REPORT

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GREEN HYDROGEN FOR SUSTAINABLE DEVELOPMENT

The Role of Multilateral Development Banks

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The Role of Multilateral Development Banks

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SUMMARY

This report examines the potential role of multilateral development banks (MDBs) in ensuring that Global South producer countries secure sustainable development benefits of green hydrogen development.

The analysis is founded on a dual rationale. First, it recognises that green hydrogen presents both opportunities and risks for the sustainable development of Global South countries investing in its production. On the one hand, green hydrogen can lead to desirable outcomes like industrial development, job creation, and domestic decarbonisation. On the other hand, it could create or exacerbate extractive trade relations, debt burdens, and land and water stress.

Second, it asserts that MDBs have the mandate to shape their activities in Global South countries in a way that delivers positive sustainable development outcomes for producer countries. As development banks, it is their role to champion sustainable development for producer countries in the emerging market and policy landscape for green hydrogen. It is also their role to set the right example for lending practices at an early stage, moving beyond the "do no harm" principle and prioritising value addition.

Based on this rationale, we conducted a three-step analysis. First, we examined the theoretical conditions under which green hydrogen would have desirable or undesirable impacts on nine aspects of sustainable development. This was based on a literature review and building on the analysis in our first report in this series, → **The Role of Green Hydrogen in A Just, Paris-Compatible Transition**. The conditions for positive or negative impacts are summarised in the Sustainable Development Impact Matrix → **Fig. ES 1**.

Second, we selected instruments from the MDB climate finance and strategy toolkit that have the potential to influence sustainable development and formulated recommendations on how they can be used to secure the desirable impacts presented in → **Fig. ES 1**. The recommendations are summarised in → **Tab. ES 1**. These reflect several key high-level principles for MDB engagement, including setting high eligibility standards for projects receiving MDB support, supporting comprehensive national hydrogen strategies and regulatory frameworks in borrower countries reflecting domestic development priorities, using financial and technical support tools complementarily to leverage their synergistic effects, and fostering cooperation among MDBs to maximise impact and avoid duplication of efforts.

Finally, using the analytical framework so developed, we assessed four cases of development financing support for green hydrogen – the African Development Bank in Namibia, the World Bank in India, the European Investment Bank's Green Hydrogen Fund, and Team Europe's H2Global Instrument. We analysed the impact conditions in each case to identify the opportunities and risks.

Market forces alone are insufficient to guarantee that green hydrogen production yields sustainable development outcomes for local communities and producing countries. As calls to increase green hydrogen production grow, MDBs must consider, in parallel, their role in enabling sustainable development. This report seeks to contribute to the narrative on green hydrogen production by highlighting the enabling conditions required to foster positive sustainable development impacts for producer countries in the Global South.

Fig. ES 1

Sustainable Development Impact Matrix

Sustainable Development Impact Matrix defining the conditions for potential positive (+) or negative (–) impacts of green hydrogen on sustainable development in Global South producer countries.

Legend:

- SDG 3 - Good health and well-being
- SDG 6 - Clean water and sanitation
- SDG 7 - Affordable and clean energy
- SDG 8 - Decent work and economic growth
- SDG 9 - Industry, innovation and infrastructure
- SDG 13 - Climate Action
- SDG 14 - Life below water
- SDG 15 - Life on land

Electricity access

Desired impact: Green hydrogen development improves local access to reliable, affordable, and clean electricity.

+ Green hydrogen is produced with additional and grid-connected renewable power capacity and grid-connected electrolysers, with surplus electricity supplied to the power grid.
+ Green hydrogen is produced with existing renewable power capacity and grid-connected electrolysers, with production occurring only during surplus renewable generation hours.

– Green hydrogen is produced with additional and grid-connected renewable power capacity and grid-connected electrolysers, with surplus electricity being curtailed.
– Green hydrogen is produced with existing renewable power capacity and grid-connected electrolysers, with production occurring in all hours of renewable generation.
– Green hydrogen is produced with off-grid renewable power and off-grid electrolysers, where surplus electricity cannot be shared.

Land and water access

Desired impact: Green hydrogen development improves or does not restrict local access to land and water resources without free, prior, informed consent (FPIC) and fair compensation.

+ Project infrastructures are additional, oversized, and share planned surpluses with local networks.
+ Projects establish arrangements for sharing access to land and ocean resources (or the revenues generated from restricting use) with local communities.

– Projects compete for existing infrastructure or resources needed for critical alternative uses.
– Projects restrict access of local communities to local resources, potentially leading to forced resettlement.
– Projects diminish or degrade land and water resources (particularly in regions with high scarcity) without offering benefits or fair compensation to local communities.

Local value capture

Desired impact: Green hydrogen development spurs domestic upstream and/or downstream industrial growth and creates long-term, high-quality jobs and skills.

+ There is upstream and/or downstream industrial potential and policy support for their development.
+ There are policies to ensure local skills and capacity development.

– There is potential to develop upstream industries but equipment is to be primarily sourced from abroad.
– There is potential to develop downstream industries but green hydrogen is intended for commodity export only.
– Workforce is to be primarily sourced from abroad, with no policies for local capacity building.

Trade balance

Desired impact: Green hydrogen development creates more exports than imports.

+ There is potential for the country to reduce import dependence with domestic green hydrogen or upstream industrial products.
+ There is potential for the country to export green hydrogen or its upstream/ downstream products.

– There is risk of relying heavily on exports due to the potential being overestimated.
– There is risk of relying heavily on imported equipment and workforce.

Fiscal balance

Desired impact: Green hydrogen development creates substantial public revenues and does not lead to unsustainable debt.

+ There is potential for industry and jobs growth, as well as corresponding expansion of the tax base.
+ There are resource rents generated from leasing public land and ocean access.

– Fiscal incentives are provided mainly for export-oriented production and do not generate corresponding fiscal revenues.
– There is high sovereign risk exposure built into project finance terms .

Public infrastructure

Desired impact: Green hydrogen development leads to the development of publicly owned common user infrastructures.

+ It involves upgradation of common user infrastructure (e.g., grids, ports, roads).

– It competes for use of existing infrastructure needed for other development priorities.

Sectoral decarbonisation

Desired impact: Green hydrogen development contributes to the decarbonisation of economic sectors.

+ Green hydrogen is used in domestic applications that cannot be electrified (hard-to-abate sectors).
+ Green hydrogen is used for long-term or seasonal energy storage to provide flexibility to the power grid.

– Green hydrogen is used in domestic applications that can be electrified.
– Green hydrogen is used in domestic applications that support or prolong fossil fuel use.

Public health and safety

Desired impact: Green hydrogen development does not endanger worker or community safety.

+ Project locations are carefully chosen to minimise safety risks to local communities.
+ There are robust standards and safeguards to ensure worker and community safety at all stages of the value chain.

– Project locations are not chosen carefully enough to minimise safety risks to local communities.
– There are inadequate safeguards to ensure worker and community safety at all stages of the value chain.

Nature and biodiversity

Desired impact: Green hydrogen development does not lead to degradation of natural ecosystems.

+ Projects are located where impact on natural habitats, ecosystems and species can be minimised.
+ Water pollutants generated along the value chain are adequately treated before discharge.

– Projects are located in areas of high environmental or biodiversity value.
– Water pollutants generated along the value chain are not adequately treated before discharge.

Note: The matrix considers direct impacts arising from green hydrogen value chain development, including production, storage, transport, distribution, and end-use. It does not fully consider impacts of derivatives and downstream products. The impact areas listed here are not exhaustive, mutually exclusive, or presented in hierarchical order.

Tab. ES 1

Summary of recommendations across the MDB climate finance and strategy toolkit

Tool	Type of tool	Description	Recommendations for MDBs	Opportunity for cooperation	Link to impacts
Sectoral lending strategy	**Standard setting tools**	Bank-level documents providing guidance on principles and procedures for MDB lending in different sectors.	Define the following principles, which in turn can be applied to set project-level eligibility standards: - Additionality - Green hydrogen project infrastructure, such as renewable power plants and water treatment facilities, should be additional. - Surplus sharing - Green hydrogen project infrastructure, such as renewable power plants and water treatment facilities, must be oversized and commit to surplus sharing. - Resource efficiency - Output from green hydrogen projects should be prioritised for no-regret sectors within the national context, both for domestic use and exports.	To ensure consistency	
Environmental and social framework	**Standard setting tools**	Bank-level documents detailing the approach for assessing, managing, and mitigating environmental and social risks. Typically consist of two parts - environmental and social policies (ESP) for the bank's own due diligence and monitoring responsibilities, and environmental and social standards (ESS) for the borrowers' project design and implementation.	- Ensure consistent and high-quality interpretation and application of ESSs across directly supported projects by enhancing transparency and building staff capacity. - Ensure consistent and high-quality interpretation and application of ESSs across projects involving financial intermediaries by improving oversight and accountability mechanisms. - Strengthen ESP guidelines to establish an acceptable risk classification as an eligibility standard for projects to receive MDB support. - Build capacity of public institutions, financial intermediaries, and private developers involved in approved projects to manage residual risks.	To ensure consistency	
Knowledge creation and sharing	**Country support tools**	Use of financial and technical resources to produce and share knowledge on critical issues within a sector or investment area, either on a global level or for a specific country context.	- Produce feasibility studies that assess potential demand for green hydrogen, its derivates, and its upstream and downstream products, with a breakdown by offtake sector and market (domestic vs. international). - Develop estimates of existing capacity and growth potential of domestic upstream and downstream industrial sectors. - Produce or support studies to identify appropriate policy options within the national context to capture value locally. - Facilitate platforms for knowledge exchange to share best practices and lessons learned on national strategies, enabling policies, and industrial best practices.	To combine resources and foster knowledge exchange	
Strategy support	**Country support tools**	Use of financial and technical resources to provide substantive inputs to national- or sub-national level strategic documents concerning a particular sector or development area.	- Support long-term decarbonisation strategies (including NDCs and LTSs) and sector roadmaps defining the role of green hydrogen in domestic decarbonisation efforts aligned with domestic priorities. - Support national green hydrogen strategies outlining principles or intentions for near- and long-term domestic use, a realistic outlook on exports, and policies for local value capture. - Support industrial development plans for key upstream (e.g., electrolysers) and downstream sectors (e.g., fertilisers, green steel) where significant potential exists.	To combine resources and foster knowledge exchange	
Policy and regulatory support	**Country support tools**	Use of financial and technical resources to support policy and regulatory design at the national- or sub-national levels.	- Support green hydrogen policy development, such as mandates for additionality and oversizing of project infrastructure (renewable power plants, water treatment facilities, etc.) and for surplus electricity and water sharing. - Support industrial policies and demand creation measures including phased local content measures, green public procurement, and consumption or production mandates, to spur domestic upstream or downstream industrial growth and local employment generation where there is significant potential. - Support grid regulatory reform to enable electrolyser integration and to encourage private investments in grid infrastructure. - Support tax reforms to ensure commodity exports of green hydrogen generate proportionate fiscal revenues in the form of export duties. - Support adoption or strengthening of environmental and social safeguards on wastewater treatment, project siting, labour and community safety, and stakeholder engagement and grievance redressal.	To combine resources and foster knowledge exchange	

Tool	Type of tool	Description	Recommendations for MDBs	Opportunity for cooperation	Link to impacts
Capacity building	**Country support tools**	Use of financial and technical resources to support the building of skills and capacity locally, either on the project level or at the institutional level.	- Build institutional and project developer capacity to ensure compliance with policy and regulatory frameworks related to green hydrogen (e.g., local content measures, environmental and social safeguards.). - Build institutional and project developer capacity to adapt and implement international green certification schemes for hydrogen produced with grid-connected electrolysers and for downstream products. - Provide legal support in negotiating surplus sharing or benefits sharing arrangements to ensure that projects are established under equitable terms. - Assist governments in building technical skills and vocational training for the workforce across value chain segments. - Offer safety training for workers handling hydrogen across value chain segments. - Support the re-skilling of workers in transition-affected industries, such as grey hydrogen.	To combine resources and foster knowledge exchange	
Policy-based lending	**Country support tools**	Provision of financial support (loans, grants, guarantees) in exchange for pre-determined policy or institutional reforms in the borrower country or financial intermediary. Usually provided in the form of untied budgetary support but can also be linked to specific investment projects or sectors.	- Support regulatory reforms to encourage private sector investments in common user infrastructure relevant to the green hydrogen value chain (e.g.,transmission and distribution grids, ports, roads.). - Support the development and implementation of a national green hydrogen strategy or policy programme that mandates additionality and oversizing of project infrastructure and sharing of electricity and water surpluses, prioritises offtake in domestic no-regret sectors within the national context, and includes exports to a reasonable and realistic extent. - Support industrial policies and demand creation measures including phased local content measures, green public procurement, and consumption or production mandates, to spur domestic upstream or downstream industrial growth and local employment generation where there is significant potential. - Support adoption, strengthening, and implementation of environmental and social safeguards governing green hydrogen projects on wastewater treatment, project siting, labour and community safety, and stakeholder engagement and grievance redressal.	To combine resources and foster knowledge exchange	
Preferential finance	**Project financing tools**	Provision of finance on favourable terms to projects meeting minimum eligibility benchmarks in strategic investment categories where private sector participation is low. Includes finance provided at below-market interest rates, longer repayment periods, in local currency, or blended with private finance.	- Support common user infrastructure projects relevant to the green hydrogen value chain, notably expanding and upgrading transmission and distribution grids (at the national, regional, or local levels), ports, and road transport networks. - Support project development for strategic early-stage green hydrogen projects with high potential to yield sustainable development benefits. - Support project development for strategic early-stage projects in upstream and downstream industries with significant potential to contribute to economic growth and decarbonisation.	To combine resources and expand the volume of available finance	
De-risking mechanisms	**Project financing tools**	The use of MDB donor funds to address a variety of risks associated with investment projects that impact their bankability, such as political, technology, currency, credit, or revenue risk.	- Provide guarantees to address specific project-level risks and raise private capital for common user infrastructure investments, strategic green hydrogen projects, or strategic upstream and downstream industrial projects. - Support existing double auction mechanisms (e.g., the H2Global instrument) to provide offtake guarantees to projects meeting high standards for local sustainable development impact. - Set up a joint MDB double auction mechanism to provide regional or domestic offtake certainty to no-regret end-use sectors. - Support national governments in designing and funding a domestic double auction mechanism to support domestic offtake in no-regret end-use sectors.	To combine resources, cover larger proportion of risks, and foster knowledge sharing on innovative mechanisms	

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ABBREVIATIONS

AfDB	African Development Bank
ALSF	African Legal Support Facility
CCUS	Carbon capture, utilisation, and storage
ESF	Environmental and social framework
ESP	Environmental and social policy
ESS	Environmental and social standards
EUR	Euro
FIA	Feasibility and Implementation Agreement
FPIC	Free, Prior, Informed Consent
GIS	Geographic Information System
GW	Gigawatt
HIPC	Heavily Indebted Poor Countries
LTS	Long-Term Strategy
MDB	Multilateral Development Banks
Mt	Megaton
NDC	Nationally Determined Contributions
OECD	Organisation for Economic Cooperation and Development
PBL	Policy-based lending
PV	Photovoltaics
SDG	Sustainable Development Goal
USD	United States Dollar

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INTRODUCTION

1.1 THE ROLE OF GREEN HYDROGEN IN A JUST, PARIS-ALIGNED TRANSITION

Green hydrogen will play an important but limited role in a Paris-aligned transition across sectors. Green hydrogen is the only type of hydrogen produced and combusted without emissions and the only one we consider unambiguously Paris-aligned. It currently makes up a small share of global hydrogen production, but demand for the green energy carrier is expected to increase substantially (IEA, 2023b).

