

INTERNATIONAL GREEN HYDROGEN AND P2X EXPORT PROJECTS: KEY CONSIDERATIONS

A rapid acceleration in the global production of green hydrogen and its derivatives is required if the world is to meet its greenhouse gas emissions reductions and net zero targets. We have seen an explosion of activity in the sector in the past years and months, with green hydrogen taking centre stage at COP27 and with numerous announcements being made in respect of large-scale hydrogen production projects with an export focus. In this briefing, we explore some of the key considerations which developers of such export-focussed projects will need to keep in mind.

Background

The energy transition requires a rapid acceleration in the global production of green hydrogen and its derivatives (collectively, power-to-X (P2X) products). This will help decarbonise hard-to-abate sectors (such as heavy industry, long-haul transportation, etc.), but is also needed to replace current hydrogen production from fossil fuels. In 2021, the production of hydrogen was responsible for the emission of more than 900 Mt CO₂ - by way of comparison, only five countries in the world emit more CO₂ annually, and hydrogen production is responsible for more emissions than all of international shipping (700 Mt CO₂) and all international aviation (400 Mt CO₂).

Whilst certain countries like the USA are incentivising the development of domestic production projects for domestic markets, other jurisdictions with scarcer renewable resources and land availability are seeking to source green hydrogen and P2X products from abroad. For example the EU, Japan and South Korea have all highlighted their intentions to import large volumes of P2X products.

This represents a significant opportunity for countries with an abundance of available land, sun and wind to use this momentum to build up their own industries and export capabilities.

Potential developers of export-focused P2X projects in those jurisdictions will need to keep in mind a number of key considerations and navigate some complex and challenging issues, a high level overview of which is set out in this briefing.

Fundamental Structuring Considerations

The first set of questions which developers must answer at the outset relate to the overall scale, focus and structure of the intended project. In particular:

How will the renewable power be sourced?

It is self-evident that a project involving the construction of renewable power generation assets alongside the P2X production assets will be costlier and more complex to develop than one which does not. On the other hand, a project relying on a third-party supply of power will face increased project-on-project risks which will need to be managed, as well as the potential certification issues for its P2X products or operational complexity which might arise from not controlling exactly the power production process (and ensuring the “green” nature of the electricity supplied).

Which P2X product will the project focus on?

The production of hydrogen, ammonia, e-methanol and other P2X products relies on different technologies, and each of these products comes with different transport and storage challenges, has different feedstock requirements, and presents different offtake opportunities. As such, the project design and its risk profile will be heavily impacted by the developer’s decision as to which P2X products to focus on. Further, developers may want flexibility (in particular those of vertically integrated projects who could use the generated electricity more economically, depending on market conditions) which would also need to be factored in the project’s structure and design.

What is the intended offtake strategy?

Developers of export production projects will need to determine their offtake strategy at the outset in some detail. It will be necessary to ensure that the project can produce products conforming with the certification and other product specification requirements of the jurisdiction(s) they are selling into, as there is currently no global standard. They will also need to determine the right balance (based on their risk appetite and financing requirements) between locking-in long-term offtake agreements with fixed pricing to secure their investment, and retaining an ability to trade freely and so benefit from

anticipated price increases over time for the P2X products they are selling. A merchant offtake strategy (for all or part of the output) is likely to entail management of price volatility as trading increases due to the lumpy nature of supply.

In which country should the project be established?

Another fundamental question for developers relates to the identification of the country or countries in which they should invest. A significant number of jurisdictions with excellent natural resources (in the form of land and renewable power generation potential) are only just beginning to explore the potential for a domestic hydrogen industry and how it should be incentivised and regulated. A clear and stable legal and fiscal framework being securely in place will be vital for project success. Additionally, local workforce availability (and in particular the availability of skilled labour) will be an important factor to keep in mind.

How will the project be financed?

Developers' appetite for and ability to manage risks at the project level, and therefore the resulting project structure, will also be influenced by the intended financing strategy: investors relying on their balance sheet and making equity investments will generally be able to tolerate higher risks than financiers funding the development on a project finance basis. Determining the financing strategy and objectives upfront will be important to ensure the project can be structured to maximise the prospect of raising the necessary development capital.

Key Risks

Regardless of developers' decisions in respect of each of these fundamental points, ultimately all P2X export production projects will entail risks (to a greater or lesser extent) which will need to be managed. In this briefing, we focus on four principal risks which will be especially relevant for P2X export projects to acknowledge and mitigate: Completion Risk, Offtake Risk, Political Risk and Environmental Risk.

