element risk	Potential country-level assessment criteria	Chile	Oman	Australia	Denmark	South Africa	USA	Kazakhstan
Climate and energy	Activity requires significant amounts of electricity	Energy mix, energy poverty, renewable energy sources, additionality	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Climate and energy	Activity requires significant amounts of heat energy or cooling	Energy mix, renewable energy sources, additionality	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Climate and energy	Activity requires significant amounts of fuel	Dependency on fuel import	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis
Water use & water availability	Activity requires significant amounts of fresh water	Water quality & availability	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Water use & water availability	Activity requires water desalination or other treatment	Water desalination	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Water use & water availability	Activity generates significant amounts of wastewater (including brine from desalination)	Wastewater management	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Land restoration and regeneration	Activity requires cleaning up and restoring of mining sites after use	Mining site restoration	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Insufficient information available	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Community health and safety (community impacts)	Activity generates significant noise and vibration emissions	EIA framework, inclusion of noise/vibration	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Community health and safety (community impacts)	Explosion risks of plants, storage tanks, pipelines, etc. and products toxicity.	Safety regulations	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Community health and safety (community impacts)	Activity requires to develop additional infrastructure	EIA framework applicable for infrastructure projects	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Land use & property rights	Activity requires relatively large areas of land and/or sea	Population density	Does not trigger project level analysis	Does not trigger analysis at the project level	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Does not trigger project level analysis
Land use & property rights	Activity is typically related to engagement	Presence of indigenous peoples	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis

Topic	Potential supply chain element risk	Potential country-level assessment criteria	Chile	Oman	Australia	Denmark	South Africa	USA	Kazakhstan
	with indigenous peoples								
Child labor	Child labor is a contextual risk for the industry	Prevalence of child labor	Triggers project level analysis	Triggers project level analysis	Insufficient information available	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Forced labor and human trafficking	Forced labor is a contextual risk for the industry	Prevalence of forced labor	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Forced labor and human trafficking	Presence of migrant workers is a contextual risk for the industry	Migrant workers, conditions for migrant workers	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Discrimination and gender	Discrimination and/or gender inequality is a contextual risk for the industry	Discrimination and gender equality	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Wage & renumeration	Not providing living wage is a contextual risk for the industry	Living wage	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis
Gender-based violence	Gender-based violence is a contextual risk for the industry	Gender-based violence	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining is a contextual risk for the industry	Freedom of association and/or collective bargaining	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis
Health and safety at work	Substantial occupational health and safety risks are typical for the activity	Occupational health and safety	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Government influence	Activity requires political commitment	Political stability	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Conflict and security	Activity typically requires security services	Absence of violence	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis
Market distortion and competition	Environmental and safety standards are not yet defined for the activity	EIA regulation	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Market distortion and competition	Third parties (investors) typically have a significant stake in the industry	Regulatory quality, rule of law	Does not trigger project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis

Topic	Potential supply chain element risk	Potential country-level assessment criteria	Chile	Oman	Australia	Denmark	South Africa	USA	Kazakhstan
Taxation	Taxation is a contextual risk for the industry	Tax and enforcement	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Does not trigger project level analysis	Triggers project level analysis
Corruption	Corruption is a contextual risk for the industry	Control of corruption	Does not trigger project level analysis	Triggers project level analysis	Does not trigger project level analysis	Does not trigger project level analysis	Triggers project level analysis	Triggers project level analysis	Triggers project level analysis

The results of the analysis point to **five environmental risks** as being particularly noteworthy, since project level analysis is triggered for all (or most, in the case of water) countries analyzed:

- ***Biodiversity and ecosystems*** and ***soil loss, erosion, deforestation***: biodiversity is under threat in all countries analyzed, and as mentioned in section 3.1 of this report, almost every component of the hydrogen value chain can generate negative impact on biodiversity. These topics are therefore considered to be a contextual risk in the analyzed countries.
- ***Carbon sources***: potential contextual risk relates mostly to uncertainties surrounding carbon capture and storage technologies. Pilot projects are being conducted in certain countries, but the technology has thus far not lived up to the promises of its proponents.
- ***Energy mix***: green hydrogen production requires energy derived from renewable sources. While some countries are doing better than others when it comes to decarbonizing their energy mix, the analysis indicates that all countries analyzed are still reliant on fossil fuels. Another important matter within this context is the issue of additionality. Caution should be taken to ensure that hydrogen projects do not simply use existing renewable energy sources since this would increase the exporting country's reliance on fossil fuels with regards to its own consumption. Instead, hydrogen projects should contribute to the decarbonization of a country's energy mix by promoting the development of additional renewable energy sources.
- ***Water***[10] & ***water desalination***: water is a necessary input for hydrogen production. Countries such as Chile, Oman, and Australia, as well as certain states in the USA, are already suffering from severe droughts. Countries such as South Africa, the USA, and Kazakhstan also score poorly in the areas of water sanitation and drinking water. The uncertainties resulting from these factors pose a contextual risk for hydrogen production. In areas where water is scarce, it should also be considered whether hydrogen production for export does not further exacerbate water scarcity. While water desalination may present a solution to this issue in some areas, there associated environmental impacts such as those related to high energy intensity of this process as well as the management of brine.

With regards to **social risks**, the results of the analysis point to **three** topics as being particularly noteworthy. The social topics below triggered project level analysis for all countries analyzed:

- ***Forced labor***: while forced labor is more prevalent in some countries than others, reports indicate that to some extent the forced labor occurs in all countries analyzed. It should therefore be considered as a contextual risk.
- ***Migrant workers***: in all countries analyzed, migrant workers are facing challenges and poor conditions to at least some extent. In certain countries, such as Chile, current legislation inadequately protects migrants. In Oman, slavery and trafficking are criminalized, but enforcement is reported to be weak. In other countries, such as Denmark, steps are taken to protect migrant workers but exploitation persists. Given the possibility that migrant workers fulfill positions in the hydrogen value chain, including low-skilled such as in construction, this topic is of particular importance.
- ***Discrimination & gender equality***: while some countries are performing better than others with regards to women's safety and discrimination in the workplace, room for improvement is apparent in all countries analyzed. Considering these matters in workplaces along the hydrogen value chain is considered to be of particular importance.

None of the **governance risks** triggered a project level analysis in every country analyzed. Nevertheless, the following topics are still considered noteworthy:

- ***Tax and enforcement****:* this is a contextual risk in 5 out of 7 countries analyzed. For example, some of the countries analyzed are considered to be tax havens. In other countries, the tax system is described as 'secretive', which poses risks with regards to money laundering. The complexity of national tax systems and the diverse range of risks that these systems may pose make the topic of taxation a contextual risk is some of the analyzed countries.
- ***Political stability*** and ***Control of Corruption***: both topics relate to the state of a country's government. Governmental bodies are likely to be involved in various aspects of the hydrogen value chain. Examples are the formation of trade agreements between countries, as well as the development of large infrastructural projects for hydrogen transport. A stable and reliable government is indispensable for ensuring a secure value chain. With regards to political stability, project level analysis was triggered in 5 out of 7 countries analyzed. In the case of corruption, project level analysis was triggered in 4 our of 7 countries. While these topics did not trigger project level analysis in all countries, the importance of a stable and reliable government when it comes to the hydrogen value chain should not be understated.

[10] The topic of water triggered project level analysis in 6 out of 7 countries analyzed.

4 EU Directives and hydrogen supply chain risks

This section presents a structured overview of the main components of two proposed EU directives the (1) Corporate Sustainability Reporting Directive (hereafter: CSRD) and the (2) Corporate Sustainability Due Diligence Directive (hereafter: CSDDD)., as well as the ways in which they are linked. Additionally, it indicates the extent to which the European Sustainability Reporting Standards (implementing the CSRD) will require organizations to report on matters related to the hydrogen value chain; and the extent to which the CSDDD would require organizations to perform sustainability due diligence.

4.1 Corporate Sustainability Reporting Directive (CSRD)

The CSRD aims to improve the reporting of sustainability matters of undertakings, in order to ensure that adequate information surrounding sustainability issues is publicly available[11] . The directive revises the sustainability reporting requirements set out in the Non-financial Reporting Directive[12]. Through these new standards, the CSRD aims to ensure that reported sustainability information is comparable, reliable, and easy to find for users[13]. The CSRD's requirements cover various environmental, social, and governance (ESG) aspects of sustainability. It is an ambitious directive that will require undertakings operating in the European Union to not only report but also to take action when it comes to addressing their impact on society and the environment.

The Corporate Sustainability Reporting Directive was published in the Official Journal of the European Union on 16th December 2022 having been formally adopted by the European Parliament and Council of the European Union in November. The CSRD has entered into force on 5th January 2023 and its provisions will have to be integrated into member states' national laws after 18 months.

4.1.1 Companies in scope

The CSRD will affect both large and small undertakings operating in the EU. The new sustainability reporting requirements under Article 1 of the CSRD will apply progressively from 2024–2028 to four categories of companies (Table 4-1). Companies will be required to report on:

- The impact of the company on sustainability matters; and
- Impact of sustainability matters on the company's development, performance and position.

Table 4-1 Companies in scope[14]

Year of reporting	Who?	Criteria
2025 on the financial year 2024	companies already subject to the NFRD	Must be a large EU undertaking which: • is a 'public interest entity', and • has more than 500 employees.
2026 on the financial year 2025	large companies that are not currently subject to the NFRD	Must meet two of the following criteria (either as a single entity or on a consolidated group basis): • Balance sheet total of EUR 20 million; • Net turnover of EUR 40 million; and/or • An average of 250 employees during the financial year.
2027 on the financial year 2026	listed SMEs (except micro undertakings), small and non-complex credit institutions and captive insurance undertakings	Must (i) have securities listed on a regulated EU market; and (ii) meet two of the following criteria: • Balance sheet total: EUR 4 million; • Net turnover: EUR 8 million; and/or

[11] CSRD proposal (p. 3).
[12] CSRD proposal (p. 4).
[13] CSRD proposal (p. 3).
[14] Table based on: https://www.consilium.europa.eu/en/press/press-releases/2022/11/28/council-gives-final-green-light-to-corporate-sustainability-reporting-directive/

Year of reporting	Who?	Criteria
		• An average of 50 employees during the financial year.
2029 on the financial year 2028	third-country undertakings with net turnover above 150 million in the EU if they have at least one subsidiary or branch in the EU exceeding certain thresholds	Meet the following criteria: • Net turnover of EUR 150 million in the EU for each of the last two consecutive financial years; and • At least one subsidiary or branch in the EU which: – For a subsidiary meets the criteria for categories (2) or (3) above; and – For a branch has a turnover of more than EUR 40 million.

4.1.2 Sustainability matters covered

An overview of the sustainability matters on which the CSRD will require companies to report are presented in Figure 4-1 below[15].

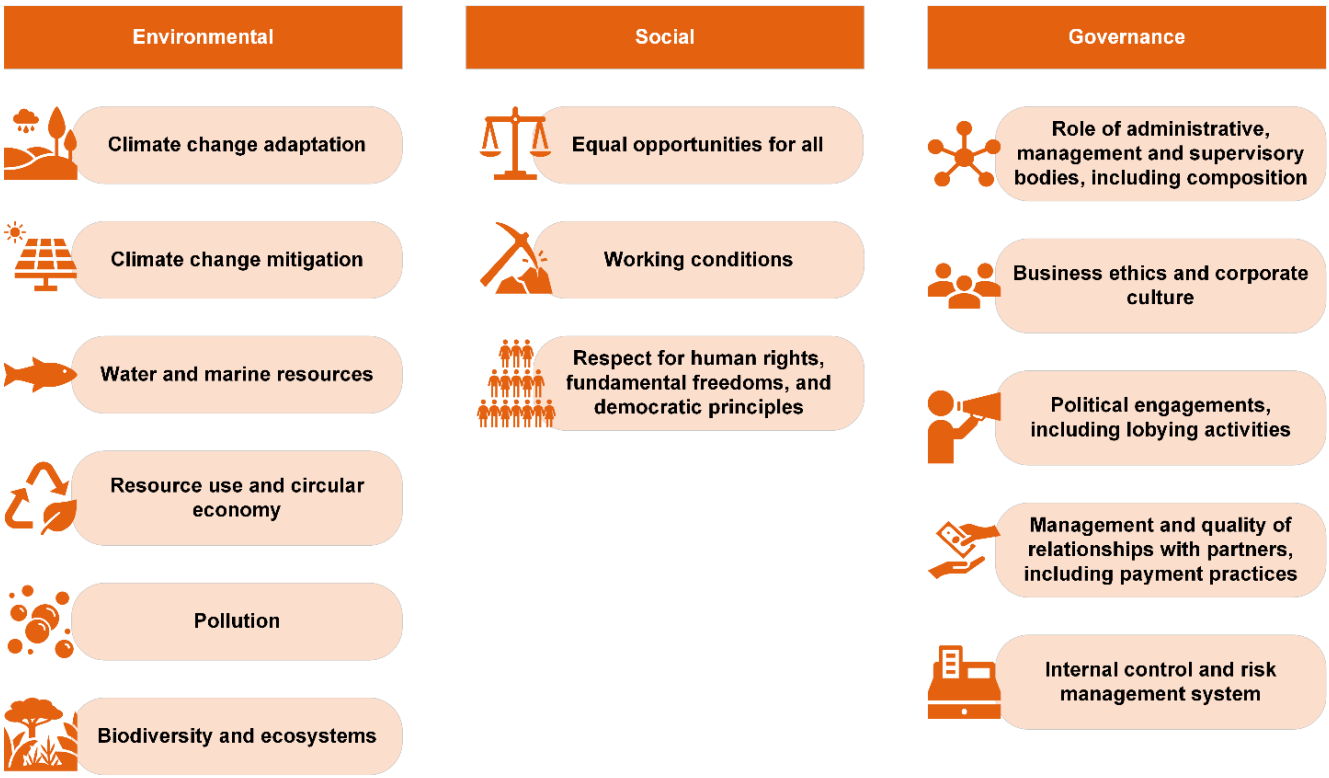

Figure 4-1 Topics covered

[15] Based on CSRD proposal (p. 45 - 46).

4.1.3 Information to be reported

Management reports of undertakings covered by the CSRD must include information on sustainability matters. Organizations will have to report on the impacts that concern not only their own operations, but also value chain operations that are carried out by other entities. An overview of the information surrounding sustainability matters that should be provided in particular is presented Figure 4-2[16]. The CSRD requires companies to report on their due diligence processes, and this part of the directive is therefore connected to the proposed Corporate Sustainability Due Diligence Directive (CSDDD)[17].

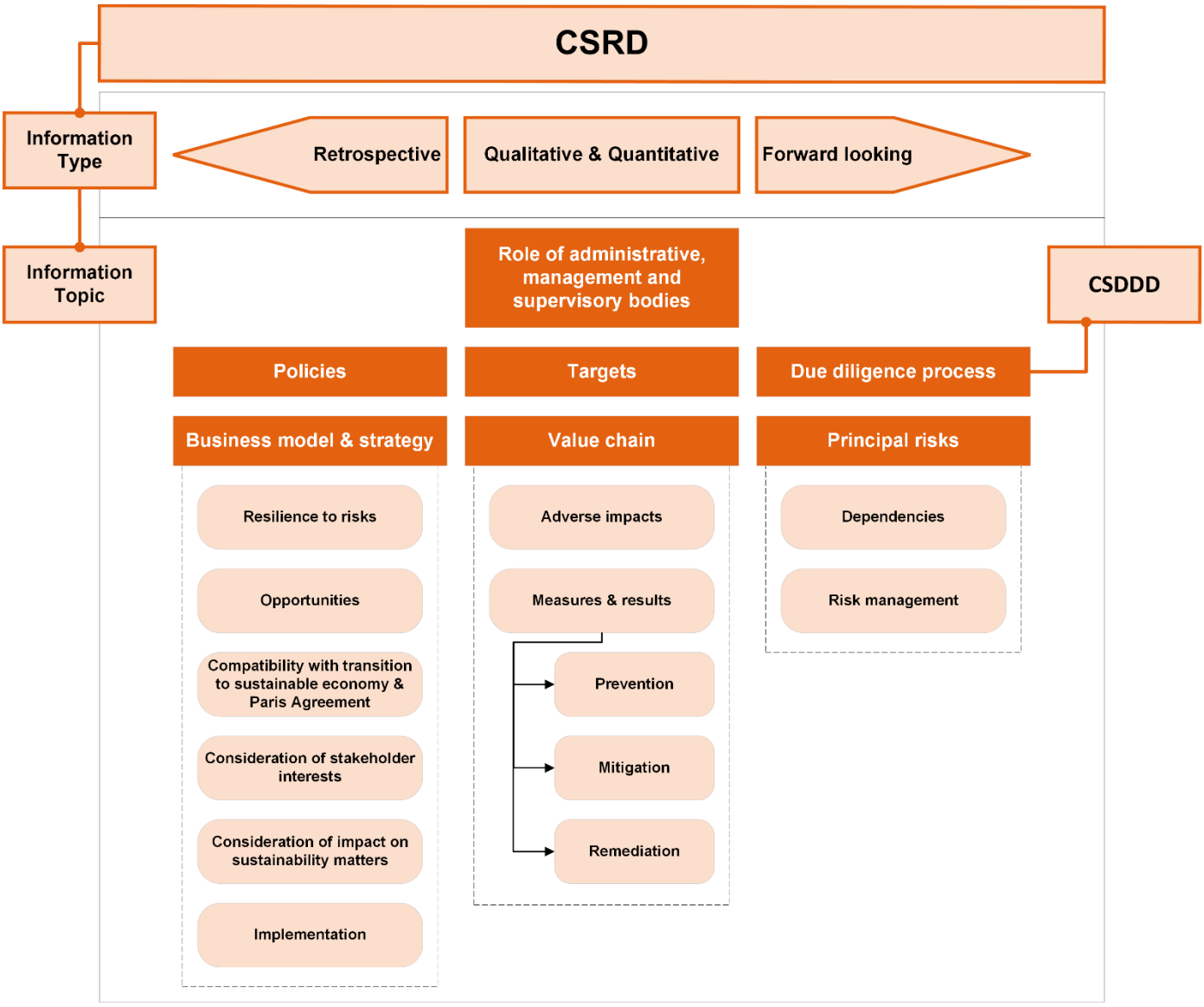

Figure 4-2 Overview of the information surrounding sustainability matters that should be provided

[16] Based on CSRD proposal (p. 42 - 45).
[17] CSDDD proposal.

4.1.4 Reporting Standards & Statutory Audit

CSRD requires companies to report using a double materiality perspective[18] in compliance with European Sustainability Reporting Standards (ESRS), adopted by the European Commission as delegated acts. Under the proposed CSRD, European Financial Reporting Advisory Group (EFRAG) was appointed technical adviser to the European Commission developing draft ESRS. EFRAG has proposed the draft ESRS to the European Commission.

An entity should disclose material sustainability information, including:
- 3 tiers: sector independent, specific to a given sector and specific to a given entity;
- 5 reporting areas: governance, strategy, impact, risk and opportunity management, metrics and targets; and
- 3 topics: environmental, social, governance/corporate.

The first set of 12 draft ESRS is composed of:
- **Cross-cutting standards,** which apply to all sustainability matters**:**
  - Draft ESRS 1 General requirements; and
  - Draft ESRS 2 General disclosures.
- **Topical standards:**

  Environment:
  - Draft ESRS E1 Climate change;
  - Draft ESRS E2 Pollution;
  - Draft ESRS E3 Water and marine resources;
  - Draft ESRS E4 Biodiversity and ecosystems; and
  - Draft ESRS E5 Resources and circular economy.

  Social:
  - Draft ESRS S1 Own workforce;
  - Draft ESRS S2 Workers in the value chain;
  - Draft ESRS S3 Affected communities; and
  - Draft ESRS S4 Customers and end-users.

  Governance:
  - Draft ESRS G1 Business conduct.

ESRS 1 prescribes the mandatory concepts and principles to be applied when preparing sustainability statements under the CSRD. A company should disclose all material information about its sustainability-related impacts, risks and opportunities, in accordance with the applicable ESRS. In this context, ESRS 1 requires companies in scope to disclose certain sustainability information irrespective of the companies' judgment of their materiality, including information on governance, strategy, management of impacts risks and opportunities, and metrics and targets related to climate change. Under the ESRS, there are requirements to report standardized disclosures that apply to all entities (sector-agnostic standards) and those that apply to entities doing business in one or several specific sectors (sector-specific standards).

ESRS 2 sets out the disclosure requirements of sustainability reporting that are cross-cutting. This includes general characteristics of the company and an overview of the company's business but also specific disclosures on compliance such as approximations in relation to value chain and boundaries, estimation uncertainty, changes in preparation and presentation, and prior period errors. Additionally, disclosures about strategy, governance, and the materiality assessment of sustainability impact, risks and opportunity are covered by ESRS 2

[18] Note: the CSRD will require in-scope companies to disclose information on 'sustainability matters' that affect the company, as well as the impacts of the company on sustainability matters.

The commission will also adopt assurance standards to which auditors will have to adhere[19] (CSRD proposal, 2021, p. 59) as CSRD requires limited assurance of sustainability reporting. For limited assurance, the main focus is to understand the process that was used to compile the information that is being reported[20]. Limited assurance usually provides conclusions in negative form, stating that the practitioner has not identified any matters that point to material misstatements[21].

4.2 Corporate Sustainability Due Diligence Directive (CSDDD)

The CSDDD is a proposed Directive that aims to ensure that companies integrate human rights and environmental considerations into their operations and governance practices; doing so should result in corporate behaviour that is both more sustainable and more responsible[22]. The Directive places a corporate due diligence duty on companies. The rules imposed by the Directive will require businesses to identify and end, prevent or mitigate negative impacts and subsequently incorporate this into their reporting. The obligations placed on companies regarding adverse impacts concern not only their own operations, but also value chain operations that are carried out by other entities[23]. The proposed CSDDD will significantly affect decision-making processes and operational processes of companies by requiring them to take consideration of (potential) adverse impacts resulting from their actions. Companies are also required to report on these processes and results, and the CSDDD is therefore intrinsically linked to the CSRD.

It should be noted that the CSDDD regulation is currently being negotiated by the Council and European Parliament. The Council has concluded its position and the European Parliament is likely to do so in May 2023. The actual obligations and scope of the directive will become clear after the trilogues which will start once the European Parliament has voted on its position.

4.3 Companies in scope

The proposed Directive will apply to large EU companies as well as certain non-EU companies. The European Commission[24] identifies four categories of companies to whom the new rules will apply; an overview is presented in Figure 4-3 below. The proposed rules could indirectly affect SMEs and supporting measures are therefore provided by the proposed directive.

[19] CSRD Proposal (p. 59).
[20] Accountancy Europe (2021). FAQs on sustainability information assurance. Available at: https://www.accountancyeurope.eu/publications/faqs-on-sustainability-information-assurance/
[21] CSRD Proposal (p. 37).
[22] European Commission (n.d.). Corporate sustainability due diligence. Available at: https://ec.europa.eu/info/business-economy-euro/doing-business-eu/corporate-sustainability-due-diligence_en
[23] CSDDD Proposal.
[24] European Commission (n.d.). Corporate sustainability due diligence. Available at: https://ec.europa.eu/info/business-economy-euro/doing-business-eu/corporate-sustainability-due-diligence_en

Figure 4-3 Applicability of CSDDD

4.3.1 Required Due Diligence actions

The proposed CSDDD requires companies to carry out several steps within the context of due diligence. These steps, as outlined in articles 5 to 11 of the proposed CSDDD[25], are presented in the figure Figure 4-4 below.

[25] CSDDD Proposal (p. 54-59).

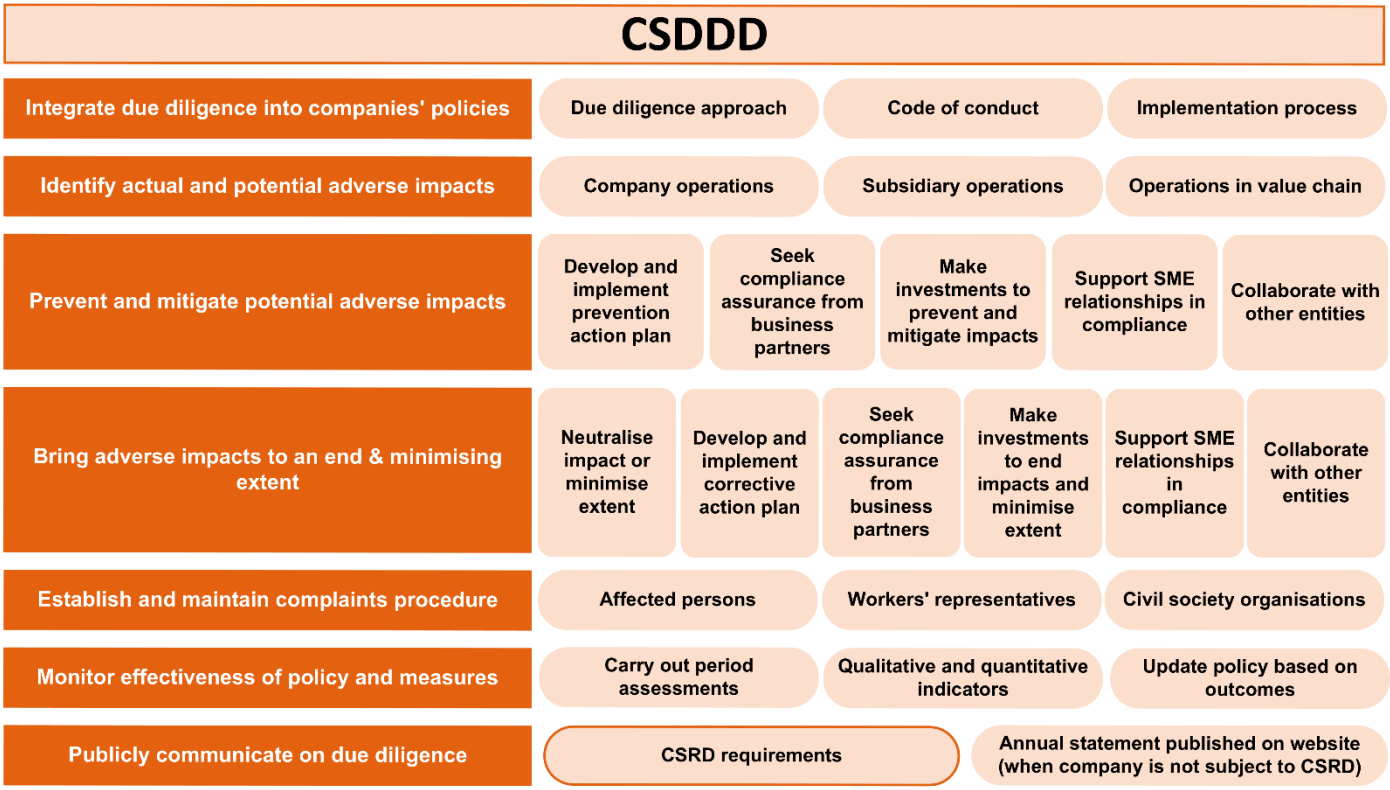

Figure 4-4 Required due diligence steps

4.4 Relationship between directives

The CSRD and CSDDD are intrinsically linked. The obligations that the CSDDD places on undertakings with regards to adverse impacts and due diligence must be reported on in accordance with the CSRD. The CSRD[26] requires undertakings to disclose information on:

- Sustainability due diligence processes implemented.
- Adverse impacts connected with the entire value chain.
- Actions taken to prevent, mitigate or remediate adverse impacts.

