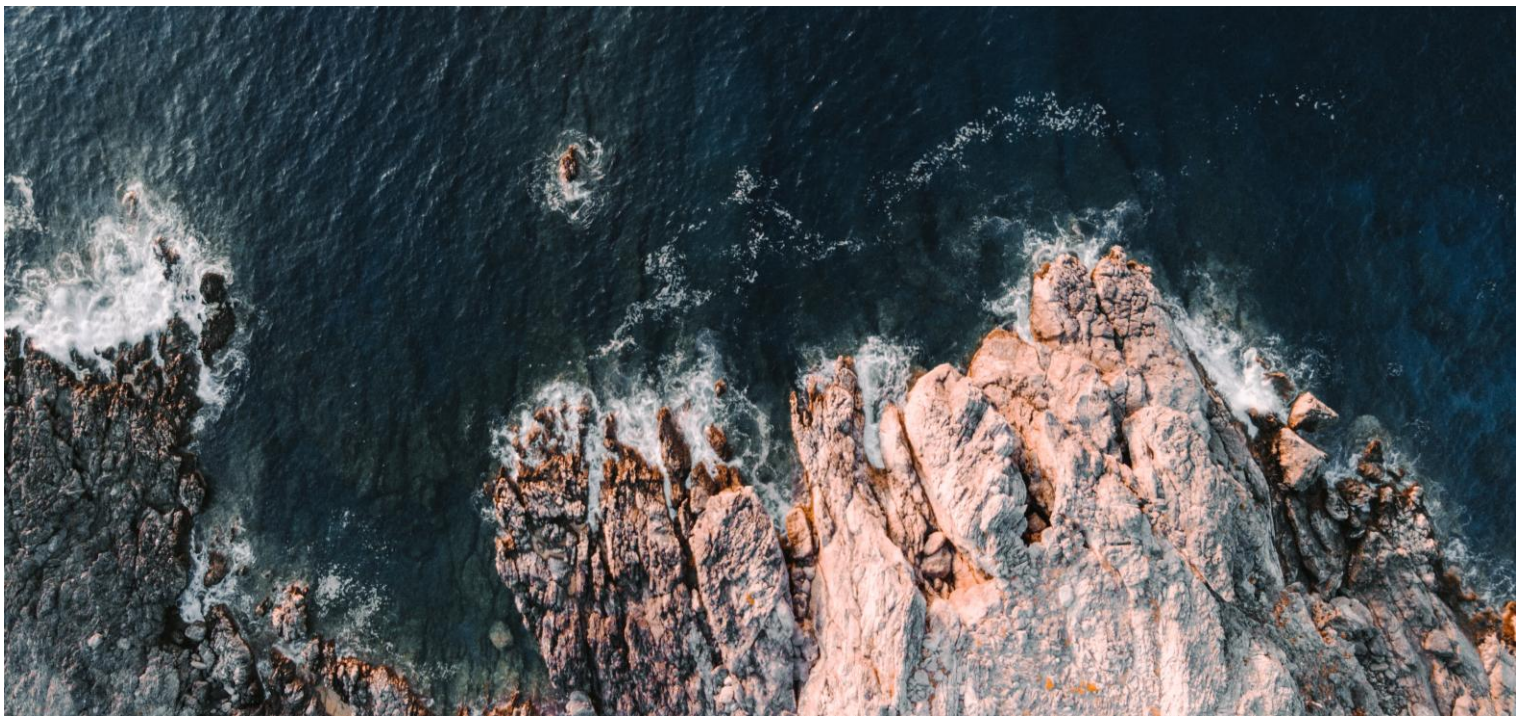

BalticSeaH2

Hydrogen Economy
Drivers and Barriers

Barrier – Bankability and risk allocation in large-scale hydrogen derivative projects

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Contents

Original Flexens plan

Flexens was a BalticSeaH2 partner with roots in Finnish research and demonstration work on renewable energy systems. Flexens was incorporated as a private limited company in 2018 and later developed into a project development company focused on large-scale Power-to-X and hydrogen value chains.