While there is no international standard for green hydrogen, it is generally defined as hydrogen produced by water electrolysis powered with 100% renewable electricity.

Resource-rich producer countries in the Global South can capitalise on the emerging green hydrogen market and secure a portion of its potential sustainable development benefits. Since 2017, more than 40 countries have announced national hydrogen strategies detailing their green (and sometimes blue) hydrogen production ambitions (IEA, 2023b). The Global South is anticipated to produce 25-50% of the world's hydrogen by 2050 (ESMAP et al., 2023). Green hydrogen production presents a range of development opportunities, including economic diversification, industrial development, infrastructure development, job creation, and skill upgrading. It can also support domestic decarbonisation, improve energy security, and address energy and water poverty (see → **Section 2**).

Blue hydrogen refers to hydrogen produced with fossil gas through steam methane reforming coupled with carbon capture, utilisation, and storage (CCUS). While some actors refer to blue hydrogen as "low-emission" hydrogen, it continues dependence on fossil gas, involves significant methane emissions from pipeline leakages, and relies on unproven CCUS technology that is yet to be available at commercial scale (NewClimate Institute, 2023d).

However, the production of green hydrogen is energy-intensive and involves efficiency losses along the supply chain, particularly as a result of conversion to ammonia, liquid hydrogen, or liquid organic hydrogen carriers for long-range transport. This means that while green hydrogen can be used for many end-uses, it is not the most energy- or cost-effective solution in many instances (NewClimate Institute, 2023d). The magnitude of projected future demand and the potential size of an international market should thus be understood with a degree of caution. While some countries in the Global North have announced import targets, emerging research suggests that imported green hydrogen may be more expensive than locally produced hydrogen which could impact the size of future trade flows (Adams et al., 2023; Galimova et al., 2023). It is more efficient to produce green hydrogen, where possible, near demand centres.

The production of green hydrogen alone will not lead to positive, sustainable development outcomes for local economies; a tailored policy framework and safeguards are needed to capture benefits and avoid negative impacts. Production could substantially burden scarce local resources and infrastructure without providing proportionate local benefits like increased local access to clean water and renewable energy. Local value capture could be limited if project infrastructure and requisite equipment, such as wind turbines, solar photovoltaics

(PV), and electrolysers, are predominantly built and manufactured by foreign firms and foreign workforces, with minimal incorporation of local content. In the absence of sustainability safeguards and supportive policy frameworks, green hydrogen production could undermine the sustainable development goals of producer countries and worsen existing disparities.

If produced solely for the purpose of export to energy-hungry countries in the Global North seeking to decarbonise their economies, green hydrogen production in the Global South would further worsen global disparities and injustices. There are several reasons why extensive exports are not desirable from the perspective of the Global South. Firstly, prioritising exports may delay the decarbonisation of domestic energy-intensive sectors and hinder the potential for Global South countries to develop downstream green industries that capture value locally. Local decarbonisation and the export of green goods can contribute positively to both local benefits and climate ambitions. Secondly, the focus on exporting green hydrogen as a commodity risks reproducing extractive trade relations that have plagued other resource exports (Hickel et al., 2022). Critics from civil society have labelled the export model as an "outsourcing" of risk, arguing that extracting resources for green hydrogen destined for foreign use amounts to green colonialism (Al Jazeera, 2023). If export demand is overestimated, countries could be left with stranded assets and heightened debt distress.

Green colonialism is defined as the appropriation of resources in the name of climate mitigation and environmentalism (Fairhead et al., 2012).

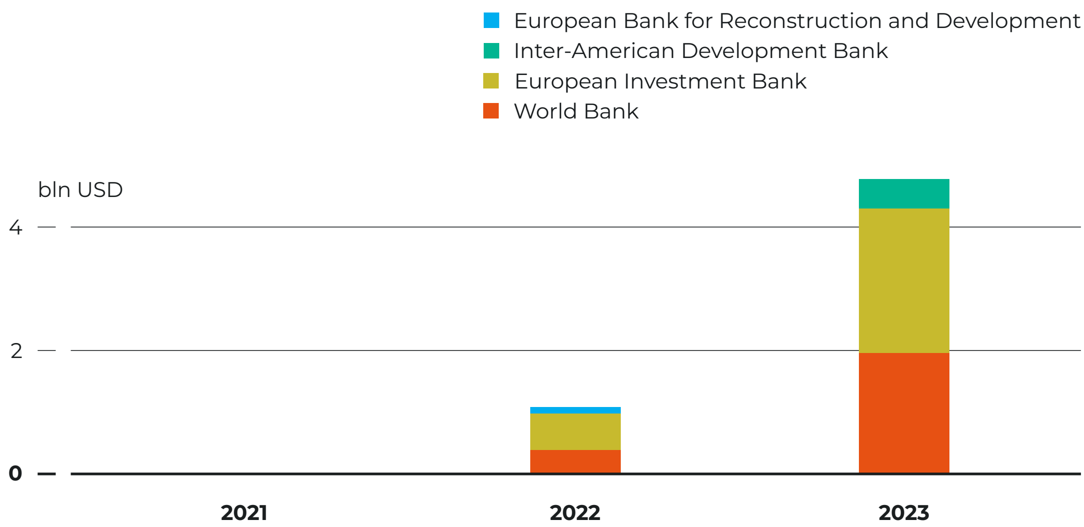
1.2 THE ROLE OF MULTILATERAL DEVELOPMENT BANKS IN SUPPORTING GREEN HYDROGEN

Multilateral development banks (MDBs) are increasingly engaging in green hydrogen development. In 2023, commitments reached over USD 4 billion (→ **Fig. 1**), mostly in the form of loans. Less than 1% of the total has been pledged as technical assistance grants or project equity (IEA, 2023b). MDBs' engagement in the green hydrogen sector is still in its early stages, focusing mainly on de-risking, policy support, and knowledge creation. Although there has been a rise in pledged direct investments from both private and public sources, only a limited number of projects have progressed to financial closure (Hydrogen Council and McKinsey & Company, 2023). (See → **Section 4** for case studies on recent initiatives by MDBs on green hydrogen and → **Annex** for a non-exhaustive list of MDB activities on green hydrogen).

Note that we use the term green hydrogen, but not all banks use this terminology. AfDB and EIB use the term green hydrogen, while the World Bank uses the term clean hydrogen, which encompasses hydrogen produced from renewables (green hydrogen) and hydrogen produced from fossil fuels with carbon capture and storage (blue hydrogen).

Based on current projections on the size of the future hydrogen market, it is estimated that emerging markets and developing countries require an average annual investment of USD 250-500 billion through 2050 to scale up green hydrogen production (ESMAP et al., 2023). However, countries in the Global South

Fig. 1
Financial commitments to hydrogen by multilateral development banks by source and year of announcement



Source: Reproduced based on (IEA, 2023b).

compete for investments against countries in the Global North, which have increasingly offered subsidies, production tax credits, and business-favourable special economic zones to attract investors and capture the market (Erraia et al., 2023; IEA, 2023a). Countries in the Global South often face high perceived risk, which leads to a higher cost of capital and limits access to financing (Ameli et al., 2021). This steep competition for investments in green hydrogen may create conditions for a race to the bottom in which countries compete by lowering standards and regulations to attract investors and gain a competitive advantage.

MDBs are uniquely positioned to level the playing field and support green hydrogen production in the Global South that facilitates sustainable development gains. However, publications on the role of MDBs in green hydrogen production often highlight their role in mitigating risk and fostering market development (Gilles and Brzezicka, 2022; Green Hydrogen Organisation, 2022; ESMAP et al., 2023). MDBs' role in ensuring the Paris-alignment of hydrogen production and sustainable development impacts for producers has been less pronounced.

MDBs have a spectrum of instruments at their disposal to support sustainable green hydrogen development, discussed in detail in → **Section 3**, which extends beyond direct investment support and risk mitigation mechanisms. These include internal standards, technical assistance for national strategies and regulatory frameworks, knowledge creation, and capacity-building initiatives. Supporting sustainable green hydrogen production in the coming decade will require a combination of enabling policy frameworks, strong sponsors, offtake certainty, and financial and technical support.

The mandate of MDBs

MDBs have committed to aligning their financial flows with the 1.5°C temperature goal of the Paris Agreement (MDBs, 2023b). Operating under a mandate to promote inclusive and resilient development pathways that address poverty and inequality, MDBs can play a key role in supporting green industrialisation in the Global South, through engaging in sustainable green hydrogen initiatives.

MDBs cannot solely rely on market forces to create just and sustainable outcomes in green hydrogen development. They can play a key role in levelling the playing field between Global North and South producers while safeguarding the sustainable development interests of Global South countries. Rather than waiting for the market to mature, MDBs should take proactive action to ensure local impact. MDBs' role in creating a market should be secondary and limited to specific cases where the sustainable development benefits of green hydrogen production are clearly established.

With their clear mandate for sustainable development in the Global South, it is crucial for MDBs to proactively examine how green hydrogen production can promote sustainable development in the region. This demands that MDBs prioritise the perspectives and priorities of Global South producer countries in their approach to green hydrogen development. Unlike bilateral funding arrangements, which might prioritise donors' trade and economic interests, MDBs have the mandate to focus on tangible value addition, moving beyond only market- or project-level considerations and the "do no harm" principle (Morgen et al., 2022).

1.3 RATIONALE, SCOPE AND STRUCTURE

This report analyses the potential role of MDBs in securing the sustainable development benefits of green hydrogen for Global South producer countries. We diverge from the prevailing narrative that MDBs must primarily support the early development and scaling of the green hydrogen industry for the benefit of the global energy transition. Instead, we explore how they can use their role in highlighting and securing sustainable development impacts for producer countries.

The report's scope is limited to green hydrogen because we assert that sustainable green hydrogen is the only type of hydrogen that is Paris-aligned and should be directly or indirectly supported by MDBs. Blue hydrogen, which relies on fossil gas and commercial availability of carbon capture and storage technology, presents lock-in risks and is not considered Paris-aligned (NewClimate Institute, 2023d). The Paris Agreement highlights the intrinsic relationship between climate action and sustainable development. Therefore, green hydrogen development that may negatively impact a country's economy, environment, or society or perpetuate historical cross-border injustices, cannot be considered Paris-aligned.

The report offers guidance on how MDBs (and development finance institutions more broadly) can centre sustainable development impacts in their support for green hydrogen initiatives in the Global South. It can also serve as a guiding document for governments, policymakers, and civil society in Global South countries to assess and inform green hydrogen strategies and policy frameworks that ensure sustainable development impacts.

Note that our analysis is limited to green hydrogen development in Global South countries and does not examine the appropriate conditions for development in Global North producer countries. Further clarification on the terminology used in this report is provided in → **Terminology**.

The report is structured as follows.

- → **Section 2** examines the conditions under which green hydrogen would have desirable or undesirable impacts on sustainable development in Global South producer countries.
- → **Section 3** provides recommendations on how selected instruments from the MDB climate finance and strategy toolkit can be employed to secure the desirable sustainable development impacts highlighted in → **Section 2**. It also considers some of the potential challenges MDBs might face in implementing the recommendations and identifies key high-level principles along which MDBs could shape their engagement on green hydrogen.
- → **Section 4** presents selected case studies of how such tools are being used or supported by development finance and analyses how these activities can be better aligned with the recommendations in → **Section 3**.

TERMINOLOGY

The following is a compiled reference list of frequently used terminology in this report in alphabetical order. Frequently used terms are also defined in the margins wherever they first appear in the text.

Blue hydrogen Hydrogen generated from fossil gas through steam methane reforming where emissions are captured through carbon capture (utilisation) and storage.

Common user infrastructure Physical infrastructure shared among multiple users including roads, ports, grids etc.

Derivative Liquid or gas molecules produced from hydrogen and another reactant such as nitrogen or carbon dioxide. Examples include ammonia, methanol, and kerosene (Bauer et al., 2023).

Downstream industries Industries associated with the use of green hydrogen, including for production of derivatives (e.g., methanol, ammonia) and green products (e.g., steel, fertilisers).

Electrolysis A process that uses an electrical current to divide water (H_2O) into oxygen (O) and hydrogen (H_2). Electricity for this process can come from either renewable or non-renewable sources. When renewable electricity is employed, the process is emission-free, yielding only hydrogen and water.

Fiscal balance The difference between a government's total revenues and its total expenditures over a specific period, typically a fiscal year. When revenues exceed expenditures, the fiscal balance is positive and the government has a fiscal surplus, and when expenditures exceed revenues, the fiscal balance is negative and the government has a fiscal deficit.

Global North & South Geographical and socio-economic classifications that highlight different income and development levels of countries. Global North countries are those with higher levels of income, industrialisation, and human development indicators, whereas Global South countries have lower levels of income, industrialisation, and human development indicators.

Green hydrogen Hydrogen generated through water electrolysis using entirely renewable electricity. Its production is facilitated by an electrolyser and demands substantial inputs of renewable energy and water.

Green hydrogen development	The overall development of the green hydrogen value chain, including production, storage, transport, distribution, and end-use.
Grey hydrogen	Hydrogen produced from fossil gas through steam methane reforming. Greenhouse gas emissions are not captured.
Hard currencies	Globally traded currencies that serve as reliable and stable stores of monetary value, including the United States Dollar (USD) and Euro (EUR).
MDB climate finance and strategy toolkit	The full of range of MDB instruments used to guide or channel their climate finance, spanning strategy and policy documents, knowledge products, advisory services, technical assistance, grants, loans, equity, and de-risking instruments.
No-regret applications	End-use sectors where the use of green hydrogen is the only viable decarbonisation solution. For example, hard-to-abate sectors such as fertilisers or heavy industry.
Sustainable development	Sustainable development fosters environmental and social priorities over the long term. In line with the UN Sustainable Development Goals and the Paris Agreement, we recognise that sustainable development and climate action are inherently linked. The term sustainable development used in the report means both traditional sustainable development priorities and climate action.
Sustainable green hydrogen	Hydrogen produced with 100% renewable electricity without causing harm to the planet which contributes to environmental, social, and economic priorities.
Trade balance	The difference between the value of a country's imports and exports. It is positive when exports exceed imports and negative when imports exceed exports.
Upstream industries	Industries associated with the production of green hydrogen, including manufacturing of renewable energy equipment (e.g., solar photovoltaics, wind turbines, inverters, batteries) and electrolysers.