Completion Risk

Completion risk can be understood broadly as the risk that the project is not completed within the anticipated timeframe and budget, and/or that it fails to produce the anticipated level of P2X products at the anticipated marginal production cost and/or meeting the required product specification.

Whilst all projects face completion risk, this is likely to be an especially important focus for the first wave of P2X export projects in circumstances where the technologies involved remain unproven at scale and indeed where technology learning and development is continuing to evolve at a rapid pace.

Developers electing to implement a modular project design (where the upstream power and/or downstream export process is separated from the core hydrogen and P2X production process) will also face co-completion risk - also known as project-on-project risk. It will not be enough for those developers to ensure that their own project is delivered to specification and on time, but the risk of delivery of all other essential "modules" (i.e. the upstream power project and/or the downstream export infrastructure) will also need to be managed and mitigated, as otherwise developers may be left with stranded assets.

In contrast, developers opting for a vertically integrated project design will have less exposure to co-completion risk, but they are likely to face more challenges in terms of internal project structuring: it is unlikely that a single contractor would be willing to assume responsibility for the delivery of the entire project (again, at least at this early juncture), leaving developers with the need to manage and mitigate interface risk between the various project elements.

Beyond the initial construction and commissioning risks, developers in this nascent industry will need to identify how they can best secure project performance in the longer term, noting that the technology remains untested at scale and over long time periods, with the consequence that there is no settled position as to performance guarantees (and length of warranty). With significant technology providers competing to establish themselves at the top of the market, however, we expect robust packages to emerge.

One particularly novel issue for P2X projects is that not all components of the project will have the same lifespan (with electrolyzers typically having a much shorter guaranteed lifespan than upstream power generation assets or downstream gas conversion assets). Developers will likely need to think about and address upfront the replacement strategy for the shorter-lived assets, to ensure that the investment cost of the longer-lived items can be recovered over the entirety of their normal useful economic life. That is a somewhat atypical risk for developers to have to deal with at the onset of the project.

To mitigate all of these risks, it will be important for developers to deal with cross-default and interdependency risks, as ultimately the integrated value chain of their projects will only be as strong as its weakest link. Developers should strive to ensure that there are no uncovered interface risks and no gaps (unless they are willing and prepared to bear such risks on their own balance sheet and take responsibility for such gaps). Careful project structuring, coupled with the adoption of a holistic approach to the entire suite of project agreements, will be essential.

Offtake Risk

The success of export-focused P2X production projects will depend on their ability to secure offtake for their products at prices sufficient to cover projects' costs of production and transport and deliver a commercial return to the developers. However, there is no established offtake market yet in existence for green hydrogen and its derivatives, and such products are not generally today price competitive when compared to their fossil-fuel based alternatives (absent a significant carbon price).

As such, project developers in the short to medium term are likely to be reliant on government support in the form of incentives or subsidies, and in a number of cases (such as within the European Union) it is anticipated that such support will be provided indirectly to offtakers in their host jurisdiction. Such schemes will have their own qualification requirements, which developers will need to understand at the outset. This will also impact the assessment of the political risk faced by the project (as discussed further below).

In addition to this, developers will face the more typical offtake risks, such as price and volume risk and counterparty risk. These are risks which are well known and typically can be mitigated - in this respect, it is likely that certain key features of LNG sale and purchase agreements (LNGSPAs) will be transferred across and applied equally to hydrogen sale and purchase agreements (HSPAs) (such as take-or-pay obligations, delivery mechanisms, credit support undertakings, etc.). In this respect, and [as we explored in a separate article](#), some potential standard form of HSPAs may be beginning to emerge, in particular under the H2Global mechanism.

That is not to say, however, that HSPAs will in all respects track across the positions under LNGSPAs. The supply of green hydrogen and P2X products raises unique challenges not relevant or previously seen in a LNG context, which will need to be catered for by HSPAs.

By way of example, offtakers will require the products to be delivered to them to meet additional product requirements over and beyond mere chemical composition requirements, as evidence of the "green" properties (and in some jurisdictions, of the "sustainability" properties) of the products will likely be a key condition to the receipt of any government support (which, as noted, is anticipated to be required to make the supply economic both to the developer and to offtakers).

Decisions will also need to be taken in respect of the tenor and delivery window periods to be specified under the HSPAs. Offtakers will have an interest in clear pre-defined commitments, but developers will want to maximise flexibility to address any unexpected events or circumstances such as delays in the construction of the project or any performance issues.

Additionally, unlike LNG or other commodities, the resale potential of products not accepted by the offtaker is likely

to be limited (at least initially, whilst global markets and infrastructure develop), which means HSPAs will likely need to address the risk that the seller is unable to dispose of products which offtakers have failed to take.