The specific actions that companies need to take in this context are outlined in the CSDDD. Figure 4-5 below presents an overview of both directives, as well the connection between them.

[26] CSRD Proposal (p. 43).

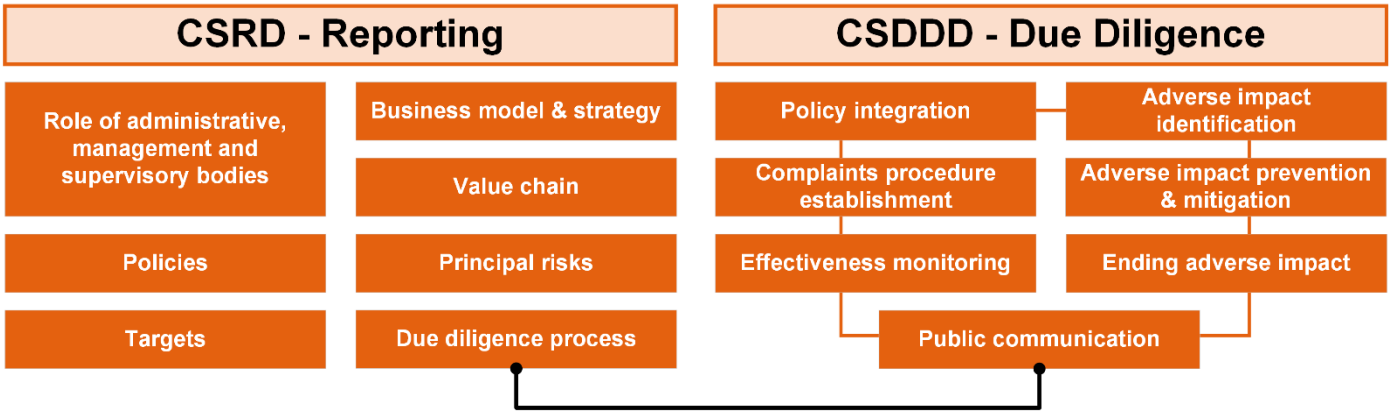

Figure 4-5 Connection between CSRD and CSDDD

4.5 EU Directives & Hydrogen Supply Chain Risks

The CSRD requires companies within its scope to report in compliance with European Sustainability Reporting Standards (ESRS)[27]. The first set of (sector agnostic) draft standards was published in November 2022. The next table presents an overview of the RBC topics relevant to the hydrogen supply chain that were analyzed in the study and the extent to which the ESRS will require organizations to report on matters related to these risks. It should be noted that sector specific standards will be presented at a later date[28]. Specific standards for the Energy Production and Utilities sector are under development[29]. It is therefore likely that companies in the hydrogen production and transportation sector will be subjected to additional requirements described in these standards.

Table 4-2 also maps which sections of the proposed CSDDD directive (Proposal adopted by Commission on 23rd February 2022) cover specific topics.

Table 4-2 EU Directives & Hydrogen Supply Chain risks

Topic		CSRD/ ESRS	CSDDD
Biodiversity and deforestation	• Biodiversity and ecosystems • Soil loss, erosion, deforestation	ESRS E4 – Biodiversity and ecosystems	CSDDD Annex Part I
Air pollution	• Air pollution	ESRS E2 – Pollution	General DD requirement
Waste & resources	• Waste, including hazardous waste • Hazardous substances, Critical Raw Materials, carbon sources	ESRS E5 – Resource use and circular economy ESRS E2 – Pollution ESRS E1 – Climate change	CSDDD Annex Part II
Climate and energy	• Energy	ESRS E1 – Climate change ESRS E2 – Pollution	CSDDD Annex Part II

[27] EFRAG (November, 2022). ESRS draft. Available at: https://www.efrag.org/lab6
[28] PWC (n.d.). Corporate Sustainability Reporting Directive. Available at: https://www.pwc.nl/en/topics/sustainability/esg/corporate-sustainability-reporting-directive.html
[29] EFRAG (November, 2022). Workshops for draft sector sustainability reporting standards. Available at: https://www.efrag.org/News/Project-622/Calling-the-EFRAG-Community-Sector-Groups---Workshops-for-draft-Sector-Sustainability-Reporting-Standards

	Topic	CSRD/ ESRS	CSDDD
Water use & water availability	• Water and wastewater	ESRS E3 – Water and marine resources ESRS E2 – Pollution	General DD requirement
Land restoration and regeneration	• E&S impacts related to mining site restoration	General requirement to report on impacts, risks and opportunities in the value chain	General DD requirement
Community health and safety (community impacts)	• Noise and vibration • Safety	ESRS E2 – Pollution	CSDDD Annex Part I
Land use & property rights	• Communities, including indigenous peoples	ESRS S3 – Affected communities	CSDDD Annex Part I
Child labor	• Child labor	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain	CSDDD Annex Part I
Forced labor and human trafficking	• Forced labor • Conditions for migrant workers	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain	CSDDD Annex Part I
Discrimination and gender	• Discrimination and gender equality	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain ESRS S3 – Affected communities	CSDDD Annex Part I
Wage & renumeration	• Living wage	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain	CSDDD Annex Part I
Gender-based violence	• Gender-based violence	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain	CSDDD Annex Part I
Freedom of association and collective bargaining	• Freedom of association and/or collective bargaining	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain	CSDDD Annex Part I
Health and safety at work	• Occupational health and safety	ESRS S1 – Own workforce ESRS S2 – Workers in the value chain	CSDDD Annex Part I
Government influence	• Political stability	ESRS G1 – Business conduct 1 ESRS S3 – Affected communities	General DD requirement
Conflict and security	• Security	ESRS S3 – Affected communities	CSDDD Annex Part I
Market distortion and competition	• EIA regulation	General requirement to report on impacts, risks and opportunities in the value chain	General DD requirement
Taxation	• Tax	General requirement to report on impacts, risks and opportunities in the value chain	General DD requirement
Corruption	• Corruption	ESRS G1 – Business conduct 2	General DD requirement

To conclude, both directives require to address environmental and social impacts not only in the organization's own operations, but also in the entire value chain. While the scope of applicability of the CSDDD is not finalized yet, it is clear that the CSRD will gradually cover a broad range of companies (approximately 50 000 companies in total), including all large companies, listed companies and certain third-country undertakings. To that end, the companies importing hydrogen to the Netherlands are likely to fall under the scope of CSRD.

Most of the environmental and social topics that were identified as potentially relevant for the hydrogen supply chain are covered by specific topics in CSRD/ESRS and CSDDD (proposal). The topics that are not specifically mentioned are likely to be identified by the importing companies given the general due diligence requirement of the CSDDD and general requirement of the CSRD to report on material impacts, risks and opportunities in the value chain. As a result, companies will still need to address and report on these matters in order to comply with the directives.

5 Key takeaways

The study conducted by Arcadis aligns with the due diligence approach described in the OECD Guidelines for Multinational Enterprises, 2011 and the OECD Due Diligence Guidance for Responsible Business Conduct, 2018. More specifically, it supports the first sub-step in the identification and assessment of actual and potential adverse impacts, which is to carry out a scoping exercise and identify RBC risks (including in the supply chain) considering, amongst other things, information about sectoral, geographic risk factors. To that end, the results of this study may support organizations in providing an approach for scoping contextual risks in the hydrogen supply chain.

While many of the risks and opportunities that were identified during this study relate to those that are typical for industrial, infrastructure development and transportation activities, the following were identified as risks that are especially relevant in the context of hydrogen supply chain:

- Renewable energy availability and additionality.
- Water availability.
- Critical Raw Materials.
- Carbon capture, storage and utilization technologies.
- Health and safety.
- Political commitment.
- Corruption; and
- Environmental and safety standards.

Opportunities include:

- Renewable energy infrastructure development.
- Increasing water availability.
- Infrastructure development; and
- Economic development.

The conducted analysis exemplifies the fact that any potential risks and opportunities that may be present in the international hydrogen supply chain should be considered in the local context. For example, the need for big quantities of fresh water may be considered as a general risk but the implications of this risk will vary per country. Same can be said for most environmental, social and governance risks and opportunities.

While the analysis has limited itself to 7 countries and was conducted at the country level, it provides a methodology that could be implemented to assess hydrogen-related risks for any country.

The analysis highlights the topics that may require to implement further RBC due diligence steps in accordance with the OECD guidelines given the sectoral and country context. Existing and upcoming legislation from the European Union on Corporate Sustainability Due Diligence and Corporate Sustainability Reporting might also introduce additional relevance. When a specific project is developed, compliance with local Environmental & Social Impact Assessment (ESIA) regulations, organizations' internal policies and in some cases also international standards, is required.

The assessment and conclusions presented in this report demonstrate the many risks and opportunities associated with the development of international hydrogen value chains. Both private and institutional stakeholders have responsibilities when it comes to addressing and managing specific risks. It is therefore essential that these stakeholders, both in the Netherlands as well as in countries from which hydrogen is imported, take an active collaborative approach. Doing so will not only ensure risks are mitigated effectively, but also that benefits resulting from the development and operation of an international hydrogen value chain are shared equitably.

Appendix A

Inputs

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
Biodiversity and deforestation	Risk	Activity can cause intervention, loss and/or fragmentation of ecosystems; alteration or disturbance of habitats	X	In large-scale projects, the generation of electrical energy through wind farms or photovoltaic/thermal solar farms require large areas of land, which can generate this impact. Severity: Impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered as highly severe. Probability: Medium.	X	Gas and coal extraction activities could generate this impact. Severity: Impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered as highly severe. Probability: Medium.
Biodiversity and deforestation	Risk	Activity can cause soil loss and/or erosion.	X	The construction works, mainly electricity generation in large projects, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.	X	Gas and coal extraction activities could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.
Air pollution	Risk	Activity generates significant amounts of atmospheric emissions to air		n.a.	X	Gas and coal extraction activities could generate this impact mainly during the operations phase. Severity: Air emissions are typical for mining activity, considered to be of high severity in sensitive receptors. Probability: Medium.
Air pollution	Opportunity	The activity generates low amounts of atmospheric emissions to air	X	The generation of renewable energy allows countries to move toward decarbonization and, therefore, initiate/promote the energy transition.		n.a.
Waste & resources	Risk	Activity generates significant amounts of solid waste	X	Only during the closing phase of large wind and solar photovoltaic power generation projects, large amounts of solid waste may be generated, such as parts and pieces of wind turbines and supports and structures of photovoltaic modules. The photovoltaic modules and wind turbines have a useful operating life (e.g. 25 to 30 years). In the closure phase of the project, part of them will be recycled and the rest corresponds to large amounts of solid waste. The other hydrogen project facilities are not expected to produce large amounts of solid waste in all their phases, compared to the power generation facilities in the closure phase and also most of them can be recycled too. Severity: Large amounts of waste may be generated at closure, possibly requiring increased recycling prior to final disposal, as well as increased capacity for waste disposal or treatment sites. Therefore, it is of medium severity. Probability: medium.	X	During the execution of coal exploitation projects, large amounts of solid waste can be generated, such as non-hazardous domestic and industrial waste. Severity: Large amounts of waste may be generated, possibly requiring increased recycling prior to final disposal, as well as an increased capacity for waste disposal or waste treatment. Therefore, it is considered to be of medium severity. Probability: medium.
Waste & resources	Risk	Activity generates significant amounts of hazardous waste	X	During the operation phase and mainly in the closing phase of large solar photovoltaic/thermal power generation projects, hazardous waste from photovoltaic modules may be generated, depending on their composition. Severity: A large amount of hazardous waste could be generated at closure, possibly requiring increased recycling prior to final disposal, as well as a greater number of hazardous waste treatment or final disposal sites. It is considered of medium severity. Probability: Medium.	X	During the execution of coal exploitation projects, large amounts of hazardous waste can be generated. Severity: Large amounts of hazardous waste may be generated, eventually requiring a greater number of sites for final disposal or waste treatment. Therefore, it is considered of medium severity. Probability: medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
Waste & resources	Risk	Activity requires significant amounts of hazardous substances		n.a.	X	The execution of coal and gas exploitation projects could require large amounts of hazardous substances such as fuels, explosives, oils and lubricants, depending on their size. Severity: Large amounts of hazardous substances may be required, so it is considered medium severity. Probability: medium.
Waste & resources	Risk	Activity requires Critical Raw Materials (CRM), according to the EU list, such as iridium, platinum, tantalum, cobalt and nickel		Production of wind turbines and solar PV requires Critical Raw Materials. Severity: considerable amounts of CRM mayb be required for large scale generation of renewable energy. Probability: medium.		n.a.
Waste & resources	Risk	Activity requires carbon sources (as a raw material)		n.a.	X	The inputs for the production of hydrogen require gas and/or coal. Severity: Large amounts of gas and/or coal (carbon sources) may be required, which is why it is considered High severity. Probability: High.
Climate and energy	Risk	Activity requires significant amounts of electricity		n.a.	X	The mining and hydrocarbon industries, depending on the size of their projects, could require large amounts of electricity in their processes. Severity: Large amounts of electricity may be required, it is considered medium severity. Probability: Medium.
Climate and energy	Opportunity	Activity requires significant amounts of electricity	X	A fraction of the electrical energy generated for the process could be a contribution or donation for the neighboring community.		n.a.
Climate and energy	Risk	Activity requires significant amounts of heat energy or cooling		n.a.		n.a.
Climate and energy	Risk	Activity requires significant amounts of fuel		n.a.	X	The mining and hydrocarbon industries, depending on the size of their projects, could require large amounts of fuels in their processes. Severity: Large amounts of fossil fuel may be required, it is considered high severity. Probability: Medium.
Water use & water availability	Risk	Activity requires significant amounts of fresh water	X	Electrolysis requires significant amounts of fresh water which can be produced though desalination process or fresh water could be obtained through the extraction of surface and/or groundwater. Severity: Significant amounts of fresh water are required, produced mainly through seawater desalination, it is considered medium severity. Probability: High.	X	Seawater desalination could be used to supply significant amounts of freshwater, or freshwater could be obtained through surface and/or groundwater extraction. Severity: Significant amounts of fresh water could be required, it is considered medium severity. Probability: High.
Water use & water availability	Risk	Activity requires water desalination or other treatment	X	Obtaining fresh water for electrolysis could be done through desalination of seawater or by other methods for surface and/or underground water treatment . Severity: Desalination is considered low severity, based on existing studies and experience to date in desalination projects. In general, the effects are limited and due to the great dilution and dispersion capacity, no significant impacts are generated. Probability: High.	X	Obtaining fresh water could be done through desalination of seawater or by other methods for surface and/or underground water treatment. Severity: Desalination is considered low severity, based on existing studies and experience to date in desalination projects. Probability: High.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
Water use & water availability	Opportunity	Activity requires water desalination or other treatment	X	The use of seawater lowers the pressure towards other sources of water such as surface and groundwater used by the community and the ecosystems.	X	The use of seawater lowers the pressure towards other sources of water such as surface and groundwater used by the community and the ecosystems.
Water use & water availability	Opportunity	Activity requires water desalination or other treatment	X	A fraction of the fresh water obtained through the desalination process could be a contribution or donation to the neighboring community and agricultural activities.	X	A fraction of the fresh water obtained through the desalination process could be a contribution or donation to the neighboring community.
Water use & water availability	Risk	Activity generates significant amounts of wastewater (including brine from desalination)	X	Desalination of seawater for electrolysis could generate significant amounts of brine. Severity: Brine discharge is considered low severity, based on existing studies and experience to date in desalination projects. In general, the effects are limited and due to the great dilution and dispersion capacity, no significant impacts are generated. Probability: High.	X	Desalination of seawater could generate significant amounts of brine. Severity: Brine discharge is considered low severity, based on existing studies and experience to date in desalination projects. Probability: High.
Land restoration and regeneration	Risk	Activity requires cleaning up and restoring of mining sites after use		n.a.	X	The mining and hydrocarbon industries, depending on the size of their projects, could require to rehabilitate large areas of exploitation sites. Severity: The rehabilitation of exploitation sites is considered to be of high severity. Probability: High.
Community health and safety (community impacts)	Risk	Activity generates significant noise and vibration emissions	X	The construction of the seawater desalination and electricity generation generates noise emissions and vibrations affecting sensitive receptors. The impacts are also relevant for the wind farms. Severity: Noise and vibration emissions must comply with the regulations of each country; therefore it is considered low severity. Probability: High.	X	Mining and hydrocarbon operations will generate noise and vibration emissions affecting sensitive receptors. Severity: Noise and vibration emissions must comply with the regulations of each country; therefore it is considered low severity. Probability: High.
Community health and safety (community impacts)	Risk	Explosion risks of plants, storage tanks, pipelines, etc. and products toxicity.		n.a.	X	The transportation of natural gas from the production sites to the plant could lead to explosions or release of hazardous substances. Severity: There is a risk of explosion and release of hazardous substances, but if transportation is carried out in line with safety protocols so it is considered of medium severity. Probability: medium.
Community health and safety (community impacts)	Risk	Activity requires to develop additional infrastructure	X	Given the magnitude of the power generation required for a project and/or desalination plant, additional infrastructure could be required to minimize or avoid changes to access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Given the magnitude of the project, additional infrastructure could be required to minimize or avoid changes to access or the quality of goods, equipment, services or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.
Land use & property rights	Risk	Activity requires relatively large areas of land and/or sea	X	In large projects, the generation of electricity through wind farms (on/offshore) or photovoltaic/thermal solar plants require large areas of land. Severity: Large areas of land are required, therefore it is considered high severity. Probability: High.	X	In large utility projects, they may require large areas of land. Severity: Large areas of land could be required, therefore it is considered severe. Probability: High.
Land use & property rights	Risk	Activity is typically related to engagement with indigenous peoples	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
Child labor	Risk	Child labor is a contextual risk for the industry	X	Child labor is not necessarily a contextual risk for renewable energy production or water supply industries; however it can occur in certain countries. Moreover, child labor is a contextual risk in the mining of, so called conflict minerals, which are part of the value chain in the renewable energy industry. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not necessarily a contextual risk for coal and natural gas extraction industry, however it can occur in certain countries. Severity: Child labor should not be common in the industry, but the impact would be highly severe. Probability: Medium
Forced labor and human trafficking	Risk	Forced labor is a contextual risk for the industry	X	Forced labor is not necessarily a contextual risk for renewable energy production or water supply industries, however it can occur in certain countries. Moreover, forced labor is a contextual risk in the mining of, so called conflict minerals, which are part of the value chain in the renewable energy industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Medium	X	In some countries there may be forced labor in the industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.
Forced labor and human trafficking	Risk	Presence of migrant workers is a contextual risk for the industry	X	In some countries, migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.
Discrimination and gender	Risk	Discrimination and/or gender inequality is a contextual risk for the industry	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.
Wage & renumeration	Risk	Not providing living wage is a contextual risk for the industry	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.
Gender-based violence	Risk	Gender-based violence is a contextual risk for the industry	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry; it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry; it would be of high severity. Probability: Medium.
Freedom of association and collective bargaining	Risk	Freedom of association and/or collective bargaining is a contextual risk for the industry	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.
Health and safety at work	Risk	Substantial occupational health and safety risks are typical for the activity	X	While substantial occupational health and safety risks are not typical for renewable energy or water supply industries, it is a contextual risk in the supply chain of renewable energy. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.	X	In the mining industry (coal) and hydrocarbons (gas), supplies for the production of hydrogen, the risks to health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.
Government influence	Risk	Activity requires political commitment	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium
Government influence	Risk	Government is typically participating in the companies	X	In some countries, there may be participation of government companies in the value chain when it comes to renewable energy generation or water supply. Severity: The participation of government companies in the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain when it comes to extraction of natural gas and coal. Severity: The participation of government companies in the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
		in the value chain				
Government influence	Opportunity	Government is typically participating in the companies in the value chain	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.
Conflict and security	Risk	Activity typically requires security services	X	In some countries or regions, security measures against terrorism or crime may be necessary for infrastructure projects. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary for mining operations. Severity: The need for security in the industry would be of high severity. Probability: Medium.
Market distortion and competition	Opportunity	economic value creation		n.a.		n.a.
Market distortion and competition	Opportunity	Use in national transport infrastructure		n.a.		n.a.
Market distortion and competition	Opportunity	Opening of new export markets		n.a.		n.a.
Market distortion and competition	Risk	Environmental and safety standards are not yet defined for the activity		n.a.		n.a.
Market distortion and competition	Risk	Third parties (investors) typically have a significant stake in the industry	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.
Market distortion and competition	Opportunity	Third parties (investors) typically have a significant stake in the industry	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.
Taxation	Risk	Taxation is a contextual risk for the industry	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.
Corruption	Risk	Corruption is a contextual risk for the industry	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.