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SUSTAINABLE DEVELOPMENT IMPACTS OF GREEN HYDROGEN

This section analyses the potential impacts of green hydrogen value chain development across nine impact areas reflecting social, economic, and environmental dimensions of the Sustainable Development Goals (SDGs) (United Nations, 2015) (→ **Fig. 2**). These are electricity access, land and water access, local value capture, trade balance, fiscal balance, public infrastructure, sectoral decarbonisation, public health and safety, and nature and biodiversity.

These were identified as the areas where green hydrogen development is likely to have direct and significant impacts based on a review of the literature (Falcone et al., 2021; PtX Hub, 2022; Fokeer et al., 2023; Green Hydrogen Organisation, 2023; IRENA, 2023; Samadi et al., 2023) and building on our past publication in this research series, → **The Role of Green Hydrogen in A Just, Paris-Compatible Transition**.

In the following sections, we present "impact matrices," which define the specific conditions under which green hydrogen value chain development could have desirable or undesirable impacts on each of the nine development impact areas. This approach stresses that green hydrogen development can lead to both positive and negative outcomes depending on the country's context. National governments can build on the ideas and considerations presented in the matrices to incorporate sustainable development and climate justice elements into their green hydrogen strategies. The impact matrices also provide the starting point for MDBs and other development finance institutions to adapt their climate finance and strategy toolkit to help secure the developmental benefits of hydrogen and avoid its potential negative impacts (see → **Section 3**).

It is important to note that the selected development impact areas are **not mutually exclusive**. Most are interrelated, but the conditions for their interactive or cumulative effects (i.e., trade-offs and synergies) are not defined here. For instance, green hydrogen exports could contribute positively to the trade balance but can have a negative impact on indicators like local value capture or sectoral decarbonisation. Such interactive and cumulative impacts can only be meaningfully determined within national contexts on a case-by-case basis.

The selected development impact areas are **not presented in hierarchical order**. We do not attach weights to the individual impact areas, as this would be context-specific and cannot be standardised. This selection should thus be understood as an illustrative overview of relevant impacts rather than a prioritisation.

The impact areas **do not have a temporal dimension**. Some impacts may manifest in the near term while others could take decades to materialise, depending on the national context.

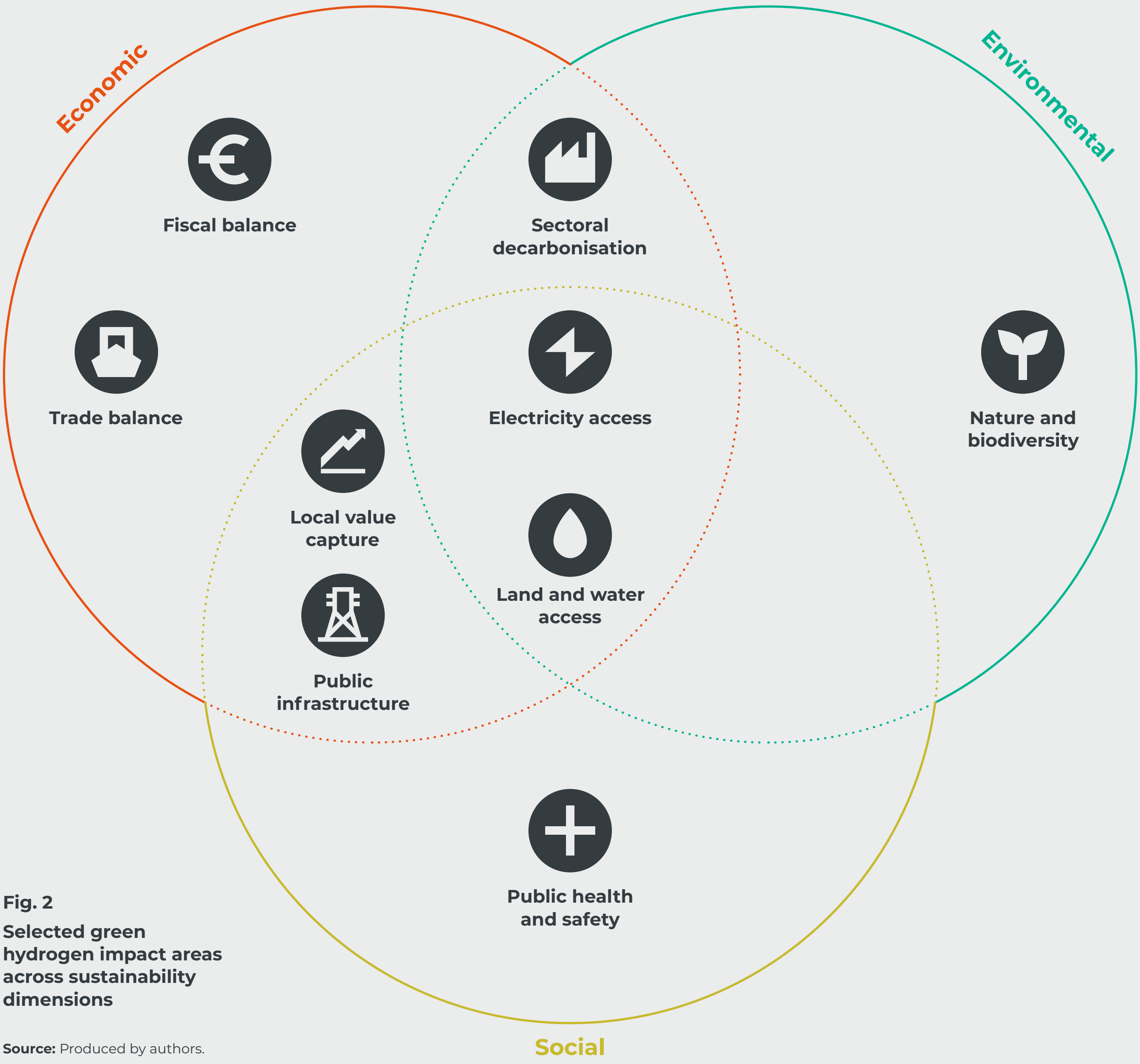


Fig. 2

Selected green hydrogen impact areas across sustainability dimensions

Source: Produced by authors.

Grey hydrogen refers to the type of hydrogen produced by the steam reformation of fossil gas, where greenhouse gas emissions are not captured. It is the most common form of hydrogen currently in use.

Further, the conditions presented in the impact matrices describe **direct impacts** only and do not consider indirect or net impacts of green hydrogen. Indirect impacts are created as green hydrogen development interacts with the broader social, political, and economic context of a country, on indicators like income distribution, peace and social harmony, and governance. Net impacts of green hydrogen on development priorities (such as job creation) could be positive or negative depending on the broader context (e.g., job creation from a new green hydrogen industry relative to job losses due to the displacement of an existing grey hydrogen industry). Both indirect and net impacts can only be meaningfully determined within national or local contexts.

Finally, this analysis considers the impacts of **green hydrogen value chain development** ("green hydrogen development" for short), including production, storage, transport, distribution, and end-use segments. We do not separate impacts across value chain segments but consider them overall. Impacts arising during the conversion of green hydrogen into derivatives, (such as green ammonia and methanol) and downstream products (such as green steel) or at their point of consumption, are not fully captured in this analysis.

The following sections describe the individual impact areas in turn. An overview of the analysis across the nine impact areas is presented in the Summary (→ **Tab. ES 1**).

2.1 ELECTRICITY ACCESS

SDG 7 - Affordable and clean energy

Desired impact: Green hydrogen development improves local access to reliable, affordable, and clean electricity.

Positive impact conditions

+ Green hydrogen is produced with additional and grid-connected renewable power capacity and grid-connected electrolysers, with surplus electricity supplied to the power grid.
+ Green hydrogen is produced with existing renewable power capacity and grid-connected electrolysers, with production.

Negative impact conditions

− Green hydrogen is produced with additional and grid-connected renewable power capacity and grid-connected electrolysers, with surplus electricity being curtailed.
− Green hydrogen is produced with existing renewable power capacity and grid-connected electrolysers, with production occurring in all hours of renewable generation.
− Green hydrogen is produced with off-grid renewable power and off-grid electrolysers, where surplus electricity cannot be shared.

Green hydrogen production is an energy-intensive process. Producing 1 million tonnes of green hydrogen per year is estimated to require approximately 20 gigawatts (GW) of renewable power capacity and 10 GW of electrolyser capacity (Rocha et al., 2023). Depending on how this energy requirement is fulfilled and what the electricity consumption profile of the electrolyser is, green hydrogen could contribute to either improving or deteriorating the level of electricity access in the producer country (→ **Fig. 3**).

Note that the conditions defined below only apply to producer countries with less than 100% access to reliable, clean, and affordable electricity, which is the case for most Global South countries. In the case of countries with universal access, impacts in most scenarios are neutral and not described here.

Green hydrogen production can positively impact local electricity access only if the renewable power capacity and electrolyser are grid-connected. For example, if the project developer builds the requisite renewable power capacity and shares surplus generation with a grid, this increases the supply of renewable power available in the grid for use by local households, businesses, and industries (Path A in → **Fig. 3**).

Grid-connected here implies a connection to either the national, regional, or local mini- or micro-grid.

In case the project does not build its own renewable capacity but draws down on existing renewable supply in the grid, the impact is positive only if the electrolyser runs exclusively during surplus renewable generation hours (Path C in → **Fig. 3**). This means green hydrogen is produced only in the hours when the amount of renewable power generation is more than sufficient to meet the power demand, using the surplus generation that would otherwise be curtailed (Chang and Phoumin, 2021; Collins, 2023).

In either case, the grid-connected electrolyser offers the possibility of energy storage, thus providing crucial flexibility services to the grid and facilitating further grid integration of variable renewables (Cozzolino and Bella, 2024).

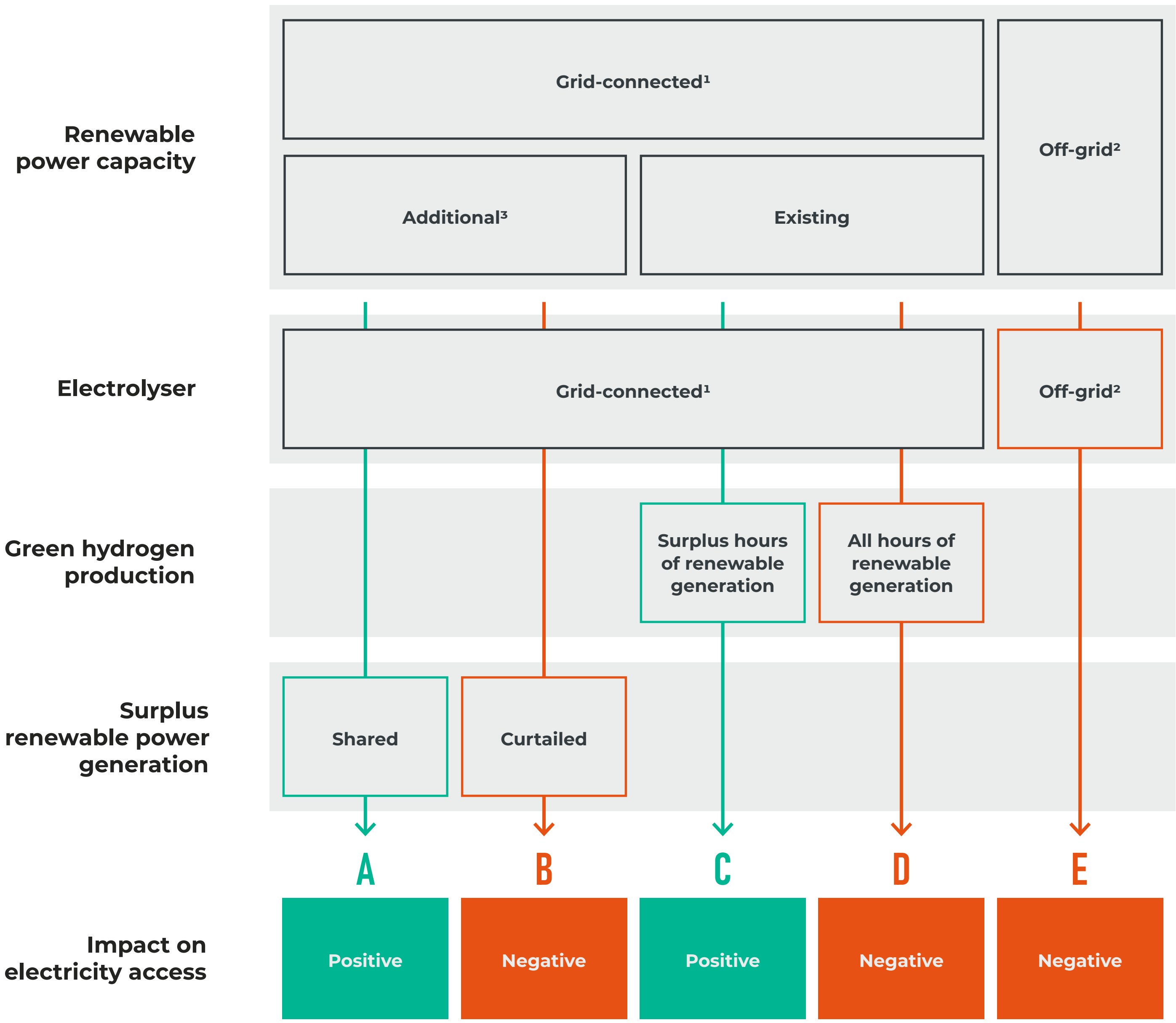
All other scenarios lead to negative impacts on electricity access. If the renewable power capacity is not additional and the grid-connected electrolyser runs full-time (Path D in → **Fig. 3**), green hydrogen production would diminish the renewable power supply available to meet demand. This may lead to increases in wholesale electricity prices unless countries add more supply capacity to meet the shortfall.

If the renewable power capacity is additional and grid-connected, and the electrolyser is grid-connected, but surplus renewable power generation must be curtailed due to oversupply in the grid, this results in wastage of resources (Path B in → **Fig. 3**). The surplus could instead be stored and used to provide short-term (battery storage) or seasonal (hydrogen storage) flexibility services to the grid, which in turn would facilitate further renewable integration and improve electricity access.

Fig. 3

Pathways of green hydrogen impacts on electricity access

This figure depicts the pathways through which green hydrogen can potentially have a positive or negative impact on electricity access in a Global South producer country without universal energy access to reliable, clean, and affordable electricity. In the case of countries with universal access, impacts in most scenarios are neutral and not depicted here.



1. Grid-connected implies a connection to either the national, regional, or local mini- or micro-grid.
2. Off-grid implies a lack of connection to either the national, regional, or local mini- or micro-grid.
3. Additional implies that infrastructure is built by the project developer in addition to existing infrastructure.

Source: Produced by authors.

Off-grid here implies a lack of connection to either the national, regional, or local mini- or micro-grid.

