Unlocking the Hydrogen Economy: How Common User Infrastructure drives Project Bankability

A blueprint for Common User Infrastructure based on key case studies in MENA and Sub-Saharan Africa

Contents

Executive Summary

The global transition to a zero-emission hydrogen economy faces a critical barrier: bankability. While ambitious giga-scale projects hold the promise of energy security and transition to clean energy, many remain stalled, struggling to secure financing against immense upfront capital requirements and complex risk profiles.

This study explores the strategic role of Common User Infrastructure (CUI) - shared utilities such as power transmission, pipelines, water, storage, and port facilities. Drawing on key examples from the Middle East and North Africa (MENA) and Sub-Saharan regions, this report provides a strategic blueprint for structuring and implementing CUI.

As one of the two key factors for success, along with long-term offtake agreements, CUI is the indispensable key to unlocking these investments and making the hydrogen economy financially viable.

For resource-rich regions like the Middle East and North Africa (MENA), CUI is the essential bridge connecting their abundant and competitive renewable energy potential with the production and delivery of low-carbon molecules to both local industries and high-demand export markets.

It provides the robust, scalable backbone required to transform national hydrogen strategies into competitive economies. While the implementation of such shared infrastructure introduces its own technical, commercial and legal complexities, navigating them is not an option but a necessity.

A central insight is that the complexity of CUI can be deconstructed into three distinct categories of risk:

1. Traditional Risks: Standard challenges inherent to any large infrastructure project, for which legal precedents and solutions already exist.
2. Complex Risks: Traditional risks that are amplified by the multi-asset, multi-user nature of hydrogen hubs, such as "project-on-project risk".
3. Novel Risks: Hydrogen-specific challenges that require new, bespoke legal frameworks, such as ensuring product certification and managing state aid rules for export.

This framework allows developers and governments to design a CUI that directly addresses the investment challenge in three key ways.

First, by pooling the costs of capital-intensive assets, CUI dramatically lowers the investment hurdle for individual developers, making projects significantly more attractive to lenders and investors. Second, it functions as a powerful de-risking tool.

A well-governed CUI framework can isolate shared assets from individual project failures, effectively mitigating the "project-on-project" risk that could otherwise jeopardize an entire industrial hub. Third, it fosters a more dynamic and competitive market by providing open, non-discriminatory access, which enables smaller players to participate in developments that would otherwise be prohibitively expensive.

Ultimately, CUI should not be viewed as a simple efficiency measure but as a foundational prerequisite for a viable hydrogen market. It is the imperative that makes giga-scale projects bankable, secure and scalable, turning the promise of a global hydrogen economy into a tangible and financeable reality.

Highlights

The global green hydrogen economy is rapidly advancing, with the Middle East and North Africa (MENA) region positioned to become a key production and export hub. However, the transition from ambitious national strategies to operational giga-scale projects is hampered by unprecedented complexity and significant financial hurdles. Common User Infrastructure (CUI) is the essential blueprint for unlocking investment, improving project bankability and enabling the large-scale development required to build competitive hydrogen economies.

Common User Infrastructure, a foundational tool for bankability

- Common User Infrastructure (CUI) is a foundational prerequisite to address **project bankability.** By sharing capital-intensive assets like pipelines, desalination plants, and port terminals, CUI offers the **potential for lowering the upfront investment** required from individual developers, making projects far more attractive to lenders.
- The transition from "moving electrons" in renewables to "moving molecules" in hydrogen and derivatives production introduces a **new level of complexity,** making shared infrastructure indispensable for managing giga-scale developments.

A framework for navigating complexity

The complexity of CUI can be deconstructed into three manageable categories for assessing challenges across all critical domains – technical, commercial, financial, and legal – allowing for a more structured and effective project design:

- **Traditional Risks,** for which solutions are well-established.
- **Complex Risks,** like "project-on-project risk," which are known but amplified in a multi-user environment.
- **Novel Hydrogen-Specific Risks,** such as certification and state aid rules, which require new legal frameworks.

De-risking giga-scale investments

- CUI acts as a powerful **de-risking engine.** A well-structured CUI, with a ring-fenced legal entity, can isolate investors from "project-on-project risk," ensuring the failure of one developer does not cascade and threaten an entire hub.
- Governments play a decisive role in creating a stable investment environment through clear **regulatory design,** fair **tariff-setting,** and **transparent rules for access** and competition.
- Technical challenges remain, including **standardizing infrastructure** to accommodate proprietary technologies, designing for **modularity and staged expansion** as new projects gradually connect to the CUI, **managing renewable variability** and protecting intellectual property through robust information barriers.
- Financing the CUI itself presents a "chicken-and-egg" dilemma, requiring **innovative financing models** that blend private capital with multilateral support, especially in a market that is not yet liquid.

From regional vision to global reality

- Case studies in **Namibia, Oman, Morocco and Jordan** showcase diverse CUI models - from state-driven to fully private - each tailored to local financing conditions, geographical constraints and strategic priorities.
- For nations with physical limitations, like Jordan's limited coastline, CUI is not a strategic choice but a **geographical necessity** for enabling ambitious national hydrogen plans.

What is a CUI?

Common User Infrastructure (CUI) refers to a set of utilities or infrastructure that can be jointly developed and utilized by multiple stakeholders. In the Middle East and North Africa (MENA) region, the interest in CUI is emerging for electricity-derived renewable fuels, specifically green hydrogen and its derivatives. As new layers of complexity are added, going beyond simple upstream renewable energy projects, the case for common use infrastructure becomes more relevant.

The infrastructure becomes more complex, as power generation is complemented by a water infrastructure (desalination, transportation), electrolysis infrastructure, and derivative infrastructure (production or conversion, storage, transportation). The more complex the infrastructure becomes, the more beneficial are shared infrastructures, enabling projects to reduce costs and improve efficiency.

However, the hydrogen value chain brings with it specific risks that were not as prominent in renewable energy (RE)-only projects. This includes the challenge of sizing infrastructure for an uncertain market, managing intellectual property (IP) with information barriers in shared systems, and mitigating "project-on-project risk" where one developer's failure impacts others.

The lack of a legal or commercial template for a hydrogen CUI and the challenge of securing financing for a market that is not yet liquid are primary aspects to be considered in the CUI framework. These multifaceted challenges that arise - spanning technical, legal and financial domains - are what make the topic so complex and a key driver for developing this paper.

At this early stage, a single entity rarely possesses the capacity to independently develop the entire spectrum of required infrastructure. While exceptions exist, such as NEOM's integrated mega-project, giga-scale hydrogen hubs in Jordan, Egypt and Oman where multiple developers are involved can significantly benefit from CUI.

A collaborative approach facilitates optimal land and infrastructure utilization, contributing to substantially reducing capital expenditure. This unified approach prevents the duplication of essential facilities, ensuring sufficient space for a diverse set of projects and fostering the establishment of true giga-scale hubs with multiple participants.

From a governmental perspective, CUI frameworks present a significant opportunity to enable the creation of a structured ecosystem that accommodates new market entrants and maximizes value creation for the nation while safeguarding the interests of early movers.

Furthermore, this approach can also promote localization efforts, attracting a larger subset of companies, including smaller players. By strategically fostering CUI, MENA countries can establish robust and competitive green hydrogen economies, positioning themselves as key players in the global energy transition.

Developing CUI is not a novel concept, with well-established precedents having been implemented in the oil and gas industry. In prior instances, large, competing private entities would pool resources, either at their own initiative or at the behest of a State, to conceptualize, design, develop and operate a common infrastructure to meet the end goal of ensuring supply without generating any profit out of the infrastructure developed. Regulatory authorities ensured access to anyone willing to use the services of the infrastructure and bear the costs of the development and operation of such facilities.

Oil and gas pipelines

The oil and gas sector offers a precedent for common user systems, where upstream companies often have a pro-rata share in pipeline ownership and directly fund their development. This model can inform the structuring of hydrogen pipeline ownership to minimize project-to-project risk.

The Caspian Pipeline Consortium (CPC)

One of the prime examples of establishment of a common-use infrastructure, the Caspian Pipeline Consortium (CPC) (Figure 1) was founded based on the governmental agreements between Kazakhstan, Oman and Russian federation. In 1996, it was joined by eight private shareholders representing the interests of the world's major oil producer companies from seven countries.

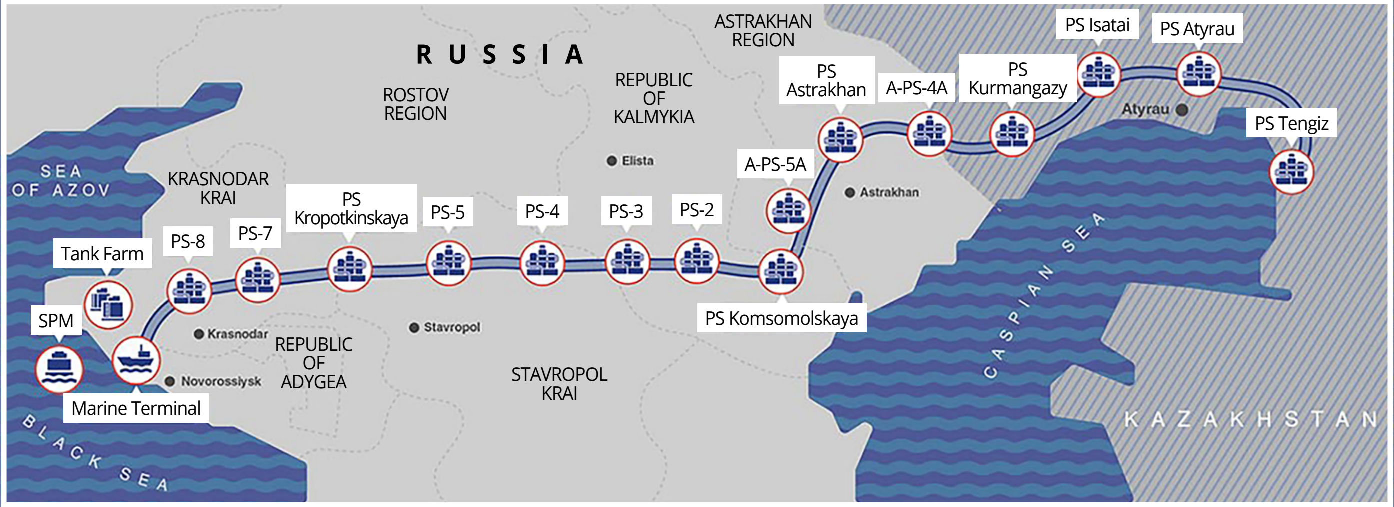


Figure 1: The Caspian Pipeline Consortium (CPC) pipeline route, showing its path from the Tengiz oil field in Kazakhstan to the Novorossiysk sea terminal in Russia.

The pipeline serves as an important oil transportation route in the Caspian-Black Sea region. The construction started in 1999 and was completed in 2001. The 1,510 km pipeline had initial design capacity of 28.2 MMTA which was scaled to 67 MMTA in 2009. The expansion plan required a shareholder agreement addressing all key organizational, technical, financial, and commercial details.

A common-thinking approach in the renewable energy industry

In the past, renewable energy projects were often developed by a single entity on a dedicated site to serve a specific purpose, such as feeding power into the national grid. These projects had their own, self-contained infrastructure model that, while effective, did not fully leverage the potential for scale and collaboration. The establishment of a common planning framework for renewable giga-scale projects in the MENA region can be seen as the first step that would lead today to the emergence of the Common User Infrastructure (CUI) concept for hydrogen projects. The basis for this approach was sharing basic utilities and optimizing land use to reduce costs and improve efficiency.

The Benban Solar Park in Egypt is a prime example of the start of CUI evolution: a centralized approach focused on shared electrical infrastructure and land management for a group of independent developers[1,2]. The Egyptian government divided a large desert area into 30 individual plots and allocated them to multiple developers through a Feed-in Tariff program. Subsequently, through the Egyptian Electricity Transmission Company (EETC), four new substations were developed and the entire park connected to an existing 220 kV transmission line. A "Facilities Management Company" was appointed to manage these common facilities and ensure the implementation of environmental, social, health and safety standards for the entire complex.

A similar approach was taken in the Ma'an Development Area in Jordan where multiple individual projects have been co-located taking a centralized approach. Jordan also provides an early example of scaling approach through the Seven Sisters case study[3]. The project involved seven solar photovoltaic (PV) projects with a total capacity of 102 MW, with projects ranging in size from 10 to 50 MW. To overcome the lack of scale and high transaction costs for these small projects, the IFC aggregated them into a single financing program. This programmatic approach, based on standardized documentation and a "one size fits all" principle, made the projects more attractive to investors and allowed developers to share costs and resources.

Why is CUI essential for green hydrogen projects?

The advent of the 2020s brought a heightened urgency to defossilize, a movement built upon the foundations of the Paris Climate Agreement and dramatically accelerated by two key factors: the economic crisis arising from the COVID-19 outbreak and an increasingly unstable geopolitical landscape that underscored the need for energy independence. Major economies like the European Union, Japan, South Korea and Australia have been at the forefront, championing low emission hydrogen as a key de-fossilization solution.

Their leadership has catalyzed a global trend and to date, about 70 countries have adopted national hydrogen strategies[4], with projects actively being developed in most of them[1]. Joining this push, several countries in the MENA region have emerged as pivotal players, launching ambitious national strategies of their own. These countries are leveraging this potential not just for domestic industrial use but also to become major energy exporters to markets like Europe[5].

The establishment of Common User Infrastructure (CUI) is a crucial step to accelerate hydrogen developments. By providing shared, capital-intensive infrastructure, CUI lowers project costs and enables smaller developers to participate, effectively transforming projects on paper into reality. Furthermore, by fostering a green hydrogen economy, CUI allows countries to increase their energy security and independence by reducing their reliance on fossil fuels.

1. Improving bankability to unlock investments

The urgency for CUI is also rooted in the bankability challenges facing the nascent green hydrogen market. Projects often struggle to secure funding due to the complexity of off-take agreements and the overall regulatory environment. CUI addresses this directly by allowing developers to share costs and resources, which is critical for projects with high capital expenditure requirements. By providing shared infrastructure, CUI directly improves project bankability and makes these capital-intensive projects more attractive to lenders and investors, thereby helping the market move from paper projects to reality.

2. Reducing the Levelized Cost of Hydrogen

A primary driver for CUI is its direct impact on reducing the overall cost of production. By developing shared, large-scale infrastructure, projects can leverage significant economies of scale and avoid the massive capital expenditure associated with redundant, project-specific facilities. For example, building a single large desalination plant or pipeline system is far more cost-effective than constructing multiple smaller ones.

Furthermore, the CUI's ownership structure has a material impact on its operating cost. When project developers are also joint shareholders in the CUI, they have a clear incentive to operate it on a cost basis, avoiding extra profit margins. In contrast, if a third party owns the infrastructure, it will seek a return on its investment, which can increase costs for users.

This unified approach prevents the duplication of essential assets, optimizes resource utilization, and ultimately lowers the Levelized Cost of Hydrogen (LCOH). Achieving cost competitiveness is critical for making green hydrogen a viable alternative to grey hydrogen, whose low cost is due to a lack of a price on CO_2 emissions and a history of subsidies for fossil fuels[6].

[1] The precise number of countries with a national hydrogen strategy varies depending on the source and counting methodology. This report's figure is based on trackers from the IEA and Columbia University's CGEP, which count 65-69 officially adopted national strategies. Higher figures often include regional plans (e.g., counting the EU strategy for each member state), strategies that are still in draft form or national objectives that have not yet been formalized into a dedicated strategy document.

3. Overcoming geographical and resources constraints

A geographical imbalance exists between where clean fuel is needed and where it can be produced affordably. While major economies have the demand, regions like MENA have the abundant solar and wind resources for cost-competitive production. This challenge is often compounded by physical constraints at the national level, such as limited land or access to the sea.

