ESF Europe 2022

ENERGY & SUSTAINABILITY FORUM

Decarbonising the Downstream Industry

21–23 March 2022 | Berlin

POST EVENT REPORT

HOSTED BY EURO PETROLEUM CONSULTANTS

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INTRODUCTION

ESF Europe 2022 took place on 21-23 March at the Berlin Marriott Hotel gathering oil and gas downstream leaders to drive forward the decarbonisation of the downstream industry. Across three days of interactive panels and seminars, insightful presentations and a variety of networking formats, attendees shared with optimism, case studies, perspectives and the technologies of how Europe's refining and petrochemical sectors are reinventing themselves through the creation of low carbon operating models and high-performing ecosystems.

The conference focussed on four key themes. First, **Decarbonisation Strategies & Deployment**, looking at how the downstream industry can be enabled and supported to move as fast as it can, in the technology directions that's best for them, and wider society. Across a series of presentations, **en2x**, **Wood Mackenzie**, **Topsoe**, **Honeywell**, **Schneider Electric**, and **Honeywell UOP** presented the opportunities for refiners and producers to carbon base line their assets to help accelerate the adoption of low carbon technologies and digitalisation. Short term achievability was also explored through the delivery of energy and operational efficiency to minimise carbon footprint and operating costs. The session also featured our two keynote panels – first the keynote producer panel **'Building a World-Leading Low Carbon (Downstream) Business – Pushing Profitable Decarbonisation to the Limits'** joined by **Repsol**, **Braskem**, **Aramco Europe** and **BP** and our Technology CEO panel **'Develop, Scale and Deploy - Accelerating Commercially Competitive Low and Zero Carbon Technologies'** joined by **Honeywell UOP**, **ExxonMobil Catalysts & Licensing**, **Wood**, **Axens** and **Topsoe**.
Read the full take-aways from the panels below.

The transition is a journey with many steps, not a competition or challenge between technology or colour. Cooperation and collaboration are needed between different sources of energy and the many opportunities available today must be embraced in parallel. The second session, **Transition & Diversify**, saw presentations from **ExxonMobil Low Carbon Solutions**, **Alfa Laval**, **EagleBurgmann**, **W. R. Grace & Co.**, **Sulzer Chemtech** focused on the latest conversion technologies to support the evolution of refiners and producers through increased flexibility and (product slate) diversification, including the production and development of bio, renewable and e-fuels. Our panel **'Collaborate and Cluster – The Realignment of the Fossil Fuel Refinery to the Sustainable Energy Park of the Future'** joined by **Boston Consulting Group**, **TotalEnergies**, **Phillips 66**, **Repsol Technology Lab** and **KBC** concluded the discussions.
Read the full take-aways from the panel below.

The third session focussed on **H2 as a Key Enabler to the Future of the Downstream Industry and Utilisation of CO2**. Europe's politicians are pushing hard for green hydrogen but for the industry to deliver within the desired timeline we need enough renewable power for the electrification of crackers along with the development of a non-energy intensive route to produce olefins. Until then fossil based blue hydrogen, using carbon capture and sequestration, remains a proven key mechanism to allow the industry to reduce its emissions. Through presentations from **Topsoe**, **BASF**, **Wood**, **Technip Energies** and **BD Energy Systems**, the session explored the latest low and zero carbon technologies and projects essential to achieving deep decarbonisation targets. Our panel **'A Blue Bridge to a Green Future'** joined by **Roland Berger Strategy Consultants**, **Neste**, **BP**, **SOCAR**, **Fuel Cells** and **Hydrogen Joint Undertaking (FCH-JU) - Refhyne Project** and **Dena** discussed maximizing the blue opportunities available to Europe today and how can we make green competitive and accelerate it's scale up.
Read the full take-aways from the panel below.

The fourth session focussed on **Circularity**. With such expectations from stakeholders on Scope 3, how can we get more of our products/services to be circular? Innovation, regulation, integration, and infrastructure are all needed to ensure that waste becomes a valuable material that comes back into the chain. There is a big innovation challenge for the whole industry to make these technologies scalable and affordable, especially to be successful by 2050. **Axens**, **Plastic Energy**, **Honeywell UOP**, **Mura Technology** and **Evonik** joined this session to highlight the ways to scale and commercialise circularity, by working with the entire value chain and deploying the best technologies on the market to help close the loop. Our panel **'Giving New Life to Plastic Waste'** joined by **Accenture**, **Shell**, **ORLEN UniCRE a.s.**, **Borealis** and **Petrochemicals Europe/Cefic** discussed amongst many issues, getting the complementary mechanical and chemical recycling technologies to scale.
Read the full take-aways from the panel below.

EXHIBITOR HAPPY HOUR

NEW to ESF Europe was our Exhibitor Happy Hour.