Hydrogen production

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
Biodiversity and deforestation	Risk	Activity can cause intervention, loss and/or fragmentation of ecosystems; alteration or disturbance of habitats	X	In large projects, the construction of the electrolysis plant could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, therefore, it could be considered highly severe. Probability: Medium.	X	In large projects, the construction of the steam methane reforming (SMR) plant, gasification, carbon capture and storage, could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, therefore, it could be considered highly severe. Probability: Medium.
Biodiversity and deforestation	Risk	Activity can cause soil loss and/or erosion.	X	The construction of the plant, in large projects, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.	X	In large projects, the construction of the SMR plant, gasification, carbon capture and storage, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.
Air pollution	Risk	Activity generates significant amounts of atmospheric emissions to air		n.a.	X	The production of hydrogen from fossil fuels generates emissions, such as CO_2 and other gases. Severity: CO_2 air emissions are considered high severity, however, much of it would be captured and stored. Probability: Medium.
Air pollution	Opportunity	The activity generates low amounts of atmospheric emissions	X	The production of green hydrogen allows countries to decarbonize and move towards the energy transition.		n.a.
Waste & resources	Risk	Activity generates significant amounts of solid waste		n.a.		n.a.
Waste & resources	Risk	Activity generates significant amounts of hazardous waste		n.a.		n.a.
Waste & resources	Risk	Activity requires significant amounts of hazardous substances		n.a.	X	The production of hydrogen through steam methane reforming, depending on its size, requires large amounts of hazardous substances (gas). Severity: Large amounts of hazardous substances may be required, so it is considered medium severity. Probability: medium.
Waste & resources	Risk	Activity requires Critical Raw Materials (CRM), according to the EU list, such as iridium,	X	The manufacturing of electrolyzers requires Critical Raw Materials. Severity: As the manufacture of electrolyzers industrializes, the requirement for Critical Raw Materials could increase, being considered as moderately severe. Probability: High.		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
		platinum, tantalum, cobalt and nickel				
Waste & resources	Risk	Activity requires carbon sources (as a raw material)		n.a.	X	The inputs for the production of hydrogen correspond to carbon sources (gas and/or coal). Severity: Large amounts of gas and/or coal (carbon sources) may be required, which is why it is considered High severity. Probability: High.
Climate and energy	Risk	Activity requires significant amounts of electricity	X	The production of hydrogen through electrolysis requires large amounts of green electricity. Severity: Large amounts of electricity may be required, so it is considered high severity. Probability: High.	X	The production of hydrogen through steam methane reforming, depending on the size of the Plant, could require large amounts of electricity. Severity: Large amounts of electricity could be required, so it is considered low severity. Probability: Medium.
Climate and energy	Opportunity	Activity requires significant amounts of electricity		n.a.		n.a.
Climate and energy	Risk	Activity requires significant amounts of heat energy or cooling	X	In large projects, thermal energy could be required for the purification of the hydrogen produced. Severity: Thermal energy could be required, so it is considered low severity. Probability: Medium.	X	The production of hydrogen through methane reforming with steam requires high temperatures. Severity: It is required to generate high temperatures, which is why it is considered low severity. Probability: Medium.
Climate and energy	Risk	Activity requires significant amounts of fuel			X	The inputs for the production of hydrogen correspond to fuels from carbon sources (gas and/or coal). Severity: Large amounts of gas and/or coal (carbon sources) may be required, which is why it is considered High severity. Probability: High.
Water use & water availability	Risk	Activity requires significant amounts of fresh water	X	The electrolysis process requires large amounts of fresh water. Severity: Significant amounts of fresh water are required, mainly through seawater desalination, which is why it is considered medium severity. Probability: High.	X	Hydrogen production through steam methane reforming could require large amounts of fresh water. Severity: Significant amounts of fresh water could be required, which is why it is considered medium severity. Probability: Medium.
Water use & water availability	Risk	Activity requires water desalination or other treatment		n.a.		n.a.
Water use & water availability	Opportunity	Activity requires water desalination or other treatment		n.a.		n.a.
Water use & water availability	Opportunity	Activity requires water desalination or other treatment		n.a.		n.a.
Water use & water availability	Risk	Activity generates significant amounts of wastewater (including brine from desalination)		n.a.		n.a.
Land restoration and regeneration	Risk	Activity requires cleaning up and restoring of	X	Considering the extraction of Critical Raw Materials for the manufacture of electrolyzes. Severity: The rehabilitation of exploitation sites is considered to be of high severity. Probability: High.		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
		mining sites after use				
Community health and safety (community impacts)	Risk	Activity generates significant noise and vibration emissions	X	The construction of the plant and production of hydrogen by electrolysis could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.	X	The construction of the plant and production of hydrogen by reforming of methane and steam could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.
Community health and safety (community impacts)	Risk	Explosion risks of plants, storage tanks, pipelines, etc. and products toxicity.	X	Hydrogen is flammable gas, therefore there could be a risk of explosion in the plant. Severity: There is a risk of explosion but given existing security protocols it can be considered medium severity. Probability: medium.	X	Hydrogen is flammable gas, therefore there could be a risk in the plant. Severity: There is a risk of explosion but given existing security protocols it can be considered medium severity. Probability: medium.
Community health and safety (community impacts)	Risk	Activity requires to develop additional infrastructure	X	Construction of additional infrastructure may be required to minimize or avoid changes to access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it depends on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure may be required to minimize or avoid changes to access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it depends on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.
Land use & property rights	Risk	Activity requires relatively large areas of land and/or sea		n.a.		n.a.
Land use & property rights	Risk	Activity is typically related to engagement with indigenous peoples	X	The projects could be developed in or next to indigenous peoples' land, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects could be developed in or next to indigenous peoples' land, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.
Child labor	Risk	Child labor is a contextual risk for the industry	X	Child labor is not a contextual risk for the chemical industry; however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the chemical industry; however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium
Forced labor and human trafficking	Risk	Forced labor is a contextual risk for the industry	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.
Forced labor and human trafficking	Risk	Presence of migrant workers is a contextual risk for the industry	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.
Discrimination and gender	Risk	Discrimination and/or gender inequality is a contextual risk for the industry	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.
Wage & renumeration	Risk	Not providing living wage is a contextual risk for the industry	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
Gender-based violence	Risk	Gender-based violence is a contextual risk for the industry	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.
Freedom of association and collective bargaining	Risk	Freedom of association and/or collective bargaining is a contextual risk for the industry	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.
Health and safety at work	Risk	Substantial occupational health and safety risks are typical for the activity	X	The risks of hydrogen production for health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.	X	The risks of hydrogen production for health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.
Government influence	Risk	Activity requires political commitment	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium
Government influence	Risk	Government is typically participating in the companies in the value chain	X	In some countries, there may be participation of government companies when it comes to hydrogen production projects. Severity: The participation of government companies in the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies when it comes to hydrogen production projects. . Severity: The participation of government companies in the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.
Government influence	Opportunity	Government is typically participating in the companies in the value chain	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.
Conflict and security	Risk	Activity typically requires security services	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.
Market distortion and competition	Opportunity	Domestic consumption	X	Opportunity for countries to advance in domestic consumption.	X	Opportunity for countries to advance in domestic consumption.
Market distortion and competition	Opportunity	Use of national transport infrastructure	X	Opportunity of the countries for its use in transport	X	Opportunity of the countries for its use in transport
Market distortion and competition	Opportunity	Opening of new export markets	X	Opportunity for countries to open up to other export markets.	X	Opportunity for countries to open up to other export markets.
Market distortion and competition	Risk	Environmental and safety standards are	X	At an industrial level and possibly in many countries, the environmental and safety standards for the production of hydrogen by electrolysis are not yet defined for the activity. Severity: Lack of industry-compliant environmental and safety standards would be of high severity. Probability: High.		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Green hydrogen	Comment	Blue hydrogen	Comment
		not yet defined for the activity				
Market distortion and competition	Risk	Third parties (investors) typically have a significant stake in the industry	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.
Market distortion and competition	Opportunity	Third parties (investors) typically have a significant stake in the industry	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.
Taxation	Risk	Taxation is a contextual risk for the industry	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.
Corruption	Risk	Corruption is a contextual risk for the industry	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.

ARCADIS

Conversion and transformation

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
Biodiversity and deforestation	Risk	Activity can cause intervention, loss and/or fragmentation of ecosystems; alteration or disturbance of habitats	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered highly severe. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered highly severity. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered highly severe. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered highly severe. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen could generate this impact. Severity: The impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, could be considered highly severe. Probability: Medium.
Biodiversity and deforestation	Risk	Activity can cause soil loss and/or erosion.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated,	X	In large projects, the construction of the infrastructure for the conversion and transformation of hydrogen, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
										therefore it is considered moderately severe. Probability: Medium.		
Air pollution	Risk	Activity generates significant amounts of emissions to air	X	Conversion requires energy, probably electricity, but fossil fuels could be required, generating atmospheric emissions. Severity: impact of CO_2 and other gases emissions are considered to be of high severity. Probability: Medium.	X	Conversion requires energy, probably electricity, but fossil fuels could be required, generating atmospheric emissions. Severity: impact of CO_2 and other gases emissions are considered to be of high severity. Probability: Medium.	X	In larger projects, the generation of CO_2 through the burning of biomass could be required, in addition to what is captured from the air, releasing other emissions. Severity: impact of CO_2 and other gases emissions are considered to be of high severity. Probability: Medium.		n.a.		n.a.
Air pollution	Opportunity	The activity generates low amounts of atmospheric emissions		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity generates significant amounts of solid waste		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity generates significant amounts of hazardous waste		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity requires significant amounts of hazardous substances	X	Hydrogen is considered a hazardous substance. Severity: It depends on the size of the production and the safety measures, which is why it is considered medium severity. Probability: High.	X	Hydrogen is considered a hazardous substance. Severity: It depends on the size of the production and the safety measures, which is why it is considered medium severity. Probability: High.	X	Methanol and other fuels are considered a hazardous substance. Severity: It depends on the size of the production and the safety measures, which is why it is considered medium severity. Probability: High.	X	Ammonia is considered a dangerous substance. Severity: It depends on the size of the production and the safety measures, which is why it is considered high severity. Probability: High.	X	LOCHs contain hazardous substances. Severity: It depends on the size of the production and the safetymeasures, which is why it is considered medium severity. Probability: High.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
Waste & resources	Risk	Activity requires Critical Raw Materials (CRM), according to the EU list, such as iridium, platinum, tantalum, cobalt and nickel		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity requires carbon sources (as a raw material)		n.a.		n.a.	X	In larger projects, the generation of CO_2 through the combustion of biomass could be required, in addition to what is captured from the air, releasing other emissions. Severity: Air emissions of CO_2 and other gases are considered to be of high severity. Probability: Medium.		n.a.	X	Some LOHC carriers are derived from fossil fuels, such as diesel, toluene, benzyltoluene, gasoline. Severity: If carriers derived from fossil fuels are used, but the feedback loop is ensured", they are considered medium severity. Probability: Medium.
Climate and energy	Risk	Activity requires significant amounts of electricity	X	Conversion and transformation of hydrogen requires electricity. Severity: Large amounts of electricity may be required, so it is considered medium severity. Probability: Medium.	X	Conversion and transformation of hydrogen requires electricity. Severity: Large amounts of electricity may be required, so it is considered high severity. Probability: High.	X	Conversion and transformation of hydrogen requires electricity. Severity: Large amounts of electricity may be required, so it is considered medium severity. Probability: Medium.	X	Conversion and transformation of hydrogen requires electricity. Severity: Large amounts of electricity may be required, so it is considered medium severity. Probability: Medium.	X	Conversion and transformation of hydrogen requires electricity. Severity: Large amounts of electricity may be required, so it is considered medium severity. Probability: Medium.
Climate and energy	Opportunity	Activity requires significant amounts of electricity		n.a.		n.a.		n.a.		n.a.		n.a.
Climate and energy	Risk	Activity requires significant amounts of heat energy or cooling		n.a.	X	Liquification of hydrogen requires significant amounts of energy since itneeds to be cooled to -253^{0}C. Severity: Big amounts of energy may be required to liquefy hydrogen, considered high severity. Probability: High.	X	The production of methanol and/or other fuels requires high temperatures. Severity: It is required to generate high temperatures, which is why it is considered high severity. Probability: Medium.	X	Ammonia production requires both high and low temperatures. Severity: It is required to generate high and low temperatures, which is why it is considered high severity.	X	The LOHC hydrogenation process takes place at high temperatures. Severity: It is required to generate at high temperatures, which is why it is considered high severity. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
										Probability: Medium.		
Climate and energy	Risk	Activity requires significant amounts of fuel		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Risk	Activity requires significant amounts of fresh water		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Risk	Activity requires water desalination or other treatment		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Opportunity	Activity requires water desalination or other treatment		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Opportunity	Activity requires water desalination or other treatment		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Risk	Activity generates significant amounts of wastewater (including brine from desalination)		n.a.		n.a.		n.a.		n.a.		n.a.
Land restoration and regeneration	Risk	Activity requires cleaning up and restoring of mining sites after use		n.a.		n.a.		n.a.		n.a.		n.a.
Community health and safety (community impacts)	Risk	Activity generates significant noise and vibration emissions	X	The construction of the plant and the conversion and transformation of hydrogen could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.	X	The construction of the plant and the conversion and transformation of hydrogen could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low	X	The construction of the plant and the conversion and transformation of hydrogen could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.	X	The construction of the plant and the conversion and transformation of hydrogen could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country,	X	The construction of the plant and the conversion and transformation of hydrogen could generate noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
						severity. Probability: High.				therefore it is considered low severity. Probability: High.		
Community health and safety (community impacts)	Risk	Explosion risks of plants, storage tanks, pipelines, etc. and products toxicity.	X	Hydrogen is flammable, therefore there could be a risk in the conversion and transformation process. Severity: There is a risk of explosion, but given the existing safety protocols can be considered medium severity. Probability: medium.	X	Hydrogen is flammable, therefore there could be a risk in the conversion and transformation process. Severity: There is a risk of explosion, but given the existing safety protocols can be considered medium severity. Probability: medium.	X	Hydrogen and combustibles (toxic) are flammable, therefore there could be a risk in the conversion and transformation process. Severity: There is a risk of explosion, but given the existing safety protocols can be considered medium severity. Probability: medium.	X	Hydrogen and ammonia (toxic) are flammable, therefore there could be a risk in the conversion and transformation process. Severity: There is a risk of explosion, but given the existing security protocols can be considered medium severity. Probability: medium.	X	Hydrogen and LOHC (toxic) are flammable, therefore there could be a risk in the conversion and transformation process. Severity: There is a risk of explosion, but given the existing security protocols can be considered medium severity. Probability: medium.
Community health and safety (community impacts)	Risk	Activity requires to develop additional infrastructure	X	Additional infrastructure may be required to minimize or avoid changes to community access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure may be required to minimize or avoid changes to community access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure may be required to minimize or avoid changes to community access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure may be required to minimize or avoid changes to community access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory.	X	Additional infrastructure may be required to minimize or avoid changes to community access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
										Probability: Medium.		
Land use & property rights	Risk	Activity requires relatively large areas of land and/or sea		n.a.		n.a.		n.a.		n.a.		n.a.
Land use & property rights	Risk	Activity is typically related to engagement with indigenous peoples	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.
Child labor	Risk	Child labor is a contextual risk for the industry	X	Child labor is not a contextual risk for the chemical industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the chemical industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the chemical industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the chemical industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the chemical industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium
Forced labor and human trafficking	Risk	Forced labor is a contextual risk for the industry	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist	X	Forced labor is not a contextual risk for the chemical industry, However, it is a risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
						highly severe. Probability: Low.		highly severe. Probability: Low.		in the industry, the impact would be highly severe. Probability: Low.		
Forced labor and human trafficking	Risk	Presence of migrant workers is a contextual risk for the industry	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Especially in construction industry, presence of trafficked persons is a risk. Severity: Illegal migrant labor could exist in the industry, the impact would be highly severe. Probability: Medium.
Discrimination and gender	Risk	Discrimination and/or gender inequality is a contextual risk for the industry	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry.. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.
Wage & renumeration	Risk	Not providing living wage is a contextual risk for the industry	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could	X	In some countries, industry workers may not be ensured a living wage. Severity: the	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-	X	In some countries, industry workers may not be ensured a living	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
				exist in the industry would be of medium severity. Probability: Medium.		non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.		offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.		wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.		wage could exist in the industry would be of medium severity. Probability: Medium.
Gender-based violence	Risk	Gender-based violence is a contextual risk for the industry	X	In the industry or in some countries there could be gender-based violence against industry workers.. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.
Freedom of association and collective bargaining	Risk	Freedom of association and/or collective bargaining is a contextual risk for the industry	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.
Health and safety at work	Risk	Substantial occupational health and safety risks are typical for the activity	X	The risks of hydrogen production for health and safety at work are typical of the activity. Severity:	X	The risks of hydrogen production for health and safety	X	The risks of hydrogen production for health and safety at work are typical of	X	The risks of hydrogen production for health and	X	The risks of hydrogen production for health and safety at work are typical of the activity.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
				risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.		at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.		the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.		safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.		Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.
Government influence	Risk	Activity requires political commitment	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries.. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries.. Severity: Lack of political commitment could have high severity. Probability: Medium
Government influence	Risk	Government is typically participating in the companies in the value chain	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain.. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
										and inefficiency. Probability: Medium.		
Government influence	Opportunity	Government is typically participating in the companies in the value chain	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.
Conflict and security	Risk	Activity typically requires security services	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary.. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.
Market distortion and competition	Opportunity	Domestic consumption		n.a.		n.a.		n.a.		n.a.		n.a.
Market distortion and competition	Opportunity	Use of national transport infrastructure		n.a.		n.a.		n.a.		n.a.		n.a.
Market distortion and competition	Opportunity	Opening of new export markets		n.a.		n.a.		n.a.		n.a.		n.a.
Market distortion and competition	Risk	Environmental and safety standards are not yet defined for the activity		n.a.		n.a.	X	At the industrial level and possibly in numerous countries, environmental and safety standards are		n.a.	X	At the industrial level and possibly in numerous countries, environmental and safety standards are

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
								not yet defined for the activity. Severity: Lack of industry-compliant environmental and safety standards would be of high severity. Probability: High.				not yet defined for the activity. Severity: Lack of industry-compliant environmental and safety standards would be of high severity. Probability: High.
Market distortion and competition	Risk	Third parties (investors) typically have a significant stake in the industry	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain.. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.
Market distortion and competition	Opportunity	Third parties (investors) typically have a significant stake in the industry	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.
Taxation	Risk	Taxation is a contextual risk for the industry	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Hydrogen compression	Comment	Hydrogen liquefaction	Comment	Synthetic fuels plant	Comment	Green ammonia plant	Comment	LOHC hydrogenation	Comment
Corruption	Risk	Corruption is a contextual risk for the industry	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.

Transportation, distribution and storage

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
Biodiversity and deforestation	Risk	Activity can cause intervention, loss and/or fragmentation of ecosystems; alteration or disturbance of habitats	X	If there is no existing gas pipeline network, the construction of such network can generate this impact. Severity: Impacts on biodiversity if they involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, therefore, it could be considered as highly severe. Probability: Medium.		n.a.		n.a.		n.a.	X	In large projects, the construction of the storage plant could generate this impact. Severity: The impacts on biodiversity involve large surfaces, ecosystems and a high number of species, low restoration capacity or long repair time, therefore, it could be considered highly severe. Probability: Medium.
Biodiversity and deforestation	Risk	Activity can cause soil loss and/or erosion.	X	If there is no existing gas pipeline network, the construction of this can generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.		n.a.		n.a.		n.a.	X	The construction of the storage plant, in large projects, could generate this impact. Severity: Prevention and/or rehabilitation measures are required when the impact is generated, therefore it is considered moderately severe. Probability: Medium.
Air pollution	Risk	Activity generates significant amounts of emissions to air		n.a.	X	The transportation by trucks using fuel derived from petroleum generates emissions of particulate matter and gases into the atmosphere. Severity: Air emissions are considered high severity. Probability: High.	X	The transportation by trains using fuel derived from petroleum generates emissions of particulate matter and gases into the atmosphere. Severity: Air emissions are considered high severity. Probability: High.	X	The transportation by ships using fuel derived from petroleum generates emissions of particulate matter and gases into the atmosphere. Severity: Air emissions are considered high severity. Probability: High.		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
Air pollution	Opportunity	The activity generates low amounts of atmospheric emissions		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity generates significant amounts of solid waste		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity generates significant amounts of hazardous waste		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity requires significant amounts of hazardous substances	X	Hydrogen and its derivatives are hazardous, toxic and flammable substances. Severity: correspond to hazardous substances, therefore it is considered of medium severity. Probability: High.	X	Hydrogen and its derivatives, mainly ammonia, are hazardous, toxic and flammable substances. Severity: correspond to hazardous substances, therefore it is considered of medium severity. Probability: High.	X	Hydrogen and its derivatives, mainly ammonia, are hazardous, toxic and flammable substances. Severity: correspond to hazardous substances, therefore it is considered of medium severity. Probability: High.	X	Hydrogen and its derivatives, mainly ammonia, are dangerous, toxic and flammable substances. Severity: correspond to hazardous substances, therefore it is considered of medium severity. Probability: High.	X	Hydrogen and its derivatives, mainly ammonia, are dangerous, toxic and flammable substances. Severity: correspond to hazardous substances, therefore it is considered of medium severity. Probability: High.
Waste & resources	Risk	Activity requires Critical Raw Materials (CRM), according to the EU list, such as iridium, platinum, tantalum, cobalt and nickel		n.a.		n.a.		n.a.		n.a.		n.a.
Waste & resources	Risk	Activity requires carbon sources (as a raw material)		n.a.	X	Transport by truck may require a carbon source, corresponding to petroleum-derived fuel. Severity: Large amounts of fuel (carbon sources) may be required, which is why it is considered high severity. Probability: High.	X	Transport by train may require a carbon source, corresponding to petroleum-derived fuel. Severity: Large amounts of fuel (carbon sources) may be required, which is why it is considered high severity. Probability: High.	X	Transport by ship may require a carbon source, corresponding to petroleum-derived fuel. Severity: Large amounts of fuel (carbon sources) may be required, which is why it is considered high severity. Probability: High.		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
Climate and energy	Risk	Activity requires significant amounts of electricity		n.a.		n.a.	X	Transportation by trains could require large amounts of electricity. Severity: Large amounts of electricity may be required, so it is considered medium severity. Probability: Medium.		n.a.	X	Storage could require large amounts of electricity. Severity: Large amounts of electricity may be required, so it is considered medium severity. Probability: Medium.
Climate and energy	Opportunity	Activity requires significant amounts of electricity		n.a.		n.a.		n.a.		n.a.		n.a.
Climate and energy	Risk	Activity requires significant amounts of heat energy or cooling		n.a.	X	Depending on the form of the hydrogen (liquid) or derivative (e.g., liquid ammonia), transport may require refrigeration. Severity: Low temperature is required, so it is considered low severity. Probability: Medium.	X	Depending on the form of the hydrogen (liquid) or derivative (e.g., liquid ammonia), transport may require refrigeration. Severity: Low temperature is required, so it is considered low severity. Probability: Medium.	X	Depending on the form of the hydrogen (liquid) or derivative (e.g., liquid ammonia), transport may require refrigeration. Severity: Low temperature is required, so it is considered low severity. Probability: Medium.	X	Depending on the form of the hydrogen (liquid) or derivative (e.g., liquid ammonia), storage may require refrigeration. Severity: Low temperature is required, so it is considered low severity. Probability: Medium.
Climate and energy	Risk	Activity requires significant amounts of fuel		n.a.	X	Transportation could require large amounts of fuel. Severity: Large amounts of fossil fuel may be required, which is why it is considered high severity. Probability: Medium.	X	Transportation could require large amounts of fuel. Severity: Large amounts of fossil fuel may be required, which is why it is considered high severity. Probability: Medium.	X	Transportation could require large amounts of fuel. Severity: Large amounts of fossil fuel may be required, which is why it is considered high severity. Probability: Medium.		n.a.
Water use & water availability	Risk	Activity requires significant amounts of fresh water		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Risk	Activity requires water desalination or other treatment		n.a.		n.a.		n.a.		n.a.		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
Water use & water availability	Opportunity	Activity requires water desalination or other treatment		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Opportunity	Activity requires water desalination or other treatment		n.a.		n.a.		n.a.		n.a.		n.a.
Water use & water availability	Risk	Activity generates significant amounts of wastewater (including brine from desalination)		n.a.		n.a.		n.a.		n.a.		n.a.
Land restoration and regeneration	Risk	Activity requires cleaning up and restoring of mining sites after use		n.a.		n.a.		n.a.		n.a.		n.a.
Community health and safety (community impacts)	Risk	Activity generates significant noise and vibration emissions		n.a.	X	Transportation generates noise emissions and vibration. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.	X	Transportation generates noise emissions and vibrations. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.	X	Transport generates noise and vibration emissions. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.	X	Storage could generate noise emissions and vibrations. Severity: Noise and vibration emissions must comply with the regulations of each country, therefore it is considered low severity. Probability: High.
Community health and safety (community impacts)	Risk	Explosion risks of plants, storage tanks, pipelines, etc. and products toxicity.	X	Hydrogen and its derivatives (toxic) are flammable, therefore there could be a risk during transport, including the risk of leakage. Severity: There is a risk of explosion, if existing security protocols are considered severity is medium. Probability: medium.	X	Hydrogen and its derivatives (toxic) are flammable, therefore there could be a risk during transport. Severity: There is a risk of explosion, if existing security protocols are considered severity is medium. Probability: medium.	X	Hydrogen and its derivatives (toxic) are flammable, therefore there could be a risk during transport. Severity: There is a risk of explosion, if existing security protocols are considered severity is medium.	X	Hydrogen and its derivatives (toxic) are flammable, therefore there could be a risk during transport. Severity: There is a risk of explosion, if existing	X	Hydrogen and its derivatives (toxic) are flammable, therefore there could be a risk in storage Severity: There is a risk of explosion, if existing security protocols are considered severity is medium. Probability: medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
								Probability: medium.		security protocols are considered severity is medium. Probability: medium.		
Community health and safety (community impacts)	Risk	Activity requires to develop additional infrastructure	X	Additional infrastructure could be required to minimize or avoid changes to community access to goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure could be required to minimize or avoid alterations to community access to or the quality of goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure could be required to minimize or avoid alterations to community access to or the quality of goods, equipment, services or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure could be required to minimize or avoid changes to community access to or the quality of goods, equipment, services, or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.	X	Additional infrastructure could be required to minimize or avoid alterations to community access to or the quality of goods, equipment, services or basic infrastructure. Severity: It is considered medium severity, since it will depend on the size of the project and the existing infrastructure situation in the territory. Probability: Medium.
Land use & property rights	Risk	Activity requires relatively large areas of land and/or sea		n.a.		n.a.		n.a.		n.a.		n.a.
Land use & property rights	Risk	Activity is typically related to engagement with indigenous peoples	X	New pipeline projects to be built could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	Projects for new highways to be built could be developed in indigenous peoples' territories, or increase traffic on existing routes, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.	X	The projects of new railway tracks to be built could be developed in indigenous peoples' territories, or increase traffic on existing railway, having the potential to impact indigenous communities. Severity: if there is	X	New port projects to be built could be developed in indigenous peoples' territories, or increase traffic in existing ports, having the potential to impact indigenous	X	The projects could be developed in indigenous peoples' territories, having the potential to impact them. Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
								a presence of indigenous territories, the severity is high. Probability: Medium.		communities . Severity: if there is a presence of indigenous territories, the severity is high. Probability: Medium.		
Child labor	Risk	Child labor is a contextual risk for the industry	X	Child labor is not a contextual risk for the industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the l industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium	X	Child labor is not a contextual risk for the industry, however it can occur in certain countries. Severity: Child labor can occur in the industry, but the impact would be highly severe. Probability: Medium.
Forced labor and human trafficking	Risk	Forced labor is a contextual risk for the industry	X	Forced labor is a contextual risk in construction industry. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.	X	Forced labor is not a contextual risk for the logistics industry, however in some countries it may occur. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.	X	Forced labor is not a contextual risk for the logistics industry, however in some countries it may occur. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.	X	Forced labor is not a contextual risk for the shipping industry, however in some countries it may occur. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.	X	Forced labor is not a contextual risk for the industry, however in some countries it may occur. Severity: Forced labor could exist in the industry, the impact would be highly severe. Probability: Low.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
Forced labor and human trafficking	Risk	Presence of migrant workers is a contextual risk for the industry	X	In some countries, migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.	X	In some countries migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.	X	In some countries, migrant workers could work in the industry. Severity: Illegal migrant labor could exist in the industry would be highly severe. Probability: Medium.
Discrimination and gender	Risk	Discrimination and/or gender inequality is a contextual risk for the industry	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.	X	In the industry or in some countries there could be discrimination and/or gender inequality towards workers in the industry. Severity: Discrimination and/or gender inequality could exist in the industry would be of medium severity. Probability: Medium.
Wage & renumeration	Risk	Not providing living wage is a contextual risk for the industry	X	In some countries, industry workers may not be ensured a living wage.. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity.	X	In some countries, industry workers may not be ensured a living wage. Severity: the non-offering of a living wage could exist in the industry would be of medium severity. Probability: Medium.

