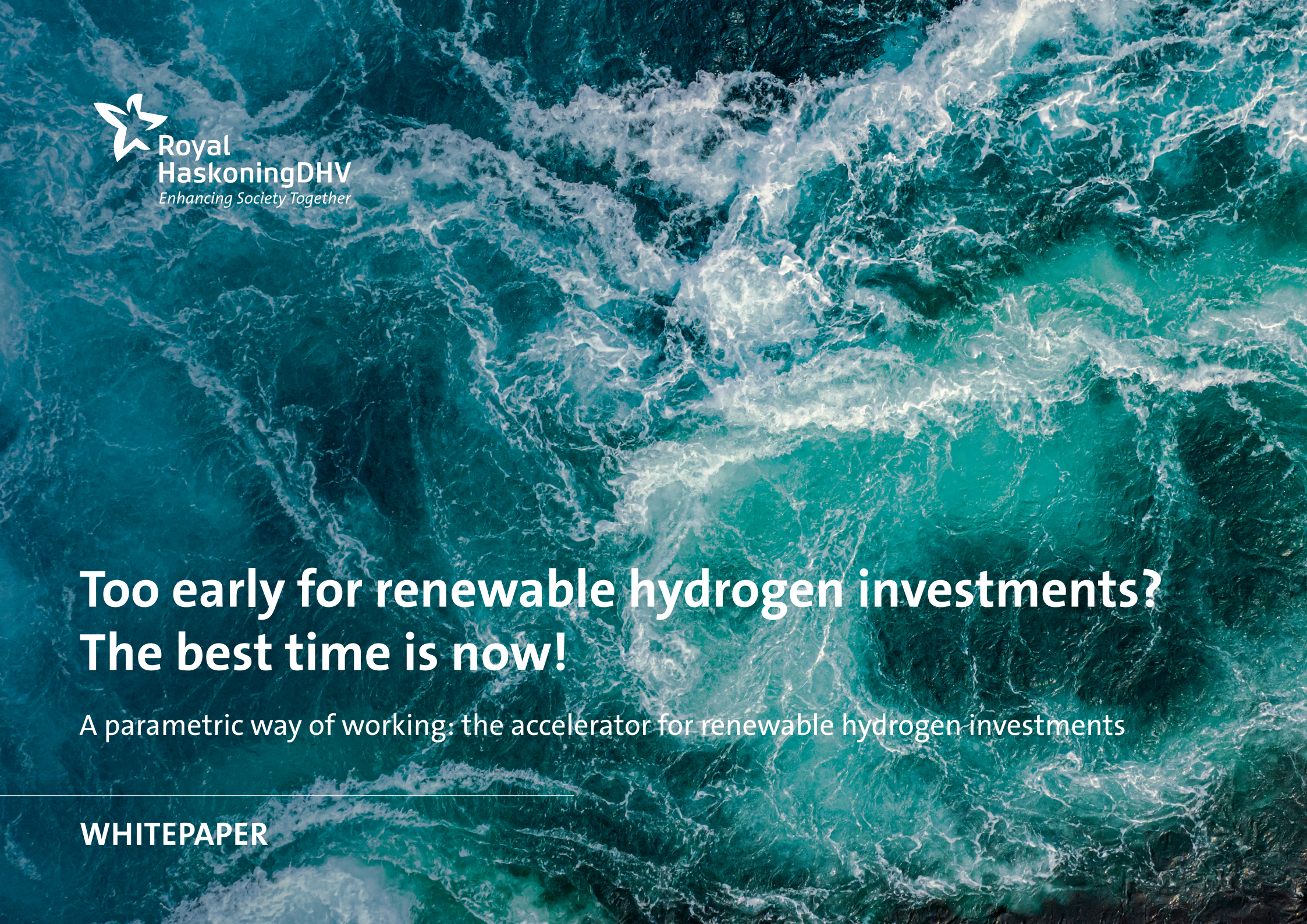


Royal HaskoningDHV
Enhancing Society Together

Too early for renewable hydrogen investments? The best time is now!

