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Hydrogen Update

November 2021

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CONTENT – HYDROGEN UPDATE NOVEMBER 2021

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Hydrogen, November 2021

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Dear friends and readers,

HYDROGEN IS REGARDED BY MANY AS A KEY in the transfer to a low carbon economy and to fulfil the commitments of the Paris Agreement, while meeting the world's future energy needs.

Norway is well positioned for the development, production and use of both green and blue hydrogen, as well as carbon capture and storage. This creates great opportunities, and several Norwegian industry and energy companies are in the forefront of developing hydrogen projects.

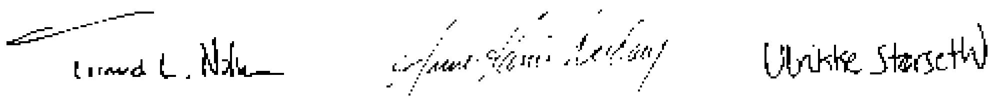
However, in building the bridge between the past and the future, and in order to accelerate the development of hydrogen, several challenges and barriers must be tackled such as technology, costs, investments, and infrastructure. In this newsletter, we focus on the regulatory backdrop which is essential for the development of a hydrogen economy, in particular within the EU, and the state aid framework necessary to boost demand and supply of hydrogen.

Drawing on recent experience, we also address the practical and legal issues that have to be kept in mind when successfully developing hydrogen projects, as well as the legal framework for hydrogen sales and purchase contracts and carbon capture and storage agreements. We also consider the potential for hydrogen in the shipping industry, and marine transport solutions and applications of hydrogen.

We are particularly grateful to DNV for sharing valuable insights from their hydrogen research exploring the outlook for the emerging hydrogen economy, which supports the industry view that hydrogen is essential to a cleaner future, in particular in heavy-to-decarbonise sectors. We also thank our Brazilian partner firm Vieira Rezende who provides their reflections on the prospects for low-carbon hydrogen in Brazil, giving an international flavour to the discussion.

We hope that you will find the articles of this newsletter interesting, and welcome any feedback you may have as well as your participation in our on-going discussion on hydrogen. •

> Hydrogen is regarded by many as a key in the transfer to a low carbon economy and to fulfil the commitments of the Paris Agreement.



Tormod L. Nilsen   Anne-Karin Nesdam   Ulrikke Størseth

Photo: Kari M. Sandbukt

Wikborg Rein's Hydrogen Task Force. From left: Senior Associate Ulrikke Størseth, Partner Tormod L. Nilsen, Partner Aadne M. Haga, Specialist Counsel Anne-Karin Nesdam, Partner Hanne C. Zimmer and Partner Andreas Fjærvoll-Larsen. Partner Christian James-Olsen was not present when poto was taken.

Hydrogen essential to a clean energy future:

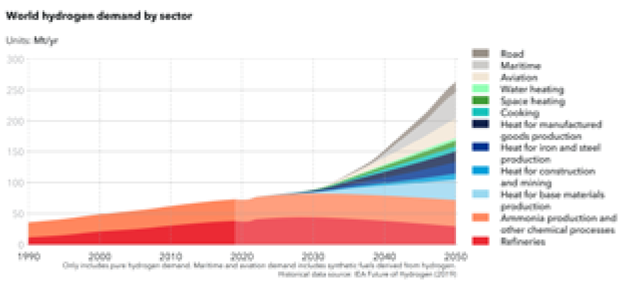
Rising to the challenge

The energy industry is rising to the challenge of a hydrogen economy. For many, it is essential for a clean energy future. Some three quarters (73%) of senior energy professionals say Paris Agreement targets will not be possible without a large-scale hydrogen economy and a similar share (74%), say there is no way to achieve a zero-carbon economy by 2050 without hydrogen.

Text: Jørg Aarnes, Global Segment Lead – Hydrogen and CCS, DNV

THESE ARE THE FINDINGS OF DNV'S latest hydrogen research: Rising to the Challenge of a Hydrogen Economy. This explores the outlook for the emerging hydrogen economy, from production through to consumption, drawing on a survey of more than 1,100 senior energy professionals.

From another perspective, DNV's Energy Transition Outlook (ETO), our independent forecast of the world's energy system to 2050, finds that the world will not achieve a widescale hydrogen economy by 2050. Our analysis indicates that hydrogen will only start to scale as an energy carrier from the late 2030s, growing strongly in the 2040s to reach 5% of global energy demand in 2050, albeit with large regional variations – with hydrogen meeting 12% of final energy demand in Europe. However, our best-estimate forecast also shows that the world will miss the targets of the Paris Agreement. Cumulative emissions will exhaust the 1.5°C budget in 2029, 2°C budget in 2053 and indicate 2.3°C global warming by end of the century.



Source: Energy Transition Outlook 2021, DNV

These two findings from our ETO are closely connected and support the industry view that hydrogen is essential to a clean energy future. The issue lies in hard-to-abate sectors that cannot be easily decarbonized through electrification, including aviation, maritime, long-haul trucking and large parts of heavy industry.

Hard-to-abate sectors are currently responsible for around 35% of global CO_2 emissions and progress in reducing these emissions is stubbornly slow. We forecast that these hard-to-abate sectors will reduce their emissions by just 33% by 2050, while all other sectors combined will reduce emissions by 55%. We find that hydrogen and hydrogen-derivates are the most promising solution to decarbonize these sectors, in addition to providing energy storage to support the huge growth in renewables and electrification required for a deeply decarbonized energy system.

RISING TO THE CHALLENGE

The challenge for the hydrogen economy is not in the ambition, but in changing the timeline: from hydrogen on the horizon to hydrogen in our homes, businesses, and transport systems.

Three quarters (74%) of energy professionals say that the outlook for a hydrogen economy improved significantly in the past 12 months, while two thirds (67%) expect this will continue in the next 12 months.

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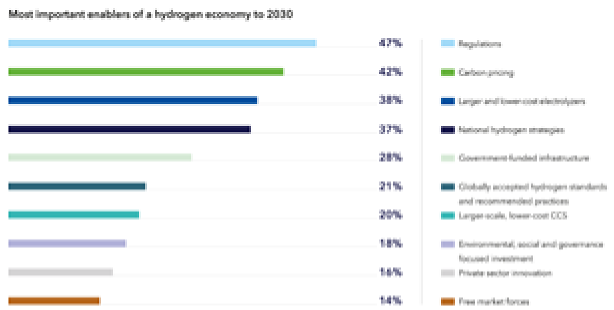
Ambitions and the rate of change in the hydrogen economy are sky high, leading some to question whether hydrogen goals are realistic. However, more than just outlook and ambition, hydrogen is rapidly rising up the agenda in terms of revenue and spending.

Almost half (44%) of energy companies involved in producing and distributing hydrogen and the supply chain expect it to account for more than a tenth of their revenue by 2025, rising to 73% of companies by 2030. This is up significantly from just 8% of the companies in the survey today.

On the other side of this new energy value chain, 33% of hydrogen consumers expect hydrogen to represent more than a tenth of their organization's energy or feedstock spending by 2025, rising to 57% by 2030. This is up from just 9% today.

While much of the required hydrogen technology is proven, hydrogen value chains require significant development. The scale to meet the expected demand and applications will require new ideas, processes, and models. The right regulations are deemed the most powerful enabler of a hydrogen economy, followed by carbon pricing.

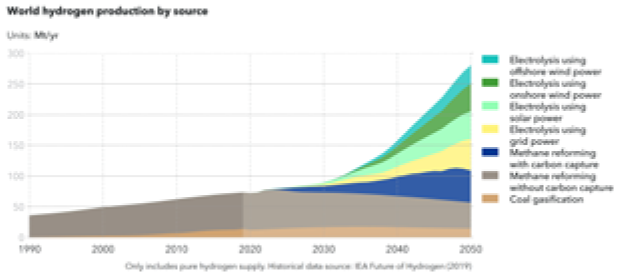


Source: Rising to the Challenge of a Hydrogen Economy, DNV

Key regulatory issues include: safety, such as the safety distances for hydrogen stations; rules for hydrogen and ammonia fuelled ships; injection and blending of hydrogen into natural gas transmission systems; subsurface storage of hydrogen, such as in salt caverns; quantity and pressure limitations in road transport; greenhouse gas footprint requirements for low carbon hydrogen; and connecting electrolysers and fuel cells to the electricity grid.

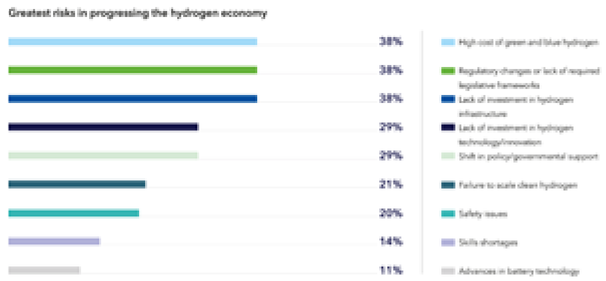
Financing will also be key. DNV's research Financing the Energy Transition raises the issue that hydrogen opportunities are currently long-term, low-return, and seemingly high-risk. Financiers are unlikely to jump at them without significant government support to create certainty and provide more direct support through subsidies or an effective carbon price.