Jordan serves as a prime example: despite ambitious plans, its 27 km coastline creates a bottleneck for all desalination and export activities. For countries facing such limitations, CUI is not just a strategic choice but a geographical necessity. It enables an optimal approach to planning and development, ensuring that critical resources like land and water are managed efficiently through a common framework that can include shared desalination, pipelines, and export terminals.

Different countries must tailor their CUI strategy to their unique competitive advantages and constraints. As Figure 2 illustrates, there is no single solution; the physical geography and resource availability of a nation directly shape the design of its green hydrogen clusters.

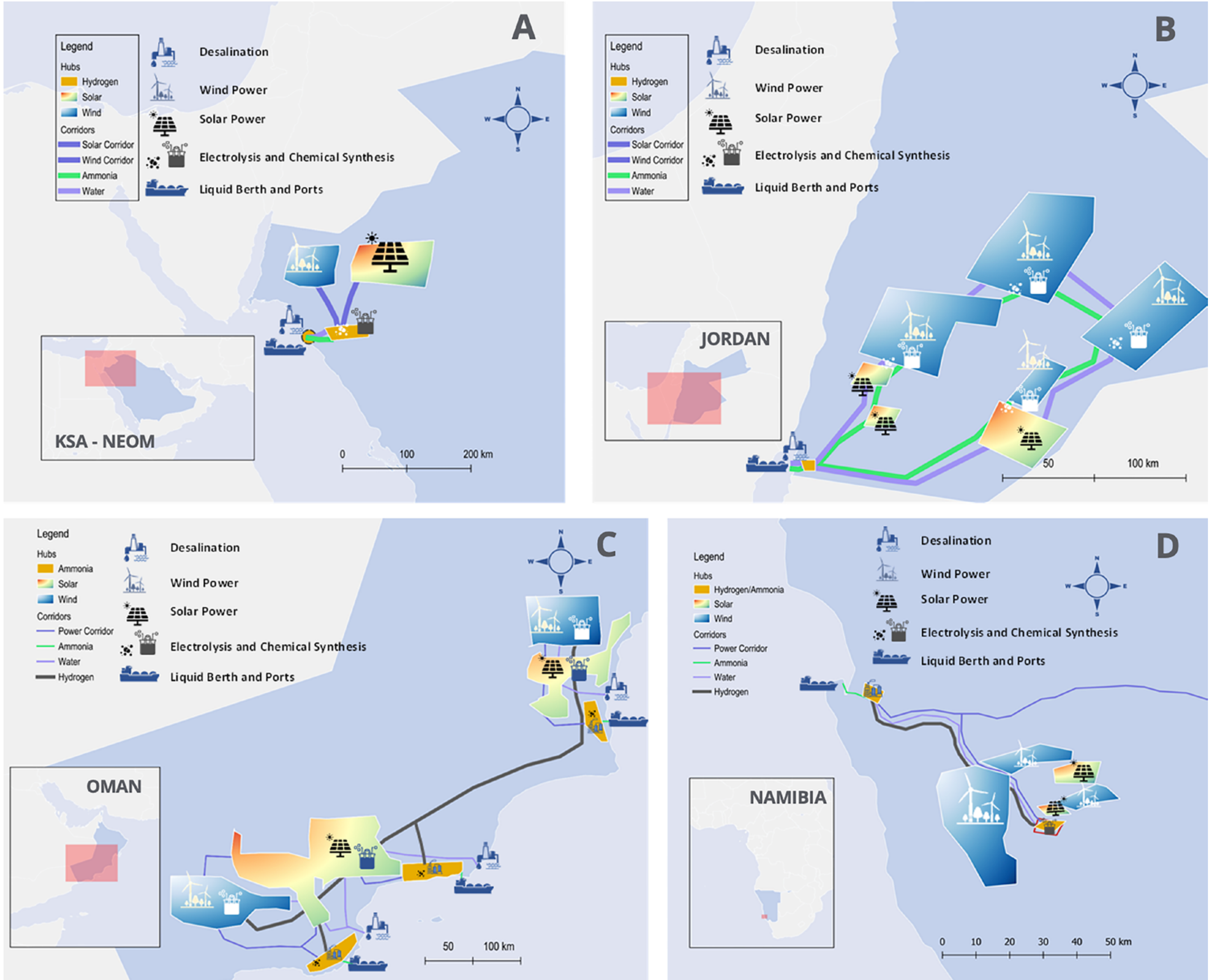


Figure 2: Overview of different set up for green hydrogen cluster depending on the physical geography and resources availability in different countries (A) KSA – NEOM Green Hydrogen Project[2]), B) Jordan, C) Oman and D) Namibia – Hyphen project. *Source: ILF Consulting Engineers.*

[2] Although NEOM is not to be considered a CUI as it is developed by a single entity (owned by three main shareholders), it is a key example to include because it demonstrated the development of a fully integrated project.

Technical overview of CUI in Green Hydrogen developments

CUI is seen as a crucial enabler for the movement of green hydrogen in the derivatives, which will need to be transported globally just as hydrocarbons have been. In this context, there is a need for the build-out of new infrastructure, part of which can be optimized through the development of shared facilities across the entire value chain.

The first consideration for CUI in green hydrogen development is the need for a common masterplan to outline the overall planning of the hub, making sure to involve all players. This masterplan would highlight the individual components in the upstream and midstream that can be developed as Common User Infrastructure.

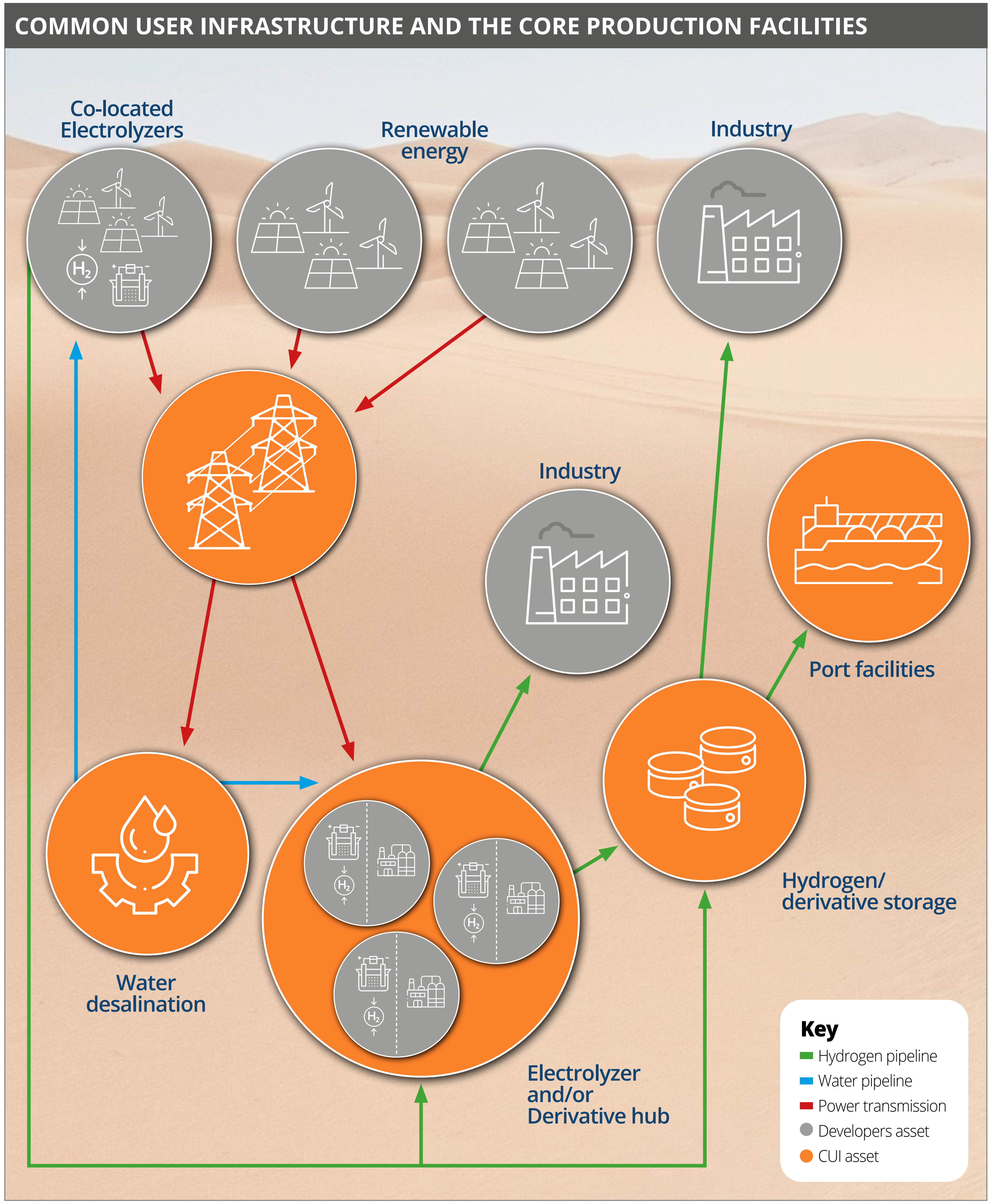
These would typically include:

- Power transmission
- Hydrogen transmission (midstream)
- Ammonia/derivatives transmission (midstream)
- Water supply and desalination
- Hydrogen conversion facilities (where feasible)
- Hydrogen and derivative storage facilities
- Export/import infrastructure

Generally, the components that are unlinked from specific technology choices can be optimized, making them strong candidates for shared infrastructure. In contrast, core processes such as electrolysis and ammonia production are generally not suitable for common development and are handled instead by individual project developers.

This is primarily due to the diverse technological choices developers make and their integration can vary significantly depending on the underlying technical choices. For instance, the strategy for procuring and managing electrolyzers is highly dependent on the upstream renewable energy plants, leading to considerable customization in terms of quantity, size and operational management. Furthermore, developers often consider hydrogen or ammonia production their core business and are reluctant to share proprietary technologies or specifications with competitors.

The nature of concessions, where different developers may win tenders for sequential phases, also supports the justification for independent core processes. Therefore, while common infrastructure can streamline accessory activities, the core production units remain distinct for each player.



This infographic illustrates assets typically developed as Common User Infrastructure (CUI) (shown in color) and the core production facilities that remain within the scope of individual project developers (shown in grey). The diagram also visualizes different hub configurations. For example, renewable energy can be transmitted over long distances via a shared grid ("moving electrons") to a central production hub, or hydrogen can be produced at co-located renewable sites and transported via a common pipeline ("moving molecules") for final processing. *Source: ILF Consulting Engineers.*

POWER TRANSMISSION SYSTEM

The common aspects of power transmission (Figure 3) relate to substations, the cabling and interconnectors between different renewable plants (solar and/or wind) and the other facilities (e.g. electrolyzers, hydrogen production plants etc). A significant challenge in developing these networks is the land required for routing corridors, which can be 60 to 90 meters wide depending on the power capacity.

The intermittency of renewables also poses challenges for grid balancing and load management - particularly when the CUI operates as an isolated system disconnected from the national network - necessitating key hardware like energy storage and specialized control systems.

As a result, critical investigations are needed into network topology (e.g., ring vs. radial systems), and this added complexity can lead to higher operational costs and transmission losses. For powering electrolyzers, developers may have proprietary models for optimizing power sourcing, so information barriers are needed to manage IP risk in a shared transmission approach.

Recommendations for CUI development

The CUI can involve integrating a dedicated power corridor into existing networks or creating a new, independent grid. Grid interconnectivity with conventional networks is also possible, provided that the system can handle large amounts of renewable electricity without significant reinforcement and that end-use certification requirements for green molecules are not violated. Regardless of the approach, regulatory compliance and detailed environmental, social, and safety studies are essential.

The construction schedule must be meticulously planned to ensure the grid is operational when the green molecule production facilities are ready to start up.

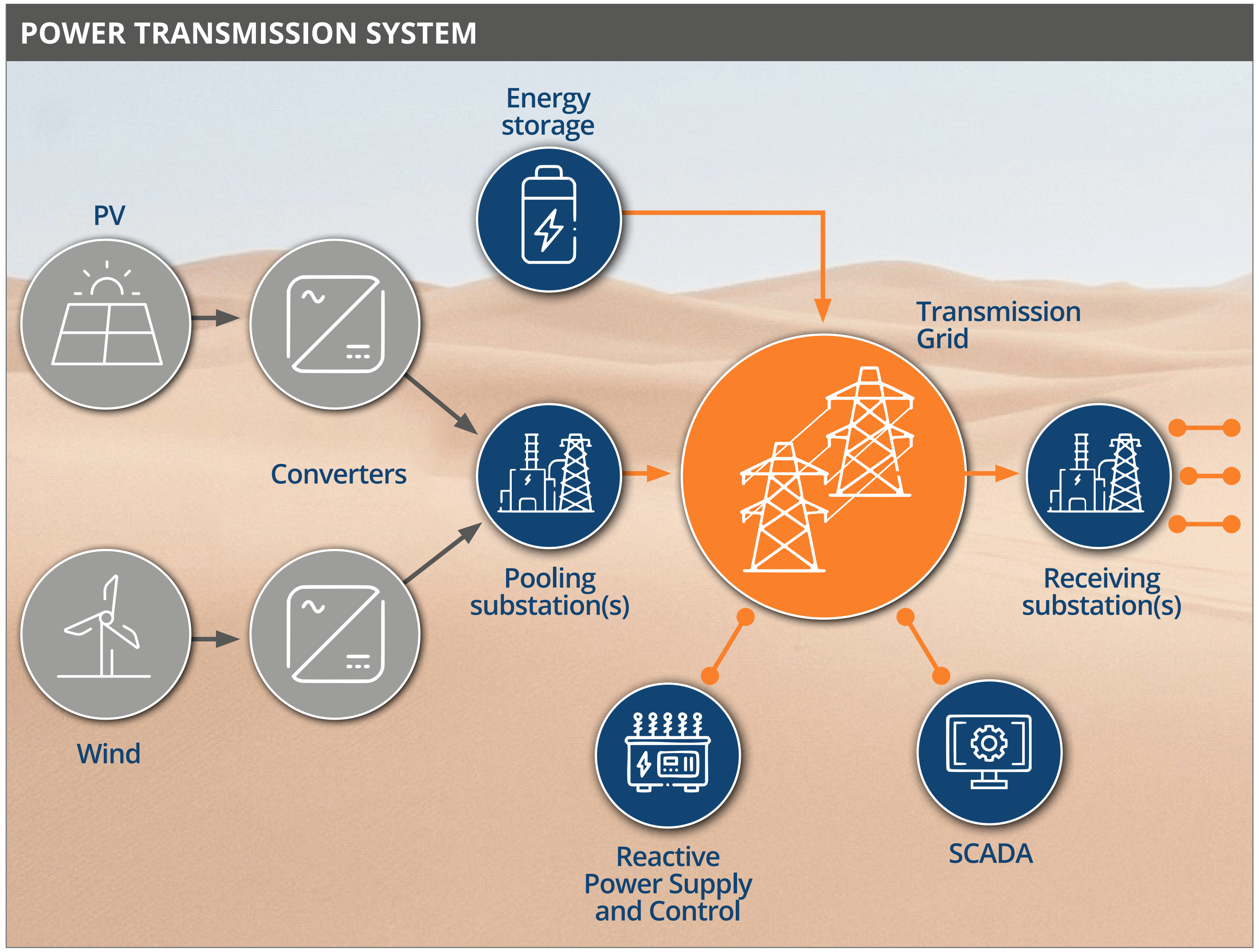


Figure 3: Overview of the system and components of power transmission required for a CUI development.

HYDROGEN TRANSMISSION SYSTEM (MIDSTREAM)

Hydrogen transmission systems require several infrastructure components (Figure 4): a water pipeline to supply electrolyzers co-located with renewable power sources and a hydrogen pipeline network that carries compressed hydrogen to a central hub. A separate, lower-level power grid also supplies electricity for derivative production and other needs.