ARCADIS

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
										Probability: Medium.		
Gender-based violence	Risk	Gender-based violence is a contextual risk for the industry	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.	X	In the industry or in some countries there could be gender-based violence against industry workers. Severity: Gender violence could exist in the industry, it would be of high severity. Probability: Medium.
Freedom of association and collective bargaining	Risk	Freedom of association and/or collective bargaining is a contextual risk for the industry	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may be not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.	X	In industry or in some countries freedom of association and/or collective bargaining may not be ensured. Severity: The prohibition of association and/or collective bargaining that could exist in the industry would be of medium severity. Probability: Medium.
Health and safety at work	Risk	Substantial occupational health and safety risks are typical for the activity	X	The risks for health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity and have high severity. Probability: Medium.	X	The risks for health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity	X	The risks for for health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical	X	The risks for health and safety at work are typical of the activity. Severity: risks to health and	X	The risks for health and safety at work are typical of the activity. Severity: risks to health and safety at work are typical of the activity

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
						and have high severity. Probability: Medium.		of the activity and have high severity. Probability: Medium.		safety at work are typical of the activity and have high severity. Probability: Medium.		and have high severity. Probability: Medium.
Government influence	Risk	Activity requires political commitment	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium	X	Lack of political commitment could generate delays or obstacles in the installation and operation of the industry in certain countries. Severity: Lack of political commitment could have high severity. Probability: Medium
Government influence	Risk	Government is typically participating in the companies in the value chain	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.	X	In some countries, there may be participation of government companies in the value chain. Severity: The participation of government companies in steps of the value chain would be of medium severity, and there may be a risk of corruption, bureaucracy and inefficiency. Probability: Medium.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
Government influence	Opportunity	Government is typically participating in the companies in the value chain	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.	X	In some countries, there could be participation of government companies in the value chain, which could be an opportunity to substantially improve the income of the respective nation.
Conflict and security	Risk	Activity typically requires security services	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.	X	In some countries or regions, security measures against terrorism or crime may be necessary. Severity: The need for security in the industry would be of high severity. Probability: Medium.
Market distortion and competition	Opportunity	Domestic consumption		n.a.		n.a.		n.a.		n.a.		n.a.
Market distortion and competition	Opportunity	Use of national transport infrastructure		n.a.		n.a.		n.a.		n.a.		n.a.
Market distortion and competition	Opportunity	Opening of new export markets		n.a.		n.a.		n.a.		n.a.		n.a.
Market distortion and competition	Risk	Environmental and safety standards are not yet defined for the activity	X	At an industrial level and possibly in many countries, environmental and safety standards are not yet defined for the activity of transporting hydrogen and its derivatives through pipelines. Severity: Lack of industry-compliant environmental and		n.a.		n.a.	X	At an industrial level and possibly in many countries, environmental and safety standards are not yet		n.a.

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
				safety standards would be of high severity. Probability: High.						defined for the activity of transporting hydrogen and its derivatives by ships. Severity: Lack of industry-compliant environmental and safety standards would be of high severity. Probability: High.		
Market distortion and competition	Risk	Third parties (investors) typically have a significant stake in the industry	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.	X	In some countries, investors could be widely involved in the value chain. Severity: Investor participation in the value chain is considered medium severity. Probability: Medium.
Market distortion and competition	Opportunity	Third parties (investors) typically have a significant stake in the industry	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.	X	In some countries, the arrival of companies that will invest is an opportunity for the generation of local work and the collection of taxes for the country, among others.
Taxation	Risk	Taxation is a contextual risk for the industry	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high severity. Probability: Medium.	X	In some countries, very high taxes could discourage investment. Severity: Taxes are considered high	X	In some countries, very high taxes could discourage investment. Severity: Taxes	X	In some countries, very high taxes could discourage	X	In some countries, very high taxes could discourage investment. Severity: Taxes are

Topics	Risk/ Opportunity	Potential supply chain element risk and opportunities	Pipeline	Comment	Trucks	Comment	Train	Comment	Shipping	Comment	Storage	Comment
						severity. Probability: Medium.		are considered high severity. Probability: Medium.		investment. Severity: Taxes are considered high severity. Probability: Medium.		considered high severity. Probability: Medium.
Corruption	Risk	Corruption is a contextual risk for the industry	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.	X	In some countries corruption could put the supply chain at risk. Severity: Corruption in the industry could be of high severity. Probability: Medium.

Appendix B

Biodiversity & deforestation

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 59/180 • EPI score: 51.20/100 • 10-year change: 13.40	Chile | Environmental Performance Index (yale.edu)	Certain parts of Chile are considered global biodiversity hotspots, and since these are regard as threatened, extra care should be taken to ensure that activities do not contribute to further negative impacts on these hotspots.	**Triggers project level analysis**
		The central and southern zones of Chile are considered a global biodiversity hotspot and among the most threatened. In general, ecological conditions are better in southern Chile and worse in the country's central zone. In the northern zone, activities conducted by the mining and agricultural sectors are negatively impacting the status of rivers and lakes and coastal wetlands. The main threats to biodiversity are changes in land use due to activities related to the forestry and agricultural sectors. Other threats are associated with urbanization, invasive alien species, forest fires, climate change and water extracted for mining and agricultural activities in the northern zone of the country.	Main Details (cbd.int)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	Net change of -0.079 % in tree cover from 2000 to 2020. From 2001 to 2021, 6.8% of tree cover loss occurred in areas where the dominant drivers of loss resulted in deforestation.	Chile Deforestation Rates & Statistics | GFW (globalforestwatch.org)	Chile's relatively low EPI score in terms of tree cover loss indicates that deforestation is a significant topic in the country. Soil erosion is also a relevant topic in Chile.	**Triggers project level analysis**
		EPI Tree cover loss • Rank: 99/180 • EPI Score: 12.60 • 10-year change: -0.90	Chile | Environmental Performance Index (yale.edu)		
		Over the last two decades, ecosystems located in the coastal zone of Maule and Bio Bio lost about 26% of their tree coverage. During the same period, losses of 10% to 20% have been recorded in 11 other ecosystems in the central zone.	Main Details (cbd.int)		

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		It is estimated that 60% of the land in Chile is affected by some degree of erosion. However, Chile has lower soil erosion rates than its neighbors.	Countries and the global rate of soil erosion | Nature Sustainability Hillslope soil erosion and mobility in pine plantations and native deciduous forest in the coastal range of south-Central Chile (forestproductivitycoop.net)		

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 149/180 • EPI Score: 33.50/100 • 10-year change: 2.60	Oman | Environmental Performance Index (yale.edu)	Given Oman's relatively low EPI rating with regards to ecosystem vitality, the topic of biodiversity and ecosystems require attention. Overuse of and damage to coastal and marine ecosystems is considered one of the main threats which could be relevant for activities related to hydrogen value chain.	**Triggers project level analysis**
		Despite the country's arid climate, it possesses a relatively high level of biodiversity, especially in regions that have higher levels of precipitation. The main threats to biodiversity in Oman include overgrazing, loss of habitat, overuse of and damage to coastal and marine ecosystems, invasive species, as well as population growth and use of modern technology.	Main Details (cbd.int)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	Coastal erosion has been observed in Oman.	Beach erosion along Al Batinah coast, Sultanate of Oman | SpringerLink	Coastal and soil erosion is a potential contextual risk in Oman, considering the current situation in its coastal area.	**Triggers project level analysis**
		No EPI data available on tree cover loss	/		
		Oman has higher erosion rates than its neighbor countries.	Countries and the global rate of soil erosion | Nature Sustainability		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 16/180 • EPI Score: 62.30/100 • 10-year change: 14.10	Australia | Environmental Performance Index (yale.edu)	Even though Australia's EPI score in terms of Ecosystem Vitality is relatively high, given the national and global importance of Australia's ecosystems, this topic should be investigated before engaging in the activity.	**Triggers project level analysis**
		Australia's biodiversity is both rich and unique; between 7 and 10 % of all species on Earth occur in Australia. Australia's terrestrial and marine biodiversity is important both nationally and globally, establishing an obligation for its conservation and sustainable use. Loss and degradation of native vegetation is an ongoing threat to Australia's biodiversity and to the productivity of industry. Major threats to biodiversity include climate change and enhanced climate variability; loss, fragmentation and degradation of habitats; introduction and spread of invasive alien species; marine and coastal pollution; altered hydrology; inappropriate grazing and fire regimes; and population growth and the competing pressure of economic development.	Main Details (cbd.int)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	Australia remains one of the world's hotpots for deforestation according to a 2021 WWF report.	Australia the only developed nation on world list of deforestation hotspots | Environment | The Guardian	Given the fact that Australia is considered a deforestation hotspot, this topic should be investigated before engaging in the activity.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 21/180 • EPI score: 61.30/100 • 10-year change: -1.20	Denmark | Environmental Performance Index (yale.edu)	Given the fact that biodiversity in Denmark is declining, this topic should be investigated before engaging in the activity.	**Triggers project level analysis**
		Danish biodiversity is in net decline. Over the last century, extensive drainage and intensification of forestry for timber production has led to a significant net decrease in open forest glades, forest wetlands and structures related to old growth forests.	Main Details (cbd.int)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	EPI Tree cover loss: • Rank: 112/180 • EPI score: 10.30/100 • 10-year change: 0.60	Denmark | Environmental Performance Index (yale.edu)	Given Denmark's low tree cover loss EPI score, the topic of deforestation should be investigated before engaging in the activity.	**Triggers project level analysis**

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		Denmark has slightly higher erosion rates than its neighbor countries.	Countries and the global rate of soil erosion | Nature Sustainability		

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 92/180 • EPI score: 44.20/100 • 10-year change: 12.70	South Africa | Environmental Performance Index (yale.edu)	Given the fact that South Africa's ecosystems are greatly endangered, investigation of this topic is necessary before engaging in the activity.	**Triggers project level analysis**
		South African biodiversity is greatly endangered. National Red List assessments indicate that 10% of South Africa's birds and frogs, 20% of its mammals and 13% of its plants are threatened.	Main Details (cbd.int)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 139/180 • EPI score: 5.80/100 • 10-year change: -1.30	South Africa | Environmental Performance Index (yale.edu)	Given South Africa's low tree cover loss EPI score, the topic of deforestation should be investigated before engaging in the activity.	**Triggers project level analysis**
		South Africa has lower erosion rates than its neighbor countries.	Countries and the global rate of soil erosion | Nature Sustainability		

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 57/180 • EPI Score: 51.40/100 • 10-year change: 1.10	United States of America | Environmental Performance Index (yale.edu)	Biodiversity in certain areas faces significant pressures in USA. The extent to which investigation of this topic is necessary is highly dependent on the state in which the activity is to take place. Generally, investigation is necessary.	**Triggers project level analysis**
		California state has the most imperiled biodiversity of any state in the continuous United States. Southern Appalachia is a hotspot for species at risk of vanishing.	This Map Shows Where Biodiversity Is Most at Risk in America - The New York Times (nytimes.com)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	EPI Tree cover loss: • Rank: 117/180 • EPI score: 9.80/100 • 10-year change:	United States of America | Environmental Performance Index (yale.edu)	Given the USA's low tree cover loss EPI score, the topic of deforestation should be investigated before engaging in the activity.	**Triggers project level analysis**

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		United States has lower erosion rates than its neighbor countries.	Countries and the global rate of soil erosion | Nature Sustainability		

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Biodiversity and deforestation	Biodiversity and ecosystems (policy/regulation, state)	EPI Ecosystem Vitality: • Rank: 72/180 • EPI Score: 48.10/100 • 10-year change: 2.00	Kazakhstan | Environmental Performance Index (yale.edu)	Given the fact that many of Kazakhstan's species are endangered, the topic of biodiversity and ecosystems must be investigated before engaging in the activity.	**Triggers project level analysis**
		Many species in Kazakhstan are endangered, mostly due to habitat destruction and hunting. The main pressures on biodiversity in Kazakhstan are linked to oil and gas extraction; coal extraction; extraction of uranium and other minerals; rock and slag run-off; atmospheric pollution; draining; waste storage; road construction; electric power transmission lines; oil and gas pipelines; channels and water reservoirs; and irrigation,	Main Details (cbd.int)		
Biodiversity and deforestation	Soil loss, erosion, deforestation (policy/regulation, state)	EPI Tree Cover Loss: • Rank: 25/180 • EPI score: 42.50/100 • 10-year change: 11.60	Kazakhstan | Environmental Performance Index (yale.edu)	Compared to other countries, Kazakhstan ranks relatively high with regards to it EPI tree cover loss score. However, 42.50/100 is not a strong score, and investigation of this topic is therefore necessary.	**Triggers project level analysis**
		Kazakhstan has lower erosion rates than its neighbor countries.	Countries and the global rate of soil erosion | Nature Sustainability		

Air pollution

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 50/180 • EPI Score: 48.40/100 • 10-year change: 4.20	Chile | Environmental Performance Index (yale.edu)	Chile's air quality has been improving over the past ten years, and caution should be taken to ensure that activities related to hydrogen value chain do not hamper progress.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 96/180 • EPI Score: 36.4/100 10-year change: 10.3	Oman | Environmental Performance Index (yale.edu)	Given Oman's low EPI score with regards to air quality, this topic should be investigated before engaging in hydrogen production.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 6/180 • EPI Score: 91.10/100 • 10-year change: 4.10	Australia | Environmental Performance Index (yale.edu)	Australia's air quality ranks among the highest in the world. Assuming that local legal requirements are met, further analysis at the project level is therefore not necessary.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 12/180 • EPI Score: 80.50/100 • 10-year change: 9.50	https://epi.yale.edu/epi-results/2022/country/dnk	Denmark's air quality ranks among the highest in the world. Assuming that local legal requirements are met, further analysis at the project level is therefore not necessary.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 147/180 • EPI Score: 22.20/100 • 10-year change: 7.50	https://epi.yale.edu/epi-results/2022/country/zaf	Given South Africa's low EPI score with regards to air quality, further investigation at the project level is necessary.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 16/180 • EPI Score: 77.00/100 • 10-year change: 9.10	https://epi.yale.edu/epi-results/2022/country/usa	The USA's air quality ranks among top 20 in the world. Assuming that local legal requirements are met, further analysis at the project level is therefore not necessary.	**Does not trigger project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Air pollution	Air quality (policy/regulation, state)	EPI Air Quality: • Rank: 118//180 • EPI Score: 28.60/100 • 10-year change: 6.60	https://epi.yale.edu/epi-results/2022/country/kaz	Given Kazakhstan's low EPI score with regards to air quality, further investigation at the project level is necessary.	**Triggers project level analysis**

Waste and Resources

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 58/180 • EPI Score: 46.40/100 • 10-year change: 0.10 EPI Solid Waste: • Rank: 48/180 • EPI Score: 75.70/100	Chile | Environmental Performance Index (yale.edu)	Chile's Waste Solid Management EPI Score of 75.70/100 indicates it controls waste in a reasonably sustainable manner, however the overall Waste Management EPI score is much lower. A need to further analyze this topic at the project level is therefore triggered.	**Triggers project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	Hazardous waste management is regulated. In Chile, more than 70% of Municipal Solid Waste is disposed of in authorized facilities. Management of mining waste, which can contain hazardous, waste is a challenge.	Waste and hazardous substance regulations in Chile – Lexology Waste Management in the LATAM Region (rvo.nl) Chile: the advance of the toxic mountains - London Mining Network	While Chile has a developed waste management system, there has been reports on mismanaged waste including hazardous waste from the mining industry.	**Triggers project level analysis**
Waste & resources	Hazardous substances (policy/regulation, enforcement)	In 2017, Chile published the National Chemical Safety Policy action plan 2017-2022. In 2021, it was the first country in Latin America to implement a comprehensive chemical regulation. The new regulations are being implemented gradually.	Chile Publishes GHS and Chemical Registration Decree (3eco.com)	While Chile is the first country in Latin America to implement a comprehensive chemical management regulation, the regulation is not fully in place and its effectiveness is not yet clear.	**Triggers project level analysis**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	Chile is one of the top producers of lithium and copper, in an industry that is highly regulated. The mining industry in Chile is facing risks from political instability in the regions.	Critical minerals supply and demand topics | EY – US Share of top producing countries in total processing of selected minerals and fossil fuels, 2019 – Charts – Data & Statistics - IEA	Chile has domestic supply of lithium and copper. With regards to availability of the critical raw materials, project level analysis is therefore not triggered. It should be noted that the activity of mining critical raw materials itself is not without risks. However, for the topic of *critical raw materials,* the analysis looks solely at the availability of these materials. Other risks associated with mining are considered in other parts of the analysis.	**Does not trigger project level analysis**
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	Energy requirements and land use management are a sustainability risks for Ambient Air (DAC) Land use risk and biodiversity risks exist for biogenic sources CCU is not compatible with a closed carbon system, which poses an important sustainability risk.	PtX-Hub-PtX.Sustainability-Dimensions-and-Concerns-Scoping-Paper.pdf (p.22)	Chile is reported to be raising its biomass capacity, which presents opportunities for hydrogen production. However, Chile does not appear to incorporate CCU in its strategy. This means that the potential to use CCU as part of Ptx processes is limited. Investigation at the project level is therefore required.	**Triggers project level analysis**
		The strategy by the Ministry of Environment and Energy does not consider carbon capture,	CCUS challenges and opportunities in Chile (decarbonisationtechnology.com)		

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		utilization and storage (CCUS) as a technology to achieve its targets.			
		2022 is likely to show the strength of Chile's biomass potential, with a development of a large project, a new cogeneration boiler that would process forest biomass at the Arauco Plant (MAPA) in the center-south Biobío region. The project is expected to add 166MW of biomass capacity to the national grid in March, growing the national generation park of the technology by 38% to 601MW. Other significant biomass projects include a plan by Engie to overhaul its Hornitos and Andina units in its Mejillones generation complex, to utilize biomass as a fuel, completely replacing coal.	Chile expects to raise biomass, hydroelectric capacity this year - ICSC (sustainable-carbon.org)		

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 86/180 • EPI Score: 32.80/100 • 10-year change: -1.00 EPI Solid Waste: • Rank: 75 • EPI Score: 49.50/100	https://epi.yale.edu/epi-results/2022/country/omn	Oman's Solid Waste EPI Score of 49.50/100 indicates that there is plenty of room for improvement when it comes to the sustainable management of solid waste. There is therefore a need for further analysis at the project level.	**Triggers project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	Oman has a regulatory framework for hazardous waste management since 1993. A license is needed to handle hazardous waste. However, the country lacks waste collection, sorting and disposal facilities.	Oman - Regulation for the Management of Hazardous Waste. (ilo.org) Frontiers | Sustainable Waste Management Strategies for Effective Energy Utilization in Oman: A Review (frontiersin.org)	Oman lacks waste management infrastructure which should be also considered in the context of hazardous waste.	**Triggers project level analysis**
Waste & resources	Hazardous substances (policy/regulation, enforcement)	Information on the effectiveness of management of hazardous substances is not available.	/	/	**Insufficient information available**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	Mining is one of the Omani government's focus sectors under its economic diversification program. Oman's mining industry has attracted increasing interest from both foreign and local operators as Oman was the first GCC producer and exporter of ferrochrome.	Oman – Mining and Minerals (trade.gov) Oman: number of active mines by mineral | Statista	The production of renewable energy technologies requires critical raw materials. Although Oman demonstrates increased focus on the mining sector, currently the country is not amongst the top producers of metals required for renewable energy technologies.	**Triggers project level analysis**

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		Although numerous quarrying and mining operations are underway, Oman's mineral resources are still relatively untapped, with large deposits of metals and industrial minerals waiting to be unearthed. Oman's mountains host intact and exposed ophiolites, which could contain metal deposits such as chromite, cobalt, copper, gold, lead, magnesium, manganese, nickel, palladium, platinum, silver, vanadium, and zinc.			
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	Oman Shell and PDO have agreed to collaborate and jointly study CCUS opportunities in Oman.	Oman Shell, PDO to study Carbon Capture Utilisation and Storage - Oman Observer	Oman appears to have the ambition to utilize CCUS technologies, with a study investigating the country's opportunities underway. At the moment, Oman does not utilize biomass for electricity generation. While it does aim to increase its use of biomass for electricity generation, it is only expected to make up 3% of its energy mix within the next ten years. Analysis at the project level is required in order evaluate if Oman meets the requirements for sustainable Ptx processes.	**Triggers project level analysis**
		Rare Mantle Rocks in Oman Could Sequester Massive Amounts of CO_2. Tests are underway to pull carbon from the air and turn it into minerals belowground	Rare Mantle Rocks in Oman Could Sequester Massive Amounts of CO2 - Scientific American		
		Various research investigations demonstrate that Oman can generate electricity using renewable energy resources such as solar, wind, and biomass. In the total energy mix, Oman is planning to use 2 to 3% bio power within a decade.	Biomass: A promising resource for renewable energy development in Oman - Oman Observer		
		Currently, biomass is not part of Oman's energy mix.	Oman: Energy Country Profile - Our World in Data		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 11/180 • EPI Score: 69/100 • 10-year change: 3.10 EPI Solid Waste: • Rank: 18/180 • EPI Score: 95.00/100	Australia | Environmental Performance Index (yale.edu)	Australia solid waste EPI score indicates its management practices are relatively sustainable. Further analysis at the project level is therefore not necessary.	**Does not trigger project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	The majority of hazardous waste is sent to landfill (51%). One of the challenges when it comes to hazardous waste management is aging infrastructure. However, new capability is emerging.	Hazardous Waste in Australia 2021 (agriculture.gov.au)	Although Australia has a developed infrastructure for hazardous waste management, for some types of waste it might be not sufficient.	**Triggers project level analysis**

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Hazardous substances (policy/regulation, enforcement)	New legislation has established the Industrial Chemicals Environmental Management Standard – or IChEMS. The IChEMS register was established in 2022.	New national chemicals management standard | Australian Industrial Chemicals Introduction Scheme (AICIS)	While national reforms for use, handling and disposal of industrial chemicals are being implemented in Australia, its effectiveness is not yet clear.	**Triggers project level analysis**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	Nickel, manganese and cobalt are needed to make batteries, and are all mined in Australia.	Critical and rare: the minerals Australia can supply to the world – ECOS (csiro.au)	Australia has a domestic supply of critical raw materials. With regards to availability of the critical raw materials, project level analysis is therefore not triggered. It should be noted that the activity of mining critical raw materials itself is not without risks. However, for the topic of *critical raw materials,* the analysis looks solely at the availability of these materials. Other risks associated with mining are considered in other parts of the analysis.	**Does not trigger project level analysis**
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	Carbon capture and storage projects are being developed in Australia. However, some of them are not successful.	Australian company secures $700,000 deal for carbon capture and storage machine | Environment | The Guardian Australia's only working carbon capture and storage project fails to meet target | Western Australia | The Guardian	Australia is developing CCS at a commercial scale. However, in some project industrial scale implementation appears to be a challenge. It also utilizes bioenergy at a large scale.	**Triggers project level analysis**
		Bioenergy accounts for 47% of Australia's current renewable energy production and 3% of total energy consumption. Bioenergy has the potential to provide up to 20% of Australia's energy consumption by the 2050s.	australia-bioenergy-roadmap-report.pdf (arena.gov.au)		

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 13/180 • EPI Score: 68.30/100 • 10-year change: 2.90 EPI Solid Waste: • Rank: 4/180 • EPI Score: 99.40/100	Denmark | Environmental Performance Index (yale.edu)	Denmark's high EPI score indicates its waste management practices are relatively sustainable. Further analysis at the project level is not necessary.	**Does not trigger project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	In 2016, 42% of hazardous waste was recycled, which is a considerable amount. In addition, Denmark has one of the most established waste management systems in the world	Waste, materials management and the circular economy | OECD Environmental Performance Reviews: Denmark 2019 | OECD iLibrary (oecd-ilibrary.org)	Hazardous waste management in Denmark is relatively low risk in the global context.	**Does not trigger project level analysis**