On the debate between green and blue hydrogen, just under half believe that more blue hydrogen will be produced and consumed than green hydrogen in 2030, while 35% have the opposite view. Crucially, the majority of energy professionals (77%) believe that both blue and green hydrogen need to work in synergy to successfully scale the hydrogen economy. This is also DNV's view and the view from our ETO research. Green hydrogen will dominate in the long run, but blue hydrogen will be key to scaling the hydrogen economy. We forecast a roughly 80/20 split between blue and green hydrogen in 2050. At this point, we expect two thirds of green hydrogen to be produced via electrolysis from dedicated off-grid renewables, with the remaining third produced from cheap grid electricity.



Source: Energy Transition Outlook 2021, DNV

The energy industry is aware of the significant challenges involved in rapidly adopting hydrogen. Some 71% of senior energy professionals believe current hydrogen ambitions underestimate the practical limitations and barriers to adoption. Infrastructure and cost are two of the biggest hurdles. For those currently not invested or involved in hydrogen, a lack of infrastructure is the top reason why they focused elsewhere. Some 78% of the energy industry believes repurposing existing infrastructure will be essential to develop a large-scale hydrogen economy.



Source: Rising to the Challenge of a Hydrogen Economy, DNV

Nevertheless, around 43% of the industry believe that the majority of national and organizational hydrogen goals are realistic. This could be seen as quite high, considering how ambitious some of those targets are and the challenges involved.

To progress to the stage where societies and industry can enjoy the benefits of hydrogen at scale, all stakeholders will need immediate focus on proving safety, enabling infrastructure, scaling production and incentivizing value chains through policy. •

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THE HYDROGEN PUZZLE

– EU regulatory initiatives in the pipeline

Following the adoption of the EU Hydrogen Strategy and the EU Energy System Integration Strategy in July 2020, the European Commission has worked on various regulatory initiatives, as announced in the respective strategies, to facilitate the development of a well-functioning hydrogen market.

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THIS ARTICLE ADDRESSES the purpose and the status of the ongoing regulatory initiatives at EU level, which include revisions of EEA relevant legislation already implemented in the EEA Agreement and in Norwegian legislation.

THE PURPOSE OF THE REGULATORY INITIATIVES

In July 2021, the European Commission (EC) presented the "Fit for 55" package, seeking to implement the at least 55% emission reduction target compared to 1990 levels which the EU has set for 2030. Proposed revisions to RED II (Directive 2018/2001/EU) and the EU Emissions Trading System (EU-ETS) (Directive 2003/87/EC) were part of this package. In parallel, the gas market legislation is currently under review and a legislative proposal is expected before the end of this year. The purpose of these legislative initiatives is to promote *inter alia* hydrogen by creating a level playing field and to facilitate the market entry of renewable and low-carbon gases, including hydrogen, and remove any regulatory barriers.

> The gas market legislation is currently under review and a legislative proposal is expected before the end of this year.

PROPOSED REVISION OF RED II TO INCLUDE RENEWABLE HYDROGEN

RED II is the EU's main legal instrument for the promotion of renewable energy across all sectors of the EU economy, establishing common principles and rules *inter alia* to remove barriers, stimulate investments and drive cost reductions in renewable energy technology. The proposed revision extends the EU-wide certification system for renewable fuels to include hydrogen. Also, to support the 40GW electrolyser goal in the EU's Hydrogen Strategy, a new target for a 50% renewable share in hydrogen consumption in industry has been proposed, as well as binding targets for heavy-duty and long-distance transport, which are hard to decarbonise. The adoption of the proposed revision, which demonstrates how the EC is focusing on boosting hydrogen produced from renewable energy sources, is expected by the end of 2022.

PROPOSED REVISION OF THE EU EMISSIONS TRADING SYSTEM TO INCLUDE RENEWABLE AND LOW-CARBON HYDROGEN

The EU Emissions Trading System (EU-ETS) contributes to the EU's greenhouse gas reduction targets by setting a cap on the total amount of greenhouse gas emissions from participating entities, which include entities in energy-intensive industrial sectors, such as power stations and industrial plants. In essence, the scheme follows the "polluter pays" principle. Participating entities must buy, through auctions, or receive emissions allowances for each tonne of CO_2 equivalent they emit. The participating entities may also trade emission allowances between each other.

Currently, only fossil-based hydrogen production is part of the scope of and receives free allowances under the EU-ETS. However, the revision proposed by the EC will extend the scope of the EU-ETS to include production of hydrogen with electrolysers, making renewable and low-carbon facilities eligible for free allowances. The purpose is to incentivise production from installations that reduce greenhouse gas emissions and to ensure a level playing field for all existing technologies. Specifically, broadening the scope of the EU-ETS will prevent participating entities wanting to switch to renewable or low carbon technology from facing competitive disadvantages. An adoption of the revised EU-ETS is expected by the end of 2021.

THE ON-GOING REVISION OF THE EU SECONDARY GAS MARKET LEGISLATION

The Gas Directive (Directive 2009/73/EC) and the Gas Regulation (Regulation 715/2009) are currently subject to review. The European Commission has indicated that a legislative proposal, which could be in the form of either revisions of the existing legislative instruments and/or a new legislative act, can be expected before the end of 2021.

First, the revision of the gas market legislation will need to address the emergence of a hydrogen market and hydrogen infrastructure. It is clear that the EC considers early regulatory intervention important to provide regulatory predictability for investors and avoid the emergence of non-regulated monopolies. The aim is that the market design for hydrogen should build on the existing EU market design for natural gas, including unbundling between regulated network activities and market-based supply and production (including Power-to-Gas) activities, non-discriminatory third party access, transparency, customer protection, tariff principles, network development based on foreseeable demand – aiming at avoiding stranded assets - and appropriate supervision and governance. This is reflected both in the EC's inception impact assessment (roadmap) published on 10 February 2021 and the conclusions from the 35th Madrid Forum in March 2021. The challenge is to design rules that provide regulatory predictability, yet are flexible enough to allow for the various pathways hydrogen production patterns and infrastructure deployment may take.

Second, the gas market legislation has to be revised to facilitate access to existing gas infrastructure, including transmission, distribution and storage infrastructure and LNG terminals, and markets, subject to what is technically possible. The Gas Directive and the Gas Regulation are designed for the organisation and functioning of the current fossil-based natural gas sector. For instance, the current design of the gas market legislation reflects that natural gas is mainly imported to the EU from third countries. However, production facilities for hydrogen and decarbonised gases are decentralised, and may not be connected to any network at all as the gas could be consumed at the place of production or transported by other means to where it is used depending on e.g. the cost effectiveness and emissions associated with a particular means of transportation. Consequently, the rules have to be adapted to anticipate decentralised injections in the grid and allow for reverse flows from distribution to transmission level.

In addition, as the gas market legislation does not anticipate the emergence of hydrogen or decarbonised gases, it does not have mechanisms to address changes to the gas quality due to such alternative gases being added to the flows of natural gas. This quality issue also has a side to consumer protection and end-user applications. The ongoing review is addressing the quality issue that the increase of hydrogen and decarbonised gases give rise to, including work on standardisation.

The roadmap also indicates that a more integrated infrastructure planning is needed to facilitate system integration, and an alignment between the network planning procedures at European and national levels is envisaged.

THE REGULATORY FRAMEWORK FOR HYDROGEN IS STILL IN THE MAKING

The regulatory framework for hydrogen that is currently in the making will be crucial for the development of a functioning hydrogen market, by creating regulatory predictability and a level playing field for all technologies. With respect to the market design, we consider a stepwise approach likely and we are following the regulatory developments closely. •