The hydrogen network can also act as a linepack, leveraging volumetric storage to manage the variability of renewable energy production. While hydrogen pipelines offer high energy transmission capacity, they have a lower volumetric energy density than natural gas, requiring more frequent and energy-intensive compression stations. These systems, which include valve stations and in-line inspection capabilities, must be designed to mitigate safety concerns like leaks and material embrittlement, which adds to the maintenance costs, particularly for refurbished pipelines. A high investment CAPEX is a key challenge, with economies of scale only achievable at very high capacities. However, these systems have lower operational costs and require a smaller land corridor compared to power transmission networks.

Recommendations for CUI Development

Based on the project requirements, existing natural gas pipelines can be refurbished or new pipeline systems built entirely for hydrogen transmission.

In case of refurbishment, natural gas transmission system operator could oversee the development and transition process of the hydrogen pipeline, leveraging their expertise. A separate commercial structure entity would handle the development of the power transmission system and water supply backbone necessary for derivative production and electrolysis, respectively.

For new hydrogen pipelines, the new system (pipeline and compressor stations) could be packaged with water pipeline and power transmission networks as CUI. A single commercial structure could oversee the entire development, ensuring timely completion and budget adherence. Since pipelines are non-modular and benefit from economies of scale, it is crucial that development plans align at specific phases. To be noted, that hydrogen transmission at pilot-scale project level is not cost-effective when compared to power transmission alternative. Therefore, it is pertinent to converge green hydrogen hub development plans to obtain the greatest economic benefit of hydrogen pipelines and ensuring better techno-economic performance.

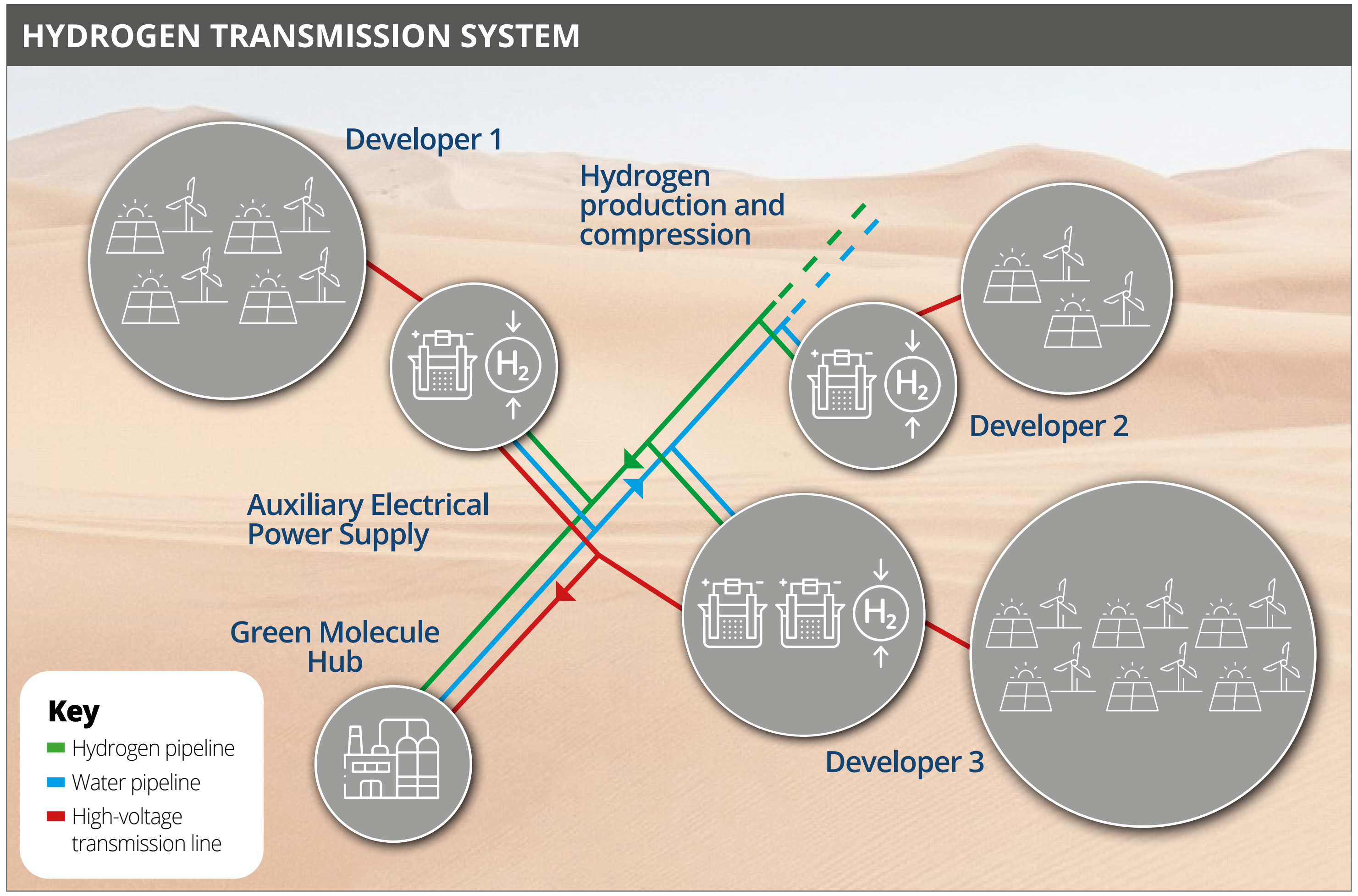


Figure 4: Overview of the hydrogen transmission system in the context of CUI for green hydrogen development. *Source: ILF Consulting Engineers.*

AMMONIA TRANSMISSION SYSTEM (MIDSTREAM)

An ammonia transmission system (Figure 5) simplifies network requirements by co-locating electrolyzers and ammonia facilities with renewable energy generation plots, removing the need for high-voltage transmission networks and corridors. Desalination plants supply water for both electrolysis and process cooling in ammonia synthesis. For transportation, key components include a pipeline system, booster pump stations, and valve stations. Examples like the US Corn Belt Pipeline and the Togliatti-Odessa Pipeline demonstrate its long-distance transport viability.

Compared to hydrogen, ammonia pipelines offer greater cost efficiency, especially when large-scale hydrogen storage isn't practical[7]. Pumping ammonia also requires less energy than compressing hydrogen, which helps reduce capital costs. For instance, a study from the Institute for Sustainable Process Technology (ISPT) found that a safe, compliant ammonia pipeline for the Delta Rhine Corridor would cost an estimated €2.1 billion, with transportation costs estimated at €0.5 per tonne of H_2 per km, which is similar to costs estimated for the European Hydrogen Backbone study[8].

Key challenges for ammonia transmission include ensuring pipeline safety, selecting appropriate materials and managing the logistics of transporting large ammonia synthesis reactors. The toxicity and corrosiveness of ammonia necessitate strict safety protocols and specialized materials.

Recommendations for CUI Development

Detailed studies on a dedicated ammonia pipeline backbone have not been conducted, as the benefits only become clear at a very large scale, similar to hydrogen. Due to safety rules that limit the volume of ammonia between valves, a single large pipeline "backbone" is challenging to scale. A more flexible and economical alternative for a Common User Infrastructure (CUI) is to build individual, scalable ammonia lines as demand grows. This approach is more adaptable for smaller capacities compared to hydrogen pipelines.

A simplified commercial structure is possible since the system primarily involves the ammonia pipeline, a water intake system and a central storage hub. Developers must coordinate their plans and work with host governments to address all regulatory, technical, environmental and social aspects. This is crucial for building the consensus needed to support further studies and for generating the initial results. The commercial structure for this type of project is also less complex than for hydrogen or power networks, as fewer entities are involved.

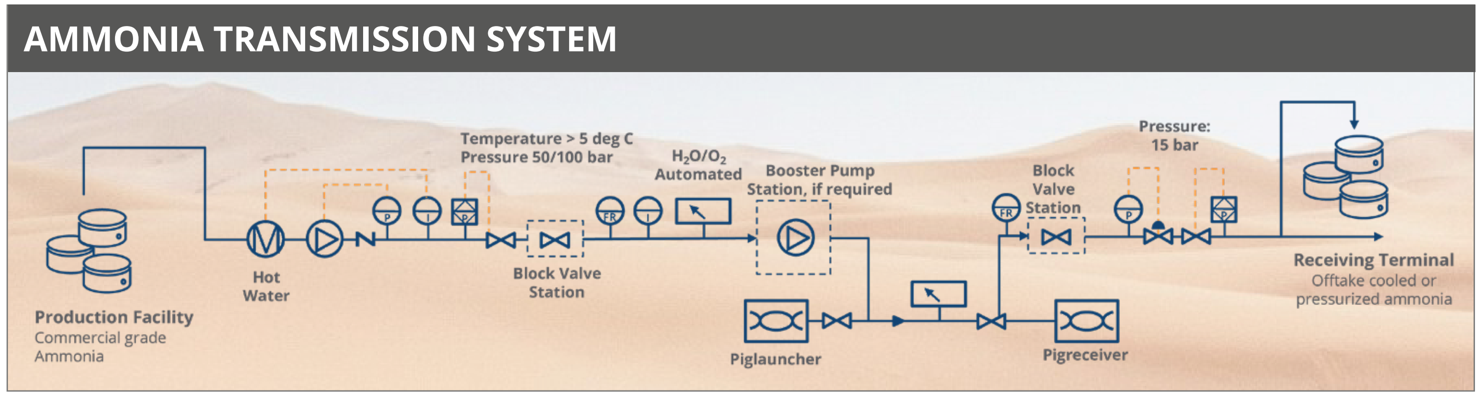


Figure 5: Overview of an Ammonia Transmission System. *Source: Institute for Sustainable Process Technology. See Figure 8 for more.*

WATER SUPPLY AND DESALINATION SYSTEM

Water supply and desalination systems, though a small part of the total cost, are crucial for CUI, particularly in regions like MENA where water must be desalinated for electrolysis. Building one large, shared desalination facility is far more efficient than building multiple smaller ones.

This is because a single large plant leverages economies of scale to lower costs, allows for more strategic and efficient land use and simplifies the management of brine discharge, a key environmental concern.

This is particularly relevant in water-scarce regions like MENA, where a single centralized plant can also be designed to supply desalinated water to other users, such as local communities and industries, expanding the economic and social benefits of the CUI beyond the hydrogen sector.

Reverse osmosis (Figure 6) is a mature and proven technology for desalination. However, detailed feasibility studies are still needed to ensure the water quality is suitable for transmission to green hydrogen production sites. A final water purification step is also required at the production site just before the water is used in the electrolyzer. This final purification system can also be part of the CUI.

Recommendations for CUI Development

The entire water system package, including water intake, water desalination, treatment and transportation could be under a single commercial structure. This structure could include interested developers and host country governments through a Public-Private Partnership (PPP). This approach ensures that both initial and future developers have equal access to the water supply infrastructure.

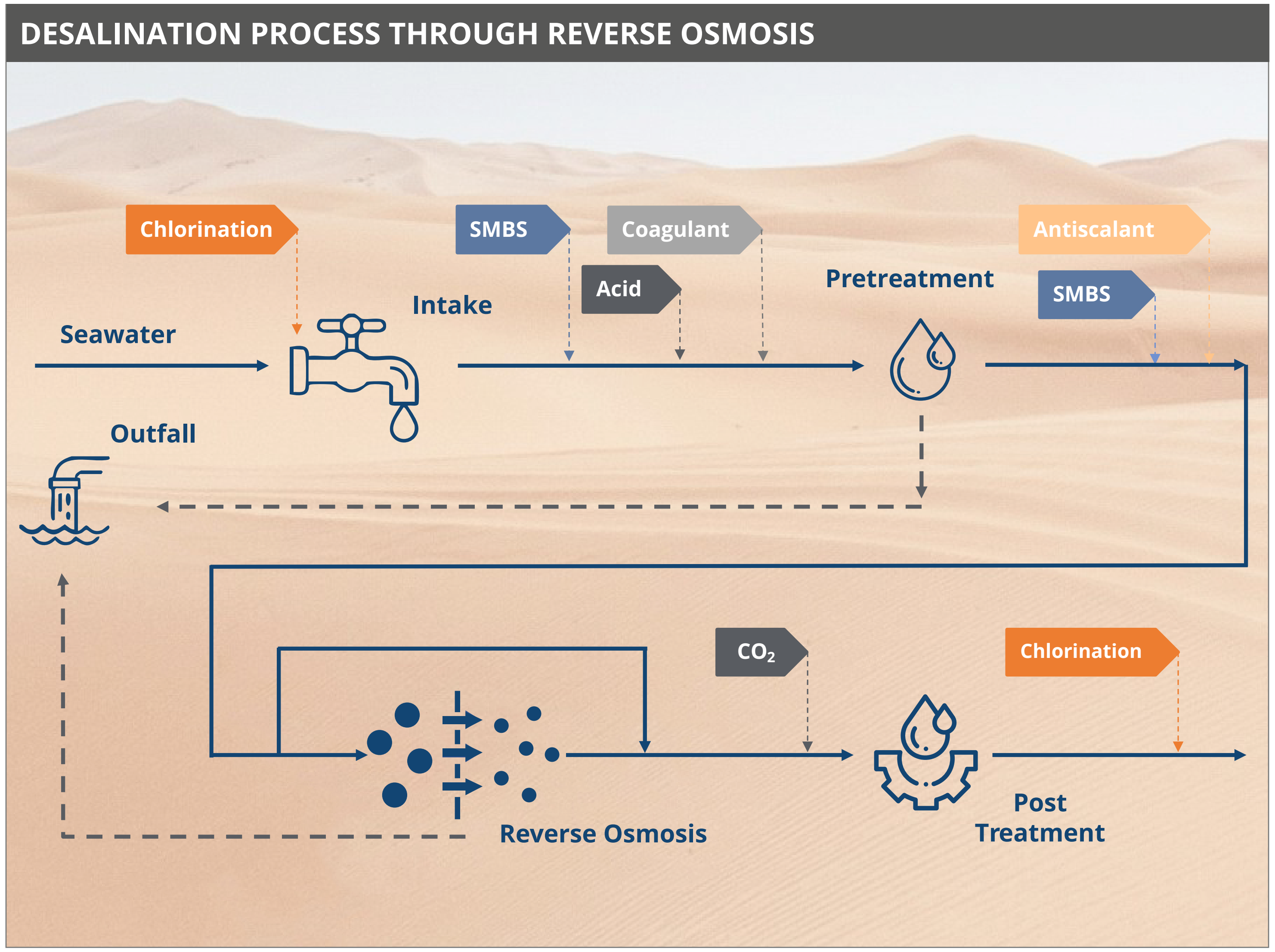


Figure 6: Overview of the desalination process through reverse osmosis. *Source: ILF Consulting Engineers.*

HYDROGEN AND AMMONIA STORAGE FACILITIES AND EXPORT/IMPORT INFRASTRUCTURE

Storage and export/import infrastructure for hydrogen and its derivatives (such as ammonia, e-methanol, sustainable aviation fuel (SAF)) can be a common asset at both production and receiving terminals (Figure 7). At ports, a single terminal with shared components like loading arms and dedicated berths is a reasonable common asset, as it helps overcome physical space constraints.

A port infrastructure is complex, and given its strategic importance, it is well suited for a CUI. With the consent and participation of port authorities, a CUI model can be used to finance, build and operate these facilities, charging developers requisite fees for their use.

Recommendations for CUI Development

Developing port infrastructure for hydrogen and its derivatives can be a major hurdle. To manage this, port development could be financed through national budgets, as long as developers provide a strong business case with committed export quantities and off-take contracts.

A Public-Private Partnership (PPP) model is also a viable option. The PPP model is particularly effective for this type of CUI, as it leverages the expertise and capital of private companies while maintaining governmental oversight of a strategic asset.