- Off-grid projects could generate negative impacts in countries without universal access to reliable, affordable, and clean electricity; countries with universal access would not be affected (Path E in → **Fig. 3**). In a situation of limited supply, regardless of whether the renewable power capacity is additional, the project diverts local resources (land, water, renewable energy potential) without being able to share surplus renewable generation with local households, businesses, and industries (→ **Section 2.2**). A good example is Namibia, where the renewable power capacity required to meet the country's green hydrogen production targets (mainly for exports) far exceeds its total power mix, raising ethical questions about resource use (NewClimate Institute, 2023c).

Role of MDBs

Additionality, grid connection, and surplus electricity sharing are the three important conditions to secure the positive impact of green hydrogen on electricity access in the producer country, particularly where access is currently low. MDBs can play a role in ensuring these conditions are met by:

- Establishing additionality and oversizing (of renewable power capacity), grid connection (of renewable power capacity and electrolysers), and surplus electricity sharing as mandatory requirements for projects receiving MDB financial support. (→ **Sectoral lending strategy**)
- Supporting policy development in the country to mandate the abovementioned criteria for green hydrogen projects. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Supporting investments in national, regional, or local micro- and mini-grid infrastructure development to enable project developers to comply with grid-connection and surplus electricity sharing requirements. (→ **Preferential finance;** → **De-risking mechanisms**)
- Supporting grid regulatory reforms to enable grid-integration of electrolysers. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Building institutional capacity to adapt and project developer capacity to implement international schemes certifying the green content of hydrogen produced with grid-connected electrolysers, to enable offtake both domestically and in export markets. (→ **Capacity building**)
- Providing legal support to governments in contract negotiations to establish surplus sharing arrangements with project developers. (→ **Capacity building**)

2.2 LAND AND WATER ACCESS

SDG 6 - Clean water and sanitation

Desired impact: Green hydrogen development improves or does not restrict local access to land and water resources without free, prior, informed consent (FPIC) and fair compensation.

Positive impact conditions

+ Project infrastructures are additional, oversized, and share planned surpluses with local networks.
+ Projects establish arrangements for sharing access to land and ocean resources (or the revenues generated from restricting use) with local communities.

Negative impact conditions

- Projects compete for existing infrastructure or resources needed for critical alternative uses.
- Projects restrict access of local communities to local resources, potentially leading to forced resettlement.
- Projects diminish or degrade land and water resources (particularly in regions with high scarcity) without offering benefits or fair compensation to local communities.

Tonelli et al. (2023) provide a range of global land needs estimates for a range of 2050 hydrogen demand scenarios. We derive the annual land needs per Mt of green hydrogen by dividing the range of land needs estimates provided (0.09-13.5 million km2 per year) by the range of 2050 demand projections assumed (92-646 Mt/year).

Including electrolysis and purification. Converted from estimated water needs per kilogram (kg) of green hydrogen provided in Fairley (2023) (9 litres for electrolysis, 15 litres for purification) to the per Mt estimate with a conversion factor of 1 Mt = 10^9 kg.

Green hydrogen entails significant natural resource requirements beyond renewable energy. Producing 1 megaton (Mt) of green hydrogen per year requires 1–20 thousand square kilometres (km2) of land and 24 billion litres of water (Fairley, 2023; Tonelli et al., 2023). Unlike the sun and the wind, these are exhaustible resources, which means allocating them for green hydrogen production reduces their availability for crucial alternative uses, such as water for drinking or land for agriculture. Further, ethical questions arise if the green hydrogen produced is mainly destined for exports, depleting local resources without contributing to meeting basic local needs or creating proportionate local benefits.

For instance, if groundwater is used for the electrolytic production process in areas with high water scarcity (such as arid regions or regions affected by changing rainfall patterns), it would further deplete the water table and compound the water crisis (IRENA, 2023). Green hydrogen production should thus be avoided in regions with high water stress. Desalination of seawater or treatment of wastewater are potential solutions in such cases, provided such processes are energy-efficient and the required infrastructure is additional, oversized, and shares surplus freshwater output for other local needs. Additionally, any by-products, such as saltwater brine, should be well-treated before discharge to avoid degradation of water resources and marine ecosystems.

Similarly, it is also problematic to dedicate limited land and water resources to building large-scale off-grid renewable farms (such as solar PV farms or offshore wind farms) solely for green hydrogen production. This is particularly true in areas with high food insecurity or low modern energy access, as these resources could otherwise be used to increase food production or provide electricity to the grid (see → **Section 2.1**).

Green hydrogen could also affect marginalised local populations who depend on land and water resources for their livelihoods, such as pastoral or fishing communities, by restricting their access to these resources. The large-scale land acquisition by the state for leasing to private companies is particularly a concern for traditionally disadvantaged communities with limited legal rights over historical land and has already been an issue with renewable energy projects (Scheidel et al., 2023). The same holds true for ocean access, as the construction of large-scale physical infrastructure along coastlines (such as green hydrogen hubs and desalination plants) could displace fishermen from their traditional economic zones or degrade marine ecosystems. In these cases, green hydrogen development could directly result in the displacement of local populations due to the loss of livelihoods and, in extreme cases, may even lead to social conflict and violence (Grobler et al., 2023).

On the other hand, the development of infrastructure as part of green hydrogen projects could also have positive spillover effects on resource access if access- or benefits-sharing arrangements are established. For example, if desalination plants or wastewater treatment infrastructure are built as part of a green hydrogen project, are oversized to ensure surplus output is generated, and share such surplus with the local water distribution network, this could create a positive impact on local water access for households, businesses, and industries alike.

Such arrangements could also be formed to share access to land or ocean resources with local populations that depend on them for their livelihoods, wherever it is possible to coexist. For example, pastoralists could be allowed to continue passing through wind farms that come up on their traditional routes, provided no damage is done to private property (as in Mongolia) (Waters-Bayer and Tadicha Wario, 2022). When such coexistence may not be feasible (e.g., the presence of offshore wind farms could impact the availability of fish for local fishing communities), a just outcome could be achieved by establishing revenue-sharing agreements (as in Kenya and Mexico) (Waters-Bayer and Tadicha Wario, 2022).

Role of MDBs

Stakeholder participation, benefits-sharing arrangements, and the additionality and oversizing of water treatment infrastructure are necessary to secure a positive impact of green hydrogen on land and water access in the producer country. MDBs can play a role in ensuring these conditions are met by:

- Ensuring comprehensiveness and high quality of local stakeholder consultations before project approval to identify concerns and jointly design access- or benefits-sharing arrangements under free, prior, informed consent (FPIC) conditions. (→ **Environmental and social framework**)
- Establishing well-functioning grievance redressal mechanisms to enhance the accountability of project developers during project implementation. (→ **Environmental and social framework**)
- Establishing additionality, oversizing, and surplus sharing for water treatment infrastructure as a requirement to avail MDB support. (→ **Sector lending strategy**)
- Supporting policy development in the country to mandate additionality, oversizing, and surplus sharing for water treatment infrastructure. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Providing legal support to negotiate fair benefits-sharing arrangements between project developers and local communities. (→ **Capacity building**)

2.3 LOCAL VALUE CAPTURE

- SDG 8 - Decent work and economic growth
- SDG 9 - Industry, innovation and infrastructure

Desired impact: Green hydrogen development spurs domestic upstream and/or downstream industrial growth and creates long-term, high-quality jobs and skills.

Positive impact conditions

+ There is upstream and/or downstream industrial potential and policy support for their development.
+ There are policies to ensure local skills and capacity development.

Negative impact conditions

− There is potential to develop upstream industries but equipment is to be primarily sourced from abroad.
− There is potential to develop downstream industries but green hydrogen is intended for commodity export only.
− Workforce is to be primarily sourced from abroad, with no policies for local capacity building.

Upstream industries are those associated with the production of green hydrogen, including manufacturing of renewable energy equipment (e.g., solar photovoltaics, wind turbines, inverters, batteries) and electrolysers.

Downstream industries are those associated with the use of green hydrogen, including for production of derivatives (e.g., methanol, ammonia) and green products (e.g., steel, fertilisers).

Green hydrogen development presents opportunities for local value capture along its value chain, in terms of industrial growth, jobs, and skills creation. Countries can maximise local value capture by leveraging upstream and downstream industrial opportunities where strong potential exists, in addition to renewable electricity generation and green hydrogen production activities. Ensuring workforce requirements during construction and operation are met with predominantly domestic workers also contributes to local value capture.

Green hydrogen could contribute to the creation or expansion of local industries, such as the manufacturing of renewable energy equipment (e.g., solar panels, wind turbines, inverters, and batteries) and electrolysers, production of hydrogen derivatives like methanol and ammonia, and manufacturing of green products like steel and fertilisers (Samadi et al., 2023). Upstream and downstream segments of the value chain also have stronger employment generation potential, far exceeding the quantity and quality of jobs available in the renewable energy generation and electrolysis phases alone (Fokeer et al., 2023).

Derivatives are liquid or gas molecules produced from hydrogen and another reactant such as nitrogen or carbon dioxide. Examples include ammonia, methanol, and kerosene (Bauer et al., 2023).

However, the feasibility and desirability of developing domestic upstream and downstream industries vary across countries. Not all countries can or should build up a full supply chain, as trade might be more cost-effective in many cases. Countries can make the decision to develop and co-locate these activities within their borders based on a thorough analysis of industrial potential, trade and competition, and long-run costs and benefits.

In cases where there is a strong rationale for domestic industrial development, it can be challenging for new players to emerge locally and compete with powerful incumbents, given the capital-intensiveness and high market concentration in these industries (Fokeer et al., 2023). The nature of the policy environment will thus be crucial in determining the exact impact of green hydrogen development on local value capture.

For instance, a lack of industrial support policies (such as local content or demand creation measures) or heavy import reliance for sourcing equipment could be a missed opportunity in countries with significant potential for domestic manufacturing industries to emerge. Similarly, if most of the workforce is sourced from abroad due to a lack of requisite skills domestically, there would be limited creation of high-quality local jobs and skills. In the same vein, if there is high potential for downstream industries but most of the green hydrogen production is earmarked for commodity exports, this leaves little room for domestic industries to develop. Careful policy choice and strategic planning are thus necessary to leverage the opportunities for local value capture offered by green hydrogen.

Role of MDBs

MDBs can help secure positive impacts of green hydrogen on local value creation by supporting robust analysis of upstream and downstream industrial potential and promoting industrial development wherever there is significant potential for it. This can be done by:

- Providing technical support to assess the exact nature and level of upstream and downstream industrial potential in the country and identifying appropriate policy options to capitalise on it. (→ **Knowledge creation and sharing**)

- Supporting the integration of such estimates and policy options into both national green hydrogen strategies and specific upstream and downstream sectoral development strategies (e.g., for fertilisers, green steel, and electrolysers) to provide timely market signals. (→ **Strategy support**)
- Supporting the gradual adoption of appropriate policies to spur upstream and downstream industrial growth and local employment generation where the potential is high, including local content measures, fiscal incentives, and demand creation measures (e.g., quotas, mandates, public procurement). Gradually phasing in such policies and signalling their use in advance can enable local industries to develop without slowing down the progress of green hydrogen projects. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Supporting local employment generation by offering vocational training for the workforce across value chain segments and re-skilling programmes for workers in transition-affected industries like grey hydrogen. (→ **Capacity building**)
- Providing financial or de-risking support for early, strategic investments in upstream and downstream sectors. (→ **Preferential finance;** → **De-risking mechanisms**)
- Building institutional capacity to adapt and project developer capacity to implement international schemes certifying the green content of hydrogen produced with grid-connected electrolysers and its downstream products, to enable offtake both domestically and in export markets. (→ **Capacity building**)

2.4 TRADE BALANCE

SDG 8 - Decent work and economic growth

Desired impact: Green hydrogen development creates more exports than imports.

Positive impact conditions

+ There is potential for the country to reduce import dependence with domestic green hydrogen or upstream industrial products.
+ There is potential for the country to export green hydrogen or its upstream/ downstream products.

Negative impact conditions

– There is risk of relying heavily on exports due to the potential being overestimated.
– There is risk of relying heavily on imported equipment and workforce.

The trade balance is defined as the difference between the value of a country's imports and exports. It is positive balance when exports exceed imports and a negative when imports exceed exports.

Green hydrogen development can involve import and export of goods and services, and corresponding outflow and inflow of foreign exchange, thus influencing countries' trade balances and foreign exchange reserves. Producer countries may need to import renewable energy equipment or electrolysers if they lack domestic manufacturing capacity. They may also need to hire workers from abroad if there is a shortage of skilled labour domestically. On the other hand, countries may also decide to export the green hydrogen they produce, or the associated upstream and downstream products, depending on their existing capacity, cost-competitiveness, and the level of market demand. The exact impact of green hydrogen development on the country's trade balance would depend on how the volume of exports related to green hydrogen compares to the volume of imports.

Green hydrogen has the potential to improve a country's trade balance if the volume of exports and foreign exchange inflow exceeds the volume of imports and foreign exchange outflows. This could be the case if that country is projected to be cost-competitive for exporting green hydrogen or its associated products, such as electrolysers, green ammonia, green methanol, and green steel. A positive impact could also be expected if the country has other comparative advantages – for example, a strategic geographic location with strong port infrastructure could lead to high potential for the country to become a green refuelling hub for international shipping, thus increasing its exports and foreign exchange earnings (IRENA, 2022).

Green hydrogen production and associated industries could also displace certain imports, such as fossil fuels for feedstock in fertiliser production or upstream equipment like electrolysers, thus improving the overall trade balance (NewClimate Institute, 2023b).

On the other hand, if a country's export potential turns out to be vastly overestimated compared to initial expectations, investment decisions made regarding green hydrogen projects, such as heavy reliance on imports for equipment or workforce, could contribute to the worsening of trade balance.

Role of MDBs

Reasonable estimations of the potential for green hydrogen and associated industries to export or to displace imports, and supporting industries where such potential is significant, are key to securing a positive impact on trade balance. MDBs can play a role by:

- Providing technical support to produce realistic export potential estimates, for instance through demand feasibility studies, for green hydrogen as well as its upstream and downstream products. (→ **Knowledge creation and sharing**)
- Supporting the integration of such estimates into national industrial development plans for green hydrogen as well as upstream and downstream industries to send accurate market signals. (→ **Strategy support**)
- Supporting the adoption of appropriate policies, as well as offering financial and de-risking support, to spur upstream and downstream industrial growth and job creation where potential is significant (as described in → **Section 2.3**). (→ **Policy and regulatory support;** → **Policy-based lending;** → **Preferential finance;** → **De-risking mechanisms;** → **Capacity building**)

The fiscal balance is the difference between a government's total revenues and its total expenditures over a specific period, typically a fiscal year. When revenues exceed expenditures, the fiscal balance is positive and the government has a fiscal surplus, and when expenditures exceed revenues, the fiscal balance is negative and the government has a fiscal deficit.

2.5 FISCAL BALANCE

SDG 8 - Decent work and economic growth
SDG 9 - Industry, innovation and infrastructure

Desired impact: Green hydrogen development creates substantial public revenues and does not lead to unsustainable debt.