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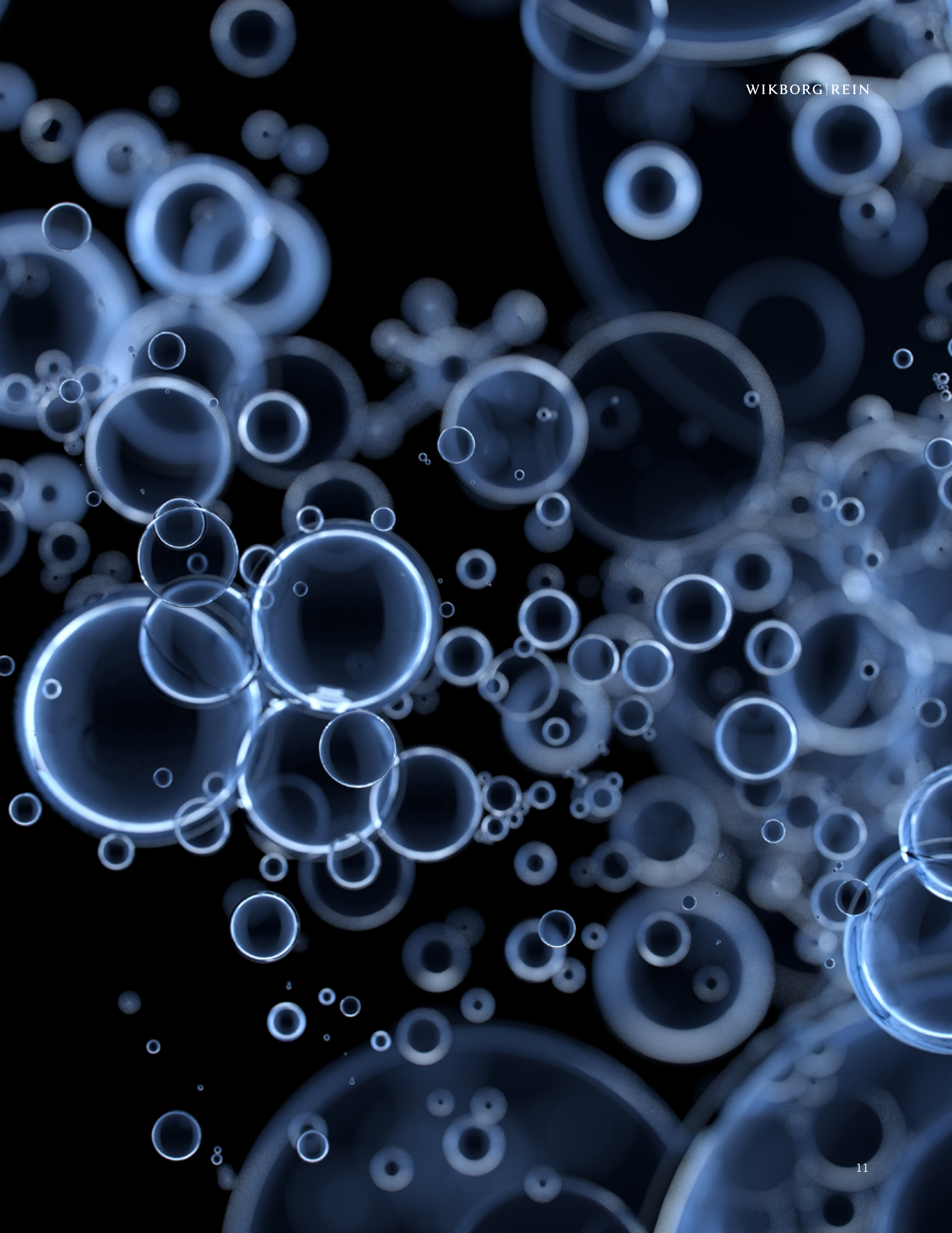

HOW DOES THE EU TAXONOMY REGULATE HYDROGEN?

In order to meet the EU's climate and energy targets for 2030, and reach the objectives of the European Green Deal, the EU deemed it vital to direct investments toward sustainable projects and activities. To achieve this, the Commission needed a common language and clear definition of "sustainable" – they in turn created a common classification system for sustainable economic activities, or an "EU Taxonomy".

THE TAXONOMY REGULATION entered into force 12 **JULY** 2020, and established the basis for the EU Taxonomy by setting out three overarching conditions an economic activity has to meet in order to qualify as environmentally sustainable. These include the "substantial contribution" and "do no significant harm" criteria. Under the Taxonomy Regulation, the Commission also needed to produce a list of environmentally sustainable activities by defining technical screening criteria for each environmental objective through delegated acts.

The Commission makes it clear that "*there is no obligation on companies to be Taxonomy-aligned, and investors are also free to choose what to invest in.*" However, many finance market participants looking for green and sustainable investments will rely on the taxonomy; in addition, rules and criteria used by the EU taxonomy will likely spread into other areas of EU law, such as state aid and guarantees of origin.

THE DELEGATED ACT: CRITERIA FOR SUSTAINABLE HYDROGEN ACTIVITIES

The Commission approved its first delegated act on sustainable activities for climate change adaptation and mitigation objectives on 21 April 2021. The Delegated Act, also called the "Climate Delegated Act" ("**DA**"), will enter into force at the end of the scrutiny period of co-legislators (four months that can be extended by another two months), and it will apply from 1 January 2022.

The DA specifically addresses hydrogen, setting out greenhouse gas thresholds relating to hydrogen production and other criteria for other hydrogen-related activities. The criteria supports hydrogen's use as an energy carrier, storage solution, fuel, or feedstock. Notably, the criteria for manufacturing hydrogen are set at a level considered sufficient to ensure a substantial contribution to climate change mitigation, favoring the production of hydrogen from renewable sources.

THE MOST IMPORTANT CRITERIA LARGELY INCLUDE THE FOLLOWING:

- The greenhouse gas emissions threshold (under substantial contribution criteria for climate change mitigation) for hydrogen production has been set at 73.4%, resulting in GHG emissions lower than 3tCO2/tH2 (total carbon dioxide per total hydrogen) on a lifecycle basis. This threshold seems to favor green hydrogen, however it may also show that carbon-efficient blue hydrogen (which uses carbon capture and storage) and turquoise hydrogen (which releases solid carbon) can qualify as taxonomy-aligned.
- The production of hydrogen-based fuels (e.g. ammonia) is included as an eligible activity. The DA requires that the GHG emissions savings be calculated using the methodology of the international standard ISO 14067:2018 or ISO 14064-1:2018, or alternatively, the methodology that the Commission must adopt under Article 28(5) of the Renewable Energy Directive ("RED II"), i.e., the methodology for assessing GHG emissions savings from renewable liquid and gaseous transport fuels of non-biological origin.
- The manufacturing of all machines that can produce hydrogen in a taxonomy-aligned way is included as an enabling activity, and will automatically qualify as an activity meeting the substantial contribution test. This means that the production of blue or turquoise hydrogen machines could qualify as taxonomy-aligned.

THE DELEGATED REGULATION WITHIN THE BROADER EU HYDROGEN STRATEGY

Today's Taxonomy criteria remains in line with the EU Hydrogen Strategy and encourages the production and use of hydrogen in accordance with the European Green Deal goals. While the European Commission must still adopt detailed rules on what should be defined as renewable (green) and low-carbon (blue) hydrogen, the Delegated Regulation sets a base standard for the sustainable production of hydrogen. •

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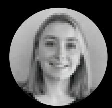
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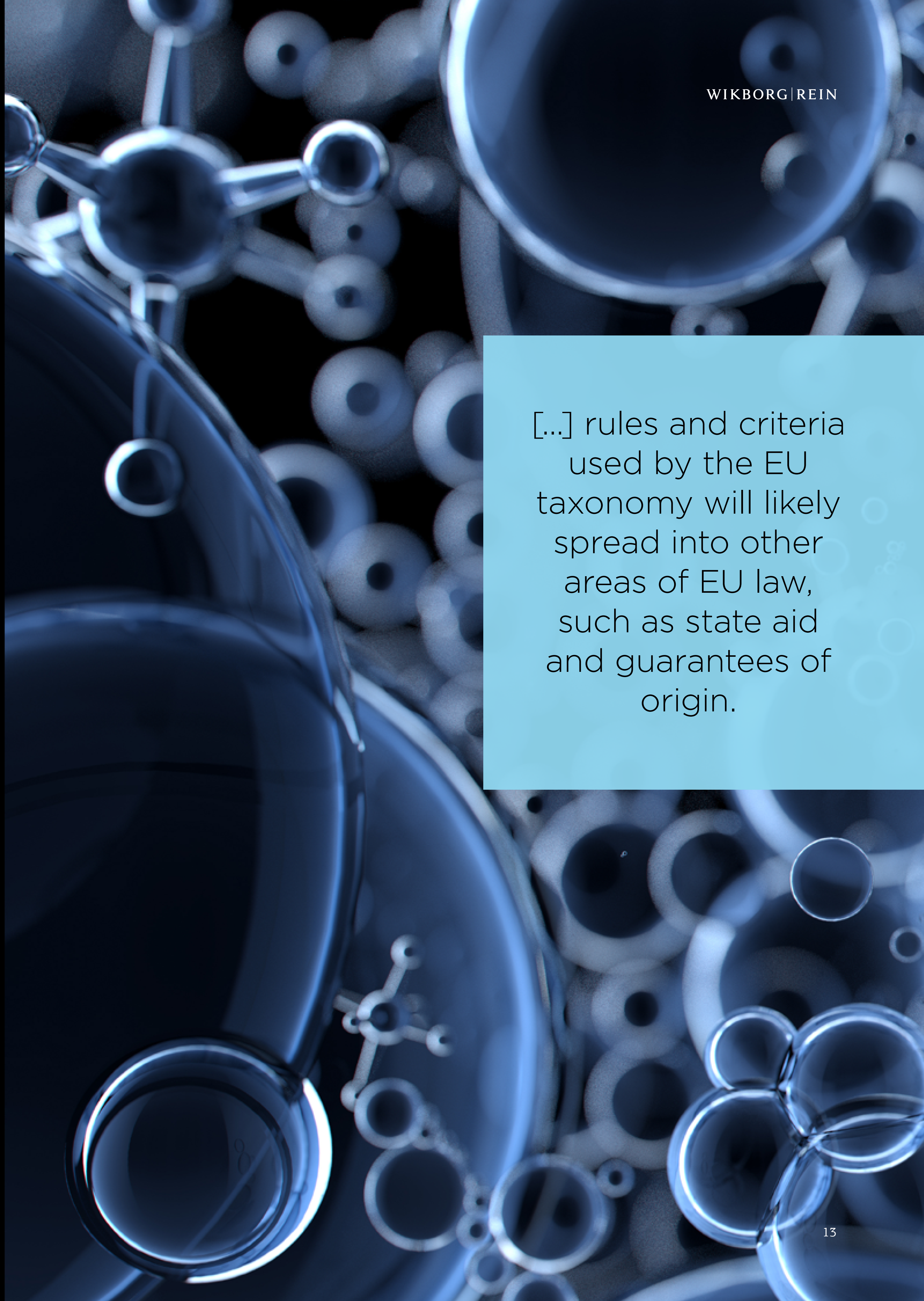

[...] rules and criteria used by the EU taxonomy will likely spread into other areas of EU law, such as state aid and guarantees of origin.