STORAGE FACILITIES AND EXPORT/IMPORT INFRASTRUCTURE

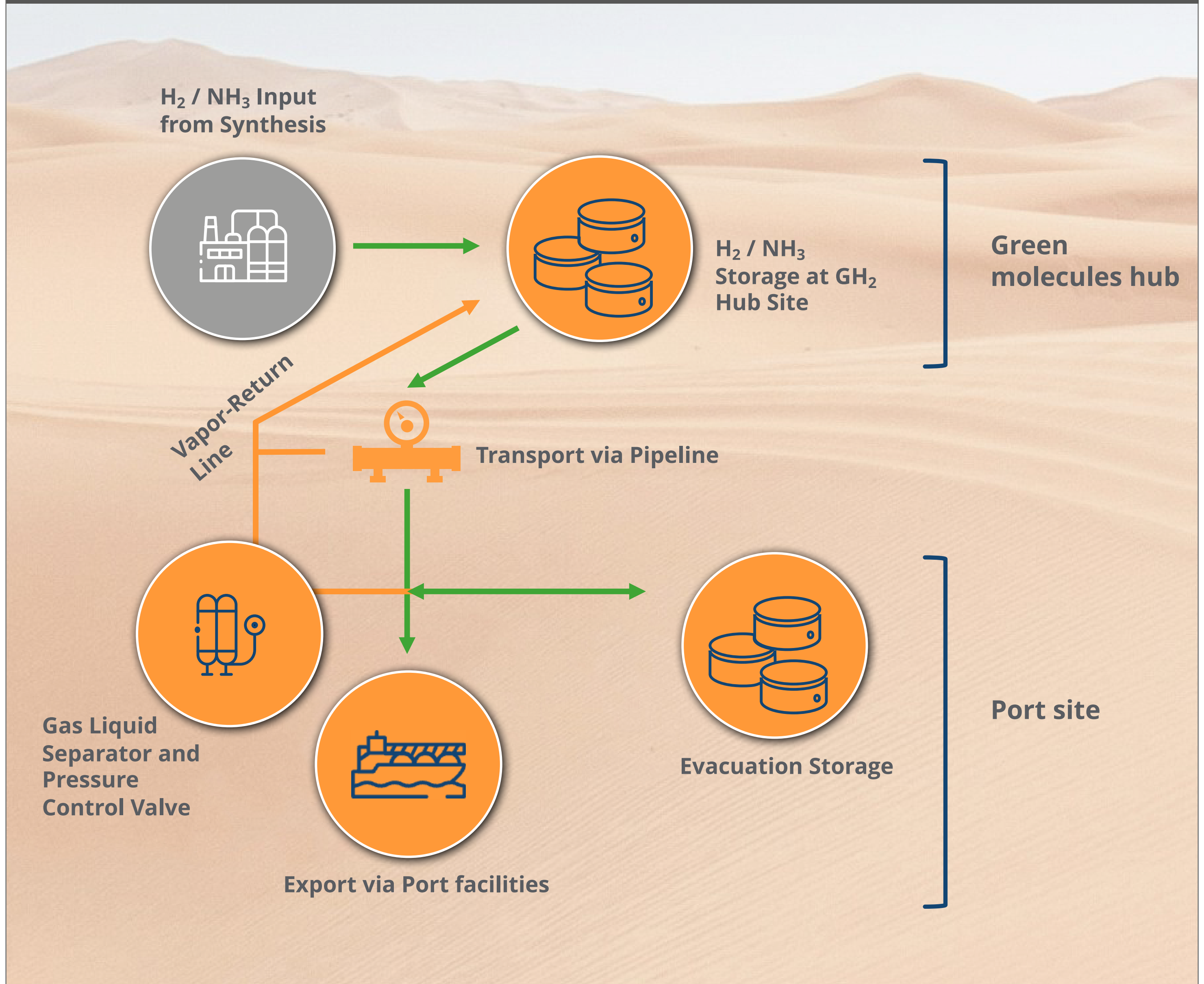


Figure 7: Overview of the storage facilities and export/import infrastructure.

Examples of design archetypes for green hydrogen hubs

A single, standardized architecture for Common User Infrastructure (CUI) does not exist. Its design must be tailored to specific factors such as geographical constraints, government requirements, and developers' business choices. To understand how these archetypes are formed, it is useful to first break down a green hydrogen hub into its primary infrastructure components. The following diagram (Figure 8) illustrates these key CUI building blocks and the principle options available for each, from initial energy transmission to final export.

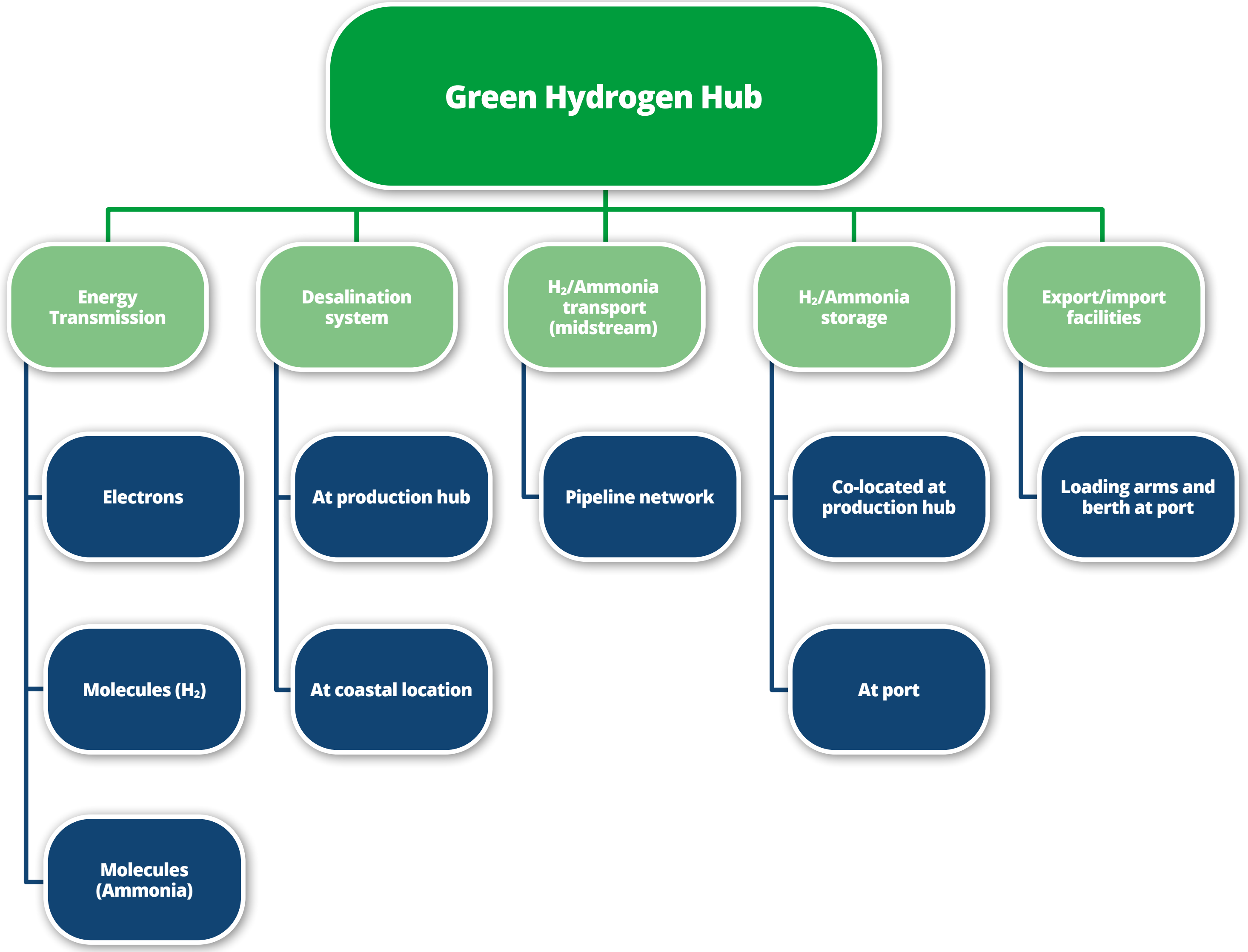


Figure 8: Overview of Common User Infrastructure (CUI) components for a Green Hydrogen Hub.

Next we provide examples of archetypes (Figure 9) that can be envisaged for the hub arrangement within a CUI development based on the location of electrolyzers and the presence or not of ammonia/derivative synthesis reactors:

1. Archetype 1: Moving Electrons to a Green Hydrogen production hub

NEOM Green hydrogen project has been implemented using this archetype (although built by a single developer). In this model, renewable electricity is transmitted to a single, integrated hub on the coast where all production and conversion steps take place. NEOM Green hydrogen project has been implemented using such an option. A CUI was not required as the development is contained within a single entity.

- Renewable energy is pooled into collecting substations and electrons are transmitted via an AC grid (less than 1000 km) or DC grid (greater than or equal to 1000 km).
- Electrolyzers and chemical synthesizers are located close to the coastline with a desalination plant providing water supply.
- Product storage is centralized at the hub and is used for dispatching and loading on to ships via a dedicated liquid-handling berth.

2. Archetype 2: Moving Hydrogen to a Green Ammonia production hub

Project HYPHEN in Namibia and developments in Oman under Hydrom are being implemented under this option.
In this archetype, electricity is converted to hydrogen at the renewable energy sites. The hydrogen gas is then transported to the coast for final processing.

- Electrolyzers are co-located with renewable energy production.
- A transmission network connects the power production units (from RE sources) to a hub substation (for ammonia synthesis).
- Water supply from a desalination plant is transmitted via water pipeline backbone up to the hydrogen production sites.
- Hydrogen is collected into a transmission backbone to a centralized hub location for green ammonia or derivative synthesis.
- The derivative production hub can be built as individual units for each developer or merged into a single production facility as ammonia reactors offer economy of scale benefits, that can be leveraged for cost optimization.
- A connecting link to the port then is used for exporting ammonia directly.

3. Archetype 3: Co-located Production with Ammonia Pipeline

This option could be an alternative solution for Jordan, where project developers are still in their initial stages of concept planning.

- RE production, electrolyzers and ammonia or derivative production are co-located (no transmission network).
- A water pipeline backbone sources desalinated water to the energy production sites.
- A single ammonia pipeline backbone (or multiple pipelines depending on throughput) transports ammonia to a centralized storage hub.
- A connecting link to the port then is used for exporting ammonia directly.

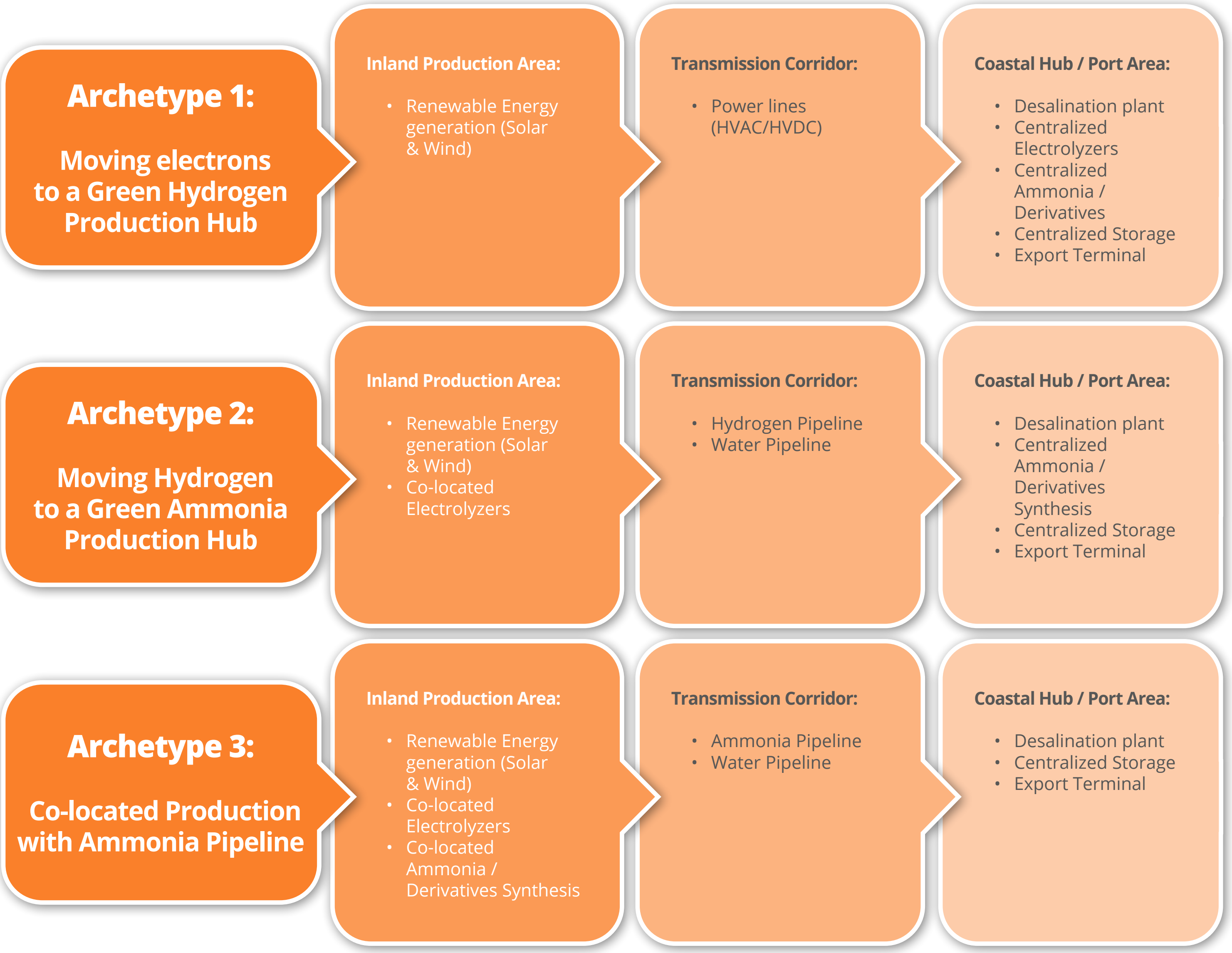


Figure 9: This flowchart compares some models for hub development, showing the different infrastructure arrangements based on whether electrons, hydrogen, or ammonia is transported from inland production areas to coastal export facilities.

Navigating the complexity of Common User Infrastructure

A CUI is normally conceived as shared, ring-fenced infrastructure that lowers project risk, reduces unit costs through pooling, and minimizes the environmental footprint while allowing orderly and potentially staged expansion.

Typically, a CUI is centrally orchestrated, either by a master developer or a government organization, and the ownership and operation of CUI is shared between multiple parties, usually including the developers / users / customers of the entire project development. Its implementation presents a complex interplay of commercial, legal, and technical considerations.

This section provides an overview of the technical, commercial and financial aspects to consider while designing a CUI. A subsequent chapter will then delve into the critical legal and regulatory aspects. Finally, the report will present practical case studies from Namibia, Oman, and Morocco to illustrate how these elements are being addressed in real-world projects.

Technical Aspects

Implementing a Common User Infrastructure requires careful consideration of several key technical challenges to ensure its long-term viability and efficiency.

Unlike traditional, single-purpose infrastructure, the CUI for green hydrogen is a novel concept that must address the complexities of integrating diverse technologies, managing fluctuating renewable energy sources, and providing a scalable framework for multiple developers.

Sizing, scalability and timing: The intertwined challenges of sizing, scalability, and timing create a fundamental "chicken-and-egg" dilemma for developing a CUI. The infrastructure must be operational and ready for the first anchor project, yet the long-term demand from future users remains uncertain and makes sizing common infrastructure, such as pipelines, particularly difficult. Investment often needs to be made for a maximum initial capacity, which may take years to fully utilize before a second phase is considered. While modularity is an attractive concept, practical implementation can be challenging for assets like pipelines, where initial excavation costs are significant.

Technology standardization: A CUI must serve multiple developers who use a variety of electrolyzer technologies, many of which are proprietary. Designing a CUI that is flexible enough to accommodate different technical needs is complex and costly. To mitigate this, some level of standardization could be considered - for example, establishing common standards for the power quality delivered to electrolyzer clusters. This would allow developers to select appropriate connection technologies while operating within a predictable framework.