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Hazardous substances (policy/regulation, enforcement)	Being an EU member state, Denmark complies with REACH, which is an EU regulation laying down obligations for EU enterprises which manufacture, import, distribute or use chemical substances or mixtures.	REACH - obligations for EU enterprises - Arbejdstilsynet	Denmark complies with REACH, which is a well-established and enforced EU regulation.	**Does not trigger project level analysis**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	Denmark does not have any economically exploitable metallic mineral reserves.	Denmark: Mining, Minerals and Fuel Resources (azomining.com)	Denmark's lack of exploitable metallic mineral reserves may pose an issue for hydrogen production. Analysis at the project level is therefore required. The analysis in this report is focused on mainland Denmark, and Greenland (part of the kingdom of Denmark) falls outside of its scope. Greenland's supply of resources is, however, likely to play an important role within the context of hydrogen production. Analysis at the project level would be required in case the project takes place in Greenland.	**Triggers project level analysis**
		There are several exploration and mining projects in Greenland focused on a number of the critical minerals such as: Cobalt, Graphite, Niobium, Platinum Group Metals, Rare Earth Metals, Tantalum, Titanium and Vanadium. However, these projects only cover comparatively small areas of the prospective areas, so the potential for new discoveries are significant. In addition, the report states the potential for Hafnium, Lithium and Silicon metals as high even though these minerals have not seen focused exploration efforts in Greenland so far.	Report: Large potential for critical minerals in Greenland and the Nordic countries | Mineral Resources Authority – Naalakkersuisut (govmin.gl)		
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	A German oil and gas producer is teaming up with other companies to expand carbon capture and storage activities around a hub on Denmark's northern North Sea Coast. The firm has long-term plans to build up a business capturing 20-30 million tons of CO_2 per annum by 2040, including deals with Norway where sector peer E.ON also has forged some ties.	Wintershall Dea expands carbon capture and storage in Denmark | Reuters	While Denmark has ambitions to utilize CCS technologies, none are commercially operational in the country as of yet. With regards to biomass, the country has legislation in place to ensure sustainable use. Investigation at the project level is necessary.	**Triggers project level analysis**
		In Denmark, CCS has been presented as an important decarbonization tool in a report by the Council on Climate Change. While Denmark is not typically associated with CCS, a new CCS project emerged in the country in 2020.	Global Carbon Capture and Storage - Status Report 2020 (hsbc.com)		
		Since 2009, Denmark has reduced the consumption of coal by 80% . This rapid phase-out of coal, which has contributed to bringing down Danish CO emissions, has been possible not least due to the use of biomass. Denmark has legislation on sustainable biomass. Among other things, the legal requirements mean that the biomass must come from legally felled trees and that felled trees must be replanted. Biomass from countries whose forests are in decline must not be used, unless it comes from sustainably managed forests or residual products. In this way, the CO2 storage found in the trees is preserved.	Denmark legislates on sustainable biomass (stateofgreen.com)		

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 73/180 • EPI Score: 39.20/100 • 10-year change: -0.40 EPI Solid Waste: • Rank: 65/180 • EPI Score: 55.60/100	South Africa | Environmental Performance Index (yale.edu)	Hydrogen production and related activities may generate large amounts of solid waste (e.g. closing phase of wind power projects). South Africa's EPI scores indicate that there is room for improvement when it comes to sustainable managing solid waste. This topic should therefore be further investigated at the project level.	**Triggers project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	South Africa faces challenges when it comes to waste management. Disposal of hazardous waste at the domestic waste landfills is one of these challenges.	South African Municipal Waste Management Systems: Challenges and Solutions	Hazardous waste management in South African is a potential risk.	**Triggers project level analysis**
Waste & resources	Hazardous substances (policy/regulation, enforcement)	Management of chemicals is one of the challenges in South Africa.	South Africa set to tackle emerging contaminants (unep.org)	Management of chemicals is a potential risk.	**Triggers project level analysis**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	South Africa is a major exporter of vanadium oxides and palladium. Both materials are important for the green transition.	The supply of critical raw materials endangered by Russia's war on Ukraine (oecd.org)	South Africa exports - and therefore holds a supply of - critical raw materials. These materials present opportunities for the green transition. With regards to availability of the critical raw materials, project level analysis is therefore not triggered. It should be noted that the activity of mining critical raw materials itself is not without risks. However, for the topic of *critical raw materials,* the analysis looks solely at the availability of these materials. Other risks associated with mining are considered in other parts of the analysis.	**Does not trigger project level analysis**
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	South Africa has started geological mapping at the country's first CCS site, where it plans to inject vast quantities of CO2 deep underground from 2023, a senior Council for Geoscience official said.	South Africa aims to bring pilot carbon capture project online in 2023 | Reuters	South Africa is planning on operating its first CCS facility in 2023. The country uses biomass at a small scale. Analysis at the project level is required.	**Triggers project level analysis**
		The Concept of Biomass to Energy is still at its infancy in South Africa but holds promise for the future sustainable development. The objective of the Working for Energy Programme is to look at the sustainable acquisition, processing and use of biomass to produce various forms energy for various application. There is currently no specific comprehensive legislative framework that governs the waste to energy sector, save for individual pieces of legislation dealing with aspects of the waste to energy sector in a piecemeal type of manner.	Biomass Energy | Department of Environmental Affairs (dffe.gov.za)		

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 46/180 • EPI Score: 54.30/100 • 10-year change: 2.70 EPI Solid Waste: • Rank: 15/180 • EPI Score: 96.00/100	United States of America | Environmental Performance Index (yale.edu)	Hydrogen production and related activities may generate large amounts of solid waste (e.g. closing phase of wind power projects). The USA's EPI scores indicate it does a good job at managing waste sustainably. Further analysis at the project level is therefore not required.	**Does not trigger project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	USA has a relatively well established and enforced regulatory framework as well as infrastructure for hazardous waste management. However, ensuring regulation of facilities (including for chemical manufacturers, hazardous waste handlers), and contaminated sites containing potentially hazardous substances is one of the key challenges.	Hazardous Waste | US EPA U.S. Environmental Protection Agency Fiscal Year 2023 Top Management Challenges (epa.gov)	Hazardous waste management is one of the key challenges when it comes to environmental management in the USA.	**Triggers project level analysis**
Waste & resources	Hazardous substances (policy/regulation, enforcement)	Providing for the Safe Use of Chemicals is one of the key challenges declared by EPA for 2023.	Report: EPA's Fiscal Year 2023 Top Management Challenges | US EPA	Management of chemicals is one of the key challenges when it comes to environmental management in the USA.	**Triggers project level analysis**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	The Biden-Harris Administration has announced major investments to expand the domestic critical minerals supply chain in order to break dependence on China and to boost sustainable practices. The U.S. is increasingly dependent on foreign sources for many of the processed versions of minerals. Globally, China controls most of the market for processing and refining for cobalt, lithium, rare earth and other critical minerals.	FACT SHEET: Securing a Made in America Supply Chain for Critical Minerals | The White House	The USA aims to expand its domestic mining operations, which could eventually be beneficial for hydrogen production. Currently, however, the USA depends on foreign countries when it comes to processed minerals. It is therefore necessary to investigate this topic at the project level.	**Triggers project level analysis**
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	In March 2021, the US Department of Energy announced up to $24 million for research into technology that captures carbon dioxide emissions from the air. The U.S. has a larger than ever number of carbon capture projects either in the proposal or construction phases, or they are already operating.	Five U.S. carbon capture projects are the first of more to come. - ASME	The USA is investing in the development of CCS projects and facilities. With regards to biomass, the US is a net exporter. Biomass makes up a small but significant amount of the nation's total energy consumption.	**Triggers project level analysis**
		In 2021, biomass provided about 5% of total U.S primary energy consumption. On an energy content basis, the United States exported more total biomass energy than it imported in 20221. In 2021, the US was a total biofuels net exporter.	Biomass explained - U.S. Energy Information Administration (EIA)		

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Waste & resources	Waste management (policy/regulation, infrastructure)	EPI Waste Management: • Rank: 104/180 • EPI Score: 27.70/100 • 10-year change: 0.30 EPI Solid Waste: • Rank: 88/180 • EPI Score: 39.60/100	Kazakhstan | Environmental Performance Index (yale.edu)	Kazakhstan's EPI scores indicate there is room for improvement when it comes to managing waste sustainably. Further investigation at the project level is therefore necessary.	**Triggers project level analysis**
Waste & resources	Hazardous waste management (policy/regulation, infrastructure)	Kazakhstan lacks waste management infrastructure. A licensing procedure for the implementation of activities for the processing, utilization, and destruction of hazardous waste has been introduced only very recently (in 2021).	SDG Country Profiles Kazakhstan - Environmental Technologies (trade.gov) Kazakhstan, Nigeria, and South Africa Strengthening Capacity to Manage Chemicals | News | SDG Knowledge Hub | IISD	Kazakhstan has deficient waste management infrastructure. Although there are attempts to regulate hazardous waste management, the licensing system and requirements have been just launched.	**Triggers project level analysis**
Waste & resources	Hazardous substances (policy/regulation, enforcement)	Kazakhstan lacks key chemical management guidelines, such as a register for hazardous chemicals, effective measures to eliminate historical pollution, and an overall regulation for handling specific chemicals.	Keeping Kazakhstan on the Path to a Green Economy (unep.org)	Kazakhstan lacks legal framework for hazardous substance management.	**Triggers project level analysis**
Waste & resources	Critical Raw Materials (status, policy/regulation, domestic supply)	On 7th November, 2022 on the fringes of the COP 27 conference in Egypt, Kazakhstan and the EU agreed to establish a new partnership ensuring the development of a secure and sustainable supply of raw materials, developing renewable hydrogen and battery value chains, and boosting the green and digital transformation of both economies.	Kazakhstan tells EU: We can supply all 30 critical raw materials you need – EURACTIV.com	Kazakhstan holds large (undeveloped) mineral reserves, which could present opportunities for hydrogen production. However, Kazakhstan's capacity when it comes to mineral processing is limited, which in turn makes it dependent from other countries. Investigation at the project level is necessary.	**Triggers project level analysis**
		Kazakhstan remains one of the world's most promising emerging markets for natural resources and is one of the 10 leading countries in the world for mineral reserves. Kazakhstan holds vast mineral reserves which are largely undeveloped. In the mining sector, the low level of mineral processing within Kazakhstan arguably limits the country's ability to establish a value-chain and exacerbates dependence on volatile world markets. Some local ores are less competitive on the world market, because of low concentrations that require complicated extraction methods and consequently drive up production costs. Kazakhstan also faces infrastructure constraints. The Kazakh mining industry is largely integrated into a single production chain with Russia and Ukraine. Existing infrastructure is designed to direct much of mining output to these countries. A lack of transport infrastructure and the fact that China's industry is located mainly in the eastern part of the country – far from the shared border – significantly increases transportation costs to China.	Mining – Kazakhstan – For Australian exporters – Austrade		

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		Nevertheless, China remains an important and growing market for Kazakh mining producers.			
Waste & resources	Carbon Sources: ambient air DAC, biogenic sources, industrial point sources CCU (policy, domestic supply)	In June 2022, KazMunayGas (KMG) and Chevron signed a Memorandum of Understanding to explore potential lowed carbon opportunities in Kazakhstan. KMG and Chevron have discussed potential opportunities for join carbon capture and storage projects.	KMG increases its carbon capture and storage capabilities: 21 October 2022, 17:32 - news on inform.kz	Opportunities for CCS developments are being explored in Kazakhstan. In terms of biomass, Kazakhstan is said to hold potential, but the nation's current use of biomass is minimal. Analysis at the project level is required.	**Triggers project level analysis**
		Despite significant biomass potential, this resource has not been sustainably captured and deployed in Kazakhstan due to a range of technical, institutional, social, and economic barriers.	Kazakhstan - Power Generation (trade.gov)		
		In 2021, Kazakhstan produced 0,05 million tons of oil equivalent of biofuels and waste.	IEA Sankey Diagram		

Climate and Energy

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	A review of Chile's energy policies by the International Energy Agency (2018) finds that the country has emerged as a world-class destination for solar and wind energy developers. New legislation encourages investment in generating capacity across the electricity sector.	Energy Policies Beyond IEA Countries: Chile 2018 Review – Analysis - IEA Energy Policies Beyond IEA Countries - Chile Review 2018 (windows.net)	Given Chile's dependence on fossil fuels, and the limited role renewables (especially solar and wind energy) play in its energy mix, it is necessary to evaluate whether or not hydrogen production would utilize existing or additional renewable energy supplies. Tapping into existing supplies would divert renewable electricity from other users in Chile and lead to an increase in overall emissions. Further analysis at the project level is required.	**Triggers project level analysis**
		The majority of Chile's energy is derived from fossil fuels. Most of its renewable energy constitutes biomass. Renewable electricity output was equal to 43.6 % of total electricity output in 2015	IEA Sankey Diagram Renewable electricity output (% of total electricity output) - Chile | Data (worldbank.org)		
		The concern with hydrogen project that are 'on-grid' is that the additional demand for green hydrogen production will reduce renewable energy consumption in other sectors (which can use renewable energy more efficiently) delaying the overall greening of the grid and raising prices for consumers, whilst driving up total emissions. "Additionality" for grid-connected green hydrogen means production is accompanied by an additional source of renewable energy capacity, and the degree to which this additional capacity needs to be matched in space (geographical correlation) and time (temporal correlation).	Green Hydrogen: From Additionality to Sustainability | Green Hydrogen Organisation (gh2.org)		
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	No data on heat energy available / no centralized heat production	IEA Sankey Diagram	No data on industrial heat sources available. Analysis at the project level is required.	**Triggers project level analysis**
Climate and energy	Dependency on fuel import	Chile imports more oil and oil products than it produces.	IEA Sankey Diagram	Chile depends on import of oil and oil products.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	Alternative and nuclear energy accounted for 0% of total energy use in 2014. This metric considers clean energy, referred to as noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others. Renewable energy consumption accounted for 0% of total final energy consumption in 2019.	Oman | Data (worldbank.org)	Even though Oman seeks to increase the generation of renewable energy, Oman's current heavy dependence on fossil fuels poses a risk for (green) hydrogen production. The fact that renewables do not yet play a role in Oman's energy mix makes the issue of additionality particularly relevant. Renewable energy used for hydrogen production should be additional. If production taps into new renewable sources that would have been developed either way, hydrogen production would divert renewable energy from other users in Oman. This would hamper carbon reduction progress within Oman. Analysis at the project level is therefore required.	**Triggers project level analysis**
		Oman plans to derive at least 30% of electricity from renewables by 2030. Oman is planning to build a hydrogen-centric economy by 2040, with an annual production of green and blue hydrogen of approximately 30GW by 2040.	Oman - Renewable Energy (trade.gov)		
		Oman is planning to build one of the largest green hydrogen plants in the world. It aims to be at full capacity by 2038.	Oman plans to build world's largest green hydrogen plant | Oman | The Guardian		
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	No data on heat energy available / no centralized heat production	IEA Sankey Diagram	No data on industrial heat sources available. Analysis at the project level is required.	**Triggers project level analysis**
Climate and energy	Dependency on fuel import	Majority of oil and oil products used for transportation is produced domestically.	Oman | Data (worldbank.org)	Oman is net oil producer and does not depend on fuel import.	**Does not trigger project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	Alternative and nuclear energy accounted for 2.2% of total energy use in 2015. This metric considers clean energy, referred to as noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others. Renewable energy consumption accounted for 10.30% of total final energy consumption in 2019.	Australia | Data (worldbank.org)	Australia is making significant improvements when it comes to the renewable energy. Nevertheless, the majority of the country's energy is derived from fossil fuels – this poses a risk for green hydrogen production. Given Australia's dependence on fossil fuels, and the limited role renewables play in its energy mix, it is necessary to evaluate whether or not hydrogen production would utilize existing or additional renewable energy supplies. Tapping into existing supplies would divert renewable electricity from other users in Australia and lead to an increase in overall emissions. Further analysis at the project level is required.	**Triggers project level analysis**
		The Australian renewable energy industry accounted for 32.5 % of Australia's total electricity generation in 2021. In the past five years, the proportion of Australia's electricity that comes from renewables has almost doubled.	clean-energy-australia-report-2022.pdf (cleanenergycouncil.org.au)		
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	No data on heat energy available / no centralized heat production	IEA Sankey Diagram	No data on industrial heat sources available. Analysis at the project level is required.	**Triggers project level analysis**
Climate and energy	Dependency on fuel import	Australia imports more oil and oil products than it produces.	IEA Sankey Diagram	Australia depends on import of oil and oil products.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	Alternative and nuclear energy accounted for 17.7% of total energy use in 2015. This metric considers clean energy, referred to as noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others. Renewable energy consumption accounted for 37.52% of total final energy consumption in 2019.	Denmark | Data (worldbank.org)	Denmark generates a significant amount of energy from renewable sources. Nevertheless, the majority of Denmark's electricity is derived from fossil fuels. It is necessary to evaluate whether or not hydrogen production in Denmark would utilize existing or additional renewable energy supplies. Tapping into existing supplies would divert renewable electricity from other users in Australia and lead to an increase in overall emissions. Further analysis at the project level is therefore required.	**Triggers project level analysis**
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	In 2020, 0.09 million tons of oil equivalent of heat were consumed by the industry. The majority of this heat was produced by power stations which are using predominantly renewable energy sources.	IEA Sankey Diagram	Denmark's power plants produce a significant amount of heat (using mostly renewable energy sources) that is subsequently used by the industrial sector. This provides opportunities for hydrogen value chain. Further analysis at the project level is not required.	**Does not trigger project level analysis**
Climate and energy	Dependency on fuel import	Denmark imports more oil and oil products than it produces.	IEA Sankey Diagram	Denmark depends on import of oil and oil products.	**Triggers project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	The Republic of South Africa is the third-largest economy in Africa and the highest primary energy consumer on the continent. The country has successfully scaled up national renewables-based generation at a competitive cost and has developed ambitious plans for gradually reducing national coal-based generation capacity.	Renewable Energy Prospects: South Africa (irena.org)	South Africa's ambitious plans to scale up renewables could eventually provide opportunities for sustainable hydrogen production. Currently, however, almost all of South Africa's energy is derived from fossil fuels. The fact that renewables do not yet play a significant role in South Africa's energy mix makes the issue of additionality particularly relevant. Renewable energy used for hydrogen production should be additional. If production taps into new renewable sources that would have been developed either way, hydrogen production would divert renewable energy from other users in South Africa. This would hamper carbon reduction progress within the country. Analysis at the project level is therefore required.	**Triggers project level analysis**
		In 2021, 94.63% of all primary energy in South Africa was derived from fossil fuels.	South Africa: Energy Country Profile - Our World in Data		
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	No data on heat energy available / no centralized heat production	IEA Sankey Diagram	No data on industrial heat sources available. Analysis at the project level is required.	**Triggers project level analysis**
Climate and energy	Dependency on fuel import	Majority of oil and oil products used for transportation is imported.	IEA Sankey Diagram	South Africa is a net oil importer thus the country depends on imported fuel.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	In 2021, renewable energy accounted for 12% of primary energy consumption in the USA.	U.S. energy facts explained - consumption and production - U.S. Energy Information Administration (EIA)	The majority of energy consumed in the USA is not generated from renewable sources. It is necessary to evaluate whether or not hydrogen production in the USA would utilize existing or additional renewable energy supplies. Tapping into existing supplies would divert renewable electricity from other users in the country and lead to an increase in overall emissions. Further analysis at the project level is therefore required.	**Triggers project level analysis**
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	In 2020, 5 million tons of oil equivalent of heat were consumed by the industrial sector. This heat was produced by power stations which predominantly use fossil fuels.	IEA Sankey Diagram	The USA's power plants produce a significant amount of heat that is subsequently used by the industrial sector, however mostly non-renewable energy sources are used. Further analysis at the project level is required.	**Triggers project level analysis**
Climate and energy	Dependency on fuel import	Majority of oil products used for transportation is produced domestically.	IEA Sankey Diagram	USA is net oil producer and does not depend on fuel import.	**Does not trigger project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Climate and energy	Energy mix, renewable energy sources, additionality (policy, state)	Kazakhstan is a major producer of all fossil fuels. Renewable energy accounted for only 1.4% of the energy mix (TPES) in 2018. Kazakhstan's strategy stipulates that alternative and "green" energy technologies must generate up to 50% of all consumed energy by 2050.	Kazakhstan energy profile – Analysis - IEA	Currently, renewable sources make up a very small percentage of Kazakhstan's energy mix. Considering its current energy mix, the country's green energy target of 50% by 2050 can be considered ambitious. This could eventually provide opportunities for green hydrogen production. In its current state, however, Kazakhstan's energy mix may not be able to sufficiently support green hydrogen production. The fact that renewables do not yet play a significant role in Kazakhstan's energy mix makes the issue of additionality particularly relevant. Renewable energy used for hydrogen production should be additional. If production taps into new renewable sources that would have been developed either way, hydrogen production would divert renewable energy from other users in Kazakhstan. This would hamper carbon reduction progress within the country. Analysis at the project level is therefore required.	**Triggers project level analysis**
Climate and energy	Energy mix, energy poverty, renewable energy sources, additionality (policy, state)	In 2020, 1.10 million tons of oil equivalent of heat were consumed by the industrial sector. This heat was produced by power stations which predominantly use fossil fuels.	IEA Sankey Diagram	The Kazakhstan's power plants produce a significant amount of heat that is subsequently used by the industrial sector, however mostly non-renewable energy sources are used. Further analysis at the project level is required.	**Triggers project level analysis**
Climate and energy	Dependency on fuel import	Majority of oil and oil products used for transportation is produced domestically.	IEA Sankey Diagram	Kazakhstan is net oil producer and does not depend on fuel import.	**Does not trigger project level analysis**

Water use & water availability

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Sanitation Drinking Water • Rank: 38/180 • EPI Score: 68.10/100 • 10-year change: 3.60	Chile | Environmental Performance Index (yale.edu)	Chile has been suffering from extended periods of drought. The Northern and Central parts of Chile are affected in particular. Its mining activities put additional pressure on water resources. This poses a risk within the context of hydrogen production, particularly if such production takes place in the north of the country.	**Triggers project level analysis**
		Annually, Chile's mining industry consumes enough water to provide for **75 %** of the needs of Chile's population. In extremely dry northern Chile, home to the country's mining industry, most of the water supply needed for operations is exposed to climate risks.	Desalination is not the only answer to Chile's water problems | McKinsey		
		In 2022, Chile has been suffering from a record-breaking drought for the past 13 years. The government estimates that the country's water availability has dropped 10% to 37% over the last 30 years and could drop another 50% in Northern and central Chile by 2060.	Chile announces unprecedented plan to ration water as drought enters 13th year | Drought | The Guardian		
Water use and water availability	Water desalination (policy/regulation, availability, state)	Seawater desalination is being used as a central strategy in Chile, not only to mitigate actual and predicted water shortages, but also to provide users with a new water source.	[PDF] Water Policy and Management in Chile (researchgate.net)	Seawater desalination is part of Chile's strategy to meet its water requirements. Nevertheless, given the severity of Chile's drought, further investigation of this risk is necessary before desalinated water can be used for hydrogen production.	**Triggers project level analysis**
Water use and water availability	Wastewater management (policy, state)	EPI Wastewater treatment: • Rank: 24/180 • EPI Score: 58.00 • 10-year change: 3.90	Chile | Environmental Performance Index (yale.edu)	Chile's ranking is relatively high compared to other countries in terms of its EPI score for wastewater treatment. Further investigation at the project level is therefore not required.	**Does not trigger project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Water Sanitation Drinking Water • Rank: 58/180 • EPI score: 58.30/100 • 10-year change: 3.70	Oman | Environmental Performance Index (yale.edu)	Oman has been suffering from extreme droughts. Since water is an input for hydrogen production, this topic should be investigated.	**Triggers project level analysis**
		Drought have been aggravated in Oman over the recent decades. Extreme and very extreme droughts have been more frequent, compared to mild and moderate droughts. Droughts occurred largely in central and eastern regions of Oman, while mountainous regions exhibited less drying.	Evidence for intensification of meteorological droughts in Oman over the past four decades - ScienceDirect		