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STATE AID FOR HYDROGEN

A revised State aid framework should help boost the demand and supply of hydrogen in Europe. The European Commission set out this promise in the EU's hydrogen strategy for a climate-neutral Europe, adopted in July last year. Has the Commission delivered on its promises?

IN THIS ARTICLE, WE TAKE A LOOK AT NEW RULES and draft legislation published by the Commission since July last year.

AID FOR HYDROGEN PROJECTS – WHY DO THE CURRENT RULES NEED AN OVERHAUL?

State aid provided to industry in the EEA must abide by the State aid framework. While the State aid rules are not aid schemes or programmes in themselves, they provide the framework that Member States' support schemes must adapt to. Straight-forward aid measures may fall within the so-called general block exemption regulation (GBER), where Member States may ensure these enter into effect without prior approval. Meanwhile, larger and more complex projects require prior notification to and approval by the Commission, or in Norway's case, by the EFTA Surveillance Authority (ESA).

The draft guidelines do not define aid for hydrogen projects as a separate category, but many objectives in the draft cover different parts of the hydrogen value chain.

The current framework (from 2014) allows aid for a number of environmental objectives, and by expanding the scope of the GBER has dispensed with the need to notify aid measures in advance in a large number of cases. While the current rules cover some hydrogen projects (e.g. aid for refuelling infrastructure), the framework has not been particularly well adapted to the general provision of aid for hydrogen production and infrastructure. This is partly because hydrogen is an energy carrier rather than a source of energy, and hydrogen projects therefore do not always fit the criteria. In addition, rules for calculating the costs eligible for aid generally presuppose a comparison with a so-called "counter-factual scenario", i.e. a similar conventional investment. This is logical where one chooses to invest in, for example, conventional vehicles rather than zero-emission vehicle. However the test remains difficult to apply where the conventional alternative is less clear, as may be the case for an investment in, for example, hydrogen production capacity. Finally, aid intensities (i.e. percentage of eligible costs covered by aid) under the current framework are, in many cases, too low for projects involving new technologies or immature markets.

NEW DRAFT GUIDELINES FOR STATE AID – CLIMATE, ENVIRONMENTAL PROTECTION AND ENERGY

In June this year, the Commission published new draft guidelines on State aid for "*climate, environmental protection and energy*" (CEEAG). The draft guidelines do not define aid for hydrogen projects as a separate category, but many objectives in the draft cover different parts of the hydrogen value chain:

- Instead of providing for aid for renewable energy, the draft CEEAG allows aid for "*the reduction and removal of greenhouse gas emissions, including through the support for renewable energy*". In other words, aid may not only be granted for renewable energy, but also for projects which otherwise aim at reducing greenhouse gas emissions. This explicitly includes "dedicated infrastructure projects" for hydrogen and other low-carbon gases, i.e. infrastructure without third party access. In addition, the production of low-carbon/carbon free hydrogen, e.g. as a fuel or for industrial processes, likely also applies under this section.
- Aid for *energy infrastructure* now explicitly covers hydrogen infrastructure, including transmission pipelines; underground storage facilities connected to such pipelines; dispatch, reception, storage, regasification or decompression facilities for hydrogen; and equipment or installations essential for the hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity. Aid under this heading requires third party access. Where this is not the case, such infrastructure may be "dedicated infrastructure" and be eligible as aid for the reduction or removal of greenhouse gases.
- Aid for *clean mobility* may include aid for refuelling infrastructure for alternative fuels, including hydrogen. Interestingly, this aid may also apply to the on-site production of electricity or hydrogen from renewable sources connected to the refuelling infrastructure, as well as on-site storage facilities.

To determine the aid element, the draft CEEAG relies increasingly on a competitive bidding procedure. The big benefit of this approach is that aid awarded through a competitive bidding procedure does not require any detailed assessment of the *net extra cost* by reference to a counterfactual investment, and is not capped at a fixed percentage of such "extra cost". In principle, up to 100% of the extra costs may therefore be covered. Awards through a competitive bidding procedure is the main rule for most types of aid, for example regarding aid for the reduction or removal of greenhouse gases, aid for hydrogen production, or aid for clean mobility (including refuelling infrastructure or on-site hydrogen production).

Aid for energy infrastructure does not rely on competitive bidding, and in principle the entire investment may be eligible cost. However, actual aid intensity must be considered for each scheme or project, with the aim to minimise competition distortion.

In summary, the new guidelines (when adopted) will cover a larger number of hydrogen projects and also allow for higher aid intensities, bringing a welcome change. It should be noted, however, that the Commission's emphasis on competitive bidding is a clear signal that more generous rules do not allow Member States to create "national champions" enjoying preferential treatment by their national government. The draft guidelines were subject to public consultation this summer. Certain changes may be made before the expected adoption of final guidelines in late 2021. An important caveat is that the draft is relatively vague as regards what it takes for hydrogen to be considered as "green". Several stakeholders have commented on this in the consultation and adjustments to the exact scope of the guidelines are therefore not unlikely.

Importantly, before aid under the revised rules may be available to industry, national authorities will have to update and (re)notify their aid schemes. In Norway, such aid is mainly granted by Enova SF.

UPDATE TO THE GBER – AID WITHOUT NOTIFICATION

As aid under GBER does not require prior notification, their implementation is swifter, less burdensome and more predictable. Market participants and governments alike therefore have a clear interest in aid measures being covered by the GBER, in particular smaller projects for which a full notification procedure requires a disproportionate amount of work.

A modification to the GBER was adopted in July 2021. This modification introduces a new legal basis for aid provided to refuelling infrastructure supplying road vehicles with "renewable hydrogen". While the heading "local infrastructure" has previously covered some refuelling infrastructure, the new provisions now allow aid to large networks of such infrastructure without prior notification.

A more extensive draft update to the GBER, intended to adapt the GBER to the Green Deal and digital transformation, had just been published as this article went to press. Wikborg Rein will revert with an updated briefing on these important developments. •

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IPCEI HYDROGEN – kick-starting Europe's hydrogen revolution

High costs and low demand have hindered the creation of an emissions-free hydrogen market. With IPCEI Hydrogen, the EU's new gigantic push to bring together public and private hydrogen investments, the hydrogen market may finally have its much needed kick-start.

IN DECEMBER 2020, 22 EU countries and Norway announced their intention to launch an "important project on common European interest" (IPCEI) for hydrogen. In Norway, Enova maintains the role of organizing participation in IPCEI Hydrogen projects for Norwegian companies. The deadline for submitting expression of interest in participation was 1 February 2021. Enova is currently considering several Norwegian projects for a matchmaking process. In this article, we will explain the legal basis for IPCEI projects, and how IPCEI provides a much needed kick-start for the development of a European hydrogen market.

The IPCEI Hydrogen project aims to pave the way for a blue and green hydrogen market in Europe, by strategically supporting hydrogen projects along the full hydrogen value chain.

WHAT IS AN IPCEI?

At its core, IPCEI is a complex state aid project. An IPCEI aims at overcoming large market failures or other large systemic failures, by combining many singular state aid projects into a common roadmap structure. The IPCEI Hydrogen project aims to answer goals set out in EU's 2020 hydrogen strategy. IPCEI's legal basis is the TFEU's Article 107(3)(b) under EU-law, and the EEA Agreement's Article 61(3)(b) under EEA-law. Both the Commission and ESA have adopted identical guidelines, regulating in detail how these provisions must be interpreted.

THE AIM OF THE IPCEI HYDROGEN PROJECT

The IPCEI Hydrogen project aims to pave the way for a blue and green hydrogen market in Europe, by strategically supporting hydrogen projects along the full hydrogen value chain. This involves supporting the production of hydrogen, developing hydrogen end-user technology for the industry and transport sectors, and developing the infrastructure needed for a functioning hydrogen market in Europe. The participating countries aim to notify the Commission and ESA of the projects by November 2021. Project implementation is intended to start in the beginning of 2022.

The IPCEI Hydrogen project is a powerful tool for developing a functioning hydrogen market in Europe, primarily due to the flexibility IPCEI's legal framework offers. In particular, the IPCEI-guidelines, as the sole state aid framework, allows support for projects involving 'first industrial deployments'. First industrial deployments constitute projects which involve commercialization of a new highly innovative product or production method, in the steps subsequent to the mass production phase. For these projects, both capital expenditures and operational expenditures (CAPEX and OPEX) count as eligible costs. Furthermore, aid intensity could include as much as 100% of the project's eligible costs, without caps in absolute amounts. In other words, the IPCEI legal framework offers an impactful value chain approach in order to kick-start the European hydrogen market.

WHAT WILL THE SCOPE OF THE IPCEI HYDROGEN PROJECT BE?