Positive impact conditions

+ There is potential for industry and jobs growth, as well as corresponding expansion of the tax base.
+ There are resource rents generated from leasing public land and ocean access.

Negative impact conditions

– Fiscal incentives are provided mainly for export-oriented production and do not generate corresponding fiscal revenues
– There is high sovereign risk exposure built into project finance terms.

Development of the green hydrogen industry requires public sector involvement and impacts fiscal balances. Given the early stage and capital-intensiveness of the industry, early mover producers in the Global South will need fiscal incentives (tax rebates, direct subsidies) or sovereign guarantees to facilitate investment decisions and compete with often highly subsidised producers in Global North markets. Consumers may also need demand-side incentives to shift away from grey hydrogen to make them willing to pay a premium for green hydrogen in the initial stages. At the same time, the industry has the potential to generate substantial public revenues through long-term rents, corporate and income taxes, or capital gains on public equity (GHO, 2022). The overall impact on the government's fiscal balance would depend on the balance between public spending on green hydrogen and the public revenues it generates.

A high export orientation can have a potentially negative impact on fiscal balance. For instance, if substantial fiscal incentives are provided for green hydrogen production mainly aimed at exports in commodity form, it may not generate proportionate fiscal revenues domestically in the form of taxes. This effect is exacerbated as initial projects in Global South countries may face incentives to export. Initial projects will likely rely on equipment imports and international project finance in hard currencies due to a lack of local equipment supply and high local currency risks. This may create an "export bias" among project developers, inducing them to favour foreign currency earnings through exports over local currency earnings through domestic sales as the former can better cover equipment import bills or loan repayments in hard currency.

Hard currencies are globally traded currencies that serve as reliable and stable stores of monetary value. Common examples include the United States Dollar (USD) and Euro (EUR).

Further, the high risk perceptions of green hydrogen, combined with the high country risk perceptions of many Global South countries, can increase the cost of finance. This may require the state to offer de-risking support through sovereign-backed guarantees or equity to boost investor confidence (OECD, 2023a). However, if returns do not materialise as expected (for instance, due to inaccurate export estimations), this could strain public finances, thus worsening the debt burden and the state's ability to invest in other development priorities, such as health, education, and infrastructure.

Role of MDBs

Reasonable estimation of export potential and reducing sovereign risk exposure are key to securing a positive impact on fiscal balance. MDBs can play a role by:

- Supporting realistic export potential estimates and the adoption of appropriate policies, as well as offering financial and de-risking support to spur upstream and downstream industrial growth and job creation where the potential is significant (as described in → **Section 2.3 and → Section 2.4**). (→ **Knowledge creation and sharing; → Strategy support; → Policy and regulatory support; → Policy-based lending; → Preferential finance; → De-risking mechanisms; → Capacity building**)
- Offering de-risking support (such as partial risk guarantees) to reduce the sovereign risk exposure in cases with high export potential but unfavourable project finance terms. (→ **De-risking mechanisms**)
- Support or establish domestic offtake mechanisms to counteract potential export bias among project developers. (→ **De-risking mechanisms**)

- Supporting export tax reforms in the producer country to ensure the commodity exports of green hydrogen generate proportionate fiscal revenues. (→ **Policy and regulatory support**)

2.6 PUBLIC INFRASTRUCTURE

SDG 9 - Industry, innovation and infrastructure

Desired impact: Green hydrogen development leads to the development of publicly owned common user infrastructures.

Positive impact conditions

+ It involves upgradation of common user infrastructure (e.g., grids, ports, roads).

Negative impact conditions

− It competes for use of existing infrastructure needed for other development priorities.

Green hydrogen production, storage, and distribution activities presume the availability and high quality of publicly owned common user infrastructure. This includes electricity transmission and distribution grids providing renewable energy access for grid-connected projects, ports and shipyards to enable the import of equipment or export of finished products, and roads for transporting equipment, derivatives, or downstream products to storage facilities or to domestic consumers.

Pipelines for transporting green hydrogen from the point of production to end-use are excluded here. While gas pipeline infrastructure (newly built or refurbished) can be used by multiple hydrogen developers and users, this cannot directly benefit the wider population like the other common user infrastructures (grids, roads, ports) described in Section 2.6. Moreover, as we assume that sustainable green hydrogen would have a limited role in the energy transition and that limited production and end-use would be closely located, it follows that the pipeline infrastructure requirements will also be limited and do not necessitate large-scale public involvement.

In cases where such infrastructure is lacking, green hydrogen could either spur investments in their development and create positive spillover effects for the wider population or add to the burden on existing infrastructure without contributing to its expansion. Such infrastructure is typically capital-intensive and non-excludable, which means privately owned green hydrogen project developers lack incentives to invest. Even if they decided to do so, they may encounter legal and regulatory difficulties, for instance, in obtaining a reasonable burden-sharing arrangement with the government or establishing a means to recoup investments (OECD, 2023b).

Role of MDBs

Mobilising investments in common user infrastructure is necessary to enable positive impacts of green hydrogen on infrastructure development. MDBs can play a role by:

- Supporting regulatory reforms, for example, of the Grid Code to integrate fair compensation rules and burden-sharing arrangements for private investments in the transmission grid. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Providing financial or de-risking support for infrastructure investments with high upfront capital requirements. (→ **Preferential finance;** → **De-risking mechanisms**)

2.7 SECTORAL DECARBONISATION

SDG 13 - Climate Action

Desired impact: Green hydrogen development contributes to the decarbonisation of economic sectors.

Positive impact conditions

+ Green hydrogen is used in domestic applications that cannot be electrified (hard-to-abate sectors).
+ Green hydrogen is used for long-term or seasonal energy storage to provide flexibility to the power grid.

Negative impact conditions

− Green hydrogen is used in domestic applications that can be electrified.
− Green hydrogen is used in domestic applications that support or prolong fossil fuel use.

Green hydrogen has the potential to contribute to the decarbonisation of economic sectors in the producer country, provided its application is reserved for "no-regret" domestic end-uses (Liebreich Associates, 2021; NewClimate Institute, 2023d). These are optimal end-uses where no other viable decarbonisation options (such as direct electrification) exist and that do not directly or indirectly hinder overall national decarbonisation. Examples include the use of green hydrogen as a feedstock in steel, chemicals, and fertiliser production or as e-fuels in shipping and aviation, as these end-uses are difficult to electrify. Additionally, the use of green hydrogen for long-term or seasonal storage can provide flexibility services to the grid, which facilitates the integration of variable renewable energy sources and the decarbonisation of the power sector.

Conversely, the application of green hydrogen in end-uses that are possible to electrify (such as road transport, low- or medium-temperature industrial heat) has a negative impact on decarbonisation. The process of using renewable electricity to make green hydrogen and converting it back to renewable electricity for application in end-uses involves high conversion losses. Using renewable electricity directly wherever possible is thus more efficient and prevents the wastage of energy resources that could be used for further decarbonisation. Additionally, the impact is negative if green hydrogen is used in applications that support or prolong the use of fossil fuels and hinder overall decarbonisation, such as petroleum refining, fossil fuel mining, blending in fossil gas pipelines, co-firing with coal, or transporting fossil fuels (NewClimate Institute, 2023d).

In several cases, however, it may not be as straightforward to determine the impact of green hydrogen use on sectoral decarbonisation. For instance, many pilot projects for green hydrogen are planned in petroleum refineries where grey hydrogen is currently used. These projects are intended to serve as proof of concept for other clearly positive sectoral applications and as a near-term offtake market for early projects. However, this may promote continued reliance on petroleum beyond Paris-compatible timelines (NewClimate Institute, 2023a). It is important to consider the overall impact of green hydrogen on sectoral decarbonisation on a case-by-case basis, keeping in mind the specific national context.

Role of MDBs

Identifying no-regret end-use applications within the domestic context and supporting offtake in those sectors will be key in ensuring a positive impact of green hydrogen on sectoral decarbonisation. MDBs can play a role by:

- Establishing efficient use of green hydrogen in no-regret sectors as a requirement to avail MDB support. (→ **Sectoral lending strategy**)
- Supporting identification of key no-regret sectors for domestic offtake by producing national sector-wise demand estimates for green hydrogen. (→ **Knowledge creation and sharing**)
- Supporting countries to mandate offtake in domestic no-regret sectors by including sector-wise offtake preferences in their green hydrogen strategies and policies. (→ **Strategy support;** → **Policy and regulatory support;** → **Policy-based lending**)
- Supporting offtake in domestic no-regret sectors with local currency lending and innovative de-risking instruments like double auction mechanisms. (→ **Preferential finance;** → **De-risking mechanisms**)
- Building institutional capacity to adapt and project developer capacity to implement international schemes to certify the green content of hydrogen produced with grid-connected electrolysers to enable offtake in and decarbonisation of domestic no-regret sectors. (→ **Capacity building**)

2.8 PUBLIC HEALTH AND SAFETY

SDG 3 - Good health and well-being

Desired impact: Green hydrogen development does not endanger worker or community safety.

Positive impact conditions

+ Project locations are carefully chosen to minimise safety risks to local communities.
+ There are robust standards and safeguards to ensure worker and community safety at all stages of the value chain.

Negative impact conditions

− Project locations are not chosen carefully enough to minimise safety risks to local communities.
− There are inadequate safeguards to ensure worker and community safety at all stages of the value chain.

Green hydrogen can pose risks to public health and safety. Although it is produced and combusted without any emissions, it is highly flammable and needs to be handled carefully. There are high risks of accidents across all stages of the value chain – production, storage, transport, and distribution. This endangers both workers involved at these stages as well as communities located near green hydrogen hubs, storage facilities, and distribution networks (Signoria and Barlettani, 2023). Locating hydrogen hubs away from residential communities with ample buffer zones, preventing pipeline leakages, and establishing robust worker safety measures along the value chain are key to mitigating these risks.

Hydrogen pipeline leakage can itself indirectly contribute to global warming, as hydrogen influences the tropospheric and stratospheric chemistry by increasing the lifetime and concentration of methane and decreasing the concentration of ozone respectively (Maple, 2023). This impact is not explicitly considered or further analysed in this report, as our scope is limited to direct impacts of green hydrogen development.

Role of MDBs

Ensuring high environmental and social standards and safeguards, both for project siting and for worker and community safety, will be crucial in avoiding negative impacts. MDBs can play a role by:

- Establishing high environmental and social standards and safeguards for green hydrogen project infrastructure and operations as a requirement to avail MDB support. (→ **Environmental and social framework**)
- Supporting producer countries to adopt robust environmental and social standards and safeguards for green hydrogen project infrastructure and operations. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Building local capacity at the institutional and/or project levels to better implement and ensure compliance with environmental and social standards and safeguards. (→ **Capacity building**)

2.9 NATURE AND BIODIVERSITY

SDG 14 - Life below water

SDG 15 - Life on land

Desired impact: Green hydrogen development does not lead to degradation of natural ecosystems.

Positive impact conditions

+ Projects are located where impact on natural habitats, ecosystems and species can be minimised.
+ Water pollutants generated along the value chain are adequately treated before discharge.

Negative impact conditions

– Projects are located in areas of high environmental or biodiversity value.
– Water pollutants generated along the value chain are not adequately treated before discharge.

As is the case with all large infrastructure projects, green hydrogen facilities can directly or indirectly impact nature and biodiversity in the areas where they are located. This could occur due to the disruption of natural habitats (e.g., due to deforestation) or migratory paths by renewable power capacity installations, such as solar farms or onshore and offshore wind farms. Careful siting of projects in areas of low nature and biodiversity value is required to ensure these impacts are minimised.

Negative impacts could also arise due to the discharge of untreated or inadequately treated pollutants from associated processes, such as desalination of seawater for electrolysis or the production of hydrogen derivatives like ammonia and methanol. High standards for wastewater management can mitigate this impact (Signoria and Barlettani, 2023).

Role of MDBs

Ensuring high environmental standards and safeguards both for siting of green hydrogen megaprojects and for wastewater treatment will be crucial in avoiding negative impacts. MDBs can play a role by:

- Establishing high environmental standards and safeguards for green hydrogen project infrastructure and operations as a requirement to avail MDB support. (→ **Environmental and social framework**)
- Supporting producer countries to adopt robust environmental standards and safeguards for green hydrogen project infrastructure and operations. (→ **Policy and regulatory support;** → **Policy-based lending**)
- Building local capacity at the institutional and/or project levels to better implement and ensure compliance with environmental and social standards and safeguards. (→ **Capacity building**)

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ADAPTING THE MDB CLIMATE FINANCE AND STRATEGY TOOLKIT

MDBs use a range of instruments to channel their climate finance, spanning advisory services, technical assistance, grants, loans, equity, and de-risking instruments (MDBs, 2023a). In addition, they use their own strategy and policy documents to guide their climate finance and dedicate a portion of resources to produce knowledge products serving as public goods for global climate action (Germanwatch & NewClimate Institute, 2018). We refer to the full range of MDB functions impacting their climate finance as the MDB climate finance and strategy toolkit.

The existing MDB climate finance and strategy toolkit can be adapted to encourage positive impacts and avoid negative impacts of green hydrogen for the producer country described in → **Section 2**. In this section, we present nine tools **(→ Fig. 4)** commonly found in the MDB climate finance and strategy toolkit, albeit sometimes under different names, and make recommendations on how to adapt their use to achieve desired outcomes in the sustainable development impact areas described in the previous section. We also identify opportunities for cooperation among MDBs and attempt to anticipate potential challenges with the recommended use of the tools.

Fig. 4
Selected tools from the MDB climate finance and strategy toolkit

Source: Produced by authors.

The selected tools can be classified into three types based on their mode or level of impact:

A **Standard-setting tools** are strategic instruments at the bank level that guide the way MDBs operate and make financial or technical support decisions. In some cases, these tools may be used to set eligibility conditions or benchmarks at the project level – for example, many MDBs have “exclusion lists” and “eligibility lists” to clarify the investment categories eligible for MDB support (Germanwatch & NewClimate Institute, 2018). Such tools can be powerful in setting the global standards for good practice in an emerging industry like green hydrogen and are particularly important to put in place early on to secure desirable sustainable development outcomes for producer countries. Selected MDB tools within this category that can be used to secure positive developmental impacts of green hydrogen include **Sectoral lending strategies and Environmental and social frameworks**.

B **Country support** tools are technical or financial support instruments used at the borrowing country level to cultivate an enabling environment for investments. Activities vary but in essence aim to strengthen or develop national strategies, regulatory frameworks, enabling policies, and local capacity (Germanwatch & NewClimate Institute, 2018). This category of tools can serve as a cornerstone for green hydrogen production in the Global South, helping producers map out long-term strategies that prioritise local benefits and establish conducive policy frameworks to reduce risks and support development priorities. Selected MDB tools within this category that can be used to secure positive developmental impacts of green hydrogen include **Knowledge creation and sharing, Strategy support, Policy and regulatory support, Capacity building, and Policy-based lending**.