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water desalination (policy/regulation, availability, state)	Oman will host the world's first solar desalination plant for produced water treatment. While conventional desalination plants use seawater or brackish water, the first-of-its kind Oman product will treat produced water (naturally occurring water in oil reservoirs that is produced along with hydrocarbons).	Oman to host world's first solar desalination plant for produced water treatment - Oman Observer	Water desalination is already prevalent in Oman. The nation plans to utilize a new technique where produced water is used as input. However, given that water of this type is produced along with hydrocarbons, this method is questionable within the context of sustainability. This topic should therefore be investigated further.	**Triggers project level analysis**
		Desalination has emerged as a major source of domestic water in Oman. By the end of 2011, there were 47 seawater desalination plants and 47 plants for brackish water. Desalination faces several challenges. These are high cost and energy requirements, non-availability of large storage facilities for meeting emergency requirements, network losses, which is estimated to be around 30%, and coastal desalination plant closure due to harmful periodic algal blooms.	Water Resources in Oman - Fanack Water		
Water use and water availability	Wastewater management (policy, state)	EPI Wastewater treatment: • Rank: 72/180 • EPI Score: 13.40	Oman | Environmental Performance Index (yale.edu)	Oman's holds a low EPI wastewater treatment score, which poses a risk in terms of wastewater treatment. Further investigation at the project level is therefore required.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Sanitation Drinking Water • Rank: 25/180 • EPI score: 87.10/100 • 10-year change: 1.70	https://epi.yale.edu/epi-results/2022/country/aus	Australia has earned a high EPI score with regards to its management of drinking water. At the same time, Australia has been suffering from major droughts. The severeness and frequency of droughts is projected to increase, and the topic of water management therefore deserves further analysis at the project level.	**Triggers project level analysis**
		Drought is an enduring, recurring feature of the Australian landscape. Droughts impact Australia's social, economic, and environmental systems, and are projected to continue to increase in the future.	Drought in Australia | National Emergency Management Agency (nema.gov.au)		
Water use and water availability	Water desalination (policy/regulation, availability, state)	Water desalination is already a common practice in Australia.	Desalination_Fact_Sheet.pdf (hubspotusercontent30.net) The role of desalination in Australia's changing climate - Utility Magazine	Water desalination is already common in Australia. However, due to environmental concerns related to desalination (high energy intensity of the process, discharge of brine) further analysis at the project level is required.	**Triggers project level analysis**
Water use and water availability	Wastewater management (policy, state)	EPI wastewater treatment: • Rank: 11/180 • EPI score: 92.90/100 • 10-year change 4.10	https://epi.yale.edu/epi-results/2022/country/aus	Australia has earned a relatively high EPI score with regards to wastewater management, indicating that its processes are relatively sustainable. Further investigation at the project level is therefore not required.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Sanitation Drinking Water • Rank: 13/180 • EPI score:97.50/100 • 10-year change: 2.50 Water scarcity in Denmark is very low to medium, depending on the region.	https://epi.yale.edu/epi-results/2022/country/dnk Think Hazard - Denmark - Water scarcity	Denmark has a relatively very high EPI score with regards to sanitation and drinking water. There is no need to investigate this topic at the project level.	**Does not trigger project level analysis**
Water use and water availability	Water desalination (policy/regulation, availability, state)	No reports on desalination in Denmark were found. It is assumed that desalination is not part of Denmark's water strategy.	/	Denmark does not currently use water desalination. Should desalination be needed for a specific project, further analysis is required.	**Triggers project level analysis**
Water use and water availability	Wastewater management (policy, state)	EPI wastewater treatment: • Rank: 1/180 • EPI score: 100.00/100 • 10-year change: NA	https://epi.yale.edu/epi-results/2022/country/dnk	Denmark's wastewater treatment processes are among the most sustainable in the world. There is no need for investigation at the project level.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Sanitation Drinking Water • Rank: 133/180 • EPI score:24.70/100 • 10-year change: 7.80	South Africa | Environmental Performance Index (yale.edu)	South Africa's EPI score indicates that there is room for improvement when it comes to sanitation and drinking water. The country's current performance poses a risk, and this topic should be investigated at the project level.	**Triggers project level analysis**
		Across Africa, water conflict threatens security, health, and the environment. Drinking water availability issues have been causing water crisis in the recent years.	Africa: Across Africa, Water Conflict Threatens Security, Health, and the Environment - allAfrica.com Water Crisis in South Africa: Causes, Effects, And Solutions | Earth.Org		
Water use and water availability	Water desalination (policy/regulation, availability, state)	South Africa has around 10 desalination plants (2018) dotted along the coast. The output is quite small and caters only for households in the immediate vicinity.	Desalination: Global examples show how Cape Town could up its game (thesouthafrican.com)	South Africa currently operates a number of desalination plants. Desalination could therefore be viable means of securing water for hydrogen production. Nevertheless, the country's continuous battle with drought presents a risk. Analysis at the project level is necessary to ensure that using water resulting from desalination processes does not negatively impact other stakeholders in terms of water security.	**Triggers project level analysis**
Water use and water availability	Wastewater management (policy, state)	EPI wastewater treatment: • Rank: 59/180 • EPI score:21.70/100 • 10-year change: NA	South Africa | Environmental Performance Index (yale.edu)	South Africa's low EPI wastewater management score poses a potential risk, and further analysis at the project level is therefore required.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Sanitation Drinking Water • Rank: 26/180 • EPI score:86.10/100 • 10-year change: 2.30	United States of America | Environmental Performance Index (yale.edu)	The USA's high EPI score indicates good performance when it comes to sanitation and drinking water. However, depending on the project location, water scarcity could be a potential risk.	**Triggers project level analysis**
		Water scarcity in USA is very low to high, depending on the state.	Think Hazard - United States of America - Water scarcity		
Water use and water availability	Water desalination (policy/regulation, availability, state)	The United States operates water desalination plants in Texas, California, Florida, and Arizona.	Desalination by country - Wikipedia	Water desalination plants operate in various states. Depending on the location of the activity, this could present opportunities for hydrogen production. However, the availability of this technology depends on the project location.	**Triggers project level analysis**
Water use and water availability	Wastewater management (policy, state)	EPI Wastewater treatment • Rank: 35/180 • EPI score: 58.90/100 • 10-year change: NA	United States of America | Environmental Performance Index (yale.edu)	The USA has attained an adequate EPI score with regards to wastewater treatment. Further analysis at the project level is therefore not required.	**Does not trigger project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Water use and water availability	Water (policy/regulation, availability, state)	EPI Sanitation Drinking Water • Rank: 66/180 • EPI score:54.00/100 • 10-year change: 4.20	Kazakhstan | Environmental Performance Index (yale.edu)	Kazakhstan's EPI score indicates that there is room for improvement with regards to its performance related to sanitation and drinking water. Investigation at the project level is necessary.	**Triggers project level analysis**
		Water scarcity in Kazakhstan is low to high depending on the region.	Think Hazard - Kazakhstan - Water scarcity		
Water use and water availability	Water desalination (policy/regulation, availability, state)	Kazakhstan is looking to desalinate the Caspian Sea as an answer to its water woes (2015).	Seawater desalination plant set for Kazakhstan | WaterWorld	Information on desalination in Kazakhstan is very limited. It appears that the country has ambitions to desalinate water, but it is not clear to what extent these ambitions are being materialized. Given a possible dependence of hydrogen production on desalination, this may pose a risk. Investigation at the project level is necessary.	**Triggers project level analysis**
		Information on desalination in Kazakhstan is very limited.	/		
Water use and water availability	Wastewater management (policy, state)	EPI Wastewater treatment • Rank: 53/180 • EPI score: 27.50/100 • 10-year change: NA	https://epi.yale.edu/epi-results/2022/country/kaz	Kazahkstan's EPI score with regards to wastewater treatment is low. This poses a risk for hydrogen production, and further analysis at the project level is therefore necessary.	**Triggers project level analysis**

Land restoration and regeneration

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	The Mining Sites and Facilities Closure Law requires all mining projects subject to environmental assessment (ESIA) to have a closure plan before they start any mining operations.	Mining in Chile: overview | Practical Law (thomsonreuters.com)	Given the fact that mining projects must have a closure plan, it is necessary to conduct an analysis at the project level.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	There have been public reports on improper rehabilitation of the mining sites. For example, a study which assessed heavy metals in the water collected from mine sumps and bore-wells of an abandoned copper mine in Lasail, northern Oman, has found that the water is extremely acidic, with very high electrical conductivity and high heavy metal concentrations. The Lasail copper mine in northern Oman was one of the largest single ore deposits which operated from 1983 to 1994. The mine as abandoned 1994, but large amounts of waste piles were left behind.	Abandoned copper mine polluted groundwater - Oman Observer	There have been public reports on improper rehabilitation of the mining sites. Analysis at the project level is therefore required.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	There have been public reports on improper rehabilitation of the mining sites, despite regulatory requirements. For example, in Western Australia, all tenement holders are required to submit disturbance and rehabilitation data for mining operations under the Mining Act. For the year 2020-21 FY, the area of land reported as 'under rehabilitation' (that is, where rehabilitation was in progress was, at 41,883ha, essentially unchanged from the previous year. For the same period, the area of 'active' disturbance increased by approximately 6.1%). Land under rehabilitation therefore represented 21% of all disturbed land and 27% of the area of active disturbance. These results suggest that, while the area under rehabilitation continues to increase, it is no longer keeping pace with the increase in overall mining activity, year-on-year.	Mining Rehabilitation Fund Yearly Report 2020-21 (dmp.wa.gov.au)	There have been public reports on improper rehabilitation of the mining sites. Analysis at the project level is therefore required.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	/	/	/	**Insufficient information available**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	South Africa has regulations with regards to the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation.	ID_161_Mesias_Mining_Liabilities_in_Chile.pdf (iaia.org)	Given the reported absence of legislative provision for rehabilitation in South Africa, it is necessary to analyze this topic at the project level.	**Triggers project level analysis**
		According to the South African Human Rights Commission, various challenges persist regarding post-closure land use, and the absence of legislative provision for concurrent rehabilitation and in respect of derelict and ownerless mines and closure costing. The Environmental Management Programs (EMPs) outlining post-closure land use are often vague or inappropriate. The Commission finds that there is an immediate need for legislative provisioning for standardized and realistic closure costing, concurrent rehabilitation, partial closure as well as the establishment of a trust account to cater for rehabilitation-related liability.	SAHRC Mining communities report FINAL.pdf		

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	In 2010, alone in the western US, at least 33 000 sites were identified that had degraded the environment by contaminating surface water and groundwater or leaving arsenic-contaminated tailings piles.	WAD | World Atlas of Desertification (europa.eu)	The USA has regulations in place when it comes to the restoration of sites subjected to mining. There are, however, many sites where contamination of water and other issues resulted have been reported. Analysis at the project level is therefore necessary.	**Triggers project level analysis**
		The USA has regulations with regards to mining environmental liabilities and the closure of mining sites. It's 'Abandoned Mine Site Characterization and Cleanup Handbook' provides standards with regards to the remediation of abandoned mining sites.	ID_161_Mesias_Mining_Liabilities_in_Chile.pdf (iaia.org)		

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land restoration and regeneration	Mining site restoration (policy, state)	There are explicit rules related to the reclamation and rehabilitation of mined lands, including in the case of advanced exploration activities where massive soil movement is involved; these were drafted taking into account the international guidelines.	Mining Laws and Regulations Report 2023 Kazakhstan (iclg.com)	Kazakhstan does have regulations in place with regards to the rehabilitation of mining sites. Nevertheless, it is necessary to investigate compliance with these regulations at the project level.	**Triggers project level analysis**

Community health and safety (community impacts)

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA[30] framework, inclusion of noise/vibration (state, enforcement)	Equator Principles consider Chile to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Chile is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	Equator Principles consider Chile to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Chile is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	Equator Principles consider Chile to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Chile is considered to be relatively robust.	**Does not trigger project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA framework, inclusion of noise/vibration (state, enforcement)	Oman has a regulatory framework for the EIA. Depending on the type of the project an environmental permit might be required. The Omani environmental laws deal with various aspects of pollution including noise pollution. Equator Principles consider Oman to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Major projects: environmental risks in Oman: overview | Practical Law (thomsonreuters.com) Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental laws include requirements for noise pollution. However, environmental and social governance in Oman is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	The Omani environmental laws deal with various aspects of pollution including environmental hazards and safety in the workplace. Equator Principles consider Oman to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental laws include requirements for environmental hazards. However, environmental and social governance in Oman is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**

[30] Environmental Impact Assessment

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		systems and institutional capacity designed to protect their people and the natural environment).			
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	The Environment Ministry's internal guidelines do not provide for a specific category for transport/infrastructure projects, but an applicant must obtain an environmental permit. Omani laws merely require that an activity must conform to the relevant domestic legislation (some of which may not necessarily conform to international standards). In the absence of domestic standards, the Environment Ministry can require compliance with international standards. Many large infrastructure projects comply with the international environmental and social standards as compliance with these standards is typically required by the lenders/financers rather than necessary under local law.	Major projects: environmental risks in Oman: overview | Practical Law (thomsonreuters.com)	An environmental permit must be obtained for transport/infrastructure projects. However, environmental and social governance in Oman is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA framework, inclusion of noise/vibration (state, enforcement)	Equator Principles consider Australia to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Australia is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	Equator Principles consider Australia to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Australia is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	Equator Principles consider Australia to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Australia is considered to be relatively robust.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA framework, inclusion of noise/vibration (state, enforcement)	Equator Principles consider Denmark to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Denmark is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	Equator Principles consider Denmark to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Denmark is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	Equator Principles consider Denmark to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Denmark is considered to be relatively robust.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA framework, inclusion of noise/vibration (state, enforcement)	Equator Principles consider South Africa to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in South Africa is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	Equator Principles consider South Africa to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in South Africa is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	A variety of guidelines on the EIA exist in South Africa. In 2004, the DEA published an Integrated Environmental Management Information Series (IEM), which comprises of 16 guidelines on environmental management. However, Equator Principles consider South Africa to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	ESIA/SEA per country - Eia.nl Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in South Africa is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA framework, inclusion of noise/vibration (state, enforcement)	Equator Principles consider United States to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in United States is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	Equator Principles consider United States to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in United States is considered to be relatively robust.	**Does not trigger project level analysis**
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	Equator Principles consider United States to be a designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in United States is considered to be relatively robust.	**Does not trigger project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Community health and safety (community impacts)	EIA framework, inclusion of noise/vibration (state, enforcement)	Equator Principles consider Kazakhstan to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Kazakhstan is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**
Community health and safety (community impacts)	Safety regulations (state, enforcement)	Equator Principles consider Kazakhstan to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Kazakhstan is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**
Community health and safety (community impacts)	EIA framework applicable for infrastructure projects	Equator Principles consider Kazakhstan to be a non-designated country (Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment).	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Environmental and social governance in Kazakhstan is not considered to be robust and compliance with international standards should be required.	**Triggers project level analysis**

Land use & property rights

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2020 was 26 people per sq. km of land area. Ranking: 190/234	Population density (people per sq. km of land area) - Chile | Data (worldbank.org)	Chile's population density is one of the lowest in the world. Further analysis at the project level is therefore not required.	**Does not trigger project level analysis**
Land use & property rights	Presence of indigenous peoples	There are 10 different Indigenous groups in Chile. The largest one is the Mapuche, followed by the Aymara, the Diaguita, the Lickanantay, and the Quechua peoples. Chile is the only country in Latin America, that does not recognise the Indigenous Peoples in its constitution. For that, Indigenous groups face challenges, especially in terms of territorial rights. Although the constitution does not specifically protect indigenous groups, indigenous peoples have the right to participate in decisions affecting their lands, cultures, and traditions, including exploitation of energy, minerals, timber, and other natural resources on indigenous lands. Chile is a signatory country of the 169 ILO Convention.	Chile - United States Department of State Chile - IWGIA - International Work Group for Indigenous Affairs	Indigenous groups are present in Chile. Given the fact that topics surrounding participation of indigenous peoples of Chile have been reported, this topic deserves attention.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2020 was 16 people per sq. km of land area Ranking: 212/234	Population density (people per sq. km of land area) - Chile | Data (worldbank.org)	Oman's population density is one of the lowest in the world. Further analysis at the project level is therefore not required.	**Does not trigger project level analysis**
Land use & property rights	Presence of indigenous peoples	In addition to the types of abuses against civil liberties common throughout the country, Oman has been systematically working to repress Shihuh culture and identity.	Why is Oman suppressing the voices of the Al-Shuhuh tribe? – Foreign Policy News	The Shihuh/Shuhuh tribe inhabits the territorial exclave located in the North of Oman. The country is reported to systematically repress the Shihuh culture and identity. Investigation at the project level is required in order to ensure that the activity does not negatively impact the tribe.	**Triggers project level analysis**
		The Shuhuh tribe exists on both sides of the UAE-Omani border and its members make up the majority of the residents of Musandam, known locally as Ru'us al-Jibal, which is a territorial exclave of Oman. There have been waves of arbitrary detentions of Musandam residents championing the region's local history and culture since 2015, and reliable reports of arbitrary detention of Shuhuh tribe members in Musandam dating back at least to 1991. In addition, the government has repeatedly undertaken demolitions of homes on the pretext that they are in violation of building codes. Authorities have often expropriated lands for state use after demolishing the homes built on them.	OMAN: Shuhuh Tribe Member Forcibly Disappeared - Amnesty International Canada		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2022 was 3 people per sq. km Ranking: 229/234	Countries by Population Density | Countries by Density 2022 (worldpopulationreview.com)	Australia's population density is one of the lowest in the world. Further analysis at the project level is therefore not required.	**Does not trigger project level analysis**
Land use & property rights	Presence of indigenous peoples	The Australia's Indigenous land and forest estate (2020) dataset shows that a total of: - 134 million hectares of land in Australia (17%) is indigenous owned - 174 million hectares of land in Australia (22%) is under some form of Indigenous management - 337 million hectares of land in Australia (44%) is subject to other special rights for Indigenous people	Australia's Indigenous land and forest estate (2020) - DAFF (agriculture.gov.au)	Given the significant amount of land that is owned and/or managed by Indigenous peoples, it is necessary to analyze at the project level to what extent development of the activity affects these lands.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2022 was 147 people per sq. km Ranking: 89/234	Countries by Population Density | Countries by Density 2022 (worldpopulationreview.com)	Denmark has a moderate population density. Further analysis at the project level is therefore required.	**Triggers project level analysis**
Land use & property rights	Presence of indigenous peoples	Denmark is mostly inhabited by ethnic Danes. Very few Faroese or Greenlanders have settled in mainland Denmark despite their status as Danish citizens.	Denmark - World Directory of Minorities & Indigenous Peoples (minorityrights.org)	With regards to mainland Denmark, analysis at the project level is not required. The analysis in this report is focused on mainland Denmark, and Greenland (part of the kingdom of Denmark) falls outside of its scope. Greenland's supply of resources is, however, likely to play an important role within the context of hydrogen production. Mining these resources is likely to affect indigenous communities in Greenland. Analysis at the project level is therefore required in case the project takes place in Greenland.	**Does not trigger project level analysis**
		The Indigenous Peoples of Greenland (part of the Kingdom of Denmark), Kalaallit Nunaat, are Inuit and make up the majority of the Greenlandic population. Kalaallit Nunaat is a self-governing country within the Danish Realm, and although Denmark has adopted the UN Declaration on the Rights of Indigenous Peoples, Greenland's population continue to face serious challenges. Denmark is a signatory country of the ILO Convention 169.	Greenland - IWGIA - International Work Group for Indigenous Affairs		

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2022 was 49 people per sq. km Ranking: 163/234	Countries by Population Density | Countries by Density 2022 (worldpopulationreview.com)	South Africa has a relatively low population density. Further analysis at the project level is not required.	**Does not trigger project level analysis**
Land use & property rights	Presence of indigenous peoples	South Africa's total population is around 59 million, of which Indigenous groups are estimated to comprise approximately 1%. Collectively, the various African Indigenous communities in South Africa are known as Khoisan, comprising the San and the Khoikhoi. Conducting stakeholder engagement process with indigenous communities is one of the challenges when conducting an EIA.	The Indigenous World 2022: South Africa – IWGIA – International Work Group for Indigenous Affairs Project Finance in South Africa: Overview | Practical Law (thomsonreuters.com)	Given the presence of indigenous communities, as well as the topics that have been reported surrounding construction on a site of historical and cultural significance, potential risks within the context of hydrogen production exists.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2023 was 37 people per sq. km Ranking: 178/234	Countries by Population Density | Countries by Density 2022 (worldpopulationreview.com)	The USA has a relatively low population density. Further analysis at the project level is not required.	**Does not trigger project level analysis**
Land use & property rights	Presence of indigenous peoples	The number of Indigenous people in the United States of America is estimated at between 4 and 7 million, of which around 20% live in American Indian areas or Alaska Native villages. Indigenous Peoples in the United States are more commonly referred to as Native groups.	The Indigenous World 2022: United States of America - IWGIA - International Work Group for Indigenous Affairs	The presence of indigenous groups is dependent on the region in which the activity will take place. Analysis at the project level is therefore necessary.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Land use & property rights	Population density	Population density in 2022 was 7 people per sq. km Ranking: 229/234	Countries by Population Density | Countries by Density 2022 (worldpopulationreview.com)	Kazakhstan's population density is one of the lowest in the world. Further analysis at the project level is not required.	**Does not trigger project level analysis**
Land use & property rights	Presence of indigenous peoples	Ethnic Kazakhs derive from a mix of Turkic nomadic tribes that migrated to the region in the 15th century. 68% of Kazakhstan's inhabitants are Kazakh. Other ethnic groups are: Russian (19.3%), Uzbek (3.2%), Ukrainian (1.5%), Uighur (1.5%), Tatar (1.1%), German (1%), other (4.4%) (2019 est.)	Kazakhstan - The World Factbook (cia.gov)	Kazakhstan is economically dependent on China, a country that is committing severe human rights abuses against Uyghurs. Due to their ethnicity, Uyghur communities in Kazakhstan could be considered as vulnerable. Analysis at the project level is necessary.	**Triggers project level analysis**

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
		A prominent campaigner who has documented the plight of Muslim minorities in China's Xinjiang region says he has barred from entering neighboring Kazakhstan. Central Asian Kazakhstan is one of several former Soviet states that have appeared to toe Beijing's line on Xinjiang. Thousands of Kazakhs have family ties to Xinjiang, where Kazakhs are the second-largest Turkic group after the Uyghurs. Kazakhstan, Central Asia's richest economy, has billed itself as the "buckle" in China's trillion-dollar belt and road initiative and relies on China as a market for its oil and gas exports.	Prominent campaigner for Uyghur rights in Xinjiang barred from Kazakhstan | Xinjiang | The Guardian		

Child labor

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	Worst forms of child labor and (child) trafficking are a persistent problem in Chile. Although Chile has ratified all key international conventions concerning child labor, in 2021, Chile made only moderate advancement in the efforts to address this problem. The government has established policies, but policy gaps exist. Additionally, there is low enforcement of child labor laws.	Findings on the Worst Forms of Child Labor - Chile | U.S. Department of Labor (dol.gov)	Despite moderate advancements, child labor continues to pose a risk. This topic should therefore be investigated.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	Despite support by the Sultanate for instruments of protection against child labor, researches show that it still persists unofficially in some sectors such as agriculture, fishing or family businesses.	Children of Oman - Humanium and Findings on the Worst Forms of Child Labor - Oman | U.S. Department of Labor (dol.gov)	Child labor persists in Oman. Even though it appears to predominantly occur in the agricultural sector, it is necessary to analyze this topic at the project level.	**Triggers project level analysis**
		The majority of child workers are working in traditional family industries, such as fishing, agriculture or livestock and other minor professions, usually near home and with their families.	'Child labour prevalent among low-income families in Oman' - Times of Oman		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	/	/	/	**Insufficient information available**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	Denmark is an important destination and transit country for child victims of trafficking. Work, and especially forced prostitution, are activities imposed on these children having arrived in Denmark.	Children of Denmark - Humanium	Denmark is reported to be a destination for child victims of trafficking. It has been reported that work is imposed on children upon arrival. This appears to predominantly concern forced prostitution. However, given the fact that Denmark is an important trafficking destination, there is a risk that child labor occurs within the hydrogen value chain. Reported issues surrounding child trafficking and labor in Denmark pose a contextual risk , and this topic must therefore be investigated at the project level.	**Triggers project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	There are children in South Africa who are subjected to the worst forms of child labor, including in commercial sexual exploitation, sometimes as a result of human trafficking, forced begging, and use in illicit activities. Child labor has been reported to occur in agriculture, industry (factory work), and services.	Findings on the Worst Forms of Child Labor - South Africa | U.S. Department of Labor (dol.gov)	Child labor occurs in various industries in South Africa. Investigation at the project level is necessary.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	The United States is the only nation in the world that has not ratified the UNCRC, a document drafted in 1989 that serves to protect children's rights through government action. One way that young people in the US suffer from children's rights violations is through child labor – especially in the agricultural sector.	Child Labor in the United States - Humanium	Child labor does occur in the USA, albeit predominantly in the agricultural sector. Nevertheless, given the occurrence of child labor in the country, investigation at the project level is necessary.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Child labor	Child labor (policy/regulation, state)	In 2021, Kazakhstan made minimal progress in the efforts to eliminate the worst forms of child labor. Despite new initiatives to address child labor, Kazakhstan is assessed as having made only minimal advancement because it implemented a law that delays advancement to eliminate child labor: on December 30, 2021, the President of Kazakhstan signed a law significantly restricting the circumstances under which unannounced inspections can be performed.	Findings on the Worst Forms of Child Labor - Kazakhstan | U.S. Department of Labor (dol.gov)	Child labor occurs in Kazakhstan. A law delaying advancement was implemented, and child labor therefore presents a risk. Analysis at the project level is required.	**Triggers project level analysis**