Since adopting the IPCEI-guidelines in 2014, the Commission has approved three large value chain-directed projects. In 2018, the Commission approved an IPCEI-project notified by France, Germany, Italy and the UK, allowing a total of €1.75 billion in state aid for the development of microelectronics. In 2019 and 2021, the Commission approved two battery related projects involving 11 EU member states. The 11 member states plan to invest a total of €6,1 billion of public funds in order to develop a full battery value chain, from the extraction of raw materials to the recycling of used batteries. The size of the IPCEI Hydrogen project has not yet been revealed, but with more participating countries (23 in total), it will likely be even larger than previously approved IPCEI projects.

Although the train may temporarily have left the station for Norwegian companies who wish to participate in the IPCEI Hydrogen project, the two IPCEI battery projects indicate that this may not be the last round of IPCEI Hydrogen projects. Interested companies should therefore follow future developments in the EU/EEA, and potential future calls from Enova, closely. •

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IMPORTANT STEPS WHEN DEVELOPING HYDROGEN PROJECTS

Hydrogen will play a key role in decarbonising the global economy. But how do you successfully develop your business to reach your projected target?

THE DEVELOPMENT OF A HYDROGEN PROJECT remains complex. In this article we discuss some key steps from a legal perspective to guide you on the way.

IDENTIFY SIGNIFICANT RISKS AND DEPENDENCIES

Hydrogen is on the verge of becoming scalable. The product will generate business opportunities similar to those we experienced for onshore wind 10-15 years ago, and what we are currently witnessing for offshore wind. As in on- and offshore wind markets, early movers within the hydrogen industry need to expect and handle high risk. However, they may also receive high rewards.

While all businesses are exposed to a variety of risks, many risk factors may be reduced or mitigated. Evident risks include technical risks, and risks of not obtaining required input (such as grid capacity, power or gas). Meanwhile others, such as future regulatory risks, remain more uncertain as regulations can develop and change over time. Identifying relevant risk factors for your project at an early stage will enable you to implement mitigating measures, which may for instance include contractual measures, knowledge, security measures or insurance coverage.

A clear contractual allocation of risk factors will reduce the likelihood of unexpected consequences for your project, and as a starting point, one should seek to allocate risks to the party best placed to manage them. Furthermore, regulatory risks can to some extent be mitigated through close dialogue with public authorities.

The complexity behind hydrogen projects implies a risk per se, since several steps during project development are closely connected and dependent on one another. Identifying significant dependencies at an early stage is therefore also key to developing a project, and reducing the risk of, among others, unnecessary delays and cost overruns. We will elaborate further on some main dependencies below.

ASSESS YOUR OWN STRENGTHS AND CONSIDER STRATEGIC PARTNERSHIPS

Handling the whole value chain of a hydrogen project alone is difficult – you must therefore understand your business' area of expertise. Identifying your own strengths consequently brings up the question of which areas you need to partner up with third parties, as well as how and when to lock in your preferred strategic partners. Whether to engage in partnerships through non-binding memorandums of understanding or by legally binding agreements should be decided on a case-by-case basis. You may also consider whether it is possible to obtain some level of exclusivity for the crucial stages of the project development.

SET YOUR AMBITION LEVEL REGARDING TECHNOLOGY

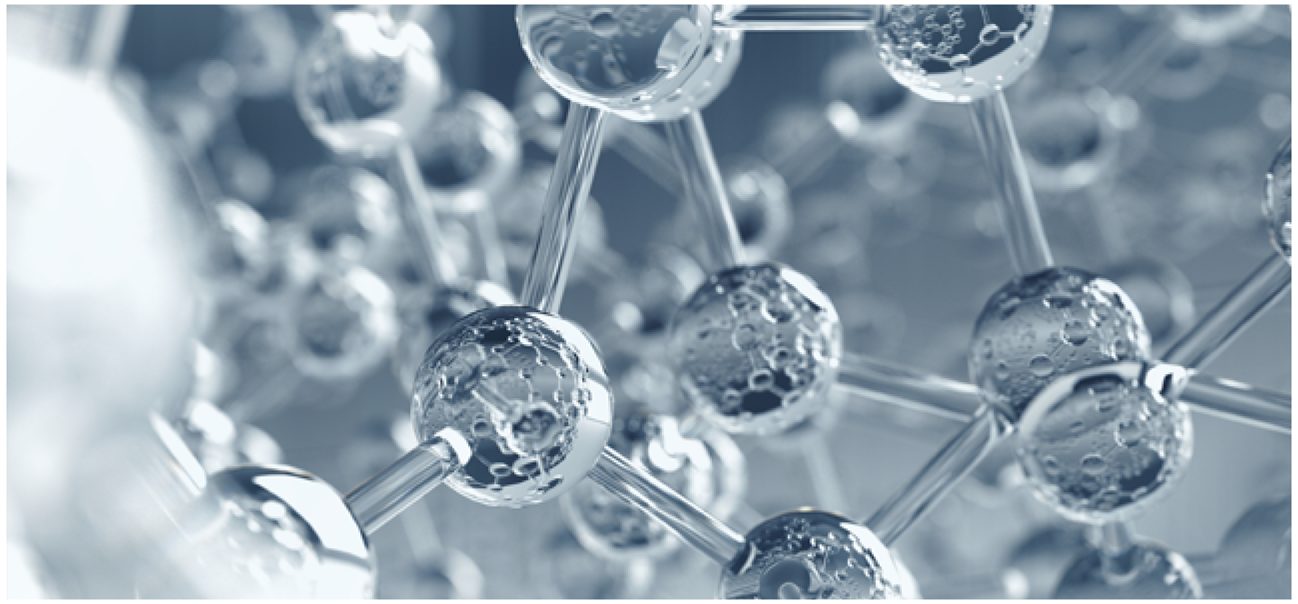
Technology will play a part regardless of your place in the hydrogen value chain, and clarifying your technological ambition level is therefore important. If you plan on developing and owning technology, then securing the rights and ownership to such technology is essential and should be planned for at an early stage. Make sure agreements are in place to ensure that technology and intellectual property developed as part of the project belong to your company.

A less time consuming approach could include buying equipment or licensing existing technology from third parties and partners.

IDENTIFY KEY PROJECT AGREEMENTS AND REQUIRED PUBLIC PERMITS

Key agreements to develop hydrogen projects are not limited to strategic partnership- and technology agreements. Agreements for securing the right location, a stable supply of power and water, as well as an offtake agreement at attractive pricing terms and quantities levels, will also be essential for the successful production of, for example, green hydrogen.

Some key agreements may be difficult to complete, and contract negotiations are often time consuming. Identifying such key agreements and initiating the process towards relevant counterparties at an early stage may therefore help avoid unnecessary delays. Having finalised several key agreements will also help make your project look attractive to other third parties, including potential investors, suppliers and customers. In order to avoid binding commitments in the project's initial phase, agreements may be made contingent upon, for example, conditions precedent or notification letters ("notice to proceed").



The need for public permits will also impact a project's timeline – the expected time for completing application processes should be clarified early to avoid putting other processes on hold until the required permits have been obtained.

DECIDE HOW TO FINANCE YOUR PROJECT

Financing is an important work stream for all successful hydrogen projects. However, the required type of project financing may have a material impact on the project's timeline and other criteria which must be met to fund your project.

Bringing in strategic investors may be useful to obtain both the funding and competence required for a project. Prior to investing, investors will look into and have an opinion on your business plan, project agreements, expansion model, etc. A joint venture agreement should reflect your final agreement with investors concerning these topics. The JV agreement should also govern the general relationship between yourself and the investors, and protect your rights and control over the project.

Applying for bank loans or other debt financing is also possible, but how do you make your project "*bankable*"? Most lenders provide a list of conditions, terms and covenants which the borrower must adhere to in order to borrow sufficient funds. For example, a lender will usually require that public permits and key project agreements are in place, and that rights to required property are secured and registered in the land registry, before disbursement of funds.

Finally, your project may be eligible for public funding or similar support schemes. Identifying such support schemes, and the criteria and timeline to apply, could potentially provide your project with helpful capital. The earlier you identify the criteria for receiving funding from such support schemes, the more time you will have to adapt your project to these criteria, avoiding unnecessary amendments with resulting delays and costs.

PLANNING IS KEY

As outlined above, development of successful hydrogen projects requires the balance and coordination of several work streams. Detailed planning and preparation are therefore key to reach your projected target. •

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HYDROGEN AS A MARITIME FUEL

and the shipping industry's need for transition

In the coming decades, the shipping industry will have to make a transition to sustainable fuels and energy carriers. Hydrogen has been highlighted as one of the means to achieve this transition, and in Norway several interesting projects are currently ongoing.

IN THIS ARTICLE, WE WILL HIGHLIGHT some of the recent developments within hydrogen for the shipping industry. Further, and based on our hands-on experience with these types of projects, we will highlight some of the innovative and potentially game-changing projects which currently are ongoing as well as certain key legal elements for such development projects.

SHIPPING AS A SOURCE FOR GREENHOUSE GAS EMISSIONS – IMO'S FOURTH GHG STUDY

International shipping is essential for trade and vital for the global economy. However, it is also a source of greenhouse gas emissions. According to the Fourth IMO GHG Study, published by the International Maritime Organization ("IMO") earlier this year, emissions from international shipping amounted to over one billion tons of CO_2 in 2018. This corresponds to almost 3 percent of the global greenhouse gas emissions. The study also shows that the amount of CO_2 emissions from shipping increased by almost 10 percent in the period between 2012 and 2018, primarily due to an increase in global maritime trade. It is estimated that CO_2 emissions from shipping will increase significantly towards 2050 if mitigation measures are not put in place.