Flexens also developed a green ammonia project in Kokkola, Finland. The Kokkola production plant provides a relevant case for understanding the market and financing barriers faced by large hydrogen derivative projects. The planned facility was designed around a 300 MW electrolyser capacity and an annual production volume of approximately 200,000 tonnes of green ammonia. The earliest start of operation was planned for 2029, and the estimated investment was above 600 million euros. A later capacity expansion to 400,000 tonnes per year and 600 MW was also under review.

The Kokkola Industrial Park area was a strong location for producing hydrogen derivatives. The area has existing industrial infrastructure, port operations, experience in ammonia handling, access to relevant services, and potential connections to hydrogen infrastructure. It also offered opportunities to use side streams and shared infrastructure in an existing industrial environment.

From an investment perspective, the project was considered attractive. Flexens received three non-binding offers in spring 2024 from reputable parties to finance the next development phase of the Kokkola project. The location, project concept and business case were assessed positively by potential investors.

Market and financing challenges

The main challenge was the changing financing environment around large hydrogen projects. During the hydrogen market upswing, capital was more readily available for project development. By late 2023 and during 2024, the financial market for large-scale hydrogen projects had become more cautious.

The Kokkola project needed additional financing to move into the next development phase. The target was to secure funding for the

FEED phase, requiring at least around 12 million euros. Although the project attracted serious interest, all three non-binding offers were eventually withdrawn.

The withdrawals were not mainly linked to negative findings in the project itself. Instead, the parties cited internal capital allocation decisions and reduced exposure to the hydrogen sector. Investors already had large hydrogen projects in their portfolio and wanted to limit sector exposure. Another withdrew after top management decided to concentrate resources on assets already under development. The last remaining party continued due diligence and was satisfied with the project but ultimately reached a similar conclusion and decided to focus on assets where more capital had already been committed.

This illustrates a wider barrier for large hydrogen investments. Even when a project is technically credible, located in a strong industrial area and positively assessed in due diligence, financing can fail if investors become more cautious about the whole sector.

Regulation-driven demand and the timing problem

Large hydrogen derivative projects depend heavily on regulation-driven demand. In many value chains, renewable and low-carbon hydrogen remain among the most cost-effective routes for replacing fossil fuels and fossil-based chemicals. However, the end products are still more expensive than fossil alternatives and are expected to remain so for many years. This means that demand depends on regulation, market incentives and credible long-term policy signals.

The Kokkola project was planned around green ammonia. One of the relevant demand pathways was the use of ammonia as a shipping fuel. In the long term, ammonia can be an attractive option for shipping because it does not require captured carbon dioxide as an input. Compared with e-methanol or e-methane, this can lower the cost per energy unit in applications where fuel cost is critical. Fertilisers were also considered as a demand pathway, but regulation-based demand in that market was expected to emerge even later.

However, the demand timetable changed. During due diligence in summer 2024, the anchor off-taker postponed its expected schedule by more than three years. The reason was that the company's analysis indicated it could meet regulatory obligations with biofuels until the early 2030s. The original plan had assumed off-take starting around 2029.

This created a timing problem. The project was late for the peak of the hydrogen market hype, when capital was more readily available. At the same time, it was too early for the market, because demand regulation had not yet created sufficiently firm and bankable demand for green ammonia at the needed timetable.

The case shows that regulation can create long-term demand, but this alone does not make projects financeable. The timing, strength and credibility of regulatory instruments matter. If regulation allows incumbent or transitional solutions to meet obligations for several more years, demand for new hydrogen-based fuels may emerge later than project developers and investors originally expected.

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Bankability and value chain risk

The Flexens case highlights the importance of bankability and risk allocation across the full value chain. A large-scale hydrogen derivative project is exposed to several linked risks at the same time: electricity price and availability, off-take certainty, regulatory development, infrastructure, technology scale-up, financing conditions and market demand.