A parametric way of working: the accelerator for renewable hydrogen investments

WHITEPAPER

What is holding back investments in renewable hydrogen?

In reducing industrial carbon emissions, low carbon hydrogen has a key role as a feedstock and medium for storing and transporting energy. Steps towards net zero are being taken as it is becoming more widely adopted across industries, however more than 99.9% of hydrogen used today is still generated using fossil-fuels. Therefore, to really make a difference in industrial decarbonisation, it is key to replace fossil-based hydrogen with the renewable alternative, green hydrogen. While this transition requires new upfront investments, the long-term benefits will provide much needed security with regards to having a low carbon and reliable energy source.

So, if the benefits are clear, why is this transition still progressing so slowly? As often is the case with financial investments, uncertainty - ergo risk - is a limiting factor. The external environment, encompassing politics and technological development, affects every player on the market and can generally be controlled to a very limited extent. What about the internal factors?

Within the boundaries of an investment project related uncertainties often arise from the way it is setup. Specifically, from the stage-gate model that is commonly used to decide when to move on to a next project phase. This method increases speed by enabling disciplines to work in parallel within a single project stage, however when viewing the project from a wholistic perspective this benefit does not hold up. The key characteristic of the model to only allow stage progression to be made once the current phase is completed creates a major concern: what to do if future design modifications have to be embedded in a stage that has already been finalised?

The uncertainty that results from not having an answer to this question in an environment that is very subjective to rapid change makes investors reluctant to board a project. Hence, the potential of private financing is not being fully unlocked in the renewable hydrogen market.

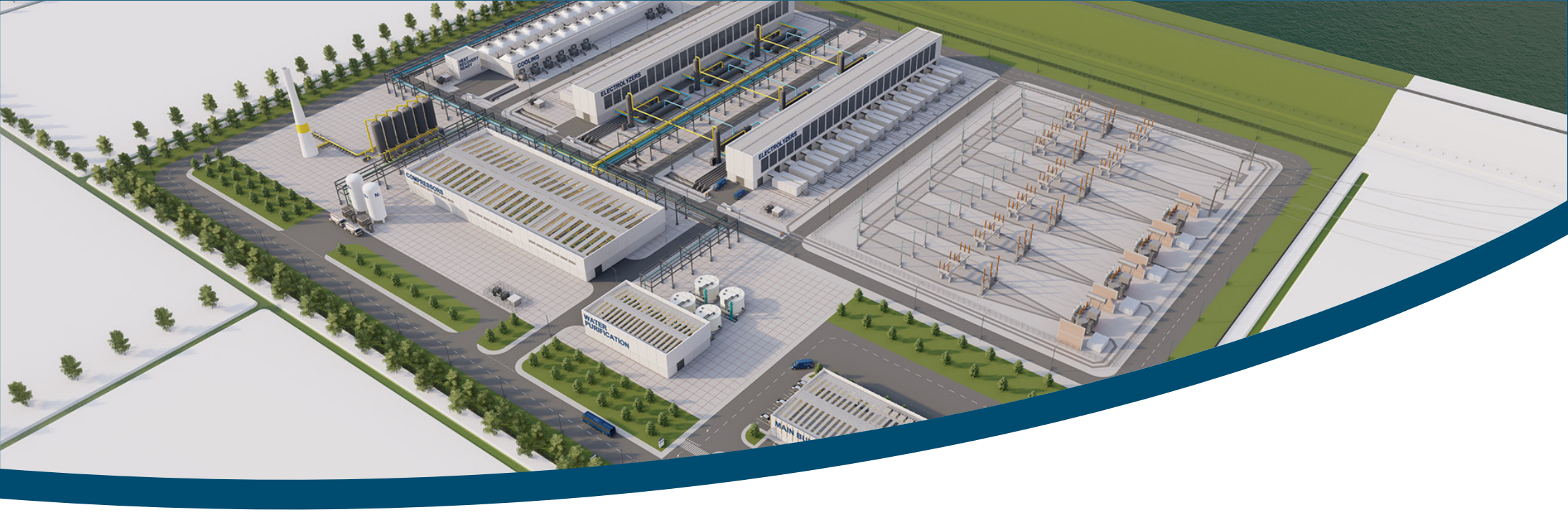
The solution: reduced risk through a parametric way of working