Information barrier protocol for IP Risk: Developers often use proprietary algorithms and operational models to maximize their efficiency. When sharing infrastructure like power transmission, they face a significant risk to their intellectual property, the so-called "IP risk". To address this, the CUI operator must establish a robust information barrier protocol. This framework ensures that sensitive operational data from one developer cannot be accessed by another, guaranteeing IP protection and fostering trust in the shared system.

Variablility of renewables vs. Electrolyzer stability: Synchronizing renewable energy production with operational needs of electrolyzer is a notable challenge. Electrolyzers perform most efficiently and have longer lifespans with a stable power supply, whereas a constant ramping up and down due to variable wind or sun can degrade their performance over time. Two primary solutions exist, each with trade-offs. Co-located batteries can provide a stable, predictable flow of power, but their high capital cost can impact the commercial viability of a project. Another option is to use the national grid to "top-off" power and smooth out variability, though it may require careful consideration to ensure the hydrogen produced remains classified as "green" in chosen certification regimes.

Commercial Aspects

A robust CUI framework is built on the principle of transparent, non-discriminatory access for all developers. The operating rules must be designed to prevent project dependency, ensuring that a default by one party does not impact others. This deliberate design is crucial for mitigating intercreditor risk and allowing separate financing packages to coexist without complex cross-negotiations. Ultimately, clear responsibilities, established operating standards, and sound governance are essential to mitigate physical risks to the shared system.

Commercially, the CUI model relies on open access, clear accession rules, and a governance structure that isolates shared assets from individual project risks.

Bankable Legal Structure: A key challenge is establishing a legal structure for CUI that is bankable and allows open access for new entrants. This means future developers should be able to enter the shareholder structure and access infrastructure proportionally. However, this flexibility for future users must be balanced with sufficient contractual obligations from anchor projects at the outset. Lenders require this predictability of cash flow to finance the CUI in the first place. Countries across the region are finding different solutions, also depending on the financing structure behind the CUI. In fact, international financing institutions may be hesitant when there is state equity in private investments, making the management of state shares a delicate phase. More details on legal aspects are discussed in the following section "Legal and regulatory aspects".

Risk Allocation: Effective risk allocation is crucial, ensuring risks are borne by the party best equipped to manage them. Public sector counterparties may need to act as a "backstop" to mitigate risks where private developers are not fully committed, though the ability to do so is often constrained by the financial limitations of the sovereign government. Interdependencies between projects, particularly when an upstream failure impacts downstream operations (project-on-project risk), require careful liability frameworks. Mitigations, such as investing in buffer storage, come with costs that need to be balanced with the resulting tariff to ensure CUI remains attractive.

Focus: Project-on-Project Risk

In hydrogen CUIs, the performance of one project (e.g. an electrolyzer facility, transmission line, or export terminal) may directly affect others using shared infrastructure.

This "project-on-project risk" is a well-known issue in LNG and pipeline projects but becomes more acute in hydrogen due to the greater number of interdependent assets and the early-stage maturity of host-country regulatory regimes.

From a legal and contractual angle, managing project-on-project risk is about ensuring that shared infrastructure remains bankable despite interdependencies. This requires robust ring-fencing, carefully drafted access agreements, allocation of construction delay risks, and in many cases regulatory backstopping to provide stability.

Key Issues and Challenges

- **Construction delay risk:** Delays in one component (caused by funding gaps, slow permitting, regulatory bottlenecks, or government decision-making) can postpone the commissioning of shared infrastructure and undermine the bankability of other linked projects.
- **Throughput risk:** If one producer under-delivers, pipeline or terminal capacity is underutilized, raising tariffs for others.
- **Default contagion:** A user's insolvency or contractual default can disrupt the financing base of shared assets.
- **Operational risk:** Technical failures (e.g. contamination of a hydrogen stream) may compromise the infrastructure for all users.
- **Intercreditor complexity:** Multiple lenders financing different projects must coordinate in case of cross-defaults.
- **Quiet enjoyment:** Each user must be legally insulated from the risks of others to maintain bankability.

Possible Solutions

- **Ring-fenced SPVs:** Separate AssetCo/OpCo structures isolate infrastructure risk from individual project risk.
- **Access contracts with step-in rights:** Regulators or lenders can "step in" to replace or support a defaulting or delayed user to preserve continuity.
- **Take-or-pay obligations:** Contractual commitments by users to pay for reserved capacity regardless of offtake ensure minimum revenue.
- **Intercreditor agreements:** Coordinated frameworks among lenders to manage defaults, delays, and protect project cashflows.
- **Construction scheduling and conditions precedent:** Legal frameworks can stage commissioning to avoid one delayed component holding back others, with defined remedies if government approvals or counterparties lag.
- **Insurance and indemnities:** Policies covering construction delays or third-party disruption can mitigate contagion.

Financial Aspects

Projects often face challenges in securing funding due to the complexity of off-take agreements and the overall regulatory environment. It is common for projects to involve consortia, often led by large energy or utility organizations, with multiple shareholders including developers and off-takers. In parallel to the legal aspects involved in setting up a bankable legal structure, a key challenge is ensuring the financial viability of CUI.

In this specific case, where we investigate green hydrogen shared infrastructure in emerging markets such as the MENA region, it is likely that commercial banks will be unwilling to take on the market risk and therefore the lenders will be multilateral institutions (IFIs). These financial institutions are mandated to finance projects in emerging markets and as such are built to take on some of the country risk and market risk, provided that the technology financed is proven and commercially viable. It is also important to remark that while the cost of capital is higher in these markets, superior local resources i.e. renewables in the specific case of green hydrogen, can still make projects financially competitive.

Three main financing models exist for Common User Infrastructure: state-owned, private-owned, and a hybrid Public-Private Partnership (PPP) model. The choice of model determines the ownership structure and financing approach, as detailed in Table 1.

TABLE 1: COMPARISON OF FINANCING MODELS FOR COMMON USER INFRASTRUCTURE

Aspect	State-Owned CUI	Private-Owned CUI	Public-Private Partnership (PPP)
Ownership	State-owned.	Privately-owned, with developers often holding a share of the ownership.	Hybrid structure where the state and private entities share ownership and risk, often through a joint SPV.
Financing Source	A combination of state equity (from national budget or wealth funds) and debt (sovereign borrowing, often from multilateral institutions).	Projects financed through a mix of private capital (developer equity and commercial loans) and often by multilateral institutions.	A blend of public funds/ guarantees and private capital, with significant involvement from IFIs to structure the deal.
Cost of Capital	Highly dependent on the country's sovereign credit rating. In investment-grade nations (e.g. GCC), sovereign risk is low, leading to a low cost of capital. In lower-rated nations (e.g., Jordan, Egypt), while sovereign loans from MDBs are often cheapest, strong private corporations may secure better rates than the state can from commercial lenders.	Cost of capital varies. It is typically higher than for a state with a strong credit rating. However, in countries with lower sovereign ratings, strong corporations can often secure better financing than the government. International Financial Institutions (IFIs) play a critical role in these markets by taking on country and market risks that commercial lenders avoid, thereby derisking the project and making it bankable.	A blended cost of capital that leverages the security of state involvement to attract cheaper private financing.
Key Advantage	In countries with strong sovereign credit ratings, this model offers the lowest possible cost of capital, making the infrastructure more affordable.	Provides developers with more control over critical infrastructure and operational decisions. Developers can become shareholders to run it on a cost basis, avoiding extra margins.	Balances risk between public and private sectors. Leverages private sector efficiency and capital while maintaining strategic state oversight.
Key Drawback	National debt ceilings and borrowing restrictions may be challenges, even for credit-worthy nations.	Higher financing costs in many scenarios. It also requires a "critical mass" of private companies to commit to the project to justify the large upfront investment.	Can be complex and time-consuming to structure. Requires clear governance to avoid potential deadlocks between partners.

Regardless of the ownership structure, the lack of a fully financed reference project in the space of green hydrogen makes it difficult to create a legal and commercial template for CUI. This issue is exacerbated by the lack of a liquid market for hydrogen, unlike oil and gas, which makes it challenging to secure financing for large, capital-intensive projects with short-term contracts.

Legal and Regulatory Aspects of Common User Infrastructure

The establishment of Common User Infrastructure (CUI) for green hydrogen hubs requires not only robust project structures and contractual frameworks but also a credible regulatory environment.

Each component of a CUI - pipelines, power transmission lines, desalination plants, storage facilities, or export terminals - is in itself a large-scale infrastructure project. Traditional legal structures and project financing challenges therefore apply to each of these elements individually. What makes hydrogen hubs unique is the aggregation of multiple such projects into a single corridor, creating both opportunities for economies of scale and new layers of complexity.

This section explores the legal and regulatory pillars that underpin hydrogen CUIs. We distinguish between traditional infrastructure risks, traditional risks in more complex form, and hydrogen-specific risks (Table 2), before turning to the crucial role of government as regulator. Case studies from oil & gas, electricity, and early hydrogen markets illustrate how different models can be applied in practice.

1. Traditional Infrastructure Risks

These are the baseline challenges present in any large infrastructure project. They apply equally to CUI components in hydrogen as they do in oil and gas or power transmission. As such, the legal solutions are well established from decades of experience in oil & gas and electricity infrastructure.

- **Project structuring and ownership:** Choosing between state-owned, private, or PPP models. Each has implications for financing, tariff setting, and operational control.
- **Project financing requirements:** Each asset must be "bankable" with clear cashflow, security structures, and risk allocation. Lenders require ring-fencing to isolate asset risks from developer balance sheets.
- **Permitting and land rights:** Securing easements for corridors, coastal permits for export terminals, and water rights for desalination plants.
- **Liability and insurance:** Allocation of construction risk, environmental liability, and force majeure and change in law coverage, as well as government responsibility for host country and host government related risks.
- **Dispute resolution:** Clear jurisdiction, governing law, and arbitration frameworks.

2. Traditional Risks in a More Complex Form

Where green hydrogen CUIs differ from conventional infrastructure is in the degree of integration: instead of one pipeline, one transmission line, one LNG hub, or one power plant, they involve multiple interconnected assets serving multiple developers. This multiplies the legal challenges:

- **Project-on-project risk:** The failure of one developer to deliver (e.g., delayed electrolyzer capacity) can affect throughput and cost-sharing for others. Legal frameworks must insulate projects from contagion, e.g. through ring-fenced SPVs (AssetCo/OpCo structures) and rules preserving each project's "quiet enjoyment."
- **Capacity allocation and access rules:** Pipelines, storage tanks, and terminals require transparent, non-discriminatory allocation. This is more complex than in oil & gas because hydrogen hubs often have more asset classes (electricity, water, hydrogen, ammonia, export logistics) to manage simultaneously.
- **Governance and accession rules:** Hydrogen CUIs are phased, with new developers joining over time. Legal frameworks must define accession rights, shareholder entry/exit mechanisms, and governance structures that preserve fairness for both early movers and late entrants.
- **Tariff design and cost sharing:** The principle of cost-reflective, non-discriminatory tariffs is not new, but applying it across multi-vector infrastructure (power, water, molecules) raises complexity in methodology and enforcement.
- **Competition and unbundling concerns:** In liberalized markets (e.g., EU), vertically integrated developers may be required to separate production from infrastructure operation. This is familiar from gas pipelines but will be more difficult in hydrogen hubs because of the tighter interlinkages of assets.

3. Hydrogen-Specific Legal Issues

Hydrogen introduces genuinely new legal challenges that do not have direct analogues in oil and gas; for this reason, they require bespoke legal and regulatory frameworks.

- **Certification and Guarantees of Origin (GoO):** Infrastructure operators may bear obligations to ensure hydrogen purity and traceability of carbon credentials. A failure in CUI management could compromise the certification of all users' products.
- **Blending and purity standards:** Shared hydrogen pipelines or storage must address liability for contamination or dilution (e.g., blending with natural gas or ammonia). This goes beyond natural gas precedents due to stricter purity requirements.
- **Linepacking:** Although linepacking is a low-cost storage method, it will require extensive operational and contractual alignment involving all stakeholders along the line.
- **Intellectual property leakage:** Shared electricity and water networks may expose operational data from electrolyzers. Confidentiality protections are essential to prevent competitive disadvantage.
- **State aid and subsidy regimes[3]:** Particularly for exports to Europe, CUIs may trigger state aid concerns if publicly financed, potentially undermining certification as "green hydrogen."
- **Technology neutrality:** CUIs must avoid discrimination between hydrogen carriers (pure H_2, ammonia, LOHC), which introduces novel legal questions about access rights and tariff equivalence across molecules.

TABLE 2: LEGAL AND REGULATORY ISSUES IN CUIs

Category	Description	Examples in Green Hydrogen CUIs
Traditional Infrastructure Risks	Legal issues common to large-scale infrastructure projects, well understood from oil, gas, and power sectors.	• Project structuring (state-owned, PPP, private SPV) • Bankable project financing (ring-fencing, security packages) • Land rights and permitting • Liability allocation and insurance • Dispute resolution frameworks
Traditional Risks in a More Complex Form	Known issues that become more challenging due to the multi-asset, multi-user, phased nature of hydrogen hubs.	• Project-on-project risk • Capacity allocation & tariffs across power, water, hydrogen, ammonia • Governance & accession rules • Unbundling & competition law • Complex cost-sharing across multiple infrastructure components
Hydrogen-Specific Legal Issues	Novel legal challenges arising uniquely from hydrogen's role in the energy transition.	• Certification & Guarantees of Origin • Blending & purity standards • IP leakage ("Information Barriers") • State aid & subsidy risks • Technology neutrality across carriers (H_2, ammonia, LOHC)

[3] Risk may be addressed through project structure, will depend on individual cases and is subject to ever evolving regulatory frameworks in both host and importing countries.

The Role of Government and Regulation

The long-term viability of a CUI ultimately rests on the credibility of the regulatory environment. Governments face critical choices that determine whether the shared infrastructure will be bankable, competitive, and fair for all participants. The following table provides a high-level overview of the three primary models for government involvement: state-led, hybrid PPP, and private-led (Table 3). The subsequent sections will explore the core topics introduced in this table in greater detail, focusing on the critical decisions governments must make regarding institutional design, tariff-setting, and rules for access and competition.

GOVERNMENT ROLE IN THE CUI VEHICLES

The Government can be involved in the actual implementation of the CUI and the applicable corporate structures in various roles that are set out below:

TABLE 3: GOVERNMENT ROLES IN COMMON USER INFRASTRUCTURE

Model	Ownership & Financing	Government Role	Advantages	Challenges	Examples
State-owned and funded (Sovereign -led)	Infrastructure financed and owned by government or state-owned enterprises (SOEs).	Provider, owner, and regulator.	• Full government control. • High certainty for private producer. • Strategic alignment with national plans.	• Heavy fiscal burden. • Risk of inefficiency or delays. • Conflict of interest between regulator and operator.	Oman (OQ Gas Network, NAMA Water, ASYAD)
Hybrid models (PPP or co-ownership)	Government retains majority stake; private sector holds minority shares.	Co-investor and regulator; shares risks/rewards with private sector.	• Mobilizes private capital. • Leverages private expertise. • Maintains state oversight.	• Governance complexity (risk of deadlock). • Need for clear shareholder agreements. • Potential disputes over exit/entry rights.	Namibia (SCDI AssetCo/ OpCo), some Gulf PPPs
Private-led (state as minority or regulator only)	Infrastructure financed, owned, and operated by private consortia; state may hold a minority share or golden share.	Primarily regulator and facilitator; may provide guarantees.	• Maximizes private capital and efficiency. • Limits fiscal exposure. • Independent regulation builds credibility.	• Less government control. • Early investors may require higher risk premiums. • Risk of public pushback on tariffs.	EU (gas transmission model)*, Morocco (Masen as gatekeeper)

**It should be noted that the EU gas transmission model was initially developed as a state-led system. The transition to the current privatized, open-access model occurred only after a liquid market had matured.*

Focus: Government as Provider or Investor in CUI

The role of government in Common User Infrastructure extends beyond regulation: in many markets, the state is also a direct **funder, owner, or shareholder** in CUIs. The approach taken has profound implications for **bankability, corporate structuring, and risk allocation.**

Key Issues and Challenges

- **Funding and fiscal space:** Many governments lack the fiscal headroom to finance CUIs alone.
- **Corporate structuring:** AssetCo/OpCo models must define ownership splits, governance rights, and decision-making processes between state and private partners.
- **Conflict of roles:** Where the state is both owner and regulator, there is a risk of bias or perceived discrimination.
- **Exit and accession rights:** Unclear rules for entry or divestment of shareholders create uncertainty for private investors.
- **State aid and subsidy concerns:** Particularly relevant for export markets (e.g., EU), where state-led financing may conflict with trade or competition law.