Enjoyed alongside a well-deserved drink at the end of day one, exhibitors **Eurecat**, **Integrated Global Services**, **Angara Industries** and **Qpinch** showcased the latest process equipment and technologies that support efficiency improvements and the reduction of emissions from the manufacturing and production of fuels, the refinery, the petrochemical plant, and the systems around it

KBC GALA DINNER

To continue the networking, KBC hosted a dinner at a local German restaurant where our attendees had the opportunity to relax and unwind with German beer tasting and sample the local cuisine

SEMINARS

ESF Europe 2022 began with two pre-conference seminars hosted by Wood & Honeywell UOP.

Wood opened the seminar day to discuss '**Delivering a low-carbon Future: How will you achieve your Net Zero ambitions?**'

Wood's experts took delegates on a decarbonisation journey to address the key solutions to reduce emissions and engineer a net-zero future.

Honeywell kicked off the afternoon focussing on '**Getting to Net Zero Emissions: Innovations for Refining & Chemicals'** where they discussed a wide range of innovations and digital solutions that are driving the sustainability transformation and helping to create a net-zero future.

Delegates then enjoyed a networking drinks reception kindly hosted by Honeywell.

#ESFEUROPE IN THE MEDIA

Thank you KBC A Yokogawa Company for sponsoring our #ESFEurope 2022 dinner at Lindenbräu, Berlin.

It was a great night of German beers, sausages and smiles, gathering many of our speakers and delegates all together for a special night!

Coming soon #ESFEurope 2022 Day 2 Spotlights!
Do not miss the latest updates from the Conference!

#ESF2022 #ESFEurope #Technology #Innovation #Energy #Industry #Sustainability #Decarbonization #LowCarbon #EnergyTransition

Exhibitor Happy Hour #ESFEurope 2022

y 1 of ESF Europe concluded with some of the Exhibitors owcasing their technologies and solutions on efficiency provements and emissions reduction whilst our delegates joyed a cold beer or glass of wine!

ank you, Reinder Van Bruggen EURECAT France S, Vitaly Geraskin, Integrated Global Services, Petra selka, Angara Global & Bruno De Jonckheere, Qpinch !!!

SF2022 #ESFEurope #Technology #Innovation #Energy ndustry #Sustainability #Decarbonization #LowCarbon nergyTransition

Aramco Europe
@Aramco_Europe

We are on a journey - this is not about changing or delaying our climate goals. We at Aramco, and our partners and peers across our industry, are fully committed to a net-zero economy" - closing remarks from Europe CEO Ahmed Alkhunaini at #ESFEurope @EuroPetro

Bryan Glover
President at Honeywell UOP
6d

It was an honor to represent Honeywell UOP and join the Keynote Technology panelists to discuss the acceleration of commercially competitive low and zero carbon technologies during this year's 2022 Energy & Sustainability Forum in Berlin. #ESFEurope. Great event to discuss ways to support the #decarbonization of the #oilandgasdownstream industry.

Roeland Baan
@BaanRoeland

Exciting to join #ESFEurope in Berlin today to give a keynote on low-carbon business. PS: Nice to show our new corporate @topsoe_official brand in action!
Thanks for having us, @EuroPetro

#LetsDecarbonize #decarbonization

Romain Roux · 2nd
Decarbonization & Consulting | Sustainable Entrepreneur | Internati...

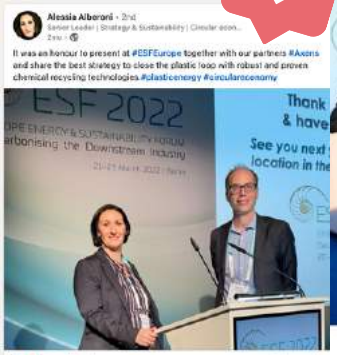
Euro Petroleum Consultants Ltd Great event! Thank you for allowing us to present how Axens and all the technology providers are delivering solutions to face the challenges of energy transition in downstream oil & gas.
From this session, I specifically appreciated the point that before considering high CAPEX, high-risk projects, we should identify low-hanging fruits ideas becoming economically viable in this high price energy conditions. #BAT #Bestavailabletecniques

Braskem
574,664 followers
3w

During Walmir Soller participation at the Energy & Sustainability Forum 2022, two weeks ago in Berlin, a lot was shared about decarbonization in the Downstream industry. As part of a panel with other important Industry Leaders, organized by Euro Petroleum Consultants Ltd, Walmir highlighted Braskem's commitment to the cause: "At Braskem, we are focusing on 3 drivers for our decarbonization: Carbon Emissions' Reduction, Carbon Compensation, and Carbon Capture and Use." Carbon emissions are being reduced through renewable energy, as well as process and energy efficiency at every level. For Carbon Compensation, renewable feedstock will play an important role. Carbon Capture and Use will complement the other initiatives in the long term to get to Net Zero by 2050, together with investments we are doing in Innovation & Technology.