C **Project financing tools** are financial instruments used at the project level by MDBs to spread risks across entities, lower the cost of finance, and mobilise additional private financing. MDBs typically offer these tools for projects that are not bankable in the commercial market due to high perceived risks, such as poor sovereign credit risk or technology risk, but have the potential to deliver good results (Choi and Laxton, 2023). For green hydrogen, such tools should be applied strategically to projects where they can maximise the developmental impact per dollar spent. Selected MDB tools within this category that can be used to secure positive developmental impacts of green hydrogen include **Preferential finance and De-risking mechanisms**.

Many of these tools are already being used by MDBs in their green hydrogen activities. A non-exhaustive list is included in the → **Annex**. → **Section 4** presents selected case studies where such tools are being used and supported by development finance and assesses them against the framework developed in this report.

It is important to note that these tools are not mutually exclusive and are better used in combination to achieve desired outcomes. It is important to systematically integrate sustainable development considerations for green hydrogen across the MDB climate finance and strategy toolkit rather than taking a siloed approach.

3.1 STANDARD SETTING TOOLS

3.1.1 SECTORAL LENDING STRATEGY

Link to impacts:

Definition: Sectoral lending strategies are bank-level documents providing guidance on the principles and procedures for MDB investments in different sectors (such as energy, transport, health), often based on Paris Alignment methods (EIB, 2023; IDB, 2024; World Bank, 2024b). The content of such documents sets a clear direction for the bank's operational policies within that sector.

Theory of change: MDBs' sectoral lending policies can be important tools to publicly communicate the principles guiding their lending practices, which can serve to provide market signals and contribute to setting global standards for lending. This is particularly important for green hydrogen as global best practices in this sector are yet to be defined.

Recommendations: To ensure that their energy sector strategies comprehensively integrate relevant green hydrogen considerations, which in turn can be applied to set project-level eligibility standards, MDBs could define the following principles:

- **Additionality** – Green hydrogen project infrastructure, such as renewable power plants and water treatment facilities, must be built in addition to electrolyser installations.
- **Surplus sharing** – Green hydrogen project infrastructure, such as renewable power plants and water treatment facilities, must be oversized and commit to surplus sharing. Electrolysers must be grid-connected and share surplus electricity with the grid in times of supply shortages, particularly in regions with low electricity access. Water treatment facilities or desalination plants should supply surpluses to local water distribution networks in regions facing high water stress levels.
- **Resource efficiency** – Output from green hydrogen projects should be prioritised for no-regret sectors within the national context, both for domestic use and exports where possible.

Opportunity for cooperation: MDBs could cooperate in this area to ensure consistency in their green hydrogen lending strategies and to avoid projects being concentrated with the bank operating under the least ambitious standards. This would contribute to setting global standards for just, Paris-aligned green hydrogen production and use.

Potential implementation challenges:

- The principles and lines of action currently defined in MDBs' energy sector lending strategies are typically broad in scope (for example, ensuring universal energy access, building institutional capacity, etc.). To ensure they translate into stringent project-level eligibility requirements, they must be interpreted consistently across cases.

- Projects may face challenges adhering to the recommended MDB eligibility standards if the enabling policy environment and infrastructure are not in place in the borrower country. MDBs should use this tool in combination with country support tools like strategy support **(→ Section 3.2.2)** and policy and regulatory support **(→ Section 3.2.3)** to shape a complementary environment in the borrower country. Additionally, project financing support **(→ Section 3.3)** for grid infrastructure is essential to enable surplus sharing.

3.1.2 ENVIRONMENTAL AND SOCIAL FRAMEWORK

Link to impacts:

Definition: MDBs' environmental and social frameworks (ESFs) are documents detailing the approach to assessing, managing, and mitigating environmental and social risks associated with the projects they finance. ESFs typically consist of two parts – environmental and social standards (ESSs), which set requirements for the borrowers on the design and implementation of their projects, and environmental and social policies (ESPs), which set requirements for the bank on its own due diligence and monitoring responsibilities (IDB, 2020; EIB, 2022; World Bank, 2024a). ESFs are broadly formulated to be applicable to the full spectrum of MDB activities, and specific investment categories or sectors can have their own environmental and social risk guidelines specified in sectoral lending policies.

Theory of change: ESFs set minimum requirements for environmental and social risk management that banks and borrowers must comply with. Introducing or enhancing elements that reflect the risks relevant to green hydrogen projects and setting high thresholds for their eligibility to avail MDB support can shape this emerging industry and enhance its compatibility with sustainable development objectives.

Recommendations: MDBs have already formulated broad and comprehensive ESSs from which the key considerations relevant to green hydrogen projects can be derived. → **Tab. 1** matches the desired environmental and social features of green hydrogen projects (based on the analysis in → **Section 2**) to the broad ESSs that most MDBs already have in place (IDB, 2020; EIB, 2022; World Bank, 2024a).

To ensure these ESSs translate into positive social and environmental outcomes of green hydrogen projects, MDBs could:

- Ensure consistent and high-quality interpretation and application of ESSs across directly supported projects by enhancing process transparency and building MDB staff capacity.
- Ensure consistent and high-quality interpretation and application of ESSs across projects involving financial intermediaries by improving oversight and accountability mechanisms.
- Strengthen ESP guidelines to establish an acceptable risk classification as an eligibility standard for projects to receive MDB support.
- Build capacity of public institutions, financial intermediaries, and private developers involved in approved projects to manage residual risks.

Opportunity for cooperation: MDBs could cooperate on their ESFs to ensure consistency in the way green hydrogen considerations are incorporated and to avoid projects being concentrated with the bank operating under the least ambitious standards. Cooperation on ESFs would send clear signals to project developers and set a global standard with which green hydrogen project proposals can be assessed.

Potential implementation challenges:

- While MDBs typically assess and disclose environmental and social risk classifications of projects, these are not used to set eligibility standards for projects receiving financial or technical support from MDBs. In fact, current World Bank green hydrogen projects in Chile and India were both classified as having substantial environmental and social risks (Seeger, 2023; World Bank, 2023a, 2023b). The recommended use of this tool thus deviates from standard practice and would require significant political will from MDB shareholders to lead by example.

- MDB ESSs are likely to be more stringent than environmental and social regulations in the borrower country. It is thus important that MDBs combine this tool with Strategy Support and Policy and Regulatory Support tools (see → **Section 3.2.2 and** → **Section 3.2.3**) to support the strengthening of domestic environmental and social regulations and green hydrogen strategies, and the Capacity Building tool (→ **Section 3.2.4**) to build institutional capacity to manage and monitor standards beyond MDB-supported projects.

Tab. 1

Desired environmental and social features of green hydrogen projects and associated MDB environmental and social standards

Desired project-level feature	Relevant MDB Environmental and Social Standards
Siting of large-scale green hydrogen projects and associated value chain activities is strictly limited to areas: - with low land and water conflict levels - with low biodiversity value - away from residential communities	- Land Acquisition and Involuntary Resettlement - Community Health, Safety, and Security - Indigenous Peoples and Vulnerable Groups - Biodiversity Conservation and Sustainable Management of Living Natural Resources
Water pollutants, such as brine from desalination or wastewater from ammonia or methanol production, are minimised and adequately treated before being discharged into water bodies.	- Resource Efficiency and Pollution Prevention - Community Health, Safety, and Security - Biodiversity Conservation and Sustainable Management of Living Natural Resources
Workers along the value chain involved in handling hydrogen are protected by adequate safety measures, such as provisioning of protective gear and safety training.	- Community Health, Safety, and Security - Labour and Working Conditions
Resource access- or benefits-sharing arrangements are designed with local communities based on comprehensive and high-quality stakeholder consultations with free, prior, informed consent (FPIC).	- Stakeholder Engagement and Information Disclosure
Well-functioning grievance redressal mechanisms are established and maintained to enhance the accountability of project developers and financial intermediaries during project implementation.	- Stakeholder Engagement and Information Disclosure

3.2 COUNTRY SUPPORT TOOLS

3.2.1 KNOWLEDGE CREATION AND SHARING

Link to impacts:

Definition: This tool refers to the use of MDB financial and technical resources to produce and share knowledge on critical issues within a sector, either on a global level or for a specific country context. Examples include supporting pre-feasibility and feasibility studies, publishing technical reports, case studies, and good practice guides, and setting up digital libraries and platforms for knowledge exchange (ALSF, 2024b).

Theory of change: Knowledge creation and sharing is crucial in nascent sectors, such as green hydrogen, where best practices are yet to be established. With this tool, MDBs can support countries in the Global South facing capacity constraints related to collecting, managing, and analysing data, which often results in data gaps or inadequate data quality. As green hydrogen projects become operational, sharing learnings – both in terms of technological advancements and supportive policy frameworks – can mitigate risks and help lower the cost of finance.

Recommendations: To use their knowledge creation and sharing function to secure the positive sustainable development outcomes of green hydrogen, MDBs could:

- Produce feasibility studies that assess potential demand for green hydrogen, its derivatives, and its upstream and downstream products, with a breakdown by offtake sector and market (domestic vs. international).
- Develop estimates of existing capacity and growth potential of domestic upstream and downstream industrial sectors.
- Produce or support studies to identify appropriate policy options within the national context to capture value locally.
- Facilitate platforms for knowledge exchange to share best practices and lessons learned on national strategies, enabling policies, and industrial best practices.

Opportunity for cooperation: MDB cooperation in this area is necessary to combine resources, to make knowledge products a global public good, and to support sharing of lessons learned between producer countries.

Potential implementation challenges: MDBs have limited resources and capacity. As there are no direct financial returns on knowledge creation, there could be limited incentive to channel resources into such activities.

3.2.2 STRATEGY SUPPORT

Link to impacts:

Definition: MDBs provide financial and technical resources to help shape strategic roadmap documents at the national or sub-national levels for specific sectors or development areas. This includes aiding in the strengthening of climate-related strategies, such as Nationally Determined Contributions (NDCs), Long-term Strategies (LTSs), or sectoral decarbonisation plans, as well as strategies focused on other development priorities, such as poverty reduction, public health, or industrialisation. MDB strategy support typically focuses on mapping opportunities, risks, stakeholders, and investment needs.

Theory of change: MDBs can help ensure sustainable development outcomes by supporting a range of country strategies relevant to green hydrogen which provide important market signals and guide private and public investments in the sector.

Recommendations: To ensure that national and sub-national strategies in a producer country sufficiently integrate and reflect the desired sustainable development outcomes of green hydrogen, MDBs could:

- Support long-term decarbonisation strategies (including NDCs and LTSs) and sector roadmaps defining the role of green hydrogen in domestic decarbonisation efforts aligned with domestic priorities.
- Support national green hydrogen strategies outlining principles or intentions for near- and long-term domestic use, a realistic outlook on exports, and policies for local value capture.
- Support industrial development plans for key upstream (e.g., electrolysers) and downstream sectors (e.g., fertilisers, green steel) where significant potential exists.

Opportunity for cooperation: MDBs can collaborate and share analysis on strategy support to overcome resource constraints and build on each other's knowledge bases.

Potential implementation challenges:

- MDB support for strategy development may be perceived as prescribing direction or action to sovereign countries. MDBs should establish open dialogue with borrower country governments to understand their needs and dedicate their technical expertise and resources to addressing these needs with this tool.
- MDBs must navigate complex political and institutional landscapes in borrower countries and work within the constraints of national ambition. For instance, countries might wish to prioritise the short-term capital gains offered by export-oriented green hydrogen production over long-term value capture.

3.2.3 POLICY AND REGULATORY SUPPORT

Link to impacts:

Definition: This tool refers to the use of MDB financial and technical resources to support policy and regulatory design or reforms at the national- or sub-national levels. Examples include support for enhancing investment policy, competition policy, transmission regulation, environmental and social regulations, etc.

Theory of change: MDBs' support can help build or strengthen an enabling policy and regulatory framework for green hydrogen production that supports the implementation of national long-term strategies and secures positive sustainable development impacts.

Recommendations: To ensure that the policy and regulatory environment in a producer country is conducive for securing the desired sustainable development outcomes of green hydrogen, MDBs could:

- Support green hydrogen policy development, such as mandates for additionality and oversizing of project infrastructure (renewable power plants, water treatment facilities, etc.) and for surplus electricity and water sharing.
- Support industrial policies and demand creation measures including phased local content measures, green public procurement, and consumption or production mandates, to spur domestic upstream or downstream industrial growth and local employment generation where there is significant potential.
- Support grid regulatory reform to enable electrolyser integration and to encourage private investments in grid infrastructure.
- Support tax reforms to ensure commodity exports of green hydrogen generate proportionate fiscal revenues in the form of export duties.
- Support adoption or strengthening of environmental and social safeguards on wastewater treatment, project siting, labour and community safety, and stakeholder engagement and grievance redressal.

Opportunity for cooperation: MDBs can collaborate on policy and regulatory support to overcome resource constraints and build on each other's knowledge bases.

Potential implementation challenges:

- MDB support for policy development may be perceived as prescriptive or attempting to influence sovereign countries. MDBs should establish open dialogue with borrower country governments to understand their needs and dedicate their technical expertise and resources to addressing these needs with this tool.
- MDBs must navigate complex political and institutional landscapes in borrower countries and work within the constraints of national ambition. For instance, countries might wish to prioritise the short-term capital gains offered by export-oriented green hydrogen production over long-term value capture.

3.2.4 CAPACITY BUILDING

Link to impacts:

Definition: This tool refers to the use of MDB financial and technical resources to support the building of skills and capacity locally, either on the project or institutional level. Examples include vocational training, reskilling or upskilling programmes, professional or institutional capacity-building workshops, project preparation or legal support facilities, etc.

Theory of change: Capacity building facilitates country ownership, which is crucial for achieving sustainable development impacts. It aids governments in developing the capability to enact robust regulatory and policy frameworks related to green hydrogen. Capacity support is also important to build technical expertise along the value chain to enable greater local value creation.

Recommendations: To use their capacity building function to secure the positive sustainable development outcomes of green hydrogen, MDBs could:

- Build institutional and project developer capacity to ensure compliance with policy and regulatory frameworks related to green hydrogen (e.g., local content measures, environmental and social safeguards, etc.).
- Build institutional and project developer capacity to adapt and implement international green certification schemes for hydrogen produced with grid-connected electrolysers and for downstream products.
- Provide legal support in negotiating surplus sharing or benefits sharing arrangements to ensure that projects are established under equitable terms.
- Assist governments in building technical skills and vocational training for the workforce across value chain segments.
- Offer safety training for workers handling hydrogen across value chain segments.
- Support the re-skilling of workers in transition-affected industries, such as grey hydrogen.

Opportunity for cooperation: MDBs can collaborate by pooling their resources to enhance their capacity-building efforts, reduce transaction costs, and amplify their overall impact.

Potential implementation challenges: MDBs have limited resources and capacity. As there are no direct financial returns on capacity building, there could be limited incentive to channel resources into such activities.