AN INTERNATIONAL APPROACH IS NECESSARY – RECENT DEVELOPMENTS AT IMO AND THE EU

Since the shipping industry is global, it is generally recognised that a global approach is necessary when addressing greenhouse gas emissions. Many are therefore of the view that IMO's role is essential. It was therefore welcomed by many in the industry, when IMO in 2018 adopted its climate strategy. In the strategy, IMO committed to ensure that the annual greenhouse gas emissions from international shipping are reduced by 50 percent by 2050 (compared to 2008 levels). Although viewed as ambitious by some, many are of the view the goals are too unambitious. Further, the strategy does not in itself implement any

> The amount of CO_2 emissions from shipping increased by almost 10 percent in the period between 2012 and 2018 primarily due to an increase in global maritime trade.

new measures for the shipping industry. Its key purpose is only to increase focus on greenhouse gas emissions, and to identify measures which may be implemented in the shipping sector in order to achieve the overall goal of reducing greenhouse gas emissions. The specific measures are up to the industry to develop and implement.

Although IMO have identified some specific measures to address greenhouse gas emissions, including further requirements to the energy efficiency measures in the International Convention for the Prevention of Pollution from Ships ("MARPOL"), few specific measures have been adopted as requirements as of today. Many therefore criticise IMO's work for progressing too slowly. This has recently triggered the European Union to take action. In September 2020, the European Commission presented its 2030 Climate Target Plan, which is part of the European Green Deal, aiming to cut greenhouse gas emissions by at least 55 percent, compared to 1990 levels, by 2030, and to put the EU on a path to becoming climate neutral by 2050.

> In Norway, hydrogen was highlighted as a potential zero emission energy carrier within certain sectors of the shipping industry.

The European Green Deal and the 2020 Climate Target Plan has since been followed up with specific policy proposals in the "Fit for 55-package" presented by the European Commission July this year. The policies proposed includes the FuelEU Maritime regulation, and the implementation of the EU Emissions Trading System (ETS) for the shipping sector. These policies aim to foster the market uptake of sustainable fuels within the shipping sector. Before being adopted, the proposals will be discussed and negotiated within the European Council and the European Parliament. If adopted by the EU, they will likely also be relevant for Norway and implemented in Norway through the EEA Agreement.

THE IMPORTANCE OF SUSTAINABLE FUELS IN THE TRANSITION IN THE SHIPPING SECTOR

The recent developments underline the need for decarbonisation and transition within the shipping sector. To a certain extent, greenhouse gas emissions can be reduced through energy-saving technologies and speed reduction of ships. However, in the Fourth IMO GHG Study it is concluded that a significant amount of the CO_2 reduction will have to come from the use of alternative sustainable fuels and energy carriers in order to achieve the commitments in IMO's own GHG Strategy from 2018. The pressure is therefore on the industry to ensure that the transition is made a reality. This pressure will likely increase in the next few years, as it is likely that additional rules and regulations will be proposed and adopted.

Currently, a wide range of different alternative low and zero-emission fuels and energy carriers are being considered and developed within the shipping sector. This includes liquefied petroleum gas, methanol, ethanol, dimethyl ether, biofuels, synthetic fuels, electricity/batteries, hydrogen, ammonia and nuclear propulsion. However, while there are significant developments, few vessels today are operating solely on sustainable fuels or energy carriers. This is partly due to the fact that the fuel and energy carriers must be adapted and optimised to suit the energy needs and operating profiles of each vessel. Different solutions will therefore likely be necessary for different types of vessels. Lack of maturity, as well as costs (and therefore need for further technology optimization) and availability of fuels, are also factors which the industry have to take into account.

In the European Union and Norway, hydrogen and hydrogen-based energy carriers, such as ammonia, have in recent years been given particular attention. In Norway, hydrogen was highlighted as a potential zero emission energy carrier within certain sectors of the shipping industry in the the Norwegian Government's "Hydrogen Strategy" from June 2020. In the Norwegian Government's "Roadmap for Hydrogen", published July 2021, it is also stated that Norway's vision is to have a well-established market for production and use of hydrogen within the shipping sector in 2050, and that hydrogen at this point in time should be used on vessels both in coastal waters and for long-distance transport.

In order to reach the vision for increased production and use of hydrogen, the Norwegian Government has stated that it will act as a facilitator and support the industry, including by creating hydrogen hubs for maritime transport within 2025, by giving support to industrial projects related production of hydrogen, as well as pilot projects for development and demonstration of new and more cost-efficient hydrogen solutions and technologies. Within 2030, the overall goal is that hydrogen vessels are competitive

and safe alternatives within shipping in Norwegian seas and short sea shipping, and that hydrogen is a competitive alternative to fossil fuels.

The UK equivalent to the "Roadmap for Hydrogen" is the UK's "Hydrogen Strategy" , which was released in August 2021, following from the UK's "Ten Point Plan for a Green Industrial Revolution, 2020". The UK's ambition is to have 5GW of low carbon hydrogen production capacity by 2030. Significant funding packages and consultations are being put in place to support this target. Short term plans must give due consideration to existing infrastructure and regulatory landscape, but the UK Government also intends to review legal and practical measures that may support more ambitious developments in the future. Similarly to Norway, one of the UK's initial focus points is on hydrogen-derived fuels such as ammonia, including as a shipping fuel.

KEY HYDROGEN PROJECTS

The hydrogen strategies build on already existing projects in Norway and the UK. In the UK, BP recently presented its plans for construction of a major blue hydrogen production facility in Teesside, which will produce up to 1GW of blue hydrogen by 2030, equal to 20 percent of the UK's hydrogen target. In Norway, the world's first ferry to use liquid hydrogen as an energy carrier, MF Hydra, was delivered earlier this year. There are also several ongoing research and development projects. For example, a consortium was established in 2019 in order to demonstrate that long-range zero-emission voyages with high power on larger ships is possible (ShipFC). This will be done by retrofitting an offshore vessel, Viking Lady, which is operated by Eidesvik Offshore, with ammonia fuel cells. The project is currently well underway, and has received substantial public funding both in Norway and from the EU's Fuel Cells and Hydrogen 2 Joint Undertaking.

Another interesting project, is the consortium established in order to build a complete maritime value chain for liquid hydrogen on the western coast in Norway. This consortium was established in 2020 by nine different companies operating on different levels of the maritime value chain. The project includes construction of a new production facility for liquid hydrogen at Mongstad, construction of new ro-ro vessels which will use liquid hydrogen as its energy carrier, and development of infrastructure, hereunder for bunkering and distribution of liquid hydrogen. The value chain will be the first of its kind in the world (subject completion). Currently, the project is well underway, and has received funding from Innovation Norway, the Norwegian Research Council and Enova.

OUR EXPERIENCES SO FAR

Wikborg Rein has been and is currently involved in several projects related to hydrogen and the industry's transition to sustainable fuels and energy carriers. We have in this respect assisted client's in all phases in different projects. In these types of project, many different considerations are necessary at different stages. In the initial phase, with letters of intent and establishment of consortiums, it is our view that it is crucial to have a good understanding of the totality of the project and each party's role, in order to ensure that the involved entities are given an efficient basis for their collaboration and prepare a foundation from the start that takes all (factual and legal) aspects into account. It is by way of example imperative to have knowledge of the incentive schemes, and to carefully consider and develop tailored rules regarding ownership to intellectual property rights and other projects results, in order to lay the foundations for, and facilitate, future commercialisation.

If a project is to be commercialised, a wide range of different areas of law will be relevant. The involved companies for example need to agree on how to commercialise the project. In this respect, many different models are possible. The partners may agree that one of them should commercialise the project alone, with or without an obligation to pay royalties to the others involved. Alternatively, the partners may agree to commercialise the project jointly by establishing a new jointly owned entity. If a new entity is to be established, legal advice on several aspects will likely be necessary, including company law, competition law, tax law, construction and contract law, employment law and state aid.

HYDROGEN PLAYS A KEY ROLE IN THE TRANSITION TO SUSTAINABLE FUELS AND ENERGY CARRIERS

The above illustrates that the shipping industry's transition to sustainable fuels and energy carries is already well underway. Furthermore, although hydrogen may not be the only answer to this transition, it has lately been given particular attention both in Norway and in the European Union. The future developments should be followed closely by those involved in the industry. •

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Marine transportation solutions and applications of hydrogen

– contractual considerations for hydrogen projects and the hydrogen value chain

The hydrogen industry is undergoing rapid development, in particular due to the ever-increasing focus on reducing the carbon footprint and emissions across all businesses and industries. Hydrogen has a wide range of applications, and projects of various scales are being developed to cater for the varying local- and end-users' needs. As a result, a variety of contractual frameworks and structures will likely emerge – both on a project-by-project basis and regarding the hydrogen value chain as a whole.