Stephen Fowler
VP Chemicals, Downstream Process & Bio Technology
1w

Thought provoking two days at #ESFEurope. Particularly enjoyed joining the panel session - Giving New Life to Plastic Waste, and being able to share updates on Shell's journey towards our ambition to recycle one million tonnes of plastic waste in our global chemical plants by 2025.



VIDEO HIGHLIGHTS

Our collective view was that it was a great event that was well organised and executed by your team. We really appreciated the efforts of the team to make sure that the 1-1 meetings went ahead to schedule. As a result, we made some new connections and started some hopefully valuable discussions. Must admit it was good to be back in a face-to-face environment!

Executive Vice President of Sales, KBC

We have really enjoyed the event. It was great to be at a physical event again especially as it was very well organized. The topics were all relevant to our industry and it was great to see so many participants engaged during the various panel sessions. We also appreciated the one-to-one meetings during the event.

President & CEO, Aramco Overseas

Well organised in person event that is critical to understanding how the European Downstream sector is responding to the challenges of sustainability and the energy transition

VP Refining, Chemicals & Oil Markets, Commodities Research, WoodMac

I enjoyed being on the panel and you and your team did a great job arranging and facilitating. I look forward to see you all at future conferences and events.

Vice President, Aromatics, Catalysts and Licensing, ExxonMobil Product Solutions

ESF EUROPE 2022 IN NUMBERS

3 Days

2 Pre-conference seminars

180+ Delegates

50 Speakers & Panellists

11 Hours of content

165 Speaker questions asked

98 Pre-arranged in-person meetings

10 Hours of dedicated networking opportunities

513 Messages exchanged via EPC event app

CARBON OFFSET COMMITMENT

At EPC, we are committed to sustainability and the future of our environment.

ESF Europe 2022 has offset its carbon footprint by purchasing credits to fund the permanent protection for *Afognak Island's Sitka spruce forests*!

The event had compensated 18.42 tonnes of CO2 emissions

See certificate

A south pole initiative

SUSTAINABLE DEVELOPMENT GOALS

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ORLEN UniCRE
TotalEnergies
WIKA
Wood Mackenzie

KEY SPEAKERS

Christian Küchen,
Director General

EN2X

Alan Gelder
VP Refining, Chemicals and Oil Markets

WOOD MACKENZIE

Roeland Baan
President & CEO

TOPSOE A/S

Jaime Juez
Corporate Director Technology & Sustainability & New Ventures
REPSOL

Ahmed AlKhunaini
President & CEO

ARAMCO EUROPE

Niels Anspach
VP Bio & Low Carbon

BP

Bryan Glover
President & CEO

HONEYWELL UOP

Walmir Soller
VP Olefins/Polyolefins Europe and Asia at Braskem, CEO Braskem Netherlands BV
BRASKEM

Jean Sentenac
President & CEO

AXENS

James Ritchie
President
EXXONMOBIL CATALYSTS & LISCENSING

Damon Hill
President - Growth & Development, Projects
WOOD

Miguel García Carreño
Senior Manager Process Design

REPSOL

Nicolas Aimard
VP Process

TOTALENERGIES

Mike Wailes
Manager, European Strategy

PHILLIPS 66

Bart Biebuyck
Executive Director FCH-JU

EUROPEAN COMMISSION

Outi Ervasti
Vice President, Renewable Hydrogen and PtX
NESTE

James Patterson
Vice President, Green Hydrogen

BP

Kristina Haverkamp
Managing Director

DENA

Kanan Mirzayev
Chief Strategy Officer

SOCAR TURKEY

Stephen Fowler
VP Chemicals, Downstream Process and Biotechnology
SHELL

Jiří Hájek
CEO & Chairman of Board of Directors
UNICRE

Thorsten Loehl
Director Innovation & Technology

BOREALIS

Frans Stokman
Executive Director

CEFIC

BUILDING A WORLD-LEADING LOW CARBON (DOWNSTREAM) BUSINESS: PUSHING PROFITABLE DECARBONISATION TO THE LIMITS

REDUCE, RECYCLE AND REMOVE

Over the coming weeks we will be reflecting on the insightful and interactive panel discussions from ESF Europe last month in Berlin, and first up is our keynote producer panel, 'Building a World-Leading Low Carbon (Downstream) Business – Pushing Profitable Decarbonisation to the Limits'. Alan Gelder, Downstream Global SME, VP Refining, Wood Mackenzie moderated an impressive line-up of panellists, Jaime Martin Juez, Executive Director, Technology & Corporate Venturing, Repsol, Ahmed M. AlKhunaini, President & CEO, Aramco Europe, Niels Anspach, VP Bio & Low Carbon, BP Europa SE and Walmir Soller, O/P VP Europe & Asia, CEO Braskem Netherlands. The discussion kicked off discussing decarbonisation routes with our panellists in agreement that when it comes to decarbonisation, there are three main routes, namely, reduce, recycle and remove. Mr AlKhunaini shared some examples of what they are doing in each area at Aramco, from combined cycle and heat power retrofitting, to harnessing and converting the CO2 as a building block to fertilisers and carbon capture and re-injection. Furthermore, the company are attempting to produce CO2 free products, with examples shared of the recent first shipment of blue ammonia to Japan, as well as the company's 12 R&D global centres working on promising research that could reduce the emissions of the internal combustion engine by 60-70%.