Possible Solutions

- **Ring-fencing and governance protocols:** Clear separation of the state's role as shareholder and as regulator reduces conflicts of interest.
- **Sovereign backstopping without direct ownership:** Government provides guarantees or offtake support while leaving ownership and operation to private entities.
- **Hybrid PPP structures:** Early majority government control with phased dilution to private sector over time as markets mature.
- **Transparent shareholder agreements:** Pre-defined rules on voting, accession, and exit rights enhance investor confidence.

INSTITUTIONAL DESIGN

The long-term viability of CUIs ultimately rests on the credibility of the regulatory environment. Governments face critical choices in these areas:

- Institutional Design
- Should regulation fall under existing agencies (electricity, water, port regulators) or a dedicated hydrogen regulator?
  - o Integrated regulation: Builds on existing expertise but risks fragmented oversight.
  - o Dedicated hydrogen regulator: Provides unified oversight and investor confidence but requires new institutional capacity.

In practice: Oman's National Champion Model

Oman has designated state-owned "national champions" (e.g., OQ Gas Network for pipelines, NAMA Water for desalination, ASYAD for logistics, Oman Tank Terminal Company (OTTCO) for green ammonia storage) to oversee shared infrastructure. A Hydrogen Advisory Board coordinates efforts. This leverages existing capacity but concentrates control in government entities, raising questions about neutrality and long-term competition.

TARIFF-SETTING

Tariffs for access to CUIs are central to bankability. Options include:

- **Cost-plus regulation:** Ensures cost recovery plus regulated return; stable but inflexible.
- **Incentive-based regulation:** Rewards efficiency; requires strong oversight.
- **Negotiated tariffs (Qatar LNG model):** Attractive in early-stage projects, but risks discrimination.

In practice: EU Gas Pipelines

Under the EU's Third Energy Package, tariffs are set by regulators using transparent, cost-reflective methodologies. This model reassures investors but reduces commercial flexibility. A similar approach may apply to hydrogen pipelines once markets mature.

ACCESS AND COMPETITION

Governments must decide whether CUIs operate as open-access infrastructure or are reserved for equity partners.

- **Open access (EU model):** Non-discriminatory, regulator-enforced access; supports competition but may deter early investors.
- **Shareholder access (Qatar model):** Simpler governance, attractive to first movers; may transition to open access as markets mature.

In practice: Namibia's SCDI

Namibia's Southern Corridor Development Initiative (SCDI) is designed as open-access CUI, overseen by an AssetCo/OpCo structure. Transparent access rules reduce intercreditor risk and enhance bankability but require strong government backing and clear oversight.

Focus: Third-Party / Open Access

The question of whether Common User Infrastructure should be reserved for shareholder use or opened to third parties lies at the heart of hydrogen hub design. From a **legal and contractual perspective,** open access raises questions of **non-discrimination, capacity allocation, and tariff setting,** while from a **regulatory perspective** it requires credible oversight to enforce these principles.

Key Issues and Challenges

- **Legal certainty:** Users need assurance that access rights cannot be withdrawn arbitrarily; this requires legally binding frameworks (licenses, access codes, or regulated contracts).
- **Capacity allocation:** Mechanisms such as "use-it-or-lose-it" rules or auction systems prevent capacity hoarding but must be legally enforceable.
- **Tariff transparency:** Discriminatory pricing is a common risk. Clear methodologies (cost-reflective, published tariffs, or regulator-approved formulas) are needed.
- **Early mover protection:** First investors often demand preferential rights; balancing these with future open access obligations is legally sensitive.
- **Regulatory fragmentation:** CUIs span electricity, water, gas, and ports; lack of a single regulatory authority complicates enforcement.

Possible Solutions

- **Phased access regimes:** Initial exclusivity for anchor investors transitioning to regulated open access once scale is reached.
- **Independent regulator or "gatekeeper" institution:** Ensures neutral enforcement of access and tariff rules.
- **Access codes and model contracts:** Legally standardized agreements reduce transaction costs and limit scope for discrimination.
- **Hybrid models:** Combining negotiated tariffs for anchor investors with regulated frameworks for later entrants.

The legal architecture must therefore reconcile bankability for early investors with long-term competitive neutrality, a balance already familiar from gas pipeline law but now extended across multiple infrastructure layers.

BROADER ROLES OF GOVERNMENT

Beyond core regulation, governments also:

- Certify hydrogen as "green" under international standards.
- Ensure compliance with trade law and state aid rules.
- Provide sovereign guarantees or act as backstop counterparties.
- Facilitate land allocation and permitting.

In practice: Morocco's Gatekeeper Approach

Morocco appointed Masen as a "gatekeeper" to coordinate between government and developers. Masen does not hold equity but facilitates land allocation, project coordination, and early discussions on infrastructure sizing. This balances neutrality, investor comfort, and oversight.

Focus: State Aid and Subsidy Risks in Hydrogen CUIs

Hydrogen CUIs often rely on some degree of public support, whether through direct state investment, concessional loans, sovereign guarantees or preferential tariffs. While such support can be essential in catalyzing early projects, it raises **state aid and subsidy concerns** under international trade law.

Hydrogen hubs targeting **exports to Europe** must be particularly attentive to subsidy risks: an otherwise bankable project may lose access to premium EU markets if state support is deemed incompatible with EU law. Legal structuring must therefore align bankability needs with trade and competition compliance.

Key Issues and Challenges

- **EU State Aid Rules:** Under Articles 107–109 TFEU, state measures that distort competition by favoring certain companies or industries may be unlawful unless approved by the European Commission. Publicly financed CUIs (e.g. pipelines, terminals) could be challenged if they grant unfair advantage to local producers.
- **Trade Law Implications:** WTO rules (e.g. the Agreement on Subsidies and Countervailing Measures) restrict export-contingent subsidies. State-backed CUIs designed primarily for export markets risk classification as "prohibited subsidies."
- **Certification Risk:** For hydrogen to qualify as "renewable hydrogen" under the EU's RED II/Delegated Acts, production and transport must comply with rules on additionality, temporal correlation, and non-distortion of competition. Excessive public support may undermine certification, even if the hydrogen is technically renewable.
- **Competitive Neutrality:** When CUIs are state-owned, non-shareholder producers may allege discriminatory access or preferential tariffs as indirect subsidies.

Possible Solutions

- **Market-conform structures:** Financing CUIs through commercially structured SPVs with cost-reflective tariffs reduces the risk of state aid classification.
- **Notification and approval:** For EU-based CUIs or projects linked to EU imports, governments can seek prior clearance under the EU's **Important Projects of Common European Interest (IPCEI)** or similar frameworks.
- **Transparent tariff methodologies:** Publishing clear, non-discriminatory access and pricing rules enhances compliance and investor confidence.
- **Sovereign backstopping instead of direct subsidies:** Providing guarantees or credit enhancement (rather than equity or concessional tariffs) can support bankability while limiting competition law exposure.
- **Future-proof design:** Structuring CUIs with phased reduction of state involvement over time, ensuring a pathway toward competitive neutrality as markets scale.

Case Study: EU State Aid in Offshore Energy Infrastructure

The EU has already applied state aid rules to shared energy infrastructure in offshore wind. In 2018, Denmark and Germany jointly notified the European Commission of state support measures for the development of a **shared offshore wind grid connection.** The Commission approved the aid, but only after confirming that:

- The support was limited to covering the **"funding gap"** that private investors could not reasonably fill.
- Access to the grid would be **open and non-discriminatory,** with regulated tariffs applying equally to all users.
- The aid would not result in **over-compensation** of the developers.

This case highlights two lessons for hydrogen CUIs:

1. State support can be compatible with EU law if it is **proportionate, transparent, and non-distorting.**
2. Open-access rules and tariff transparency are essential safeguards to secure approval.

For hydrogen hubs exporting to Europe, similar scrutiny is likely. State-backed CUIs must therefore be structured to demonstrate that support is **limited, targeted, and aligned with EU competition principles.**

Case Study: EU State Aid for LNG Terminals in Poland and Lithuania

The European Commission has assessed several state aid measures for LNG import terminals, including **Świnoujście (Poland)** and **Klaipėda (Lithuania).** In both cases, governments provided substantial public funding to ensure security of gas supply and reduce dependence on a single supplier.

The Commission approved the aid, but under strict conditions:

- **Proportionality:** Public support was allowed only to cover the "funding gap" between project costs and expected revenues, not to provide excess returns.
- **Open Access:** Terminals had to operate on a **non-discriminatory, third-party access** basis with transparent tariffs.
- **Market Conformity:** Revenues had to be cost-reflective and subject to regulatory oversight, ensuring no hidden subsidies to domestic producers or users.
- **Time-Limited Support:** Some support measures were approved only for an initial period, with reviews scheduled to reassess market conditions.

The LNG cases show that the EU tolerates significant public intervention in strategic energy infrastructure — but only if it is **transparent, proportionate, and aligned with competition law.** For hydrogen CUIs, especially those seeking to export into the EU, similar principles will apply: **state support must not distort competition** and must guarantee **fair access to all users.**

Conclusion

The journey toward a global green hydrogen economy stands at a critical juncture. Ambitious giga-scale projects often remain on paper, facing immense capital costs and complex risks that deter investors. This report demonstrates that Common User Infrastructure (CUI) is the indispensable strategic key to overcoming this challenge, offering a clear pathway to making the hydrogen economy financially viable and scalable.

The path forward requires a careful balance: offering stability and preferential access to attract anchor investments in the near term, while building a regulatory framework that evolves toward open, transparent, and competitive infrastructure regimes in the long term. A successful framework must provide enough certainty and preferential access to de-risk anchor projects, while simultaneously establishing a credible regulatory path toward open, non-discriminatory access for future players. This requires a sophisticated legal and commercial architecture - from ring-fenced SPVs that contain "project-on-project risk" to transparent tariff methodologies - that can adapt as the market evolves.

The responsibility for creating this enabling environment is a shared one. As the key case studies from across the MENA region reveal that there is no single master plan; each country must design a CUI model tailored to its own unique geography, resources and strategic goals. This demands a proactive partnership between governments, who must provide regulatory clarity and long-term vision, and developers, who bring the capital and technical expertise to build these complex systems. By working in concert, they can transform CUI from a concept into the durable, financeable backbone of a global hydrogen economy.

Examples of CUI planning and implementation in different countries

NAMIBIA

Namibia plans to accelerate large-scale green hydrogen development in the Southern Corridor Development Initiative (SCDI) through a Common User Infrastructure (Figure 10) that any developer can access on fair, transparent terms. Hyphen, and its majority shareholder Enertrag are developing the first 2 blocks (Springbock/Dolphin) of the SCDI, and are therefore also in charge of the development of the phase 1 of the CUI.

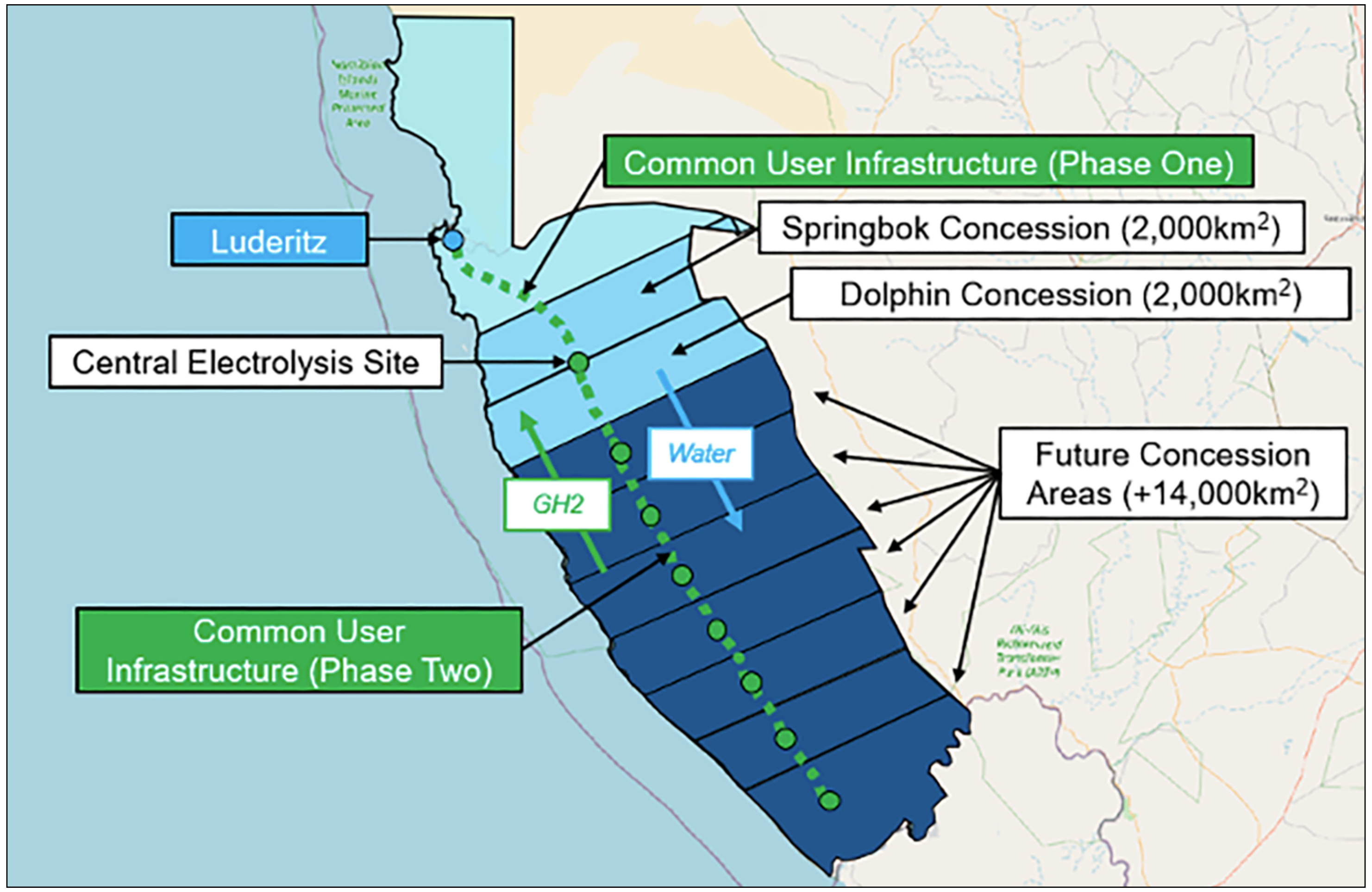


Figure 10: Overview of the Southern Corridor Development Initiative (SCDI) in Namibia, highlighting the two different phases of development of the Common User Infrastructure. *Source: Enertrag.*

Design criteria and planning logic

For the SCDI, a central technical choice favors “moving molecules” rather than “moving electrons”: electrolysers are sited inland in the renewables corridor and hydrogen is transported by pipeline to the port area for conversion and export. The proposed CUI creates a complete chain from renewable power and water intake to hydrogen production, derivative conversion, storage, and export, with curtailed electricity absorbed by the NamPower grid to maximize value capture:

- The hydrogen backbone, a trunk pipeline that gathers hydrogen from multiple inland electrolyser sites and delivers it to the Angra/Lüderitz port area.
- The overland transmission, which supplies electricity from the SCDI both to port-side processing loads. Curtailed electricity is absorbed by NamPower to maximize value capture, and it exists a future option to interconnect with South Africa.
- The water system, combining seawater desalination at Lüderitz with a water pipeline that feeds electrolyser locations across the corridor.
- The ancillary infrastructure - access roads, fiber-optic communications, and shared services such as security - preferably co-located with the pipelines and lines in a single corridor to streamline permitting and reduce land disturbance.