3.2.5 POLICY-BASED LENDING

Link to impacts:

Definition: Policy-based lending (PBL) is an MDB lending category wherein financial support (loans, grants, or guarantees) is provided in exchange for pre-determined policy or institutional reforms in the borrower country or financial intermediary. It is disbursed upon achievement of the specified actions. PBL can be either non-earmarked budgetary support, specifically for crisis-response or countercyclical measures, or linked to specific investment projects in strategically important sectors (ADB, 2021). It can be standalone (supporting a particular policy area for 1-2 years) or programmatic (supporting multiyear government action plans through broader structural reforms).

Theory of change: PBL can catalyse structural changes in the policy and institutional environments of borrowing countries and create an enabling environment for green hydrogen investments. Given the nascency of green hydrogen, the implementation of additional policy frameworks and safeguards, or reforms to existing ones, is crucial to mobilise investments while safeguarding positive sustainable development outcomes.

Recommendations: To link PBL with policy actions that could secure the positive sustainable development outcomes of green hydrogen, MDBs could:

- Support regulatory reforms to encourage private sector investments in common user infrastructure relevant to the green hydrogen value chain, such as transmission and distribution grids, ports, roads, etc.
- Support the development and implementation of a national green hydrogen strategy or policy programme that mandates additionality and oversizing of project infrastructure and sharing of electricity and water surpluses, prioritises offtake in domestic no-regret sectors within the national context, and includes exports to a reasonable and realistic extent.
- Support industrial policies and demand creation measures including phased local content measures, green public procurement, and consumption or production mandates, to spur domestic upstream or downstream industrial growth and local employment generation where there is significant potential.
- Support adoption, strengthening, or implementation of environmental and social safeguards on wastewater treatment, project siting, labour and community safety, and stakeholder engagement and grievance redressal.

Opportunity for cooperation: MDBs can cooperate to share knowledge, experiences, and best practices on policy-based approaches for green hydrogen.

Potential implementation challenges:

- Many small countries with green hydrogen potential, where MDB support is most needed to secure positive development outcomes, may not be able to benefit from the recommended use of PBL. Borrower countries must have strong macro-fiscal fundamentals to be eligible to receive PBL, which is typically determined by an IMF assessment (Neunuebel et al., 2022).
- Tying finance to policy reforms can create an additional hurdle for borrower countries to access finance. To avoid this, MDBs should use this tool in combination with tools like policy and regulatory support (→ **Section 3.2.3**) and capacity building (→ **Section 3.2.4**) to achieve optimal results.
- MDBs have internal ceilings on the amount of finance they can provide under the PBL category, and thus use this instrument sparingly.
- PBL may be perceived as overly intrusive in some cases (Koeberle, 2003). MDBs should establish open dialogue with borrower country governments to understand their needs and dedicate their technical expertise and resources to addressing these needs with this tool.
- MDBs may run into legal, administrative, or political impediments in borrowing countries to use PBL. They should work with borrower country governments to address these challenges wherever possible.

3.3. PROJECT FINANCING TOOLS

3.3.1 PREFERENTIAL FINANCE

Link to impacts:

Definition: This is a category of MDB lending provided on favourable terms to projects meeting minimum eligibility benchmarks in strategic investment categories where private sector participation is low. It includes:

- **Concessional finance:** Financing offered at below-market interest rates or with longer repayment periods.
- **Blended finance:** Concessional funds combined with private capital (e.g., through public-private partnerships) to facilitate risk sharing and mobilise larger amounts of finance.
- **Local currency finance:** Long-term debt issued in the currency of borrowers rather than in hard currencies (i.e., USD or EUR).

Theory of change: Preferential finance can greatly improve access to finance for debt-burdened borrowing countries with low credit ratings and mitigate some of the risks associated with investing in new technology or large-scale public infrastructure, where private investment appetite is low. This type of finance can be utilised strategically to mitigate risks, reduce the cost of finance, and attract private capital to high-impact investment areas that enable broader development impacts. For example, local currency finance provided to strategic green hydrogen projects can help mitigate currency risk and potential export bias among developers arising from dependence on imports and project finance in hard currencies.

Recommendations: To effectively allocate limited preferential funds to projects with high sustainable development impact, MDBs could:

- Support common user infrastructure projects relevant to the green hydrogen value chain, notably expanding and upgrading transmission and distribution grids (at the national, regional, or local levels), constructing ports, and improving road transport networks.
- Support project development for strategic early-stage green hydrogen projects with high potential to yield sustainable development benefits.
- Support project development for strategic early-stage projects in upstream and downstream industries with significant potential to contribute to economic growth and decarbonisation.

Opportunity for cooperation: MDBs can consider cooperation opportunities to pool their preferential resources and mobilise private investments for high-impact and high-priority project investments. The World Bank's proposed hydrogen lighthouse initiative is an example of pooling expertise and preferential finance together to boost the hydrogen industry in emerging markets (ESMAP, 2024).

Potential implementation challenges:

- MDBs have limited donor funds available to provide in the form of concessional finance and many development projects compete for the same funds.
- High currency risks in many borrowing countries translate into higher risk premiums added to the concessional interest rates, often making MDB finance terms comparable to local commercial finance.
- MDBs often require sovereign guarantees against concessional loans due to their low risk appetite, which can potentially exacerbate sovereign risk exposure and fiscal burden in debt-vulnerable borrowing countries. Proposals to reform the international financial architecture have called on MDBs to increase their risk appetite (G20 Expert Panel, 2022).
- Providing local currency loans requires MDBs to raise funds in local capital markets, absorb currency risk, or seek hedging products. However, local capital markets in borrowing countries are often underdeveloped and currency risk hedging tends to be unavailable at the scale required for infrastructure projects (Fink et al., 2023).

3.3.2 DE-RISKING MECHANISMS

Link to impacts:

Definition: This refers to the use of MDB donor funds to address a variety of risks associated with investment projects that impact their bankability, such as political, technology, currency, credit, or revenue risks. De-risking support could be made available in various forms, such as credit guarantees (partial risk, partial credit, or first loss), liquidity reserve facilities, equity co-investments, or other innovative mechanisms.

An example of an innovative de-risking mechanism to address offtake risk would be a double auction mechanism, wherein purchase and sales volumes of green hydrogen are auctioned separately, and the gap between production cost and market price is covered with donor funds.

Theory of change: De-risking mechanisms transfer or absorb major risks facing green hydrogen projects, which otherwise hinder their access to commercial finance without requiring sovereign guarantees. MDBs' de-risking capacity can be instrumental in attracting investments and enabling producers in the Global South to compete with often heavily subsided Global North producers.

Recommendations: To de-risk and enhance the bankability of green hydrogen projects with high sustainable development impact, MDBs could:

- Provide guarantees to address specific project-level risks and raise private capital for common user infrastructure investments, strategic green hydrogen projects, or strategic upstream and downstream industrial projects.
- Support existing double auction mechanisms (e.g., the H2Global instrument) to provide offtake guarantees to projects meeting high standards for local sustainable development impacts (H2Global Stiftung, no date c; European Commission, 2023). For instance, the bid selection process under tailored funding windows could weigh criteria on local content, workforce, or benefits sharing to encourage bidders to consider sustainable development impacts. (See → **Section 4.4**)
- Establish a joint MDB double auction mechanism to provide regional or domestic offtake certainty to no-regret end-use sectors.
- Support national governments in designing and funding a domestic double auction mechanism to support domestic offtake in no-regret end-use sectors.

Opportunity for cooperation: MDBs can consider cooperating on de-risking mechanisms to pool resources and make it possible to cover a larger proportion of risks. Such collaboration, particularly on innovative instruments, would facilitate knowledge sharing and the evolution of best practices, preventing unnecessary duplication of efforts.

Potential implementation challenges:

- MDBs have limited risk-taking capacity and must retain their credit rating to continue to offer low-cost capital. Modest increases to MDBs' risk appetite can unlock significant lending capacity (McHugh, 2024). MDBs could, for instance, reform how they account for guarantees which are currently accounted for similarly to loans regardless of their probability of being called, which reduces fiscal space for lenders and decreases demand from sovereign borrowers (G20 Argentina, 2018).
- As MDBs' risk-taking capacity is limited, they must apply de-risking mechanisms sparingly to high-impact investments. Determining which high-impact projects should receive limited financing can be a challenge as there are competing priorities.

3.4 PRINCIPLES FOR MDB ENGAGEMENT

Based on the specific recommendations for each climate finance tool or strategy (summarised in → **Tab. ES 1**), we identify the following key high-level principles to shape MDB engagement on green hydrogen in line with their sustainable development mandate and the Paris-alignment commitment:

A **Champion sustainable development** – MDBs should go beyond “do no harm” and aim to support projects that add value for producer countries. This is crucial for integrating sustainability considerations into decision-making processes regarding hydrogen from the outset.

B **Set high eligibility standards** – MDBs can enhance their lending strategies and environmental and social frameworks, using them to set high minimum social, economic, and environmental eligibility standards for green hydrogen projects seeking financial or technical support.

C **Support comprehensive national strategies** – MDBs can assist producer countries in formulating near- and long-term national green hydrogen strategies, sectoral decarbonisation plans, and roadmaps in line with the Paris Agreement, national priorities, and sustainable development objectives.

D **Use tools complementarily** – MDBs can use a combination of tools to capitalise on their cumulative and complementary impacts. High eligibility standards and policy-based lending should be accompanied by country support instruments as well as financial and de-risking instruments to create optimal conditions for green hydrogen to deliver sustainable development outcomes.

E **Enhance implementation capacity** – MDBs should ensure their own strategies and policies are interpreted and implemented consistently across projects, to ensure the principles are translated into action. MDBs can also support countries in scaling up their capacity to develop and implement regulations and action plans.

F **Ensure cooperation** – MDBs can cooperate to combine financial resources and technical expertise, build on each other’s country networks, and scale up their impact on green hydrogen lending and support initiatives. Cooperation, including with bilateral development agencies, would promote consistency, facilitate knowledge sharing and the refinement of best practices, and prevent duplication of efforts.

/Λ 04

CASE STUDIES: SELECTED MULTILATERAL AND BILATERAL INITIATIVES ON GREEN HYDROGEN

4.1 AFDB: AFRICAN LEGAL SUPPORT FACILITY IN NAMIBIA

Tools used: → Capacity building; → Knowledge creation and sharing

Funding committed: N/A

Potential impacts:

Description: The African Legal Support Facility (ALSF) is an international organisation established by the African Development Bank (AfDB) in 2008. It has a mandate to provide legal and technical advisory services to African states, particularly the Heavily Indebted Poor Countries (HIPCs), in negotiating fair and equitable terms on contractual arrangements between governments and investors (ALSF, 2024). It also provides institutional and professional capacity building support, for example, through a repertoire of online courses and legal and technical resources for stakeholders housed in its digital ALSF Academy (ALSF, 2024).

In 2023, ALSF was appointed by the Namibian Government to support negotiations related to the USD 10 billion vertically integrated green hydrogen megaproject being developed by Hyphen Hydrogen Energy, a private joint enterprise of firms based in the UK (Nicholas Holdings Ltd.) and Germany (Enertrag). ALSF is involved in ensuring a robust legal foundation for the new green hydrogen industry, notably through the processes around land allocation, environmental implications, ensuring local employment generation and industrial participation, and maximising fiscal revenues for the government (NPC, 2023).

These negotiations culminated in the signing of two contractual agreements between the government and Hyphen, the project developer. The first was a Feasibility and Implementation Agreement (FIA) delineating the roles and responsibilities of both parties, intended to serve as a benchmark for the sustainable and equitable development of other such projects. The second was a shareholders agreement establishing Nam-H2 Fund Managers, the partnership governing the SDG Namibia One blended finance fund created by the Environmental Investment Fund (owned by the Namibian government), Climate Fund Managers and Invest International (both owned by the Dutch government) (ALSF, 2023).

Assessment: ALSF involvement in the Namibian case is a good example of how MDBs can use their capacity building tool to provide legal support to the government in securing national interests in contract negotiations. Their support on the shareholders agreement helped ensure that the government has a significant role in the governance and management of the funds committed in the SDG Namibia One fund and empowered the government to take a 24% equity in the Hyphen project (EIF, 2023).

ALSF also helped secure strong commitments from the project developer outlined in the FIA, including environmental and social targets, fiscal revenues, and the potential development of common user infrastructure. Local value creation is also an important objective for the government, notably that 90% of the jobs created are filled by Namibians and 30% of the procurement is from local businesses, and the developer agreed to ensure these targets are met during construction and operation phases. Various financial obligations of the developer are also made explicit in the FIA, including the annual land rental and environmental levies for each phase, royalties as a percentage of gross revenues, and payment of corporate income and other taxes to the government. The agreement stipulated that the developer is responsible for funding feasibility activities (Republic of Namibia and Hyphen, 2023).

While it is challenging to delineate the exact role of ALSF in securing these outcomes, it is important to acknowledge the value of having legal support available to improve negotiating power and capacity for producer countries. The availability of such legal support also empowers the state to litigate if contractual commitments are not met, thus reducing vulnerability.

4.2 WORLD BANK: DEVELOPMENT POLICY LOANS TO INDIA

Tools used: → Policy-based lending

Funding committed: USD 1.5 billion provided, additional USD 1.5 billion committed

Potential impacts:

Description: The World Bank Group is providing policy-based loans to accelerate low-carbon energy development in India, of which green hydrogen is one out of three pillars. The finance will be provided in a two-part programmatic series of USD 1.5 billion each, the first part of which was approved and awarded in 2023 and the second part is at the negotiation stage as of early 2024 (World Bank, 2023a, 2023b).

The key objective of the green hydrogen pillar of the PBL is to strengthen enabling policies and regulations, reduce costs, increase market demand, mobilise private investments, and facilitate the decarbonisation of hard-to-abate industrial sectors in India. Among the expected results of this PBL by 2026 are increased green hydrogen production capacity (3 million tonnes), domestic electrolyser (3 GW) and upstream manufacturing capacity (48 GW) for high efficiency solar PV components, and the establishment of 10 safety standards governing the green hydrogen industry.

The pre-determined policy actions of the Indian government related to green hydrogen that would trigger the disbursement of the PBL include implementing fiscal incentive schemes for green hydrogen production and electrolyser manufacturing, promoting the use of green hydrogen and its derivatives in selected offtake sectors to substitute grey hydrogen or fossil fuel imports (notably refineries and fertilisers), developing an efficient public procurement model to lower offtake risk, and defining a standard for what is considered green hydrogen. Several of these policy actions have already been implemented (NewClimate Institute, 2023b).

Assessment: The World Bank PBL to India is mostly consistent with the recommended use of the tool as described in → **Section 3.2.5**. The policy actions prioritise local value capture by promoting the expansion of domestic manufacturing industries, given significant potential in India. The PBL also promotes sectoral decarbonisation by prioritising domestic offtake in hard-to-abate industries, which has a substantial import substitution effect and corresponding impact on trade balances. Further, the emphasis on high safety standards as an expected outcome of the PBL has a potential positive impact on public health and safety.

However, there are some concerning aspects of PBL. For instance, one of the hard-to-abate industries that will use green hydrogen is petroleum refining, which is currently reliant on grey hydrogen (produced with fossil gas). While this certainly contributes to decarbonising refinery operations and provides an early offtake opportunity for green hydrogen producers, the long-term use of green hydrogen in this sector should be approached with caution. It is essential to target clear political commitments and timeline for fossil fuel phase-out under the PBL.