Photo: Wilhelmsen

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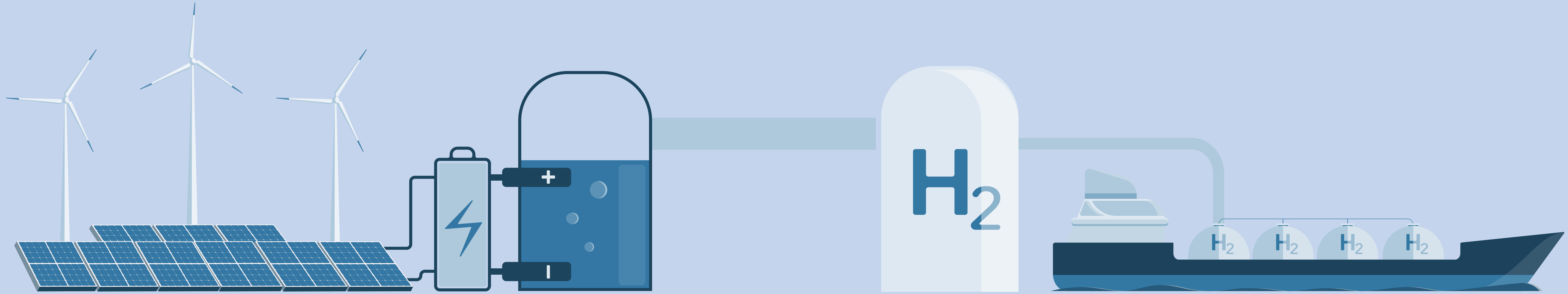

AS WITH OTHER INDUSTRY SECTORS, THE CONTRACTUAL, financial and operational particularities for hydrogen projects and the overall hydrogen value chain will depend a number of factors. When developing the contractual structure, key factors to determine will include the relevant project's location, size and scale, and intended end-users of the hydrogen to be produced.

Capital intensive, larger scale hydrogen projects and production plants will likely require structures with a longer term perspective and commitment from stakeholders, including the intended hydrogen buyers and users. This is in many respects similar to the contractual structures traditionally applied to LNG projects, with long-term transportation and offtake agreements required to ensure sound and bankable projects.

On the other hand, smaller-scale and less cost intensive projects intended for multiple hydrogen buyers and end-users may not require the same level of commitment, and could adopt more flexible contractual structures.

The need for development of different types of contractual structures is particularly evident in relation to marine transportation solutions and applications for hydrogen.

METHODS AND NEEDS FOR TRANSPORTATION

As with other energy carriers, such as crude oil and natural gas, the production of hydrogen will in many cases not occur at the same location as the location of its intended end-users – creating a need for transportation.

Hydrogen is generally either transported in a compressed state under high pressure (CH_2) or in a liquid state (LH_2). Specialised pressurised tanks can transport CH_2 by road, rail or sea. Meanwhile, creating LH_2 is a more energy consuming and extensive process than creating CH_2. In addition, LH_2 requires the transportation in cryogenic tanks by rail or trucks or, on a larger scale, on-board dedicated and costly LH_2 tankers. See further comments on contractual framework and considerations for certain types of transportation methods below.

(a) Bulk transportation:
For the transport of larger volumes of hydrogen over longer distances, using dedicated liquefied hydrogen tankers (so called "LH_2 carriers") may be preferable, as converting hydrogen from its gaseous state to LH_2 reduces its volume by a factor of 800. This volume reduction drastically improves the economics and efficiency of long distance transportation. Hydrogen projects relying on transportation by LH_2 carriers have already been developed in Asia and Australia. As mentioned above, hydrogen projects are in many respects similar to LNG projects, for example by proving capital expenditure intensive, due to the high cost of liquefaction plants and LH_2 carriers. Capital intensive projects commonly require longer term charters for the LH_2 carriers, as well as longer term commitments for the purchase and offtake of hydrogen itself.

LH_2 carrier technology is similar to that of LNG carriers – therefore provisions to consider under LH_2 charterparties will be similar to those considered under LNG charterparties. This includes provisions and warranties with respect to the amount of LH_2 cargo that will evaporate during the transportation phase (so called "boil-off").

> The production of hydrogen will in many cases not occur at the same location as the location of its intended end-users – creating a need for transportation.

(b) Container transportation:
Whereas some projects rely on transportation of hydrogen to users in a liquid state with LH_2 carriers, others rely on transportation of hydrogen in a compressed state using standard ISO sized container frames. Transporting hydrogen this way involves fitting the ISO container frames with high-pressure tanks containing CH_2. Conventional container vessels may then transport the containers (unless containers are transported by rail or trucks). For this method of transportation, traditional legal considerations and issues of general cargo trade will be applicable. However, considerations reflecting the special nature of the cargo will also be applicable. Container-based transportation solutions may also result in the development of contract structures for container leasing and rental arrangements.

(c) Marine fuel:
In projects where hydrogen is to be used as a fuel for vessels, many of the legal issues applicable to the traditional bunker trade will be of relevance. However, additional considerations have to be made to cater to the special characteristics of hydrogen, as well as whether hydrogen is to be supplied in a compressed or liquid form. Standard bunker supply terms and conditions will have to be amended and modified, and provisions and requirements in relation to quality sampling will have to be considered. The requirement for bespoke contractual arrangements will likely stand out in early phases of the development where hydrogen fuel is not generally available. From a wider project perspective, projects that aim to deliver hydrogen as a fuel for vessels may be reliant on customers committing to take certain volumes in order to justify the cost of developing bunkering facilities and equipment. If so, the contract framework will have to be tailored to meet these requirements.

TAILORING IS KEY

There are exciting times ahead for the hydrogen industry, especially within the green energy and maritime space. We expect the development of a variety of concepts, and adoption of various commercial, financial and operational structures. The contractual framework and structure chosen for hydrogen projects will need close consideration, and tailoring based on the overall project structure and value chain. •

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GREENING THE GREY

– carbon capture and storage agreements

For countries not endowed with abundant renewable energy sources, Carbon Capture and Storage (CCS) may be the way (at least in the short term) to transition to a low carbon hydrogen economy. CCS projects have been referred to as "moon landings". One may presume that, along with some of the technology, the underlying business and contracts are also something akin to rocket science. However, a closer look reveals major similarities to the gas sales business and gas sales agreements rather than something more ground breaking.

THE RETURN OF CCS. In his 2007 New Year address to the nation, then Norwegian Prime Minister Jens Stoltenberg referred to the on-going pilot CCS project at the Mongstad refinery and crude oil terminal as "our moon landing". Sadly, Norway never got to the moon – the Mongstad project was cancelled without much success.

However, today, against the backdrop of the urgency to deal with global warming and the emergence of new technology, several new large CCS projects are underway. The Norwegian Government's hydrogen strategy envisages that Norway will continue to export natural gas, but also start importing CO_2 for storage. Some of that CO_2 will presumably stem from natural gas-based hydrogen production, with CCS. On 9 March 2021, Equinor, Shell and Total launched a joint venture which is to offer commercial CO_2 transportation and storage services.

Similarly, the UK's Clean Growth Strategy aims for deployment of CCS at scale by 2030. On 17 March 2021, the UK Government awarded funding to the Northern Endurance Partnership to support the Zero Carbon Humber and Net Zero Teesside projects which intend to create decarbonised industrial clusters in the Humber and Teesside regions, including through the use of CCS. The project partners are the National Grid, ENI, Shell, Total, BP and Equinor.

THE BUSINESS MODEL

The business of CCS can very broadly be described as taking a gas (CO_2), processing it, liquefying it, transporting it by ship and/or pipeline (or by truck or railcar for smaller quantities), and pump it into a geological structure where it is intended to be trapped for ever. The heavy taxation of CO_2 emitters incentivises those emitters to pay to get rid of the CO_2 in some way other than emission into the atmosphere.

The CCS business model bears close similarities to petroleum exploration and production – but in reverse. Petroleum exploration and production involves extracting liquids and gases which were trapped (more or less) forever in geological structures, processing, liquefying (if necessary) and transporting them by ship and/or pipeline for productive use. Thus, the main difference is that the sequence is more or less reversed, and the payment is for taking gas instead of delivering it (or oil). Those similarities probably explain why so many oil and gas majors are involved in CCS projects. After all, they are experienced in liquefying and shipping gas, as well as locating and accessing geological structures where liquids and gases can be trapped forever.

CO_2 TRANSPORT AND STORAGE AGREEMENTS

Considering the business model, it is perhaps not surprising that CO_2 transportation and storage agreements (TSAs) show many similarities with gas sales contracts, although naturally they have some special features of their own.
The term "storage" in a TSA is a bit of a misnomer. Unlike other petroleum storage agreements, the customers are never going to ask to get their CO_2 back, and you will not find provisions for withdrawals. Further, it is common for the service provider to take title to the CO_2 in the process. In that sense, the TSA is more similar to a gas sales agreement (GSA), only with reversed flows of gas and money.

To develop CCS, new infrastructure has to be built, with large up-front investments, and the project owners will want to secure long-term payment commitments to underpin that investment. The number of customers and service providers within commercially reasonable shipping distance of each other may also be limited, creating a "hold-up" risk. Consequently, TSAs are likely to be long-term, and with some kind of supply-or-pay obligation, pretty much like the long-term, take-or-pay GSAs which were the norm in Europe when new big gas sales required developing new fields and/or pipelines. The contract issues are then also likely to be similar, including:

- Should there be Force Majeure relief from an obligation to pay in case supply cannot be met?
- Should there be a right to make up, i.e. to supply CO_2 in volumes corresponding to those not supplied but paid for at a reduced or no cost later, as is common in take-or-pay agreements?
- Can there still be an obligation to pay damages for breach on top of the supply-or-pay payment (which is excluded by take-or-pay)?