The CUI is designed to minimize the development footprint while preserving the SCDI’s ability to deliver very large hydrogen volumes. It seeks to provide planning certainty by setting access terms and operating rules up front and by ensuring equal treatment for all developers. The architecture must scale seamlessly, allowing new projects to join without disturbing existing operations—the proposal refers to this as preserving each project’s “quiet enjoyment.” End-to-end integrity of the value chain is a further requirement, so that no bottleneck in shared infrastructure compromises bankability or pace. These principles underpin a phased, end-state-oriented master plan that is oversized where it is financially and technically sensible, then expanded incrementally as additional developers accede to the corridor.

Technical set-up by element

The hydrogen backbone is the keystone. Electrolysers are placed within the renewables corridor to convert electricity into hydrogen at source. Hydrogen from multiple plants is aggregated into a shared trunk line that runs broadly parallel to the corridor and terminates at the port. The pipeline’s inherent linepack provides buffer storage, smoothing variable generation and raising uptime in downstream conversion units. Indicatively, a single pipeline of about 1,400 millimeters in diameter can accommodate roughly three million tonnes per year of hydrogen—an amount associated with about 50 gigawatts of renewable capacity and comparable, in energy-carrying terms, to dozens of high-voltage lines. Early phases envisage an initial connection of around seventy kilometers from the first production zone to Angra/Lüderitz, with capacity increased modularly through looping or upsizing as new producers join. This approach is paired with a small, separate green-power supply for port-side systems, typically in the order of five to ten percent of total installed renewable capacity depending on the derivative process, to keep the downstream complex fully renewable.

The overland transmission element has two roles. It provides power to run port-side processing, storage, and loading systems, and it enables curtailed power and surplus energy to be potentially exported into the NamPower grid. In the longer term, the corridor keeps the option open to deliver dispatchable power to the Southern African power pool. By routing transmission alongside the hydrogen and water lines, the proposal contains visual, biodiversity, and land-use impacts within a single linear footprint and reduces the number of permitting interfaces.

The water system starts with seawater desalination at Lüderitz and continues with a pipeline that delivers process water to electrolyser sites. The concept balances economies of scale in desalination against pumping losses along the corridor. Initial assessments suggest that the first two to four projects can be served efficiently from Lüderitz, whereas more distant project areas may require booster stations or alternative sourcing once detailed engineering is complete. This arrangement anchors water quality and reliability while avoiding duplicated intake and treatment facilities across multiple sites.

Ancillary infrastructure runs the length of the corridor. Main and site access roads, fiber connectivity for control and communications, and shared services are established and maintained by the operating company on behalf of all users. Co-location of these services with the three principal linear assets simplifies operations and maintenance, improves safety, and supports rapid restoration following outages, all while minimizing the corridor's footprint relative to a scenario in which each project builds its own standalone route.

Commercial and operating model

Access to the CUI is open to all SCDI developers on a transparent, non-discriminatory basis. The operating rules are designed to ensure that projects are not fundamentally dependent on one another and that a default by one party does not contaminate others. Lender enforcement actions against any individual developer should not compromise third parties, and intercreditor risk is deliberately limited so that separate financing packages can coexist without complex cross-negotiations. Physical risks to the shared system are mitigated by clear responsibilities, operating standards, and governance.

To embed that governance, the proposal establishes two bankruptcy-remote special-purpose vehicles. The CUI AssetCo owns the shared infrastructure and provides ring-fencing so that assets remain insulated from the balance sheets and risks of individual project companies. The CUI OpCo manages day-to-day operations and maintenance for the benefit of all users under a rules-based regime. Equity in the AssetCo can be allocated either according to installed capacity or according to the actual capital each party contributes to CUI development, whereas equity in the OpCo is allocated based on installed capacity measured by combining generation and electrolyser megawatts. This split aligns long-term asset stewardship with cost-sharing fairness and daily operational effectiveness with capacity responsibilities.

Cost-sharing follows a fair-share logic anchored to committed capacity. In practice, each project's share of capital is calculated in proportion to its capacity commitment relative to the corridor's total. In parallel, the phasing strategy asks the first mover Hyphen, working with Government, to design, validate, finance, construct, commission, and operate the initial tranche of CUI with sensible oversizing to capture economies of scale while staying financeable. Subsequent developers then fund and build the extensions needed for their projects, preserving beneficial oversizing and pooling those additions into the shared system upon commissioning.

Advantages of the selected structure

Technically, the "moving molecules" concept is more efficient and easier to operate at SCDI scale than transmitting all electricity to a dense coastal electrolyser cluster. Because electrolysis occurs inland, the overall system moves about thirty percent less energy than a "moving electrons" alternative, improving capital productivity and reducing losses.

The hydrogen pipeline is also cheaper per unit and distance than high-capacity transmission: indicative capital costs are approximately six to ten US cents per kilogram per 100 kilometers for the pipeline versus roughly eleven to fifteen US cents per kilogram per 100 kilometers for transmission. Operationally, the pipeline's linepack acts as a buffer, smoothing variability and sustaining higher uptime for derivative plants and export operations at the port, while a relatively small green power supply covers their on-site electrical needs. Land constraints around Angra/Lüderitz further support the pipeline option; concentrating massive transmission and electrolyser capacity at the coast would strain available space, whereas the corridor approach distributes assets more sensibly.

Environmentally, bundling the hydrogen, water, and electricity networks within a single corridor minimizes the footprint and associated disturbance. Commercially and financially, the ring-fenced AssetCo/OpCo design, open-access rules, and capacity-based cost sharing reduce counterparty contagion risks and intercreditor complexity, thereby improving bankability. The structure also avoids placing CUI debt on the Government's balance sheet. At a strategic level, the model mirrors proven global practices in shared infrastructure for energy and industrial systems and draws confidence from early applications in large green hydrogen hubs, even as it is tailored to Namibia's specific geography and policy aims.

JORDAN

Jordan's ambitious hydrogen strategy provides a prime example of a country where Common User Infrastructure (CUI) is not just a strategic option but a geographical necessity. Despite signing 13 MoUs for green hydrogen projects, Jordan's physical geography presents significant limitations that demand a coordinated approach.

The country's primary constraint is its 27 km coastline on the Gulf of Aqaba, which serves as the single access point for all desalination and export activities. A dedicated land plot of just 5.5 square kilometers has been identified in the Aqaba Special Economic Zone , meaning resources like land and water must be managed through a shared system to ensure their optimal use .

To address this, the Ministry of Energy and Mineral Resources (MEMR), with support from the European Bank for Reconstruction and Development (EBRD) and ILF Consulting Engineers, has been coordinating with developers and international financiers to plan a Green Hydrogen Hub in the Aqaba Special Economic Zone (Figure 11). The idea for the CUI structure is to remain private, rather than directly government-owned, which is seen as essential for bankability. As such, the government is encouraged to adopt a moderating role in designing the commercial structure for CUI rather than having a direct interest in the projects to ensure a fair system for all players.

The base case for the hub's development is a common hub approach under a joint Special Purpose Vehicle (SPV), which would provide substantial scaling benefits for both electrolysis and ammonia synthesis and offer an optimal use of limited land resources.

Two primary energy transmission options have been assessed from renewable generation sites to the Aqaba hub: Overhead Transmission Lines (OHTL) for a centralized hub or a hydrogen pipeline for a decentralized model where electrolysis occurs at the production sites. The CUI-specific CAPEX analysis showed that a hydrogen pipeline system becomes 28% more cost-effective than an OHTL network by 2050 at higher capacities.

The plan for the water system involves a desalination plant and a two-pipeline system to supply desalinated water to the hub. The first pipeline would be built in 2030 to meet needs until 2040, with a second pipeline constructed for 2050 requirements. The existing capacity of Port of Aqaba, which is the single-point of access, is insufficient to meet the green ammonia export targets, so a new berth has been proposed to complement the Aqaba Development Company's (ADC) expansion plans. This shared asset, which could also be used for other chemicals, is a crucial part of the CUI solution.

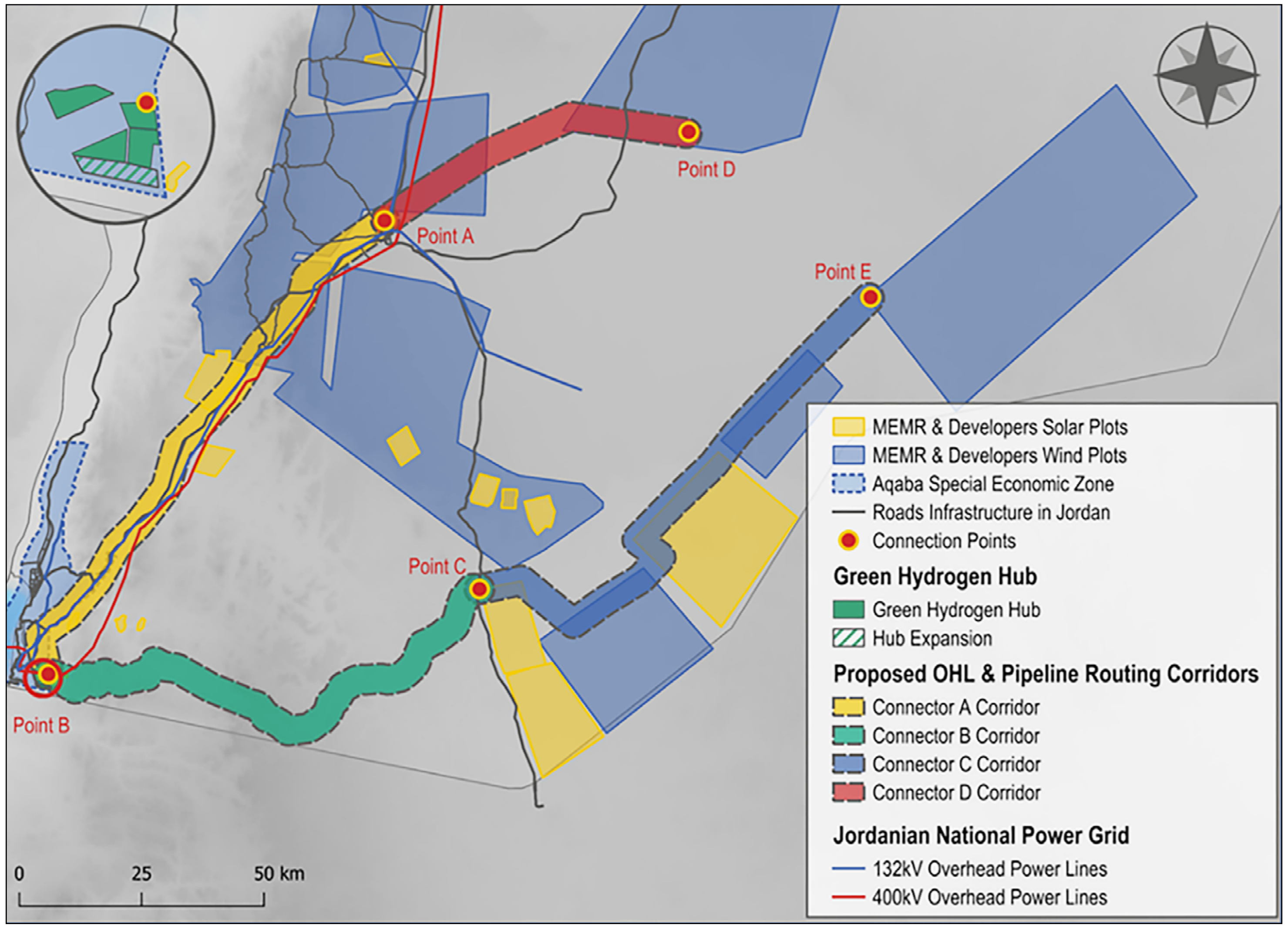


Figure 11: Overview of the planned green hydrogen development in Jordan, highlighting the land allocated to the different elements of the CUI. *Source: ILF Consulting Engineers.*

OMAN

As a central pillar of its Oman Vision 2040[11] plan to diversify the economy and ensure the sustainability of its natural resources, Oman's government has taken a proactive role in organizing the green hydrogen sector.

This initiative includes earmarking 50,000 square kilometers of land, primarily in Duqm, Salalah and Al Jazer region, as prioritized areas for green hydrogen production.

The country's strategy[12] dictates that green hydrogen must be produced co-located with renewables, with limitations on long-distance electron transport for molecule production (allowing only a 5% share for downstream plants) and a focus solely on green hydrogen transportation (no derivatives in shared pipelines). Discussions are also underway for a centralized ammonia storage and export facility.

In a landmark development, Oman has also signed a Joint Development Agreement to establish the world's first commercial-scale liquid hydrogen corridor linking the Port of Duqm to the Port of Amsterdam and the Port of Duisburg in Germany[13].

This initiative, which includes an open-access liquefaction, storage, and export facility in Duqm, aims to establish a complete liquid hydrogen supply chain (Figure 12).

Shared infrastructure services are provided by "national champions," which are state-owned companies. These include NAMA Water Services for water desalination and pipelines, Oman Electricity Transmission Company (OTC) for grid infrastructure, OQ Gas Network (OQGN) for hydrogen transportation, and Oman Tank Terminal Company (OTTCO for green ammonia storage.

Highlighting the international collaboration driving this effort, OQGN has signed a cooperation agreement with Belgian energy infrastructure group Fluxys to jointly develop the planned hydrogen pipeline network[14]. ASYAD has also been nominated as a national champion for logistics and is investing in "control towers" to manage the transport of oversized materials, such as wind turbine components, from ports to project sites, aiming to prevent delays. The newly created Oman Green Hydrogen Advisory Board facilitates discussions among national champions and developers.

The financial model for CUI aims for bankability for both developers and infrastructure providers, with tariffs designed to be cheaper than individually developed infrastructure. The Final Investment Decision (FID) for infrastructure is contingent on one developer's FID to avoid staggering delays.

A significant challenge involves "project-on-project risk," where developers are pushing for national champions to bear the liabilities for service failures, rather than developers.

Mitigations, such as investing in storage buffers for several days of production, are being explored to ensure service continuity, with associated costs integrated into the tariff structure. While modularity is being considered for elements like storage, practical challenges exist for pipelines and transmission lines in terms of economic modularity.