Financiers relevant to this type of investment, including infrastructure investors, pension funds, life insurance funds, banks and large industrial companies, generally avoid high levels of uncertainty. These investors are often seeking low-risk, long-term returns rather than venture capital-style risk. This creates a mismatch between the type of capital needed for large hydrogen infrastructure and the level of uncertainty still present in the market.

A key issue is that many actors in the value chain may have limited balance sheets. A project developer without a large balance sheet may not be a sufficiently bankable off-take partner for a renewable power producer. At the same time, a renewable power project may also be developed by a relatively light-balance-sheet developer. As a result, neither side can fully guarantee the long-term commitments required by financiers.

The same challenge can appear on the product side. An off-taker may be interested in future green ammonia or another hydrogen derivative but may not be willing or able to take long-term price, volume and regulatory risk before the market has matured. Letters of intent or early commercial discussions are therefore not enough to secure large-scale financing.

The practical result is a weakest-link problem. A project may have credible technology, a good location, interested partners and a plausible long-term market, but still fail to reach bankability if one part of the value chain cannot carry or transfer the required risk.

Electricity price and the national energy system vision

For hydrogen and derivative projects, electricity price is one of the most important competitiveness factors. In the Kokkola project, electricity represented a very large part of the expected lifetime cost of ammonia production. The impact of electricity price on profitability was therefore greater than the effect of capital expenditure subsidies alone.

This has important policy implications. Small countries cannot necessarily compete with larger countries by offering the biggest subsidies. A more durable advantage may come from an attractive and predictable electricity system. For Finland, the long-term outlook for renewable electricity was one of the key arguments supporting the Kokkola business case.

The investment case relied partly on the expectation that Finland could have a buyer's market for renewable electricity in the medium to long term. A flexible hydrogen plant could also operate in a volatile electricity market and make use of periods with more favourable electricity prices. This link between hydrogen investments and the future energy system vision is therefore central.

Climate policy, energy system planning and hydrogen investment projects need to be considered together. If national scenarios do

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not assume significant energy exports or do not reflect the possibilities created by hydrogen derivatives, the production assumptions may fail to capture the real investment opportunity. This can weaken the policy basis for infrastructure, electricity market development and industrial strategy.

Wider barriers at national level

Several barriers affecting large hydrogen projects can be influenced at national level. These include infrastructure development, industrial park competitiveness, access to biogenic carbon dioxide, invest-in activities, demonstration environments and coordination between actors.

Finland has documented competitive advantages in green, RFNBO and low-carbon hydrogen production. Electricity price is a key factor, but it is not the only one. The availability of biogenic carbon dioxide could become a significant advantage if a functioning market for CO_2 were created. This would be especially relevant for e-fuel and e-methane value chains.

However, carbon dioxide availability is also linked to risk allocation. Large investors may be reluctant to finance a project that depends on one individual chimney or one individual carbon dioxide supplier. This creates project-on-project risk, where two large investments become dependent on each other's balance sheets and long-term operations. A more open CO_2 market and supporting infrastructure could reduce this risk.

Hydrogen pipeline infrastructure could also improve bankability by creating optionality for both producers and off-takers. It would support redundancy, reduce dependence on single counterparties and make it easier to connect production potential with demand. For Finland, route-to-market questions are particularly important because not all hydrogen potential can necessarily be converted into derivatives domestically.

Industrial parks are another important part of the investment environment. Brownfield industrial locations can reduce risk by offering existing infrastructure, shared services, grid connections, port access, water treatment, district heating networks and potential side-stream use. However, the development of shared infrastructure in industrial parks is not always systematic enough to support large-scale hydrogen investments.

Policy suggestions

Policy development at both EU and national level should focus on bankability, risk sharing and mitigation in the value chain, and predictable demand creation. Capital expenditure subsidies can support individual projects, but they do not solve the full risk structure of hydrogen value chains. The main challenge is to turn long-term policy targets into investment cases that can be financed by infrastructure investors, banks and industrial actors.