Forced labor and human trafficking

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	In 2021, Chile ratified the ILO Protocol of 2014 to the Forced Labor Convention, 1930. In order to fulfil the obligations that Chile is assuming with the ratification of this instrument, and within the framework of its participation in the Alliance 8.67, the Undersecretariat of Labor will set up a "Technical Advisory Body for the implementation of the Protocol", committing itself to generating the necessary immediate actions and initiatives to eradicate child labor, end trafficking of persons and forced labor in general.	Forced labour: Chile ratifies the Protocol to Convention No. 29, reaffirming its commitment to fight against forced labour (ilo.org)	Forced labor has been reported in Chile. This topic should therefore be investigated before engaging in activities surrounding hydrogen.	**Triggers project level analysis**
		The law prohibits forced or compulsory labor, but it does not criminally prosecute those involved, except when it results from human trafficking. Labor trafficking has continued to occur. Some foreign citizens and children were subjected to forced labor in the mining, agriculture, construction, street vending, garment, domestic service, and hospitality sectors.	Chile - United States Department of State		
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	In April 2021, a new migration law entered into force that severely restricts the ability of migrants and individuals seeking protection to regulate their status once in Chile.	Everything you need to know about human rights in Chile - Amnesty International Amnesty International	Given the fact that topics have been reported with regards to the ability of migrants to regulate their status in Chile, it is reasonable to assume that conditions for migrant workers may not always be optimal.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	Oman criminalizes slavery and trafficking, but enforcement is weak. Forced labor is punished under the country's labor law, but domestic workers are excluded from that law's protections. Omani authorities have prosecuted a few individuals for forced labor, but it is unclear whether any of those cases involved domestic workers. Domestic workers have described common employer practices that kept them isolated from sources of support, namely passport confiscation, tight restrictions on communication, and confinement in the household. While Oman prohibits employers from confiscating workers' passports, it is not clear whether the law allows for criminal sanctions or whether they have ever been imposed.	"I Was Sold": Abuse and Exploitation of Migrant Domestic Workers in Oman | HRW	Forced labor has been reported in Oman, albeit mostly with regards to domestic workers. Nevertheless, given the severity of circumstances described in these reports, further investigation is still necessary.	**Triggers project level analysis**
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	Migrant workers have continued to face abuse and exploitation due to insufficient protection, including poor living conditions, forced labor and human trafficking. Domestic workers, mostly women, faced long working days, home confinement and unpaid wages.	Everything you need to know about human rights in Oman - Amnesty International Amnesty International	There have been reports that conditions for migrant workers are in some cases abusive and exploitative. While reports mostly concern domestic workers, further investigation is still recommended for this topic.	**Triggers project level analysis**
		In 2020, Oman reported hosting over 297,000 migrant domestic workers, the vast majority of whom come from South and South-East Asia and East Africa. The government has implemented limited amount of regulations to protect migrant domestic workers' rights.	World Report 2021: Oman | Human Rights Watch (hrw.org)		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	The Global Slavery Index 2018 estimated that on any given day in 2016, there were 15.000 living in conditions of modern slavery in Australia, a prevalence of 0.6 victims of modern slavery for every thousand people in the country. Cases of forced labor exploitation in Australia predominantly occur in industries considered at risk, including agriculture, construction, domestic work, meat processing, cleaning, hospitality, and food services.	Australia | Global Slavery Index	Modern slavery has been reported to occur in Australia. One of the industries that is considered at risk is the construction sector. The construction sector is relevant for hydrogen production, and this topic should therefore be analyzed at the project level.	**Triggers project level analysis**
		The Modern Slavery Act 2018 requires some entities to report on the risks of modern slavery in their operations and supply chains, and actions to address those risks, and for related purposes.	Modern Slavery Act 2018 (legislation.gov.au)		
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	Many of the industries where cases of forced labor are found employ a high percentage of migrant workers who have entered Australia through its temporary visa scheme designed to fulfil Australia's labour shortages. In addition, it has been reported that Australia has a 'silent underclass' of migrant workers, primarily made up of international students and backpackers, who are paid well below the minimum wage, with some of these also working in conditions that could amount to forced labour.	Australia | Global Slavery Index	Australia's record with regards to treatment of migrant workers is reason for concern. This topic should therefore be analyzed at the project level.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	Denmark has a strong record in combatting forced labor. It was one of the first countries to ratify the Forced Labor Convention and the Abolition of Forced Labor Convention.	Forced labour: Denmark joins renewed fight to end forced labour (ilo.org)	Despite Denmark's strong record with regards to combatting forced labor, forced labor should still be considered a risk given its prevalence in the country. Investigation at the project level is necessary.	**Triggers project level analysis**
		Even though the Modern Slavery Prevalence Index Rank (110/167) in Denmark is relatively low, around 9,000 people live in slavery-like conditions.	Maps | Global Slavery Index		
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	Denmark has been engaged in combatting trafficking in persons for a long time. It has developed a strong legal and institutional framework in this area including the establishment in 2002 of an Inter-Ministerial Working Group on Human Trafficking and the adoption of the fourth NAP against Trafficking in Human Beings which covers inter alia: identification and protection of victims, demand reduction and prosecution of traffickers.	Forced labour: Denmark joins renewed fight to end forced labour (ilo.org)	Despite Denmark's active engagement in combatting trafficking and ensuring adequate working conditions to migrant workers, the rights of workers are still being violated. Analysis at the project level is therefore necessary.	**Triggers project level analysis**
		Despite the so-called 'Danish model', in which minimum wages and working conditions are agreed through tripartite negotiations between trade unions, employers' associations and the state, there have been reports that migrant workers continue to be exploited in Danish industries. In some cases migrant workers are still receiving lower wages and are offered poor housing.	Doe de check | MVO Risico Checker		

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	Modern slavery such as forced labor, bonded labor, forced marriage, human trafficking, forced recruitment of children for armed combat, and hereditary slavery are still widespread in Africa. Even though the Modern Slavery Prevalence Index Rank (110/167) in South Africa is relatively low, around 155,000 people live in slavery-like conditions.	Doe de check | MVO Risico Checker Maps | Global Slavery Index	Forced labor occurs in South Africa and likely presents a risk for hydrogen production. Analysis at the project level is necessary.	**Triggers project level analysis**
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	The Government of South Africa does not fully meet the minimum standards for the elimination of trafficking but is making significant efforts to do so. As reported over the past five years, human traffickers exploit domestic and foreign victims in South Africa. Traffickers force both adults and children, particularly those from poor and rural areas and migrants, into labor in domestic service, mining, food services, construction, criminal activities, agriculture, and the fishing sector. High unemployment, low wages, and pandemic-related restrictions increased vulnerability of exploitation.	South Africa - United States Department of State	Despite significant efforts to eliminate it human trafficking exists in South Africa. Analysis at the project level is therefore necessary.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	According to an ILO report, modern slavery takes place in almost every country in the world and also across ethnic, cultural, and religious boundaries. Even though the Modern Slavery Prevalence Index Rank (158/167) in the US is relatively low, around 403,000 people live in slavery-like conditions.	Doe de check | MVO Risico Checker Maps | Global Slavery Index	Despite the low level risk, there is still prevalence in the country, forced labor should be considered as a risk within the context of hydrogen production. Analysis at the project level is necessary.	**Triggers project level analysis**
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	Two million migrant workers are recruited abroad and hired to work in the United States through temporary work visa programs. These temporary migrant workers are sometimes referred to as “guest” workers or “nonimmigrants” because their work visas provide only a temporary status. These workers are some of the most vulnerable in the entire United States. California is the largest host state for temporary migrant workers, according to data from the U.S. Department of Homeland Security (DHS), which should be no surprise given that the Golden State hosts nearly one quarter of all immigrants in the United States. The sheer size of the temporary migrant worker population means their protection is an area of particular concern to immigrant and worker advocates in the state.	California is on the brink of enacting the first significant law to combat international labor recruitment abuses and protect 300,000 temporary migrant workers. Will Governor Newsom sign the bill? | Economic Policy Institute (epi.org)	The USA hosts a large number of migrant workers that are recruited abroad. They are generally considered as vulnerable, and investigation at the project level is therefore necessary.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Forced labor and human trafficking	Forced labor (policy/regulation, state)	According to an ILO report, modern slavery takes place in almost every country in the world and also across ethnic, cultural, and religious boundaries. Kazakhstan's Modern Slavery Prevalence Index Rank (83/167) is medium, government response is low.	Doe de check | MVO Risico Checker Maps | Global Slavery Index	Given its prevalence all over the world, forced labor should be considered as a risk within the context of hydrogen production. Analysis at the project level is necessary.	**Triggers project level analysis**
Forced labor and human trafficking	Migrant workers, conditions for migrant workers (policy/regulation, state)	A significant amount of men, women and children from Kyrgyzstan and neighboring Central Asian states are forced to migrate to Kazakhstan in search of work. These individuals often fall victim to forced labor, unsafe and unsanitary working conditions, violations of the rights to maternity and childhood, as well as arbitrary arrests and deportations.	Invisible and exploited in Kazakhstan: New Report Sheds Light on the Plight of Kyrgyz Migrant Workers and Their Family Members (fidh.org)	Given the reported issues surrounding conditions for migrant workers, further analysis at the project level is required.	**Triggers project level analysis**

Discrimination and gender

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	A bill legalizing same-sex marriage has been approved and Congress continues to review anti-discrimination legislation.	Everything you need to know about human rights in Chile - Amnesty International Amnesty International	Chile has laws against discrimination in the workplace. However, the country's WPS score indicates that there is room for improvement with regards to treatment of women. Analysis at the project level is required.	**Triggers project level analysis**
		Chile has laws against discrimination in the workplace. This law forbids employment discrimination centered on race, sex, civil status, religion, affiliation with a union, politics, disability, sexual orientation and many others. Furthermore, this law offers civil legal options to victims of employment discrimination.	Discrimination in Chile - The Borgen Project		
		Chile Women Peace and Security Index (WPS) score: 0.757/1 (ranking 62/170)	WPS-Index-2021.pdf (georgetown.edu)		

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	Oman outlaws same-sex relations and gender expression, categorizing as offence "homosexual acts". Sentences go from one month to 3 years in prison.	#Outlawed "The Love That Dare Not Speak Its Name"	Oman's criminalization of same sex relations and its low WPS score indicate that women's and LGBTQ+'s rights are at stake and, at project level, developers need to develop further studies to promote respect of human rights.	**Triggers project level analysis**
		Woman have continued to be denied full rights in law and in practice. Oman Women Peace and Security Index (WPS) score: 0.675/1 (ranking 110/170)	Everything you need to know about human rights in Oman - Amnesty International Amnesty International WPS-Index-2021.pdf (georgetown.edu)		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	Australia Women Peace and Security Index (WPS) score: 0.856/1 (ranking 24/170) Homosexuality and gender identity are not illegal in Australia.	WPS-Index-2021.pdf (georgetown.edu)	Australia's WPS score is relatively high, however there is room for improvement with regards to treatment of women. Analysis at the project level is required.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	Denmark is one of the best countries when it comes to Women Peace and Security Index (WPS) score: 0.903/1 (ranking 4/170) Nevertheless, women in Denmark get paid less than met for the same job. According to other research, more women than men reported to have been exposed to bullying, physical violence and threats within the last 12 months at their workplace. Moreover, it was indicated that women felt they had less influence at the workplace compared to men. A survey among members of the LGBT community reported that 11 % of Danish respondents felt discriminated against or felt harassed on the grounds of sexual orientation in the workplace. Another study indicates that around 50 % of all LGBT persons choose not to reveal their sexuality and gender identity at work.	Doe de check | MVO Risico Checker WPS-Index-2021.pdf (georgetown.edu)	Discrimination in the workplace occurs in Denmark, which poses a risk for hydrogen production. Analysis at the project level is necessary.	**Triggers project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	Due to South Africa's Apartheid history, the country is facing large inequalities often coupled with extreme poverty among the previously disadvantaged. The country is aiming towards a more equal society, and it is implementing various legislations to reach this goal. Homosexuality is not illegal in South African (it is legal in only a few African countries). However, LGTBQ persons are widely discriminated against, intimidated, and increasingly experience violence, hatred, or even prison sentences. South Africa Women Peace and Security Index (WPS) score: 0.748/1 (ranking 66/170)	Doe de check | MVO Risico Checker	Various forms of discrimination occur in South Africa, and inequality persists. This poses a risk for hydrogen production, and it should be analyzed at the project level.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	Pregnant employees are discriminated against in the United States of America. United States Peace and Security Index (WPS) is high, score: 0.888/1 (ranking 9/170). However, according to the PwC's Women in Work Index 2019, The United States rank 24th, with a total of 33 countries rated according to criteria such as the gender pay gap. Homosexuality and gender identity are not illegal in the United State.	Doe de check | MVO Risico Checker	Given USA's low rank with regards to the treatment of women in the workplace, the topics of discrimination and gender must be investigated at the project level.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Discrimination and gender	Discrimination and gender equality (policy/regulation, state)	The religious freedom in Kazakhstan continues to improve. However, ongoing religious freedom violations and allegations of abuse continued in Kazakhstan. Legislation that restricts religious freedom was the primary source of such systematic and ongoing violations. The government denies registration of nontraditional religions such as Scientologists and Ahmadiyya Muslims. Without a clear legal framework in place to protect religious freedom for all, abuses are likely to persist and the overall situation could deteriorate once again. People with disabilities continue to face challenges in asserting their basic rights. LGBTI persons face high levels of discrimination and abuse. Asylum seekers also fleeing human rights abuses in China also face detention and discrimination in Kazakhstan.	Doe de check | MVO Risico Checker	Various types of discrimination have been reported to occur in Kazakhstan. This poses a risk within the context of hydrogen production workplaces. Investigation at the project level is necessary.	**Triggers project level analysis**

Wage & renumeration

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	Poverty headcount ratio at $2.15 a day (2017 PPP) was 0.7 % of population in 2020 The national minimum wage exceeds the poverty level.	Chile | Data (worldbank.org) Chile - United States Department of State	As long as activities comply with Chilean law, risks surrounding wages and renumeration are relatively low.	**Does not trigger project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	While the statistics don't indicate a high rate of the country's nationals being under the poverty line, poverty in Oman primarily affects migrant workers.	Poverty in Oman: Past, Present, and Future (borgenproject.org)	If hydrogen production activities involve migrant workers, the topic of wage & renumeration should be investigated.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	For a single adult living alone, the minimum wage exceeded the poverty line defined as 50 % of median income. Most workers received higher compensation than the minimum wage through enterprise agreements or individual contracts.	Australia - United States Department of State	Minimum wage exceeds the poverty line. Analysis at the project level is not necessary.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	The law does not mandate a national minimum wage. Unions and employer associations negotiate minimum wages in collective bargaining agreements that were more than the estimate for the poverty income level.	Denmark - United States Department of State	While the law does not mandate a minimum wage, negotiated wages in collective agreements are higher than the poverty income level. Analysis at the project level is therefore not necessary.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	In 2019 the country's first national minimum wage came into effect, replacing a patchwork of sectoral minimum wages set by the Department of Labor. The minimum wage was above the official poverty line. The employment and labor minister announced an increase to 21,69 rand ($1.47) per hour for the year that went into effect on March 1. The law protects migrant workers, and they are entitled to all benefits and equal pay. The minimum wage law also established a commission to make annual recommendations to parliament for increases in the minimum wage. However, the country is facing large inequalities often coupled with extreme poverty among the previously disadvantaged.	South Africa - United States Department of State	Minimum wage is higher than the official poverty line, but there are historical inequalities that express in high levels of poverty across the country.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	More than 40% of U.S. workers earn less than $15/hr, a level that is still lower than a living wage for families across most of the country, meaning working families can't meet their basic needs. Lack of clarity on specific living wage figures limits collaboration and engagement.	Living Wage For US – Better for Business, Workers, and Communities	A high number of workers in the USA are reported to earn less than what is considered a living wage. Analysis at the project level is required.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Wage & renumeration	Living wage (policy/regulation, state)	The national monthly minimum wage was above the poverty line. Every region estimated its own poverty line. The law stipulates the normal workweek should not exceed 40 hours. It limits heavy manual labor or hazardous work to 36 hours per week. The law limits overtime to two hours per day, or one hour per day for heavy manual labor, and requires overtime to be paid at least at a 50 % premium. The law prohibits compulsory overtime and any overtime for work in hazardous conditions. The law provides that labor agreements may stipulate the length of working time, holidays, and paid annual leave for each worker. By law employees are entitled to 24 days of paid annual leave per year.	Kazakhstan - United States Department of State	Minimum wage is higher than the poverty line. Analysis at the project level is not required.	**Does not trigger project level analysis**

Gender-based violence

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	Chilean law prohibits discrimination against persons based on sexual orientation or gender identity in housing, employment, and access to government services. The government has generally enforced these laws effectively. However, there have been reports on violence against LGBTQI+ individuals. In March, MOVILH reported that in 2020 it received 1,266 reports of violence or discrimination due to sexual orientation or gender identity, the highest number in the history of their annual report and a 15 % increase from 2019.	Chile - United States Department of State	Given the reported violence due to sexual orientation or gender identity, this topic may pose a risk within the context of hydrogen production workplaces. Investigation at the project level is necessary.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	In Oman, the percentage of women aged 15 and older who report that they 'feel safe walking alone at night in the city or area where [they] live' is equal to 63.5% In Oman, the percentage of ever-partnered women who experienced physical or sexual violence committed by their intimate partner in the preceding 12 months is equal to 18.1%	WPS-Index-2021.pdf (georgetown.edu)	Low perception of safety and high reported amounts of violence indicate gender-based violence may pose a risk within the context of hydrogen production workplaces. Investigation at the project level is necessary.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	In Australia, the percentage of women aged 15 and older who report that they 'feel safe walking alone at night in the city or area where [they] live' is equal to 49.8% In Australia, the percentage of ever-partnered women who experienced physical or sexual violence committed by their intimate partner in the preceding 12 months is equal to 3%.	WPS-Index-2021.pdf (georgetown.edu)	While reported violence committed by an intimate partner is low, perceived safety is also low. Low (perceived) safety may pose a risk, and analysis at the project level is necessary.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	In Denmark, the percentage of women aged 15 and older who report that they 'feel safe walking alone at night in the city or area where [they] live' is equal to 79.1% In Denmark, the percentage of ever-partnered women who experienced physical or sexual violence committed by their intimate partner in the preceding 12 months is equal to 3%.	WPS-Index-2021.pdf (georgetown.edu)	Reported gender-based violence is low, and perceived safety high. The topic of gender-based violence is therefore not likely to be a risk within the context of hydrogen production workplaces. Analysis at the project level is not necessary.	**Does not trigger analysis at the project level**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	There are strong signals that, despite a progressive constitution that specifically protects and enshrines the rights of LGBTQ+ people, violence and discrimination against them persists.	Doe de check | MVO Risico Checker	Violence against LGBTQ+ people presents a risk for workplaces within the context of hydrogen production. Perceived safety for women is very low. Reported gender-based violence is high. Investigation at the project level is necessary.	**Triggers project level analysis**
		In South Africa, the percentage of women aged 15 and older who report that they 'feel safe walking alone at night in the city or area where [they] live' is equal to 32.8% In South Africa, the percentage of ever-partnered women who experienced physical or sexual violence committed by their intimate partner in the preceding 12 months is equal to 13%.	WPS-Index-2021.pdf (georgetown.edu)		

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	In the USA, the percentage of women aged 15 and older who report that they 'feel safe walking alone at night in the city or area where [they] live' is equal to 70.6% In the USA, the percentage of ever-partnered women who experienced physical or sexual violence committed by their intimate partner in the preceding 12 months is equal to 6%.	WPS-Index-2021.pdf (georgetown.edu)	There is room for improvement with regards to the USA's reported violence and perceived safety. Nevertheless, since reported safety is above 70%, and since reported violence is below 10%, the USA's performance may be considered just about adequate. Investigation at the project level is therefore not necessary.	**Does not trigger analysis at the project level**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Gender-based violence	Gender-based violence (policy/regulation, state)	In Kazakhstan, the percentage of women aged 15 and older who report that they 'feel safe walking alone at night in the city or area where [they] live' is equal to 44.1% In Kazakhstan, the percentage of ever-partnered women who experienced physical or sexual violence committed by their intimate partner in the preceding 12 months is equal to 6%.	WPS-Index-2021.pdf (georgetown.edu)	While reported violence is low, perceived safety is low too. Within the context of hydrogen production, the (perceived) safety in the workplace may pose a risk. This topic should be investigated at the project level.	**Triggers project level analysis**

Freedom of association and collective bargaining

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	Chilean law, with some limitations, provide the right to form and join independent unions of their choice, bargain collectively, and conduct strikes. The law also prohibits antiunion practices and requires either back pay or reinstatement for workers fired for union activity. Workers in the private sector and in state enterprises have the freedom to unionize without prior approval. While employees in the private sector and workers in formal and regulated collective bargaining units have the right to strike, the law places some restrictions on this right. For example, an absolute majority of workers, rather than a majority of those voting, must approve of strikes. The law prohibits employees of 101 specific private-sector companies, largely providers of services such as water and electricity, from striking, and it stipulates compulsory arbitration to resolve disputes in these companies. Additionally, workers employed by companies or corporations whose stoppage would cause serious damage to the health, economy, or security of the country do not have the right to strike.	Chile - United States Department of State	Chilean law prohibits workers of certain companies in the electricity sector from striking. It is possible that this risk is relevant for the hydrogen value chain. This should be investigated.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	Omani workers are legally allowed to organize unions, bargain collectively, and strike. However, there is only one authorized trade union federation, and neither government employees nor household workers are permitted to join unions. Strikes, which are banned in the oil and gas industry, are rare in practice, partly because disputes are often resolved through employer concessions or government mediation.	Oman: Freedom in the World 2021 Country Report | Freedom House	Given the lack of authorized trade unions, the topics of association and collective bargaining in Oman require further investigation.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	Australia scores a 3 on the ITUC Global Rights Index (scale 1-5) for freedom of association and workers' rights, which stands for regular violations of rights. Governments and/or companies are regularly interfering in collective labor rights or are failing to fully guarantee important aspects of these rights. There are deficiencies in laws and/or certain practices which make frequent violations possible.	Doe de check | MVO Risico Checker	Given reported violations of workers' rights in Australia, this topic must be investigated at the project level.	**Triggers project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	Bargaining at national level provides a framework for much of the Danish industrial relations system. Pay and conditions are negotiated between unions or "cartels" of unions and the employers at industry level, but complementary negotiations at company level are becoming increasingly important. Overall 83% of employees are covered by collective bargaining. Overall, the coverage of collective bargaining is high.	Collective Bargaining / Denmark / Countries / National Industrial Relations / Home - WORKER PARTICIPATION.eu (worker-participation.eu)	Coverage of collective bargaining in Denmark is reported as high. Analysis at the project level is not required.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	South African workers are generally free to form, join, and participate in independent trade unions, and the country's labor laws offer unionized workers a litany of protections. Contract workers and those in the informal sector enjoy fewer safeguards. Strike activity is very common, and unionized workers often secure above-inflation wage increases. Union rivalries, especially in mining, sometimes result in the use of violent tactics to recruit and retain members and to attack opponents. Freedom for trade unions is evaluated 4/4 by the Freedom in the World index.	South Africa: Freedom in the World 2022 Country Report | Freedom House	Given the fact that Freedom for trade unions in South Africa is evaluated 4/4 analysis at the project level is necessary.	**Does not trigger project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	The United States score a 4 on the ITUC Global Rights Index (1-5) for freedom of association and workers' rights, which stands for systematic violations of labor rights. There have been report of cases where government and/or companies are engaged in serious efforts to crush the collective voice of workers putting fundamental rights under continuous threat. Freedom for trade unions is evaluated 4/4 by the Freedom in the World index.	Doe de check | MVO Risico Checker United States: Freedom in the World 2022 Country Report | Freedom House	The USA's low score with regards to workers' rights presents a threat within the context of hydrogen production. Analysis at the country level is required.	**Triggers analysis at the project level**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Freedom of association and collective bargaining	Freedom of association and/or collective bargaining (policy, regulation, state)	The rights to freedom of peaceful assembly and of the association are restricted in Kazakhstan and also human rights organizations and trade unions are subject to restrictions. Kazakh authorities jail and prosecute peaceful protesters, outspoken activists, and independent journalists. Kazakhstan scores a 5 on the ITUC Global Rights Index (scale 1-5) for freedom of association and workers' rights, which stands for no guarantee of rights. Countries with the rating of 5 are the worst countries in the world to work in. While the legislation may spell out certain rights, workers have effectively no access to these rights and are therefore exposed to autocratic regimes and unfair labor practices. In 2019 this resulted in state repression, the impossibility of trade union registration and prosecution of trade union leaders. Freedom for trade unions is evaluated 0/4 by the Freedom in the World index.	Doe de check	MVO Risico Checker Kazakhstan: Freedom in the World 2022 Country Report	Freedom House	Given Kazakhstan's low score with regards to workers' rights, the topic of freedom of association presents a significant risk within the context of hydrogen production. Analysis at the project level is necessary.	**Triggers analysis at the project level**

Health and safety at work

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	Chilean law establishes OHS standards, which are applicable to all sectors. Specific safety and health norms exist for specific sectors such as mining and diving. By law workers may remove themselves from situations that endanger health or safety without jeopardy to their employment, and authorities have effectively protected employees in this situation. The Health Ministry and the Labor Ministry have administered and effectively enforced OSH standards.	Chile - United States Department of State	As long as companies involved in hydrogen production comply with Chilean law, no significant risks with regards to health and safety at work exists.	**Does not trigger project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	The government sets occupational health and safety standards. Occupational safety and health (OSH) standards were appropriate for the main industries in the country. There were reports that the government did not enforce them for poor foreign workers according to an International Organization for Migration representative. Responsibility for identifying unsafe situations remains with OSH experts and not the worker based on hazards inherent to the nature of work. The law states an employee may leave dangerous work conditions without jeopardy to employment if the employer was aware of the danger and did not implement corrective measures. Employees covered under the labor law may receive compensation for job-related injury or illness through employer-provided medical insurance. Neither wage and hour nor occupational safety and health regulations apply to domestic workers.	Oman - United States Department of State	While appropriate standards are in place for the main industries, the reported lack of enforcement for foreign workers presents a possible risk. Analysis at the project level is required.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	Federal or state occupational health and safety laws apply to every workplace, including in the informal economy. The government effectively enforced laws related to minimum wage, hours of work, and occupational safety and health.	Australia - United States Department of State	Australia appears to effectively enforce standards related to occupational health and safety. Analysis at the project level is not required.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	The law prescribes conditions of work, including appropriate safety and health standards, and authorities effectively enforced compliance with labor regulations. The same inspectors with authority over minimum wage and hours conducted occupational safety and health inspections. Standards were enforced effectively for wage, hours and occupational safety and health in all sectors, including the informal economy.	Denmark - United States Department of State	Denmark appears to effectively enforce standards related to occupational health and safety. Analysis at the project level is not required.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	According to COSATU, the largest South-African trade Union federation, businesses insufficiently comply with the rules for health and safety. Lethal accidents are still common, especially in mining, energy and construction.	Home | MVO Risico Checker	The fact that lethal accidents are reported as common in the mining and energy sectors presents a risk within the context of hydrogen production. Analysis at the project level is therefore necessary.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	According to the US AFL-CIO, 100,000 people suffer serious accidents or die each year - 5,333 from traumatic injuries and an estimated 95,000 from occupational diseases. Workplace fatalities remain stagnant and the number of occupational injuries and illnesses continues to be greatly understated. According to the AFL-CIO, these high numbers are due to poor control of safety conditions by the government and companies. For Latin American workers, the number of work-related deaths is 9% higher because they often do heavy (illegal) work.	Doe de check | MVO Risico Checker	Given the reported number of workplace accidents in the USA, the topic of occupational health and safety presents a risk within the context of hydrogen production.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Health and safety at work	Occupational health and safety (policy, regulation, state)	The government set occupational health and safety standards that were appropriate to the main industries. The Ministry of Labor and Social Protection enforced standards for minimum wages, workhour restrictions, overtime, and occupational safety and health. The most dangerous jobs were in mining, construction, and oil and gas, according to an expert analysis of occupations with the highest fatalities. The Ministry of Labor and Social Protection reported that in 2020, 23 % of employees worked in hazardous conditions.	Kazakhstan - United States Department of State	While health and safety standards are in place, the high reported numbers of employees working in hazardous conditions indicate that enforcement is not always effective. Analysis at the project level is therefore necessary.	**Triggers project level analysis**