Further, the project is marked as having substantial environmental and social risks, which is explained in the project information documents as pertaining to involuntary resettlement, loss of livelihoods, occupational and community health and safety concerns, and reduction of freshwater availability. Approving a project flagged with substantial environmental and social risks is inconsistent with the recommendation in this report to set stringent eligibility criteria for green hydrogen projects. Similar issues are observed in the World Bank hydrogen project in Chile (Seeger, 2023).

The World Bank is providing several technical assistance packages to mitigate anticipated environmental and social risks. These include Geographic Information System (GIS) mapping to identify green hydrogen hubs that will exclude environmentally and socially sensitive areas, conducting assessments on desalination of water for green hydrogen production, enhancing institutional capacity building at the federal and state levels, implementing reskilling programmes for fossil fuel workers facing job displacement, and sharing global best practices on environmental and social risk mitigation. Committing additional grant resources to ensuring sound environmental and social performance is a welcome move, but its efficacy will hinge on the robustness of implementation and monitoring and evaluation procedures.

4.3 EIB: GREEN HYDROGEN FUND

Tool used: → Knowledge creation and sharing; → Policy and regulatory support; → Capacity building; → Preferential finance

Funding committed: €459 million committed by Germany; no additional donors so far

Potential impacts:

Description: The Green Hydrogen Fund is a trust fund hosted by EIB that aims to support green hydrogen-related infrastructure projects outside the European Union in developing countries and emerging economies included on the OECD Development Assistance Committee's list of recipients of official development assistance (OECD, 2021). Germany is the first and only donor, committing €459 million. The fund provides technical assistance and investment grants to get projects off the ground. Technical assistance aims to address bankability concerns by supporting project preparation, capacity building, feasibility studies, proof of concept pilots, and policy advisory services. Investment grants aim to address financial viability concerns by reducing the overall cost of the projects and, therefore, the green premium of producing green hydrogen compared with alternatives on the market. The grants can be utilised to purchase equipment, services, facilities, and securities, and are often blended with other types of finance (EIB, no date).

The Fund supports renewable hydrogen produced with additional renewable power capacity, in line with European directives on additionality. Projects across the entire green hydrogen value chain – from production to use – are eligible for funding. This includes renewable electricity generation, desalination plants, electrolysers, storage solutions, and transportation infrastructure.

Assessment: The operational framework of the Green Hydrogen Fund holds the potential to establish positive incentives that align with the suggested utilisation of tools, especially through its eligibility criteria for green hydrogen production. Green hydrogen projects must produce hydrogen in accordance with European standards to be eligible for funding. Given the absence of international standards for green hydrogen, high European eligibility standards could incentivise producers to adhere to stricter sustainability criteria (in terms of emission intensity and additionality) compared to what they might otherwise follow.

However, some incentives set by the Fund are concerning. Eligibility for the Green Hydrogen Fund rests on the project involving European companies in the value chain and exporting partially or completely to the European Union (EIB, no date). Such criteria could incentivise export over domestic use and sideline local value creation.

While the Fund aims to develop green hydrogen projects and align national decarbonisation strategies with the Paris Agreement, export-oriented production could undermine producer countries' domestic decarbonisation. Projects applying for funding that anticipate most or all export of their green hydrogen output to Europe should undergo thorough scrutiny. In such cases, benefits sharing for the producer country should be ensured, for example, in the form of access to common user infrastructure or surplus sharing of renewable electricity or desalinated water. Technical assistance provided under the project could serve to improve the policy environment, promote domestic uptake, and strengthen capacity to ensure the inclusion of domestic companies in the value chain.

Funds like the EIB's Green Hydrogen Fund are highly suitable for MDB cooperation. By pooling their resources, banks could expand the available funding and establish stringent eligibility criteria for projects to promote sustainable development impacts for producer countries.

4.4 TEAM EUROPE: THE H2GLOBAL INSTRUMENT

Tool used: → De-risking mechanism

Funding committed: €900 million for the first round of auctions provided by Germany; additional €300 committed by Germany and the Netherlands each

Potential impacts:

Description: H2Global is an auction-based instrument to facilitate the ramp-up of green hydrogen production in Europe and globally by de-risking offtake and addressing the "green premium" – i.e., the difference between supply and demand prices. This is done by the Hydrogen Intermediary Company GmbH (Hintco), which simultaneously enters into long-term purchase contracts with producers and short-term sales contracts with buyers. The difference between the supply price and demand price is compensated by grants (H2Global Stiftung, no date c). The mechanism provides long-term offtake certainty needed to make projects bankable.

The funding instrument facilitates different funding windows, each with different criteria. For instance, under each funding window, donors can stipulate the product they want to support (e.g., hydrogen, ammonia, methanol, etc.), the geographic scope of eligibility (e.g., global, regional, or country-specific), and sustainability criteria for production, transportation, and off-take (H2Global Stiftung, no date c). Bids with the lowest supply price and highest demand price are awarded.

The German Federal Ministry for Economic Affairs and Climate Action (BMWK) has provided €900 million in funding for the first round of auctions in 2022 (H2Global Stiftung, no date a). An additional €300 million each is expected from Germany and the Netherlands in a joint funding window in 2023 (H2Global Stiftung, no date b). The European Hydrogen Bank has designated H2Global to implement its international activities (H2Global Stiftung, 2023a). Ultimately, the tool aims to operate at the European level to pool resources and conduct joint auctions for imports (H2Global Stiftung, 2023b).

Assessment: While the H2Global Instrument offers the potential to establish stringent eligibility standards for funding, its current configuration fails to effectively set incentives in line with our recommendations. The H2Global instrument is inherently an import-focused tool intended to address the energy and decarbonisation demands of European industry. The focus on incentivising export-oriented production for Europe could undercut producers' domestic decarbonisation and hinder local value capture.

The instrument's use of distinct funding windows provides an opportunity to support specific hydrogen derivatives or production in predefined geographies. H2Global notes that through the instrument, donors can pursue specific objectives related to energy, industry, technology, innovation, or foreign policy (Bollerhey et al., 2023). In theory, H2Global can indirectly support the scaling of infrastructure, clean technology, and supply chains for green products in producer countries, but this depends on the objectives set by donors in eligibility guidelines. The sustainability criteria set for eligibility are thus far unclear. Additional criteria related to producers' development objectives could also be considered, such as local content and workforce requirements. Consistent with the recommended use of double auction mechanisms described in → **Section 3.3.2**, similar demand-side contracts for domestic offtakers should be concluded to support domestic uptake and decarbonisation.

MDBs could collaborate and jointly support innovative initiatives like the H2Global instrument. A distinct funding window could be supported that sets high eligibility criteria related to the sustainable development goals of producer countries.

/Λ 05 CONCLUSION

As stakeholders consider how to accelerate green hydrogen production, it is crucial for MDBs to consider, in parallel, their role in enabling sustainable development. Relying solely on market forces is insufficient to ensure that green hydrogen production creates sustainable development outcomes for local communities and producing countries. With the support MDBs can provide, ranging from advisory services and technical assistance to different forms of financing and de-risking, they are uniquely positioned to support sustainable green hydrogen production in Global South countries. This report seeks to contribute to the narrative on green hydrogen production by highlighting the enabling conditions required to foster positive sustainable development impacts for producer countries in the Global South.

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ANNEX

Tab. 2

Non-exhaustive list of MDBs activities related to Green Hydrogen

MDB	Project/Activity	Country/Region	Date	Amount	Status	Tool(s) being used	Source
ADB	Energy Storage and Green Hydrogen Sector Development Program	Georgia	2022	$103mn	Proposed	Loan with PBL component (standalone)	https://www.adb.org/projects/54448-001/main
	Preparing Energy Storage and Green Hydrogen Sector Development Program	Georgia	2022	$1.75mn	Active	Technical assistance	https://www.adb.org/projects/55173-001/main
	Supporting Green Hydrogen Through High Technology	India	2021		Proposed	- Capacity building (project preparation) - Country strategy support - Knowledge creation and sharing	
	Power Sector Reform Program	India	2023	$250mn	Approved	Policy based lending (programmatic)	https://www.adb.org/projects/55080-001/main
	South Asia Subregional Economic Cooperation Green Fuel	Regional	2022	$2.00 mn	Active	Technical assistance	https://www.adb.org/projects/56096-001/main
AfDB	African Legal Support Facility (ALSF)	Namibia	2023		Signed	Capacity building	https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/african-legal-support-facility https://gh2.org/sites/default/files/2022-11/Development%20finance%20-%20green%20hydrogen%20priority%20actions%20-%20Nov%202022.pdf
AIIB	Catalyst MENA Climate Fund II	Egypt, Jordan , Tunisia	2023	$20mn	Approved	Non sovereign finance; financial intermediation;	https://www.aiib.org/en/projects/details/2023/_download/multicountry/AIIB-PSI-P000621-Multicountry-Catalyst-MENA-Climate-Fund-II-CMCF2-Feb.-16-2023.pdf https://www.aiib.org/en/projects/details/2023/approved/Multicountry-Catalyst-MENA-Climate-Fund-2-CMCF2.html
EBRG	Egypt Green Hydrogen S.A.E	Egypt	2022	$80mn	Signed	Equity bridge loan	https://www.ebrd.com/news/2022/ebrd-supports-first-green-hydrogen-facility-in-egypt-.html https://www.ebrd.com/work-with-us/projects/psd/53558.html
	Technical cooperation	Egypt			Ongoing	- Country strategy support - Knowledge creation and sharing	https://www.ebrd.com/work-with-us/projects/psd/53558.html
	Green Hydrogen Common Infrastructure Development in Jordan	Jordan	2024		Approved	Technical assistance	https://www.ebrd.com/work-with-us/projects/tcpsd/19048.html
	Pilot Uzbek Green Hydrogen Project	Uzbekistan	2024	US$ 58.2 mn	Exploratory	Project finance	https://www.ebrd.com/work-with-us/projects/psd/54561.html
	Study on production and use of hydrogen	Azerbaijan	2023		Complete	Knowledge creation and sharing	https://caspianoilgas.az/en/news/study-on-production-use-of-hydrogen-to-be-presented-in-azerbaijan
	India Hydrogen Alliance (IH2A)	India	2023	€ 1bn	MoU	Unclear	https://www.eib.org/en/press/all/2023-045-eib-backs-green-hydrogen-deployment-in-india-and-joins-india-hydrogen-alliance
EIB	Green Hydrogen (Trust) Fund	DAC countries	2021	€ 459 mn (Germany) + €25 mn EIB	funds committed	- Regulatory support - Technical assistance	https://www.eib.org/en/products/mandates-partnerships/donor-partnerships/trust-funds/green-hydrogen-fund.htm https://www.eib.org/attachments/publications/20230044_green_hydrogen_fund_en.pdf
	Team Europe Initiative to develop green hydrogen in Mauritania	Mauritania	2022		Joint declaration	Regulatory support Capacity building	https://www.eib.org/en/press/all/2022-290-mauritania-and-the-eib-strengthen-renewable-energy-and-green-hydrogen-cooperation https://ec.europa.eu/commission/presscorner/detail/en/ip_23_5268
	Joint Declaration with Kenya	Kenya	2023	Planned € 1.8 mn	Joint declaration	Grants/preferential finance	https://www.eib.org/en/press/all/2023-083-european-investment-bank-and-kenya-strengthen-green-hydrogen-cooperation
	TEAM EUROPE GREEN HYDROGEN PLATFORM	Chile	2023	$100mn	Statement of intent	Blended finance	https://www.eib.org/en/projects/pipelines/all/20220628#:~:text=The%20operation%20consists%20in%20a,green%20hydrogen%20exports%20to%20Europe https://www.eib.org/en/press/all/2023-223-eu-eib-and-kfw-to-finance-renewable-hydrogen-projects-in-chile-with-up-to-eur216-5-million
	Green Energy in Namibia	Namibia	2022	$500mn	Joint declaration	Loan/Blended finance	https://www.eib.org/en/press/speeches/cop27-namibia-mou-hoyer
IDB	Technical cooperation projects and support for Colombia's Hydrogen Road Map	Colombia	2021			Technical assistance	https://blogs.iadb.org/energia/en/colombia-takes-position-in-the-green-hydrogen-industry-in-latin-america/
	Support for the Green Hydrogen industry in Chile	Chile	2022	$200,000	Implementation	Technical assistance	https://www.iadb.org/en/whats-our-impact/CH-T1286
	Program to Support the Development of the Green Hydrogen Industry in Chile	Chile	2023	$400mn	Implementation	Loan based on results	https://www.iadb.org/en/news/idb-approves-400-million-loan-boost-chiles-green-hydrogen-industry; https://www.iadb.org/en/whats-our-impact/CH-L1168
	Technical Assistance	LAC Region			Ongoing	- Technical assistance (prefeasibility studies, national hydrogen strategy development, certification etc.) - Preferential finance	https://publications.iadb.org/en/unlocking-green-and-just-hydrogen-latin-america-and-caribbean
IDB, GCF	E-mobility Program for Sustainable Cities in Latin America and the Caribbean	LAC	2022		Endorsed	- Preferential finance and grants - Regulatory support	https://www.iadb.org/en/news/idb-green-climate-fund-endorse-program-promote-e-mobility-latin-america-caribbean
World Bank (ESMAP)	Hydrogen 4 Development Partnership	Emerging markets and developing countries	2021		Ongoing	- Knowledge sharing and creation - Technical assistance - Capacity building - Country strategy support - Concessional finance	https://www.esmap.org/Hydrogen_for_Development_Partnership_H4D#:~:text=The%20Power%20of%20Partnership,both%20public%20and%20private%20sources
World Bank (IBRD)	Expanding Clean Hydrogen in Brazil - Ceará Hydrogen Hub	Brazil	2023	$90mn	MoU	Investment project financing	https://documents1.worldbank.org/curated/en/099122123142018715/P18151117d6de30f1a5f8195fd134a22eb.docx
World Bank (IBRD-IDA)	Chile Green Hydrogen Facility to Support a Green, Resilient and Inclusive Economic Development	Chile	2023	$350mn ($150mn initial loan, $200mn later)	Active	- De-risking instuments - Concessional finance - Knowledge creation and sharing - Technical assistance - Capacity building	https://www.worldbank.org/en/country/chile/publication/green-hydrogen-to-support-a-green-resilient-and-inclusive-economic-development-in-chile https://projects.worldbank.org/en/projects-operations/project-detail/P177533
World Bank	Low-Carbon Energy Programmatic Development Policy Loan	India	2023	$1.5bn now and potentially $1.5bn later	Approved	Policy based lending (programmatic, in a series of two)	https://documents1.worldbank.org/curated/en/099062723011526290/pdf/P181032062f0960a0ab9b08dad2b10fa5f.pdf https://documents1.worldbank.org/curated/en/099060623092565311/pdf/BOSIB0342f50d505508c7803e3b35fb5c59.pdf

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