At EU level, demand-side regulation should be predictable and strong enough to support final investment decisions. Blending obligations, ETS-related price signals, maritime and aviation fuel rules, industrial emissions requirements and instruments such as CBAM all shape hydrogen demand. If these instruments are weakened, delayed or remain unclear, off-takers have limited reason to

commit to long-term hydrogen and derivative contracts. This directly affects project bankability.

European risk-sharing instruments should be developed further to support long-term off-take and reduce uncertainty across the value chain. H2Global-type mechanisms, contracts for difference, carbon contracts for difference, auctions and guarantee instruments can help bridge the gap between producers and buyers. These mechanisms can allow producers to secure longer-term revenue visibility while buyers retain flexibility as the market develops.

Public balance sheets could be used more efficiently by guaranteeing parts of the value chain rather than only subsidising individual investments. This could make projects more financeable for low-risk, long-term investors and reduce the need for all risk to be carried by one off-taker or one project developer. This applies at EU level, through common funding and market instruments, and at national level, through complementary guarantees or participation in international schemes.

Finland and other Member States could examine how international risk-sharing mechanisms could be used or adapted nationally. Existing examples offer useful reference points, including models where several countries jointly support auctions or offtake structures. Finland could contribute to European mechanisms while also using national tools to support projects where the country has clear competitive advantages.

Hydrogen infrastructure and route-to-market development should remain priorities in European and national planning. Hydrogen pipeline infrastructure can improve the business case for several projects by connecting supply and demand, increasing optionality and reducing single-counterparty dependence. For Finland and the wider Baltic Sea region, this is particularly important because not all hydrogen potential can necessarily be utilised directly or converted into derivatives domestically. Access to wider European demand can improve investment logic.

Access to CO_2 should be treated as a market and infrastructure question. A functioning CO_2 market would reduce dependency on individual emitters and support the development of e-fuels and other CCU-based value chains. EU regulation should create clearer and more practical incentives for the use of sustainable biogenic CO_2 where this can support emissions reduction and industrial competitiveness. National policy can support this by identifying CO_2 sources, enabling infrastructure and reducing project-on-project risk.

Industrial parks should be developed as strategic platforms for hydrogen and derivative investments. This includes shared infrastructure, coordinated grid development, side-stream use, water and wastewater systems, port logistics and planning processes that make investment conditions more predictable. This is relevant across Europe, but Finland has a strong starting point because of its industrial sites, renewable electricity potential and availability of biogenic CO_2.

Finally, climate, energy and industrial policy should be aligned more closely. At

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EU level, hydrogen policy is linked to industrial competitiveness, security of supply, infrastructure planning and emissions reduction. At national level, policy scenarios should better reflect the possibility of significant energy exports, hydrogen derivatives and technology export. Domestic demand for pilots, references and demonstrations can also support technology companies that seek to scale into European and global markets.

Conclusion

The Flexens case shows that large hydrogen projects can face serious barriers even when the technical concept, location and industrial logic are strong. The Kokkola project attracted reputable investors and was positively assessed, but the wider market changed before the project reached final bankability.

The key lesson is that hydrogen investments depend on more than project-level readiness. They require credible demand, predictable regulation, manageable electricity price risk, infrastructure, bankable off-take and clear risk allocation across the value chain.

Flexens was late to the hydrogen market upswing, but too early for a fully bankable market. This timing problem is relevant for many hydrogen projects. The market is still developing, and the instruments needed to turn long-term demand into financeable investment cases are not yet mature enough.

The solution is not simply to wait for the market to mature. Public policy, infrastructure planning and value chain coordination can influence whether projects become bankable. If Finland and Europe want hydrogen and its derivatives to support industrial competitiveness, security of supply and emissions reduction, the focus must shift from project announcements to the conditions that make final investment decisions possible.

References

The paper was written based on Flexens' description of the investment case and Flexens' interpretation of the market and financing conditions that affected the Kokkola project.

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