While the reluctance to invest in renewable hydrogen appears to be grounded on valid reasons, the underlying problem is not insurmountable. In order to reduce uncertainty and be optimally prepared when taking on the Final Investment Decision (FID) process, having an up-to-date, reliable and valid stream of information is key. Introducing a parametric way of working can be the ideal solution to provide this.

A parametric way of working is a design approach implemented at the very start of a brownfield and/or greenfield project. It enables for a response to change in any design phase quickly, simply and at a low cost by having stakeholders work within a central platform. Aligning people and processes at all times for efficient project status tracking, clearer forecasting and quicker and more informed decision making. When modifying inputs, the impact of changes becomes instantly visible, giving decisionmakers the opportunity to easily generate a variety of alternative scenarios to pick the optimal solution from. Through these insights smarter decisions are made and permits can be obtained much more efficiently by modifying designs on the fly to accommodate for the latest requirements. This high level of flexibility makes the parametric approach ideal for integrating multiple requirements into a single scalable design concept that can be duplicated and applied to multiple locations.

The key to more renewable hydrogen

Characteristics of the parametric way of working have already benefited projects in a wide variety of industries. For example, through providing a competitive advantage, managing complexity and risk, increasing user experiences and precisely meeting customer needs. Similarly, its features can be very advantageous in renewable hydrogen projects when adapting to rapidly evolving technological developments, legislation, and regulations. With high flexibility and customisability to perfectly fit individual requirements of a new assignment, the way of working provides much more functionality than off-the-shelf modular solutions. Physical design parameters such as the (required) power capacity of an electrolyser or safety distances between storage tanks are decisive for the design and therefore integrated into all models. The end result will serve as a solid foundation to efficiently manage the FID processes.



Parametric design in practice

ISPT Hydrohub

The challenge:
To meet rising demand for renewable energy sources it is essential that production of green hydrogen is significantly scaled up. Together with the Institute for Sustainable Process Technology (ISPT) and other partners, our objective was to design a 1-Gigawatt green hydrogen facility while optimising the required capital investment and plot area.

Approach and results:
Using our knowledge on the technology required for this project, we analysed the potential of several alternative locations for the Gigawatt electrolyser in five large Dutch industrial clusters: Chemelot, North Sea Port, North Sea Canal, Port of Rotterdam, and the Groningen Seaport region. The most feasible design was selected using parametric designs we developed to deliver insights on technology selection, equipment configuration choices, and civil, structural, and architectural costs. A major step towards realising this new facility was taken by combining all acquired information into the first virtual experience of a large-scale green hydrogen facility while providing insight into cost and plot optimisation.

Parametric design in practice

Port of Rotterdam Import Terminal

The challenge:
Prepare our client's terminals for a future scenario in which renewable hydrogen import will rapidly increase.

Approach and results:
A simple parametric model was constructed to provide data on the space required for import terminals of liquid hydrogen, ammonia, and liquid organic hydrogen carriers. It embeds annual throughput data of hydrogen, exclusion zones and existing industrial facilities, creating a simulated environment that closely matches the real-life situation. After generating and analysing a variety of design alternatives through the parametric way of working, the results were used as input to determine the safety and environmental space by means of quantitative risk analysis and relevant environmental studies. This provided Port of Rotterdam with quick and relevant insight into space requirements and possible locations for new terminals, ultimately giving them the information needed to make faster and better decisions.

Your partner in accelerating the energy transition

As part of our mission to enhance society together, Royal HaskoningDHV is proactively contributing to renewable hydrogen initiatives. With recognised in-depth understanding of the challenges developers encounter during investment projects, we are the ideal partner to provide you with solutions to overcome these.

Would you like to learn more and discuss your ideas? Please get in touch:

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