When it comes to scope 1 and 2 emissions, Repsol are radically redefining and refining their end-to-end process, electrifying as much as possible. Looking at Scope 3, Jaime commented that we cannot recover the emissions from all our processes and activities without thinking about what is the emissions from the use of our products.

Discussing biofuels, as one of the scalable, proven technologies, our panel were convinced they are critical. Over the next decade BP will invest into five major biofuels projects with the aim to produce 100 kbd of bioenergy by 2030.

Far more than only transitional, there is a huge integration opportunity with blue and green hydrogen. If vegetable oil co-processing can be complemented and integrated with green hydrogen, there are considerable CO2 savings compared to fossil fuels.

Further advocating the possibilities that biofuels present, our panel explored their role in decarbonising significant portions of hard the abate sectors. In road transportation, EVs will drive down gasoline, but gasoline will remain a significant portion of the pool. In heavy duty transport, over the next 10-20 years diesel will not be completely removed, and so the fossil based liquid molecules must be substituted with lower carbon intensity alternatives.

Addressing bio feedstocks, it was noted that we need to have in mind that the boundary conditions of fossil feedstocks have changed with climate change, and we need to consider the broader externalities of what we do and that the same applies to bio feedstocks.

When it comes to feedstock sourcing, a responsible sourcing programme, taking into consideration biodiversity, cultural practices, labour and human rights are necessary requirements to achieve sustainability. We have a significant opportunity to influence the conditions of the agricultural industry, and keep in mind the externalities of the new system we are creating.

> *When it comes to feedstock sourcing, a responsible sourcing programme,* ***taking into consideration biodiversity, cultural practices, labour and human rights are necessary requirements to achieve sustainability.***

Whatever the route, it was agreed that success will be defined by clear, significant, and concrete targets, and as a collective, the industry needs to find, and leverage synergies and partnerships. As an industry we have all the instruments in our toolbox to drive this forward but in order to do so we need ambitious targets that are reliable, trusted and in the long run, stable. Only that will foster the investment required and bring decarbonisation at scale.

To conclude this first part of the discussion, our panellists stressed the importance to keep in mind at all times that 'it's an and' conversation, and not to fall into the trap of a 'and/or' conversation. They are concurrent paths we can go through. In the future energy mix, one is unlikely to be dominant. A combination of several energy solutions is the only way to go.

HOW DO WE SECURE PROFITABILITY?

Next looking at building a low carbon downstream industry that's profitable, it was agreed that it's a tough one. Profitability will be driven by technology, scale and deploying that technology at scale, to create competitive advantage.

Demand will drive profitability. On the one hand we talk about regulatory incentives, but on the other hand is the voluntary demand out there? Is there the willingness by big corporations to voluntarily pay and reduce their co2 emissions?

Profitability will be defined, and the market and demand for decarbonisation will be driven through customers preference or through regulation. If there is no profitable business case for providing decarbonised options, decarbonisation will not happen. Without a business case no private large corporation will invest at scale. It was commented that we're all waiting for the perfect moment where the regulatory framework is there, along with the financing and geopolitical landscape.
This will likely result in the necessary investments not being made.

Finally, first mover advantage is important, but resilience, flexibility and the openness to learn are as important. We must think laterally and remember that it's a different dynamic that we are entering into, with different variables to the traditional business.

Concluding the panel Jaime, Ahmed, Niels and Walmir were asked by Alan the key message they each wanted to leave the audience with.

The first was the huge opportunity Europe has to re-industrialise, and achieve security of supply, and sustainable supply. Second was emphasising the journey ahead, which has to be smooth, comfortable and affordable. The penultimate take-away was the optimism despite the unprecedented change that that industry is facing. Looking laterally there are lots of opportunities. We have an important role in what we do and how we mobilise and influence other industries. We might be surprised with the speed of change as we start to influence. And last but not least, we need to scale and utilise the low hanging fruit out there. We need to be ambitious with our targets. The train has left the station and travelling in the right direction. Let's make sure we are on the train, at the front and driving it at pace!

DEVELOP, SCALE AND DEPLOY: ACCELERATING COMMERCIALLY COMPETITIVE LOW AND ZERO CARBON TECHNOLOGIES

During the earlier producer keynote panel discussion, the importance of choosing the right solutions in decarbonising the downstream industry was highlighted. The subsequent technology keynote panel focussed on those solutions and technologies that will assist producers in reaching their net zero goals. Technology plays a crucial role in the energy transition, and as such licensors have a central role to play.