Again, all of these risks are capable of management and mitigation through appropriate drafting of the HSPAs. This will be key to ensure that the HSPAs provide developers with sufficient certainty for the making of final investment decisions (and indeed to bank the project).

Political Risk

Unlike upstream oil (and gas) projects, it is anticipated that there will be relatively small differences in the marginal cost of production of P2X products between the best and the worst jurisdictions (from a resource availability perspective).

Because of this, it is likely that the fiscal and other legislative burdens imposed by the host jurisdiction on projects will play an oversized role in determining the projects' profitability.

In addition, many of the jurisdictions with the best worldwide resources have not yet implemented industry-specific rules or regimes whilst hinting at their intention to do so, and as such developers may be exposed to legislation being put in place retrospectively.

Another critical consideration in this context will relate to any requirements imposed by the host country in respect of local ownership / local content requirements and the use and skilling up of the domestic workforce - it is entirely understandable for governments to want projects implemented in their countries to help further their countries' social-economic development, and this can be mandated through legislation. It will be important for developers to engage in early dialogue and set clear objectives and commitments at the outset, in partnership with host governments, to minimise the risk of subsequent frameworks being imposed and resulting in the failure of the projects if they cannot be complied with or mitigated.

In addition to the political risk in the projects' domestic jurisdiction, developers of export-focused green P2X projects must also contend with the need to understand and mitigate political risk in the intended demand centres for their products.

Indeed, as noted in the context of the discussion of offtake risk above, where projects' economic viability is likely to be reliant on their ability to qualify for government support provided indirectly to offtakers, developers will need to have regard to the stability and reliability of the government support on offer and their ability to qualify for it, but also any other risks in relation to policy developments in demand centres which may impact the attractiveness of their projects.

The European Union's recent announcements and progress towards the implementation of the EU Carbon Border Adjustment Mechanism (CBAM) is a salient example of the

political risk faced by export-focussed projects even outside their chosen host jurisdiction: a carbon-neutral P2X production project may still face EU CBAM adjustments due to the need to ship the products across the globe. Even if they do not, the cost of compliance with EU CBAM (including in respect of reporting requirements and accreditation requirements) would need to be factored in.

Environmental Risk

P2X projects are intended to play a key role in the energy transition and are needed to reach our net zero targets and help in the fight against climate change. Despite this, they will not get a free pass when it comes to complying with local environmental protection requirements, which will need to be properly understood and addressed.

In addition, developers seeking to raise finance for their projects will likely need to demonstrate compliance with the Equator Principles and/or the IFC's Environmental and Social Performance Standards - and there is no acknowledgment or consideration given in those standards to the possibility that some adverse environmental impact at a localised level may be necessary to avoid the potentially more profound adverse environmental impacts likely to result if humanity fails to curb its carbon emissions.

Developers should also be wary of environmental (and indeed other sustainability) standards being weaved by offtakers into the product specification requirements under their HSPAs. We discussed this very risk in [our separate review of H2Global's proposed standard HSPA](#) which seeks to impose stringent requirements on developers.

Closing Remarks

Green hydrogen production projects are at the frontier of the energy transition - novel and rapidly evolving technologies, deployed in new jurisdictions, in a fast-changing environment and for a new market, the size of which remains unknown and uncertain. These projects raise complex and often unprecedented structuring issues which will need to be addressed. The first projects to break ground will likely require bespoke structures and risk mitigation strategies, which have the potential to be precedent-setting.

Already, momentous milestones are being reached around the world. In the Middle East, the NEOM Green Hydrogen Company announced recently that it had reached financial close on its USD 8.4 billion green ammonia project in Saudi Arabia, a development which will be followed with great attention around the world. In sub-Saharan Africa, Hyphen Hydrogen Energy and the Government of Namibia also announced recently that they had reached agreement on the terms governing their joint development of a USD 10 billion green ammonia project in Namibia, the largest and the only fully vertically integrated project in sub-Saharan Africa. Slaughter and May advised Hyphen Hydrogen Energy on the structuring of that first-of-a-kind project and on its negotiations of its agreement with the Government of Namibia, which the Government described as setting "*a new global benchmark, creating a template for the sustainable and equitable development of other green hydrogen projects*". There is no doubt that more learnings will be drawn for the industry from these and other projects as they continue to develop.

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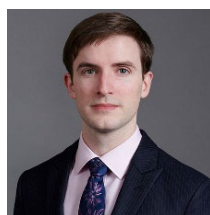
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