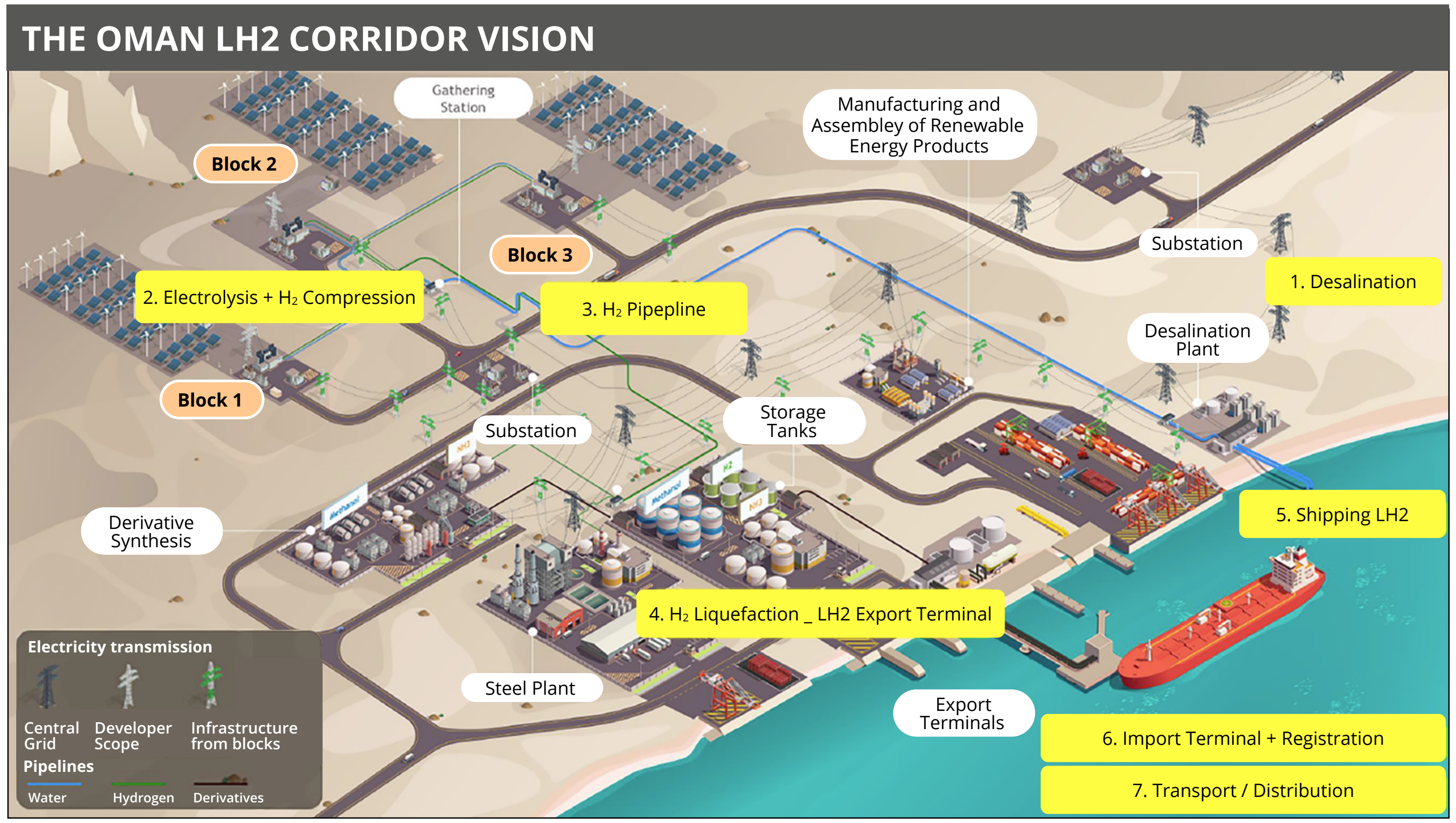


Figure 12: Overview of the Oman LH2 Corridor Vision, outlining the different elements of the Common User Infrastructure. *Source: Hydrom.*

MOROCCO

Following the launch of the Morocco Offer[15], a comprehensive framework for the green hydrogen sector, the government selected several projects for implementation, including six projects with a total investment of $32 billion as of March 2025. Contracts for land reservation are still ongoing for most, with the Chbika project securing land rights as the first project to advance[16]. As such, discussions around a Common User Infrastructure are at the early stages of reflection. Masen, serving as a "gatekeeper" and focal point, has a key role in coordinating the needs and suggestions between investors and the government. In this light, Masen will not hold any equity in the hydrogen projects or infrastructure, reinforcing its role as a neutral facilitator.

The reflection on CUI has started by consolidating water, electricity and off-take needs from the projects approved to appropriately size port infrastructure for common use. Initial plans include looking at modularity schemes to allow future investors to plug in later on. While a new port is being planned specifically for hydrogen in Guelmim, existing ports like Laayoune and Dakhla will also host hydrogen facilities. Contrary to other countries where molecules transportation is preferred to electron transitions, it is likely that in Morocco electricity will be transported to the industrial areas near the shore to power production facilities being built there rather than derivatives to the port. In terms of funding, the Moroccan government has clearly stated that it will not invest equity in common infrastructure, which is intended to be fully privately funded and shared among different investors. In this context, there is pressure to clarify the responsibility sharing for port infrastructure to provide investors with necessary timeline visibility.

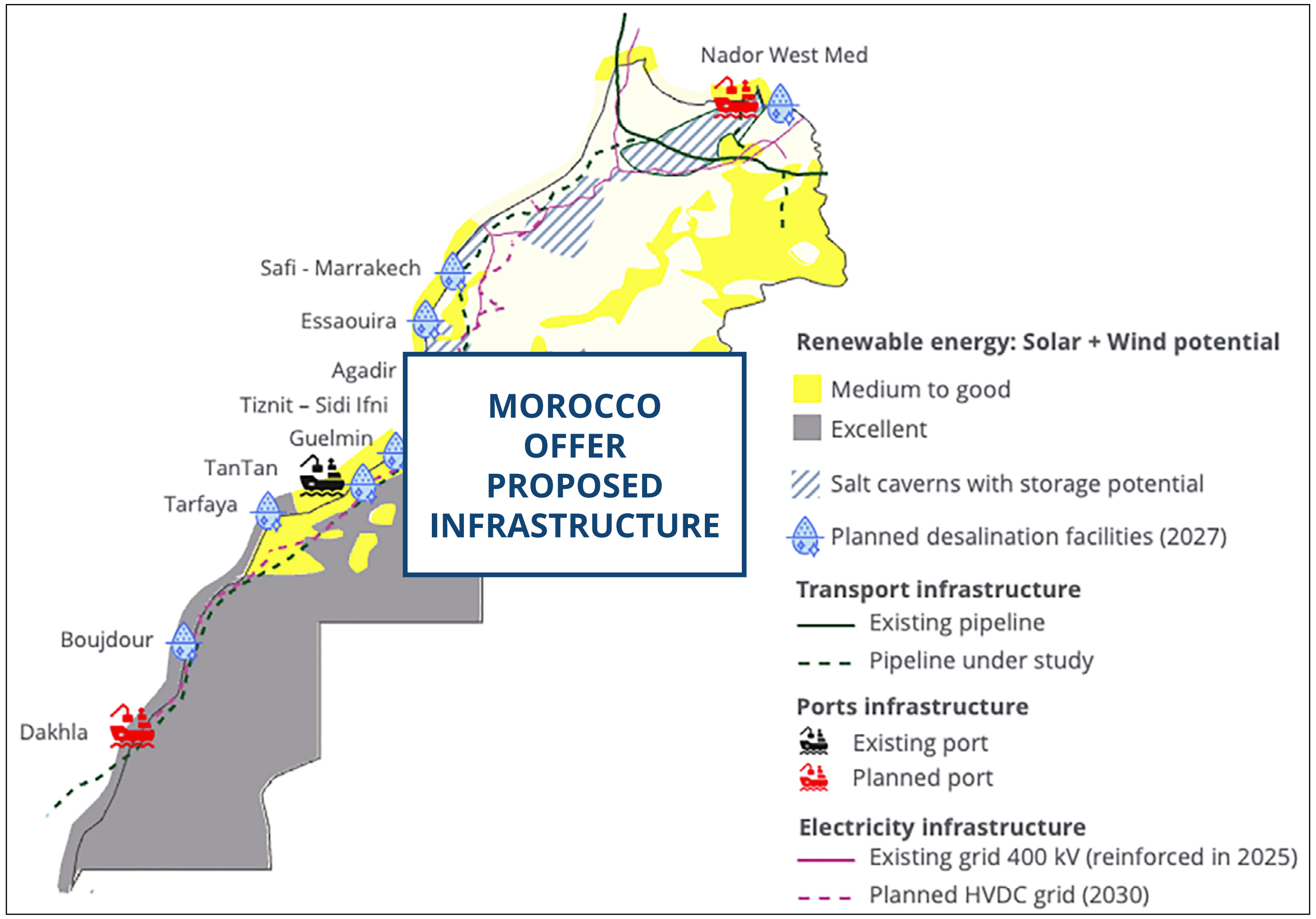


Figure 13: Combined map of renewable energy potential, existing and planned infrastructure (transport, ports, electricity). *Source: Morocco Offer.*

Authors

Chiara Aruffo
Director of Research, Dii Desert Energy
chiara@dii-desertenergy.org

Cornelius Matthes
CEO, Dii Desert Energy
cornelius@dii-desertenergy.org

Alex Sarac
Partner, Addleshaw Goddard

Prateek Banerjee
Senior Consultant, ILF Consulting Engineers

Contributors

Enertrag provided key strategic insights for this study.

The authors would like to thank Manuel Geiger (Enertrag) and Axel von Perfall (Dii Desert Energy) for their significant contributions.

Acknowledgements

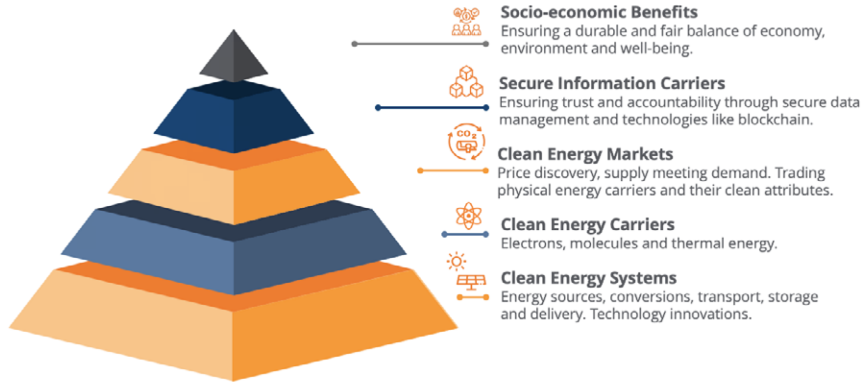
The authors would like to acknowledge the following experts whose contributions have greatly enriched this study:

Eng. Abdulaziz Al Shidhani (Hydrom), Cristian Carraretto (EBRD), Anthony El Khoury (PwC), Alan Fotheringham (Jacobs), Yousra Souaf (Masen).

Dii Desert Energy

Dii Desert Energy is an independent think tank and international network paving the way for 'net zero emission' through secure and affordable energy from the deserts. Through Dii Desert Energy and their initiatives, MENA Hydrogen Alliance and Zero Emissions Traders Alliance, they connect over 120 companies from 36 countries with authorities and institutions to accelerate MENA's energy transition.

As part our vision and mission, Dii Desert Energy in collaboration with ZETA Global, provides impartial guidance to the development MENA as a clean energy 'Power House' for local benefits and for exporting into the global energy markets. Our Clean Energy Pyramid highlights the five fundamental building blocks of this vision.



Addleshaw Goddard

Addleshaw Goddard is an international law firm with 21 offices across the UK, Europe, the Middle East, and Asia, comprising over 1,900 lawyers, including 440 partners. With five offices and more than 80 lawyers permanently based in the Middle East, we are one of the region's largest international law firms. Our team advises governments, developers, and operators on large-scale infrastructure projects across the energy and water sectors, covering every stage from inception and finance to construction and dispute resolution. We pride ourselves on delivering integrated, practical solutions combining international expertise with deep local insight.

ILF Consulting Engineers

The ILF Group is a global engineering and consulting firm with 3,000+ employees across 45+ offices on six continents. Privately owned and independent, ILF supports clients in Energy & Climate Protection, Water & Environment, Transportation & Urban Spaces, and Sustainable Industry. With 55+ years of experience and 11,100+ projects delivered in 150+ countries, ILF combines local presence with international expertise. Services include technical and management consulting, sustainable solution development, stakeholder integration, and high-quality execution. ILF is committed to client satisfaction and long-term partnerships, leveraging deep technical knowledge and on-site collaboration to meet ambitious goals efficiently and reliably.

Enertrag

ENERTRAG is a leading German renewable energy company pioneering the production and integration of green hydrogen within a fully sustainable energy system. Founded in 1998 and headquartered in Dauerthal, Brandenburg, ENERTRAG develops and operates wind, solar, and hydrogen projects across Europe, Africa, and South America. Through its Verbundkraftwerk® model, the company links renewable generation with electrolysis, storage, and sector coupling to supply climate-neutral energy for industry, and mobility. ENERTRAG's hydrogen portfolio includes flagship projects like Hyphen, showcasing scalable, sustainable development solutions that advance the global energy transition toward a fossil-free future.

Unlocking the Hydrogen Economy: How Common User Infrastructure drives Project Bankability 39

References

[1] Benban 1.8 GW PV SolarPark, Egypt. Strategic, environmental and social assessment, Final Report. Accessed 8 September 2025. ***https://www.eib.org/attachments/registers/65771943.pdf***

[2] MIGA. “Infinity Benban Park Solar Energy S.A.E.”. Accessed 8 September 2025. ***https://www.miga.org/project/infinity-benban-park-solar-energy-sae-0***

[3] International Finance Corporation. “Scaling Infrastructure: Seven Sisters (Jordan)”. Accessed 8 September 2025. ***https://www.ifc.org/content/dam/ifc/doc/mgrt/scaling-infra-jordan-10.pdf***

[4] Columbia University. "H2-Strategies_July-2025". Accessed 8 September 2025. ***https://www.energypolicy.columbia.edu/wp-content/uploads/2025/02/H2-Strategies_July-2025.pdf***

[5] Dii Desert Energy. “A Green Revolution”. Accessed 8 September 2025. ***https://dii-desertenergy.org/publications/#***

[6] Braun J.F., Konrad Adenauer Stiftung. “Saudi Arabia's Net-Zero World Narrative”. Accessed 26 September 2025. ***https://kh.aquaenergyexpo.com/wp-content/uploads/2025/03/Saudi-Arabias-Net-Zero-World-Narrative.pdf***

[7] Lutz et al. “Intermodal Transportation Pathways of Ammonia”. Accessed 23 September 2025. ***https://www.carboncapture-expo.com/agenda-2024/a-study-assessing-the-intermodal-transportation-pathways-of-ammonia***

[8] Institute for Sustainable Process Technology. “Design and safety aspects for large-scale clean ammonia pipelines”. Accessed 22 September 2025. ***https://ispt.eu/publications/design-and-safety-aspects-for-large-scale-clean-ammonia-pipelines/***

[9] Jordan News Agency. “Aqaba Authority Approves Land Use Amendments for Green Hydrogen Projects”. Accessed 8 September 2025. ***https://www.petra.gov.jo/Include/InnerPage.jsp?ID=68456&lang=en&name=en_news&cat=en_news***

[10] EBRD & ILF, Green Hydrogen Common Infrastructure Development in Jordan. Accessed 8 September 2025. ***https://www.memr.gov.jo/ebv4.0/root_storage/en/eb_list_page/ilf-ger-od-jor2025.pdf***

[11] Oman Vision 2040. “Pillars and Priorities”. Accessed 26 September 2025. ***https://www.oman2040.om/pillars?lang=en***

[12] Hydrom. “Oman Green Hydrogen Strategy 2024”. Accessed 8 September 2025. ***https://hydrom.om/Media/Pdf/Oman-Green-Hydrogen-Strategy-2024.pdf***

[13] FuelCellsWorks. “Oman’s Liquid H2 Corridor a Model for Global Hydrogen Trade”. Accessed 8 September 2025. ***https://fuelcellsworks.com/2025/06/03/green-technology/oman-s-liquid-h2-corridor-a-model-for-global-hydrogen-trade***

[14] Fluxys. Press release: “Fluxys and OQGN to cooperate on the development of a hydrogen transportation network in Oman”. Accessed 3 October 2025. ***https://www.fluxys.com/en/press-releases/fluxys-group/2025/250519_press_fluxys-oqgn-cooperation-develop-hydrogen-transportation-network-oman***

[15] Masen. “Green Hydrogen Moroccan Offer”. Accessed 8 September 2025. ***https://www.masen.ma/en/green-hydrogen-moroccan-offer***

[16] FuelCellsWorks. “Morocco Secures Strategic Land for Chbika Hydrogen Project, Presses Ahead with Euro-African Energy Ambitions”. Accessed 8 September 2025. ***https://fuelcellsworks.com/2025/07/02/green-hydrogen/morocco-secures-strategic-land-for-chbika-hydrogen-project-presses-ahead-with-euro-african-energy-ambitions***

Dii

Leopoldstr, 244
80807 München
info@dii-desertenergy.org

Local Court Munich
HRB 183595