Against this backdrop we were delighted to have our VP Stefan Chapman moderate the discussion with **James Ritchie, President, EXXONMOBIL CATALYSTS & LISCENING, Roeland Baan, President & CEO, TOPSOE A/S, Bryan Glover, President & CEO, HONEYWELL UOP, Damon Hill, President Growth and Projects, WOOD and Romain Roux, Decarbonisation & Consulting Director, AXENS** (filling in for **Jean Sentenac, President & CEO, AXENS** who unfortunately due to COVID was unable to join us on the day) to tackle this important topic.

The panel began by discussing the current global geopolitical landscape and impact on the energy transition. Despite two years of the pandemic which has provided long-lasting impacts on the industry and society as a whole, we are still not in the clear yet. Coupled with the devastating war in Ukraine, the industry is once again facing high energy prices and instability, creating difficulties to plan with so much volatility. In Europe, 40% of gas, 30% of oil and 40% of coal comes from Russia, highlighting Europe's dependency on energy imports. The situation has emphasised the need for the region to become independent and accelerate the development of alternative energy.

The European Commission announced the acceleration of their 2030 target in order to be less dependent on Russian energy imports, by diversification of gas supplies and larger volumes of biomethane and renewable hydrogen production and imports. Also in the plan is the aim to reduce the use of fossil fuels, increase energy efficiency, and renewables as well as electrification of the economy. The high cost of oil and natural gas creates opportunities for the region to develop renewable energy.

For example, depending on the refiner's location, it may now be cheaper to produce green hydrogen rather than blue. Refiners and petrochemical producers must reduce scope 1 and 2 emissions through energy efficiency, carbon capture, and electrification but at the same time, the long-term oil decline means that the industry has to switch to petrochemicals and take into consideration plastic recycling, synthetic fuels and biofuels. It will certainly not be an easy journey, but with the investment, support, and technologies available, the industry can prevail in this aspect.

So, what routes should the European downstream industry focus on in order to meet consumer demand? There is significant diversity in Europe; location plays a big factor in the sequestering of CO2. In areas where carbon capture is available, the price begins to look attainable today. It is key for each refiner to determine what their geographical challenges and opportunities are. Within their conventional asset base, refiners should look at better molecular management and improving the efficiency of their assets. The focus for the downstream industry should be to bring down scope 3 emissions and to do it profitably, whilst at the same time tackling scope 1 & 2 emissions that are driven by regulation and subsidies. Today, there are a lot of opportunities to reduce scope 3 as most investments involve transitioning the product base away from fuels into petrochemicals, which provides significant profitability. A conventical refinery is most likely to become a petrochemical feedstock producer in the future.

Beyond petrochemicals there are still a number of scope 3 opportunities that are available such as renewable fuels (either for diesel or SAF) and producing green naphtha and green LPG that can go into petrochemical production, where there are already significant premiums available. For refiners, anything that moves them into diesel, propylene and ethylene can be an attractive route before addressing scope 1 and 2 emissions.

Despite the industry's continuous improvements to operations, there are still low hanging fruits to be had. The basis always starts with running operations correctly, efficiently and using advanced monitoring tools. However, during the pandemic, refiners were placed into panic mode, running catalysts to the end, holding back on capital, which in turn comes at a cost to GHG emissions and energy efficiency. There are a vast range of technologies out there that offer different advantages depending on producers' constraints, whether it's a catalyst that gives better yield or lower energy usage.

The discussion moved on to the question of 'are we moving fast enough?' For example, green hydrogen installed capacity through electrolysis currently in the world is 300 MW. However, since the Ukraine crisis, we now need 400 GW by the end of this decade for Europe alone - but where is this going to come from? The industry needs to move faster to meet this challenge. In terms of petrochemicals, the opportunities exist, however, the industry as a whole is not moving fast enough in embracing petrochemical integration. Cost is a major factor; however, the ROI is positive along with reducing scope 3 emissions. Those who reposition quickly are going to have an advantage.

We see great numbers in renewable energy, but the resources required to design, procure and build aren't there yet, and the supply chain isn't in any shape to deliver what's needed in the next decade. On another note, the industry can only move as fast as the consumers and the push from activists is helping the industry to transition. The end goal for all is to combat climate change, but we require ways of making it happen competitively for society to keep moving.

The high cost of oil and natural gas creates opportunities for the region to develop renewable energy.

In terms of new technologies, the panellists began to debate as to whether it's better to be a front runner or first fastest follower. If the region has predictable, consistent, and reliable government regulation then it's better to be first. However, this often isn't the case and the goalposts keep moving, meaning the one in charge isn't always the final winner. New technologies take time to develop, and get to market. Historically, with new technologies on the market it's common to sell one or two units over the course of a couple years. However today, the demand for sustainable technologies is extremely high meaning there may be multiple units built in a short period of time.

The paradigm is shifting meaning whether you're first or fast, all technology providers must work together to get the technology out there quick enough. Another factor to consider is that today the front runners in many areas such as hydrogen and plastic recycling are start-ups, not the typical big technology companies. This is where further collaboration is needed to deliver the technology to scale. One technology solution isn't going to be the final answer but instead, a mix of what's available and best for that particular location, further highlighting that the collaboration between technology companies is key.