In addition, there will need to be careful consideration of 'reopener' provisions. These will be dictated by geopolitical factors as well as the potentially competing regulatory regimes in connection with cross-border transportation, waste regimes and clean energy initiatives/incentives. Flexibility and forward thinking will be the watchwords in these areas.

Like the early gas industry, CCS faces choices when it comes to pricing. The safe bet for the service providers is to go for cost-plus. But that may not satisfy the customers, whose incentive is to avoid being taxed for CO_2 emissions, and will really only choose CCS if the "storage" fee is likely to remain below the CO_2 tax for (most of) the term of the TSA. If the service providers accommodate the customers on this point and accept the price risk, the service providers may see upsides or downsides, depending on how CO_2 taxes and CCS capital and operating expenses (and subsidies) move in relation to each other. When gas was first sold in Europe, the petroleum producers overwhelmingly chose to take the price risk, pricing gas slightly below the costs of using other alternative energy sources like oil products and coal. What is certain is that any asymmetric solution, where one side attempts to take only the upside and exclude the downside, will lead to conflict. •

The term "storage" in a TSA is a bit of a misnomer. Unlike other petroleum storage agreements, the customers are never going to ask to get their CO2 back, and you will not find provisions for withdrawals.

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HYDROGEN SALES AND PURCHASE CONTRACTS

– high-value issues to keep in mind

With its ample hydropower, developing wind power, and gas reserves, Norway is particularly well placed to produce both green hydrogen and blue hydrogen. Although the potential is obvious and there is a clear will to develop it further, the hydrogen industry is still in early stages. At present, relatively few supply contracts have been entered into and few clear market principles have developed. As such, the hydrogen industry faces similar questions in respect of the contractual regulation as the natural gas industry faced in its early phase.

THIS ARTICLE BRIEFLY COVERS some of the high-value issues that typically may become subject to dispute in long-term contracts for the sale and purchase of gaseous fuels and which consequently should be kept in mind when drafting the contract, i.e. the regulation of volume and price and price revision. The issues raised in this article are in particular based on our experience with disputes under long-term natural gas sales contracts.

VOLUME PROVISIONS

The development and production costs are significant, and investments in hydrogen production require long-term off-take security. In long-term gas sales contracts, this has been addressed through volume provisions.

The volume provisions generally regulate the seller's delivery obligation and the buyer's off-take obligation. Underlying the volume regulation is a two-fold consideration. On the one hand, the seller needs to secure a regular running income to amortise the, often significant, investments in production facilities, and to cover the costs of production itself. On the other hand, the volume provisions should also provide the buyer with flexibility to vary his off-take in accordance with his varying needs.

To strike a balance between these two underlying considerations, it may be prudent to establish a maximum and a minimum volume regulation within a further specified time interval. The minimum volume obligation may be further regulated by implementing an obligation on the buyer to off-take and pay for, or only pay for, the minimum amount of volumes within the relevant time interval (the so-called take-or-pay principle). Such a take-or-pay provision would give the seller the desired guarantee for a regular future income that also may be further capitalized on up-front. The seemingly draconian obligation on the buyer to pay for volumes irrespective of whether the volumes are off-taken or not, has customarily been balanced by an entitlement for the buyer to off-take the paid for but not off-taken volumes at a later point in time (make-up volumes). Without such make-up provisions, take-or-pay provisions are akin to penalty provisions, and as such, most likely unenforceable and subject to review.

Disputes over volume provisions will often include issues of both contract and competition law, including questions regarding the validity of the volume provision(s).

PRICE AND PRICE REVIEW PROVISIONS

Furthermore, there is no separate, reliable market price for hydrogen. However, there are different pricing principles that may be applied.

Since hydrogen is a product of other energy sources, some of which have liquid and transparent prices, "cost plus" would be a relatively simple and quite transparent price methodology. In the early stages of the natural gas industry in Europe, the indifference principle became a guiding pricing principle. The indifference principle implied (near) cost parity with relevant other alternative fuels and allowed natural gas to gain market share by being priced a fraction below its competitors. The relevant fuels that may be used for (near) cost parity under this pricing principle will depend on the specific project/market. Accordingly, we expect to see a development of different price formulae in different projects/markets, depending on which fuels the to-be purchased hydrogen will compete with in the project/market in question.

When committing to sell or purchase goods over time, it is almost impossible to factor in all future market developments. To ensure that the hydrogen sold and purchased remains marketable and that the producer gets a fair share of any increases in the market value of the hydrogen, it would be prudent to consider the inclusion of a price revision provision in the contract, granting both parties the right to request a revision of the price in case of significant changes in circumstances and/or in the event that the price fails to reflect the market price of hydrogen.

Issues typically in dispute in relation to price are the scope and implications of the changes that have taken place and the level of the relevant market price(s) and its/their relation to the contract price.

REGULATION OF HIGH-VALUE ISSUES IS KEY

Hydrogen is a fuel for the future, and the technological development and the raised awareness about its potential, make for significant opportunities. However, in light of the financial interests involved, it is important to accurately regulate the high-value issues which otherwise may create disputes at a later stage. •

> In light of the financial interests involved, it is important to accurately regulate the high-value issues.

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The prospects in Brazil for LOW-CARBON HYDROGEN

Brazil has an increased focus on low-carbon hydrogen. Brazil's National Hydrogen Policy, adopted in July 2021, identifies the development of a low-carbon hydrogen industry as a national priority.

Text: *Thiago Luiz Silva and Pietro De Biase, Vieira Rezende*

THIS ARTICLE DESCRIBES BRAZIL'S INTENTION to forge a position of leadership on hydrogen development, addressing the current status and the legislative initiatives which will underpin the Brazil's hydrogen industry. Transforming this goal into reality will create opportunities for both the national public and private sectors.

Several factors contribute favourably to Brazil's ability to achieve its goal. First, and strategically important, Brazil is market-leading in both the biomass and biofuel industries. Second, posting a daily national production output of natural gas of around 4MM m3 barrels of the oil equivalent, Brazil may become a major player in blue hydrogen. Third, renewable energy is exceedingly available at rapidly decreasing prices.

WHERE BRAZIL IS CURRENTLY POSITIONED

Public and private entities are currently moving towards low-carbon hydrogen implementation and other forms of sustainable investment.

On a national level, the National Development Bank (BNDES) and the Brazilian Central Bank have issued policies to foster decarbonization and development of green projects. A new credit line linked to ESG targets

> Competitive green hydrogen production will inevitably boost carbon reduction nationwide, especially when factoring the substantial production of Brazilian steel, cement and fertilizers.

offers progressively lower rates to companies that meet recognized climate and social targets.

A further relevant instrument for green initiatives is incentivized debentures. In 2019, the volume of issued debentures attained a record level of BRL 33.7 billion. This momentum was maintained in 2020. Infrastructure debentures registered historic growth, primarily driven by the energy sector. The Brazilian Federal Government also extended incentives prioritizing financing of key infrastructure projects that proffer environmental and social benefits.

Meanwhile, Brazil's private sector is wasting no time. The latest national bid for power-purchase agreements saw project registration of 55GW of solar and onshore wind, with a remarkably low price of USD 0.038/kWh. Competitive green hydrogen production will inevitably boost carbon reduction nationwide, especially when factoring the substantial production of Brazilian steel, cement and fertilizers. These hard-to-abate industries are implementing on-site low-carbon hydrogen in the attempt to reduce their carbon footprint.

Moreover, the combination of low-price renewable energy and project proximity to port provides fertile ground for green hydrogen, both for generation, export and use in long-haul shipping.

R&D in hydrogen projects are also favoured by the surge of incentive. In addition to fast-track approval for hydrogen R&D, power generation and oil and gas companies are now positioned to heavily invest in hydrogen with the investment obligation existing under governmental contracts. As such, this provides valuable cashback for both company and country.

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SO, WHAT HAS YET TO BE DEVELOPED?

Brazil will be required to address its longstanding chicken-and-egg dilemma, which drags on both supply and demand.

Hydrogen supply and distribution is generally viewed as easier to promote. Following recently-passed legislation, the natural gas grid will be permitted to house hydrogen, and supply will be guaranteed via the upcoming creation of considerable natural gas infrastructure.

Recent additions in the electricity regulatory framework defined guidelines for implementation of mechanisms that factor in environmental benefits. To implement what is conventionally known as "consideration of environmental benefits", carbon pricing emerges as an efficient instrument to attach the social and environmental impacts generated by GHG emissions into production costs whilst further enhancing low-carbon hydrogen attractiveness.

Other measures must be taken to promote demand. For instance, the creation of a cap-and-trade or emission trading system (ETS), such as that existing in the EU, would benefit demand both locally and abroad.

Regulation for project development of hydrogen is also pending, including that related to transport and storage, specific taxation and industry incentive, if the use of water for electrolysis will be regulated, how offshore wind-energy projects will be regulated.

Finally, the yet to be approved Bill of Law for creation of a Regulated Brazilian Carbon Market will introduce specific rules and limitations for each sector of Brazilian industry. This expected regulation shall unveil a new market based on a low carbon economy, in which hydrogen will most certainly play a significant role. •

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