Government influence

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 48.58/100. The percentile rank has decreased from 62.09 in 2011 to 48.85 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Declining political stability in Chile could pose a risk, as it could result in decreased reliability with regards to hydrogen import. This topic should therefore be investigated further.	**Triggers project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 60.85/100. The percentile rank increased from 61.61 in 2011 to 72.86 in 2016, but subsequently decreased to 60.85 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Declining absence of violence could pose a risk since it could result in decreased reliability with regards to hydrogen import. This topic should therefore be investigated further.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 74.06/100 The percentile rank increased from 74.88 in 2011 to 89.05 in 2016, but subsequently decreased to 74.06 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	While political stability has decreased over the past years, Australia's performance with regards to this topic is currently considered relatively high (above 70.00). Analysis at the project level is not required.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 80.66/100 The percentile rank decreased from 87.20 in 2011 to 74.76 in 2016, but subsequently increased to 80.66 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Political stability is considered relatively high. Analysis at the project level is not required.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 21.70/100 The percentile rank has decreased from 48.82 in 2011 to 21.70 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	South Africa's low rank with regards to political stability presents a potential risk. Analysis at the project level is required.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 47.64/100. The percentile rank has decreased from 64.45 in 2011 to 47.64 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	USA's low rank with regards to political stability presents a potential risk. Analysis at the project level is required.	**Triggers project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Government influence	Political stability	Political stability and absence of violence/terrorism in 2021 – Percentile Rank: 37.74/100. The percentile rank increased from 36.02 in 2011 to 47.62 in 2016, but subsequently decreased to 37.74 in 2021.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Kazakhstan's low rank with regards to political stability presents a potential risk. Analysis at the project level is required.	**Triggers project level analysis**

Conflict and security

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	Chile's overall Global Peace Index score in 2022 is equal to 1.84/5. Perceived criminality and terrorist activity is particularly high. On the global GPI country list, Chile ranks 55/163.	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	The reported increased aggression against activists, as well as high terrorist activity, provide a trigger for analysis at the project level.	**Triggers project level analysis**
		Aggression against environmentalists and human rights activists has increased sharply. In 2020, approximately 170 environmental activists were killed in Latin America, including 65 in Colombia, 30 in Mexico, and 20 in Brazil. However, the number of unreported cases may be higher. Mostly it affects indigenous peoples defending their lands. Companies, farmers, paramilitary groups, rebels, and sometimes state actors are responsible for these acts of violence. Chile is marked as a 'high risk' country for terrorist attacks and political violence on the Aon Terrorism & Political Violence Risk Map. It is considered as level 4 on a 1-5 scale.	Doe de check I MVO Risico Checker		

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	Oman's overall Global Peace Index score in 2022 is equal to **1.89/5.** Weapons imports, military expenditure, armed services personnel, and militarization are particularly high. On the global GPI country list, Oman ranks 64/163	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	Reported high levels of military expenditure and militarization in Oman triggers further analysis at the project level.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	Australia's overall Global Peace Index score in 2022 is equal to 1.57/5. Weapons imports and exports are particularly high. On the global GPI country list, Australia ranks 27/163	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	With a GPI score of 1.57, Australia ranks in the top 30 of countries. Investigation at the project level is not required.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	Denmark's overall Global Peace Index score in 2022 is equal to 1.30/5. Weapons imports and exports are particularly high. On the global GPI country list, Denmark ranks 4/163.	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	With a GPI score of 1.30, Denmark ranks in the top 5 of countries when it comes to 'most peaceful countries'. Investigation at the project level is not required.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	South Africa's overall Global Peace Index score in 2022 is equal to 2.28/5. Perceived criminality, homicides, jailed population, violent demonstration, violent crime, weapons exports, external conflicts fought, and the score for safety and security are particularly high. On the global GPI country list, South Africa ranks 118/163.	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	Given reported of violence against land rights defenders, particularly within the context of mining, risks exist within the context of hydrogen production. South Africa's low GPI ranking provides an additional trigger for project level analysis.	**Triggers project level analysis**
		In South Africa, there have been several cases of violence, harassment, and acts of intimidation against land rights defenders. In addition, South African environmentalists suffer a long history of similar threats and violence, especially when they speak out about the impacts of mining. South Africa is marked as a ''high risk country for terrorist attacks and political violence on the AON Terrorism 7 Political Violence Risk Map.	Doe de check	MVO Risico Checker	

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	The USA's overall Global Peace Index score in 2022 is equal to 2.44/5. Jailed population, terrorist activity, military expenditure, nuclear and heavy weapons, weapons exports, deaths from external conflict, external conflicts fought, and militarization are particularly high. On the global GPI country list, the USA ranks 129/163.	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	The USA's high GPI score and low global ranking poses a risk for hydrogen production. Analysis at the project level is required.	**Triggers project level analysis**
		The score of the United States on the Global Peace Index is 2.44 out of 5, which means it scores low in the areas of (inter)national conflict, societal security and militarization.	Doe de check | MVO Risico Checker		

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Conflict and security	Absence of violence	Kazakhstan's overall Global Peace index score in 2022 is equal to 2.07/5. Violent demonstrations, weapons imports, and nuclear and heavy weapons are particularly high. On the global GPI country list, Kazakhstan ranks 97/163.	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)	In consideration of this low score, contextual situation in the country triggers futhuer analysis at the project level.	**Triggers project level analysis**
		Since early 2022, there have been protests in Kazakhstan that were sparked by rising fuel prices in the west of the country. They quickly spread to other regions and turned into a general protest against corruption, poverty, and inequality. The President of Kazakhstan labeled the protests as terrorism and is getting help from Russia to crack down on these protests. 225 people were killed and many more injured. According to the authorities, some 10,000 people have been detained in the wake of the disturbances.	Doe de check | MVO Risico Checker		

Market distortion and competition

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	Chile is considered a Designated Country according to the Equator Principles Association. It is deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Given the fact that the EP association considers Chile a Designated Country, analysis at the project level is not required once environmental and safety standards for hydrogen production are established locally.	**Does not trigger project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regularity quality index for Chile in 2021: 0.95 (-2.5 weak; 2.5 strong), Rank: 38 The index of Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Regulatory quality by country, around the world | TheGlobalEconomy.com	A lack of regulatory quality could pose significant risks within the context of hydrogen production. Chile's falls in the top 40 countries of the world, and its regulatory quality should therefore not pose any risks for hydrogen production.	**Does not trigger project level analysis**

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	The Equator Principles association does not list Oman as a Designated Country.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Since Oman is not listed as a designated county by the EP association, its regulatory quality regarding EIA cannot be guaranteed. Analysis at the project level is required.	**Triggers project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regulatory quality index for Oman in 2021: **0.33** (-2.5 weak; 2.5 strong), Rank: 65	Regulatory quality by country, around the world | TheGlobalEconomy.com	A lack of regulatory quality could pose significant risks within the context of hydrogen production. While Oman is not ranked among the best in the world when it comes to regulatory quality, it is above average. It should therefore not pose considerable risks.	**Does not trigger project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	Australia is considered a Designated Country according to the Equator Principles Association. It is deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Given the fact that the EP association considers Australia a Designated Country, analysis at the project level is not required once environmental and safety standards for hydrogen production are established locally.	**Does not trigger project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regulatory quality index for Australia in 2021: 1.84 (-2.5 weak; 2.5 strong), Rank: 4	Regulatory quality by country, around the world | TheGlobalEconomy.com	Australia's regulatory quality is ranked among the best in the world. Analysis at the project level is not necessary.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	Denmark is considered a Designated Country according to the Equator Principles Association. It is deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Given the fact that the EP association considers Denmark a Designated Country, analysis at the project level is not required once environmental and safety standards for hydrogen production are established locally.	**Does not trigger project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regulatory quality index for Denmark in 2021: 1.81 (-2.5 weak; 2.5 strong), Rank 5	Regulatory quality by country, around the world | TheGlobalEconomy.com	Denmark's regulatory quality is ranked among the best in the world. Analysis at the project level is not necessary.	**Does not trigger project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	The Equator Principles association does not list South Africa as a Designated Country.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Since South Africa is not listed as a designated county by the EP association, its regulatory quality regarding EIA cannot be guaranteed. Analysis at the project level is required.	**Triggers project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regulatory quality index for South Africa in 2021: -0.07 (-2.5 weak; 2.5 strong), Rank 93	Regulatory quality by country, around the world | TheGlobalEconomy.com	South Africa's low performance with regards to regulatory quality presents a risk. Analysis at the project level is required.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	The USA is considered a Designated Country according to the Equator Principles Association. It is deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Given the fact that the EP association considers the USA a Designated Country, analysis at the project level is not required once environmental and safety standards for hydrogen production are established locally.	**Does not trigger project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regulatory quality index for United State in 2021: 1.45 (-2.5 weak; 2.5 strong), Rank 21	Regulatory quality by country, around the world | TheGlobalEconomy.com	The USA scores relatively high with regards to regulatory quality. Analysis at the project level is not required.	**Does not trigger project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Market distortion and competition	EIA regulation	The Equator Principles association does not list Kazakhstan as a Designated Country.	Designated & Non-Designated Countries - Equator Principles Association (equator-principles.com)	Since Kazakhstan is not listed as a designated county by the EP association, its regulatory quality regarding EIA cannot be guaranteed. Analysis at the project level is required.	**Triggers project level analysis**
Market distortion and competition	Regulatory quality, rule of law	Regulatory quality index for Kazakhstan in 2021: 0.09 (-2.5 weak; 2.5 strong), Rank 80	Regulatory quality by country, around the world | TheGlobalEconomy.com	Kazakhstan's performance with regards to regulatory quality is relatively low, and may present a risk. Analysis at the project level is necessary.	**Triggers project level analysis**

Taxation

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	Chile's tax-to-GDP ratio is currently among the lowest in the OECD at 20.7% in 2019	Executive summary | OECD Tax Policy Reviews: Chile 2022 | OECD iLibrary (oecd-ilibrary.org)	Chile is not ranked in the 2021 Corporate Tax Haven index. However, given the anticipation of increased taxation on companies relevant to the hydrogen production supply chain, it has been reported that this could discourage investment; thus, further analysis at the project level is necessary.	**Triggers project level analysis**
		As Gabriel Boric won the 2021 presidential election runoff vote election in Chile, mining companies are concern about informal reports that new government could increase taxes on copper and lithium companies (which is currently very low), as well as potential delays in project approvals (considering that more detailed reviews may be performed). At the same time, the Chilean government is pledging to create a state-owned lithium company, potentially diverting strategic growth away from private-sector producers. These developments have stirred uncertainty around future investments in mining in the region.	Critical minerals supply and demand topics | EY - US		
		Chile is not listed in the 2021 Corporate Tax Haven Index	Corporate Tax Haven Index - 2021 Results (taxjustice.net)		

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	The Tax Justice Network has rated this jurisdiction as secretive. The financial secretive score of Oman is 74 on a scale of 0 ("not secretive") to 100 ("exceptionally secretive"). Financial secrecy facilitates tax abuse, enables money laundering, and undermines the human rights of all. Oman is not listed in the 2021 Corporate Tax Haven Index	Doe de check | MVO Risico Checker Corporate Tax Haven Index - 2021 Results (taxjustice.net)	The financial secrecy that characterizes Oman's tax system may present risks with regards to hydrogen production. Further analysis at the project level is required.	**Triggers project level analysis**

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	Australia is not ranked in the 2021 Corporate tax haven index	Corporate Tax Haven Index - 2021 Results (taxjustice.net)	Australia is not likely to be a tax haven. Analysis at the project level is not necessary.	**Does not trigger project level analysis**

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	Denmark is ranked in 34th place on the Corporate Tax Haven index 2021.	Corporate Tax Haven Index - 2021 Results (taxjustice.net)	Denmark could be characterized as a tax haven. Analysis at the project level is necessary.	**Triggers project level analysis**

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	South Africa is ranked in 45th place on the Corporate Tax Haven Index 2021.	Corporate Tax Haven Index - 2021 Results (taxjustice.net)	South Africa could be characterized as a tax haven. Analysis at the project level is necessary.	**Triggers project level analysis**

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	The United States of America are not ranked in the Corporate Tax Haven Index 2021.	Corporate Tax Haven Index - 2021 Results (taxjustice.net)	The USA is not likely to be a tax haven. Analysis at the project level is not necessary.	**Does not trigger project level analysis**

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Taxation	Tax and enforcement	According to the OECD, Kazakhstan is only partially compliant with the international standard of transparency and exchange of information for tax purposes. Kazakhstan is not ranked in the 2021 Corporate tax haven index	Doe de check | MVO Risico Checker Corporate Tax Haven Index - 2021 Results (taxjustice.net)	Kazakhstan's lack of transparency with regards to information related to tax may pose risks within the context of hydrogen production. Analysis at the project level is required.	**Triggers project level analysis**

Corruption

Chile

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	Control of corruption in 2021 – Percentile Rank: 81.73/100.	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Chile's has attained a high percentile rank with regards to the control of corruption. Furthermore, with a CPI score of 67 it ranks in the top 30 of countries.	**Does not trigger project level analysis**
		Chile's Corruption Perceptions Index score for 2021 is equal to 67/100, On the global CPI country list, Chile ranks 27/180.	2021 Corruption Perceptions Index - Explore the… - Transparency.org		

Oman

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	Control of corruption in 2021 – Percentile Rank: 60.10/100. The percentile rank increased from 62.09 in 2011 to 65.38 in 2016, but	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Given the reported high risk of corruption in Oman, as well as Oman's low CPI score, investigation at the project level is necessary.	**Triggers project level analysis**
		In the Corruption Perceptions Index, Oman's corruption score is 52 on a scale from 0 (very corrupt) to 100 (very clean), which means that the risk of corruption in Oman is high.	Doe de check | MVO Risico Checker		
		Oman's Corruption Perceptions Index score for 2021 is equal to 52/100. On the global CPI country list, Oman ranks 56/180.	2021 Corruption Perceptions Index - Explore the… - Transparency.org		

Australia

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	Control of corruption in 2021 – Percentile Rank: 94.71/100	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Australia has attained a high percentile rank with regards to control of corruption. Furthermore, given the country's high CPI score, analysis at the project level is not required.	**Does not trigger project level analysis**
		Australia's Corruption Perceptions Index score for 2021 is equal to 73/100. On the global CPI country list, Australia ranks 18/180	2021 Corruption Perceptions Index - Explore the… - Transparency.org		

Denmark

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	Control of corruption in 2021 – Percentile Rank: 100.00/100	WGI 2022 Interactive > Interactive Data Access (worldbank.org)	Denmark has attained a perfect percentile rank with regards to control of corruption. Denmark has also earned a high CPI score. Analysis at the project level is not required.	**Does not trigger project level analysis**
		Denmark's Corruption Perceptions Index score for 2021 is equal to 88/100. On the global CPI country list, Denmark ranks 1/88.	2021 Corruption Perceptions Index - Explore the… - Transparency.org		

South Africa

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	The corruption level in South Africa is not as high as in other African countries, yet corruption is a major obstacle when doing business in the country. The bureaucracy is predominant, and corruption is part of daily business during the awarding of government contracts and the acquisition of licenses (partly due to the preferential treatment of the rich dark elite through the Broad-Based Black Economic Empowerment strategy - B-BBEE). South Africa has set up a comprehensive legal framework to protect the environment, but government inspectors often accept corporate kickbacks to ignore non-compliance with environmental regulations. According to the Corruption Perceptions Index, the corruption score of South Africa is 44, on a scale of 0 (highly corrupt) to 100 (very clean). This means that the risk of corruption in South Africa is high.	Doe de check | MVO Risico Checker	Corruption is considered a major obstacle when it comes to doing business in South Africa. Furthermore, the country has attained a low CPI score. This presents a risk with regards to hydrogen production, and the topic of corruption should be investigated at the project level.	**Triggers project level analysis**
		Control of corruption in 2021 – Percentile Rank: **55.77/100**	WGI 2022 Interactive > Interactive Data Access (worldbank.org)		
		South Africa's Corruption Perceptions Index score for 2021 is equal to 44/100. On the global CPI country list, South Africa ranks 70/180	2021 Corruption Perceptions Index - Explore the… - Transparency.org		

United States of America

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	The report on Enforcement of Ethics Rules reflects the huge variation in enforcement efforts by state ethics agencies and the lack of transparency of those efforts in many states. Many state ethics agencies do not publish annual or biennial reports or publish their decisions on their website. Some agencies do not have websites. Too many states apply a confidentiality standard that is not warranted once probable cause of an ethics violation has been found.	Doe de check | MVO Risico Checker	The USA has attained a high score with regards to control of corruption and corruption perception. Nevertheless, reported lack of transparency with regards to state ethics enforcement efforts presents a risk within the context of corruption. Analysis at the project level is required.	**Triggers project level analysis**
		Control of corruption in 2021 – Percentile Rank: 83.65/100	WGI 2022 Interactive > Interactive Data Access (worldbank.org)		
		The USA's Corruption Perceptions Index score for 2021 is equal to 67/100. On the global CPI country list, the USA ranks 27/180.	2021 Corruption Perceptions Index - Explore South… - Transparency.org		

Kazakhstan

Topic	Country-level assessment criteria	Information	Source	Conclusion	Risk
Corruption	Control of corruption	Corruption is rampant throughout Kazakhstan's political circles and negatively affects the country's business environment. Facilitation payments and bribery are illegal, but the state bodies responsible for combating corruption are ineffective and unreliable. Companies report corruption as the number one constraint on doing business in Kazakhstan. Exporting and importing in Kazakhstan requires considerable time and paperwork to clear goods at the border, and the process is plagued by corruption and bribery. According to the Corruption Perceptions Index, the corruption score of Kazakhstan is 37, on a scale of 0 (highly corrupt) to 100 (very clean). This means that the risk of corruption in Kazakhstan is high.	Doe de check | MVO Risico Checker	Prevalence of corruption in Kazakhstan presents potential risks for hydrogen production and import. The country's low scores with regards to control of corruption and perceived corruption provide additional triggers for analysis at the project level.	**Triggers project level analysis**
		Control of corruption in 2021 – Percentile Rank: 48.08/100	WGI 2022 Interactive > Interactive Data Access (worldbank.org)		
		Kazakhstan's Corruption Perceptions Index for 2021 is equal to 37/100. On the global CPI country list, Kazakhstan ranks 102/180.	2021 Corruption Perceptions Index - Explore South… - Transparency.org		

Appendix C Glossary

Indicator	Explanation	Source
Corruption Perceptions Index (CPI)	The Corruption Perceptions Index (CPI) measures how corrupt each country's public sector is perceived to be, according to experts and businesspeople. Each country's score is a combination of at least 3 data sources drawn from 13 different corruption surveys and assessments. These data sources are collected by a variety of reputable institutions, including the World Bank and the World Economic Forum.	The ABCs of the CPI: How the Corruption… - Transparency.org
CSDDD	Corporate Sustainability Due Diligence Directive	
CSRD	Corporate Sustainability Reporting Directive	
Environmental Performance Index (EPI) (general)	The 2022 Environmental Performance Index (EPI) provides a data-driven summary of the state of sustainability around the world. Using 40 performance indicators across 11 topic categories, the EPI ranks 180 countries on climate change performance, environmental health, and ecosystem vitality. These indicators provide a gauge at a national scale of how close countries are to established environmental policy targets. The EPI offers a scorecard that highlights leaders and laggards in environmental performance and provides practical guidance for countries that aspire to move toward a sustainable future. EPI indicators provide a way to spot problems, set targets, track trends, understand outcomes, and identify best policy practices. Good data and fact-based analysis can also help government officials refine their policy agendas, facilitate communications with key stakeholders, and maximize the return on environmental investments. The EPI offers a powerful policy tool in support of efforts to meet the targets of the UN Sustainable Development Goals and to move society toward a sustainable future. Overall EPI rankings indicate which countries are best addressing the environmental challenges that every nation faces. Going beyond the aggregate scores and drilling down into the data to analyze performance by topic category, policy objective, peer group, and country offers even greater value for policymakers. This granular view and comparative perspective can assist in understanding the determinants of environmental progress and in refining policy choices.	About the EPI | Environmental Performance Index (yale.edu)
EPI – Air Quality	The Air Quality topic category measures the direct impacts of air pollution on human health in each country. It consists of seven indicators: PM2.5 exposure, household solid fuels, ozone exposure, nitrogen oxides exposure, sulfur dioxide exposure, carbon monoxide exposure, and volatile organic compound exposure.	Air Quality | Environmental Performance Index (yale.edu)
EPI – Ecosystem Vitality	The Ecosystem Vitality policy objective measures how well countries are preserving, protecting, and enhancing ecosystems and the services they provide. It comprises 42% of the total EPI score and is made up of six topic categories: Biodiversity & Habitat, Ecosystem Services, Fisheries, Acid Rain, Agriculture, and Water Resources.	Ecosystem Vitality | Environmental Performance Index (yale.edu)
EPI – Sanitation and drinking water	The Sanitation & Drinking Water topic category measures how well countries protect human health from environmental risks on two indicators: unsafe drinking water and unsafe sanitation.	Sanitation and Drinking Water | Environmental Performance Index (yale.edu)
EPI – Solid Waste	Controlled solid waste refers to the percentage of household and commercial waste generated in a country that is collected and treated in a manner that controls environmental risks. This metric counts waste as "controlled" if it is treated through recycling, composting, anaerobic digestion, incineration, or disposed of in a sanitary landfill. A score of 100 indicates a country controls 100% of its waste in a sustainable way, while a score of 0 indicates a country fails either to control any of its solid waste or to collect and report data on the fate of its solid waste.	Controlled solid waste | Environmental Performance Index (yale.edu)
EPI – Tree Cover Loss	EPI measures tree cover loss as a proportion: the average annual loss in forest area over the past five years, divided by the total extent of forest area in the year 2000. Forested areas include parcels with ≥30% canopy cover. Recognizing the greater value of mature forests, this metric only looks at gross losses, not net. Data for this indicator come from Global Forest Watch. A score of 100 indicates virtually no tree cover loss, and a score of 0 indicates the worst levels of loss.	Tree cover loss | Environmental Performance Index (yale.edu)
EPI – Waste Management	The Waste Management issue category recognizes the threats of solid waste to human and environmental health. It is based on three indicators: controlled solid waste, recycling rates, and ocean plastic pollution.	Waste Management | Environmental Performance Index (yale.edu)
EPI – Wastewater treatment	EPI measures wastewater treatment as the proportion of wastewater that undergoes at least primary treatment in each country, multiplied by the proportion of the population connected to a wastewater collection system. A score of 100 indicates that a country has 100% of its population connected to a sewer system and 100% of household wastewater is treated; a score of 0 indicates that no wastewater is reported as treated within a country. Data come from a wide variety of sources, especially the UN Statistics Division, the OECD, and Eurostat.	Wastewater treatment | Environmental Performance Index (yale.edu)
ESRS	European Sustainability Reporting Standards	
NFRD	Non-financial Reporting Directive (Directive 2014/95/EU)	

Indicator	Explanation	Source
Global Peace Index (GPI)	The overall Global Peace Index is a composite index measuring the peacefulness of countries made up of 23 quantitative and qualitative indicators each weighted on a scale of 1-5. The lower the score the more peaceful the country.	Global Peace Index Map » The Most & Least Peaceful Countries (visionofhumanity.org)
Global Slavery Index	The 2018 Global Slavery Index provides a country by country ranking of the number of people in modern slavery, as well as an analysis of the actions governments are taking to respond, and the factors that make people vulnerable.	The Index | Global Slavery Index
Poverty headcount ratio	Poverty headcount ratio at $2.15 a day is the percentage of the population living on less than $2.15 a day at 2017 purchasing power adjusted prices. As a result of revisions in PPP exchange rates, poverty rates for individual countries cannot be compared with poverty rates reported in earlier editions.	World Bank Open Data | Data
Regulatory quality index	The index of Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	Regulatory quality by country, around the world | TheGlobalEconomy.com
World Governance Indicators (WGI) – Control of Corruption	Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private interests.	WGI 2022 Interactive > Documentation (worldbank.org)
World Governance Indicators (WGI) – Political Stability and Absence of violence/Terrorism	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.	WGI 2022 Interactive > Documentation (worldbank.org)
Women Peace and Security Index (WPS) Index	The WPS Index captures three dimensions of women’s status in 11 Indicators. The dimensions are: inclusion, justice, and security	WPS-Index-2021-Summary.pdf (georgetown.edu)

Colophon

ANALYSIS OF THE RESPONSIBLE BUSINESS CONDUCT (RBC) RISKS IN THE INTERNATIONAL HYDROGEN VALUE CHAIN

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