COLLABORATE AND CLUSTER: THE REALIGNMENT OF THE FOSSIL FUEL REFINERY TO THE SUSTAINABLE ENERGY PARK OF THE FUTURE

The next panel that we are reflecting on is our Collaborate and Cluster – The Realignment of the Fossil Fuel Refinery to the Sustainable Energy Park of the Future. **Rafael Moreno Lahore**, Partner and Associate Director, O&G Downstream, **Boston Consulting Group** moderated an impressive line-up of panellists, **Nicolas Aimard**, VP Process, **TotalEnergies OneTech**, **Mike Wailes**, Manager, European Strategy, **Phillips 66**, **Miguel Ángel García Carreño**, Senior Manager Process Design, **Repsol Technology Lab** and **Duncan Mitchell**, Global Decarbonization Business Leader, **KBC** (A Yokogawa Company).

The discussion kicked off discussing the perhaps counterintuitive, industrial clustering and partnerships. Historically perceived to be competitors in the same space, today the challenge to society is so huge that we must pull all ecosystems together to collaborate and cluster!

The need for industrial clustering and partnerships is somehow counter intuitive; if we had thought 15-20 years ago that 'traditional competitors' were aligned to provide a solution, it would be impossible. Despite being perceived as competitors in the same space, the challenge from society is so huge that we need to move towards this clustering and collaboration.

Phillips 66 shared their experiences of the industrial clusters in the UK with the Humber refinery. The UK government woke up a few years ago to the concept of industrial clusters. Today there are 6-7 around the UK, ranging from two million tonnes to the Humber which has the highest at 40 million tonnes of industrial emissions, within a very small radius. The cluster shares the infrastructure, the commonality, the hydrogen, the carbon capture, and ultimately creates the alignment between the industries and companies in the region.

Creating momentum requires common purpose, which can be difficult with a mix of industries and companies. As such government engagement is critical in helping to find those strategic partners with the same alignment.

Refineries are the natural core of an industrial cluster. Hydrogen is something refineries do today. Anyone who works in a refining uses amine every day so there is a lot of commonalities that puts a refinery at the heart of the cluster, in turn creating a lot of opportunities for that refinery.

It was stressed that before looking at collaboration, each company has to define their own strategic approach. Whether driven by economical drivers or society, at the end of the day each company has to make its own choice, which very often is a combination of both.

The conversation moved onto, what's a cluster? Is it two refineries that share a battery line, is it a steel plant, is it a cement plant? How far apart those individual plants need to be to make it a cluster?

One of the great things about the downstream industry is its competitiveness. Over the last 100 years, it has continued to design efficient systems to make itself competitive and act independent to the service of consumers. Collaboration has allowed for some fascinating discussions such as, how far does collaboration go? And to what point does that collaboration start negatively impacting behaviors and decision making? One of the most exciting things when we talk about clusters is what happens if one refinery or two refineries were to optimize themselves individually, and then collectively. The decarbonization impact is huge.

Ultimately the idea of industrial clustering is relatively new. Despite historically having industrial sites, this level has never been seen before in our industry. We must foster technology to grow these partnerships. It complex but very exciting and a great time to be in the industry.

H2- THE KEY ENABLER TO THE FUTURE OF THE DOWNSTREAM INDUSTRY & THE UTILISATION OF CO2

A BLUE BRIDGE TO A GREEN FUTURE

Our hydrogen panel comprising of James Patterson, VP Green Hydrogen, BP, Bart Biebuyck, Executive Director FCH-JU, EUROPEAN COMMISSION, Outi Ervasti, VP Renewable Hydrogen & PtX, NESTE, Kanan Mirzayev, Chief Strategy Officer, SOCAR TURKEY, Kristina Haverkamp, Manging Director, DENA and Walter Pfeiffer, Partner, ROLAND BERGER STRATEGY CONSULTANTS kicked off discussing where certainty is needed regarding RED II criteria and process for capex grants. Industry needs capital to drive projects and a framework that creates certainty to move forward with confidence. This becomes a challenge in Europe with so many different countries with different projects in different situations. Countries like Germany and Netherlands are at the forefront but in other areas, for example Spain, there's still a lot of uncertainty where clarity and subsidies are required in order to move forward. RED II has strict criteria required to qualify and whilst this makes sense for driving the creation of renewables projects, it's not the case for new projects, where it will stop them getting off the ground and, in this case, slow the hydrogen industry down.

Looking at the front runners such as Neste, their priority in green hydrogen is to create the supply to refineries, lower the carbon intensity of products, and create the value to increase sustainability. Their carbon neutrality target aiming for carbon neutral production at sites by 2035 is very ambitious. Products need to reflect this and be developed in this direction; this is where green hydrogen comes in. Their main focus two years ago was to create blue hydrogen. With co2 emissions in Porvoo over 2MT, there is a need to have CCS for conventional hydrogen production based on natural gas.

In time, once negotiations have taken place regarding power supply agreements, blue will be replaced with green. In the meanwhile, refiners need blue hydrogen considering the sheer size of the task. Looking at other projects such as Refhyne which started last year with an electrolyser project, they are creating the building blocks of decarbonisation within refineries. The Shell Rhineland Refinery installed a 10MW electrolyser which activated hydrogen production last year. Now there is a further grant to build another 90MW electrolyser next to it, expanding to a total of 100MW on the site.

Hydrogen requires infrastructure for transport and storage capabilities. The most convenient locations for blue hydrogen are the ones close to storage capabilities and to low-cost natural gas. Unfortunately, Europe doesn't have access to low-cost natural gas. However, in the near future whilst green hydrogen is too expensive, there are opportunities for blue hydrogen in Europe. For those to develop, alliances need to be formed to bring together the multiple players in the market with support from regulators. For green hydrogen, in order to advance the scale up and make it more competitive, efficiency and investment in technology is key. These countries with sunshine and steady wind have clear advantages. Transport becomes another issue as pipelines need to be hydrogen ready, but the majority are not. In places like Germany and Netherlands, the industry can move now to take advantage of the subsidies and demand but, of course, these aren't the cheapest places geographically to produce green hydrogen.

Supply hubs need to be established and concrete projects need to take place in Spain as European supply hubs. Optionality needs to be looked at in the different carriers, as well as transportation and carrier methodologies. Furthermore, refineries need to explore routes to create value from waste. Green hydrogen production produces vast amounts of heat. Refiners have the responsibility to look at every project and decide how to utilise the heat. Options should be explored, for instance, instead of heating houses with natural gas, they could use the heat in electrolysers. There must be cross industry collaboration to get this running.

The views between blue and green are simple, the industry needs both especially in this transition. There is no doubt that green is the end goal but to get there, industry needs large amounts of renewables that are not available today. Europe consumes 10MT of hydrogen, of which 96% is grey. On top of that, other industries need hydrogen such as steel, cement and transport, indicating that demand is much bigger than what is available without the production capacity for electrolysers in place.

Companies are scaling up fast but to build all the required electrolysers in time remains a challenge, which is where blue hydrogen comes in. BP's Rotterdam refinery was shared as an example with its blue and green project. The aim of the blue project is to decarbonise the high temperature processes that take place in the refinery, replacing flue gas with blue hydrogen in the furnace, something that would be difficult to address with green hydrogen. In the Netherlands, certain aspects need to be in favour for blue hydrogen for example, proximity to a co2 store, level of regulatory support and low-cost natural gas. A much larger decarbonisation story can be seen with the H2-fifty project, which looks at the replacement of grey hydrogen with green in the diesel refining processes.

Support is needed, capex and opex but a clear framework is also required to ensure that investments will produce what is required by the regulator and market

It was commented that the refining industry is not going full speed into green hydrogen. For blue yes, as a lot of companies make grey hydrogen so they just need to capture the co2. For green hydrogen, there is not enough movement from the refining sector. RED II & III should give this boost once the regulation is clear. The cost of the electrolyser must be worked on. Even the steel industry is moving faster than refining industry in terms of hydrogen and this can be seen with the HYBRIT project.

The discussion moved on to regulatory requirements for renewable energy carriers and low carbon fuels. What is really green and really blue and how can a regulator look at this? In order to invest, there needs to be a certain amount of security. Support is needed, capex and opex but a clear framework is also required to ensure that investments will produce what is required by the regulator and market. The problem that occurs is having two different legal frameworks. For green hydrogen, there is RED whereby renewable fuels of non-biological origin, including green hydrogen, need to have an impact of 70% less co2 emissions. But there is uncertainty as to how this is proved. Specified criteria has been passed through European Commission but it's still outstanding so insecurity is there. For blue hydrogen, there is no particular framework as it's not renewable and therefore not covered by RED. The hydrogen and low carbon gas market package was proposed by the European Commission last year, but it still doesn't specify the criteria and won't until 2023. A level playing field must be determined in regulatory terms between green and blue. A certification system is needed that covers both so that competition is fair between the two options that have a comparable impact on co2 emissions.

> ***Refineries need to reinvent themselves to become energy providers, whether they use ethanol, or biofuels, they will need to provide low carbon green fuels.***

The panellists agreed that Ammonia provides the highest hopes as existing technology is in place. There is opportunity in shipping fuel and other uses for green ammonia. BP provided a willingness to invest capex into ammonia production process. However, the use of ammonia in mobility is not existing at scale and a question arose of how the ammonia that's imported gets converted into hydrogen and transported to the refinery? There are projects around port infrastructure but what needs further work is the cracking back to hydrogen and doing that in a cost-effective way.

The discussion continued on additionality; a politically sensitive topic debated heavily. The reason why there is so much delay is because it is a difficult discussion. If industry must generate new additional renewable power to proceed with a hydrogen project, then it will ultimately delay the hydrogen economy. This is a political choice. Industry needs to be extremely careful with additionality. In principle, if industry needs to accelerate the hydrogen market, there should not be any additionality. The first hydrogen strategy for Europe was 10MT of hydrogen by 2030, but REPowerEU aims to increase this to 20MT. Additionality requirements would put a break on this ambition for the hydrogen economy in Europe. Regarding electrolysers, Europe is leading the way with other countries purchasing from Europe. These companies are crucial to the survival of the hydrogen economy and they must not be tempted to move elsewhere, this is where additionality may have negative consequences. The strength of technology in Europe must be maintained, domestic production of green hydrogen must be accomplished to create demand for this technology and remain competitive worldwide. Additionality needs to be compromised to ensure this.

Refineries need to reinvent themselves to become energy providers, whether they use ethanol, or biofuels, they will need to provide low carbon green fuels. But for many of these, hydrogen is required as a basic element in production. The future legislation needs to support this in order for refineries to move in this direction.

GIVING NEW LIFE TO PLASTIC WASTE

Stephen Fowler, VP Chemicals, Downstream Process and Biotechnology, SHELL, Oliver Borek, Chief Commercial Officer, MURA TECHNOLOGY, Jiří Hájek, CEO & Chairman of Board of Directors, ORLEN UNICRE, Thorsten Loehl, Director of Science, Innovation & Technology, BOREALIS, Frans Stokman, Executive Director, CEFIC and Götz Erhardt, Senior Managing Director Resources Industries, ACCENTURE joined the circularity panel discussion to discuss the importance of the reduction, reuse and recycling of plastics. Stephen shared perspectives from Shell, who have been very public with their ambitions to process 1MT of plastic waste through pyrolysis oil into chemical crackers by 2025. By setting out clear ambitions, the intent is to support and encourage the development of recycling at scale. Global partnerships are crucial to enable this, and technology investments are needed. Last year, Shell announced a partnership with BlueAlp for pyrolysis technology, working together to deploy, develop and scale up the technology which is already being commercially deployed. Furthermore, Shells Energy & Chemicals Park upgrader project in Singapore will have a capacity of 50,000 tonnes per year to take pyrolysis oil as a catalyst to produce circular chemicals. Shell are collaborating with waste providers and potential pyrolysis partners in the region in the hope of creating momentum.

Society and customers have articulated the desire for a circular economy instead of a linear one. Today, the views of the customer are driving every decision and project that the industry embarks upon. Finding a solution to the global plastics problem is a must and the industry must take responsibility to provide sustainable products for this solution. Brand owners are as much a part of this equation who also are demanding high quality recycled plastics. Today's demand and supply are imbalanced, with demand outstretching supply. The industry needs to come up with the volume of supply to meet current demand but there are many challenges. First, capital is needed to advance projects and innovation. Second, there is a feedstock challenge as waste is currently not optimised for chemical recycling or even mechanical recycling. Getting access to feedstocks of a certain quality, quantity and price remains a challenge. Once the industry widens the range of what is chosen for recycling, the purity will ultimately also vary. A way of addressing this is through propriety upgrading technology. Besides the feedstocks, technology and volumes, collaboration is what is truly required between the entire value chain to bring all the different elements together.

An area with particular opportunity is in the front end of the chain, the sourcing and sorting of the plastic waste. Access to waste is key if industry is going to meet the demand, highlighting the importance to partner with waste companies. Waste collectors also have a role to play to ensure plastics are not being incinerated. Often overlooked in this context is design for recyclability. A full solution is required starting with the product.

Finding a solution to the global plastics problem is a must and the industry must take responsibility to provide sustainable products for this solution

In Europe there is a real opportunity for policy to recognise the value that chemical recycling brings, as well as the challenges around sorting and sourcing. Chemical recycling is there to compliment reduction, reuse and mechanical recycling and enable the growth in circularity. Whilst the regulatory regime is evolving, collaboration is needed between industry and the commission to articulate the pathways and tools going forward to 2030 and 2050. It's important for the commission to understand how the industry is looking at this and what mechanisms will make this transition work. Recycling policy wise, the Plastic Waste Directive specifically focusses on mechanical recycling but recognises that chemical recycling is an additional complimentary technology. Chemical recycling can deal with contaminated and mixed plastics so it is a complimentary technology that removes the impurities before its fed back into the crackers. Stable regulation is an extremely important factor that stimulates innovation and allows directs the industry.

To close off the discussion the panellists were asked, how might the state of circularity in 2025 appear? Chemical recycling will gain momentum, being in partnership with mechanical recycling and recognised as valuable. Furthermore, projects in the planning stages today will be close to completion, starting to change supply and demand dynamics and essentially laying the foundations for the next wave of plastic recycling.

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ENERGY & SUSTAINABILITY FORUM
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