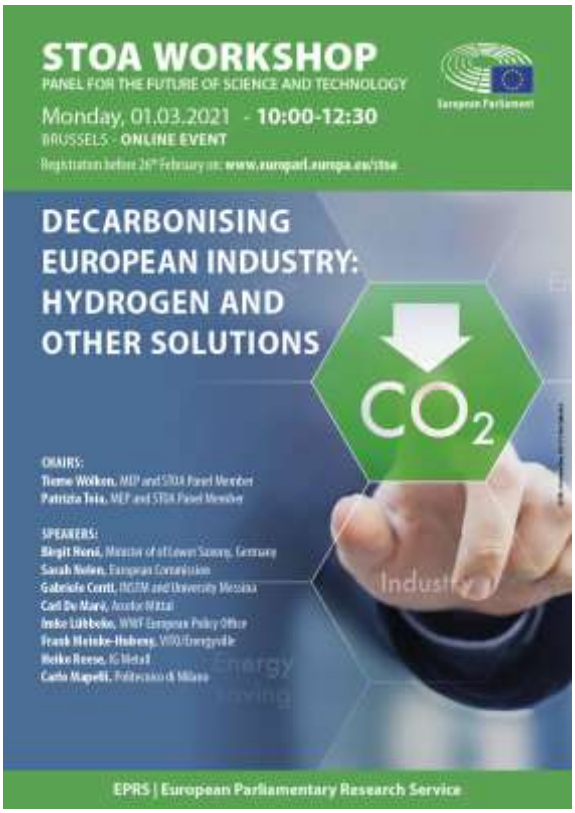
European Parliament

STOA online workshop

Decarbonising European industry: hydrogen and other solutions

Participants' booklet



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Scientific Foresight Unit (STOA)

PE 690.000 – March 2021

EN

Decarbonising European industry: hydrogen and other solutions

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STOA (online) workshop

Monday 1 March 2021, 10:00 - 12:30

Room SPINELLI 1G3, Interactio and remotely

Participants' booklet

Prepared by Andrés García Higuera, Scientific Foresight Unit (STOA)

Available at https://www.europarl.europa.eu/stoa/en/events/details/decarbonising-european-industry-hydrogen/20210208WKS03241

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Birgit Honé, Rapporteur for the European Committee of the Regions' opinion on clean hydrogen, Minister of Federal and European Affairs and Regional Development of Lower Saxony, Germany.

10:25-10:40 KEYNOTE SPEECH: Hydrogen as a key technology to reach climate neutrality in 2050

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10:40-11:30 SESSION 1: **Close the carbon cycle through substitution of fossil fuels**

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Tiemo WÖLKEN, MEP and STOA Panel Member

Patrizia TOIA, MEP and STOA Panel Member

12:25-12:30 CLOSING REMARKS

Tiemo WÖLKEN, MEP and STOA Panel Member

Patrizia TOIA, MEP and STOA Panel Member

Interpretation: English, German and Italian

2. Introduction

To assess the prospects for implementation of European Green Deal policies, it is necessary to analyze the evolving technological and behavioural trends and adress their relevant impact on the Green Deal implementation.

This event will discuss in depth the new emerging possibilities for closing the carbon cycle through substitution of fossil fuels use, especially with reference to carbon-intensive industries, underlining as well the need for further research in these subjects.

Topics to be discussed cover the new possibilities for reusing CO_2 from carbon-intensive industries, the integration of renewable energy sources in process industries as well as the storage and transport of renewable energy by chemical energy storage. Following up on the STOA Briefing 'The potential of hydrogen for decarbonising steel production' and drawing on the study carried out by STOA on 'Carbon-free steel: Cost reduction options and usage of existing gas infrastructure', this workshop is intended to look at a somewhat broader picture, including the hydrogen economy with its main ramifications as part of an evidence-based awareness-raising exercise. The event will investigate whether it is possible to foster achievement of the Green Deal objectives and successful implementation of the respective policies with regulatory changes affecting related technologies. It will also provide an opportunitie to comment on the possibilities to create a new value chain for chemical production based on the use of renewable energy and alternative raw materials, the change in the energy-chemistry nexus deriving from the above changes and the disruptive decrease in carbon footprint for large production areas, such as that of fertilizers, that can descend from new technological developments. The discussion will also focus on the initiatives to create a synergetic working together of the scientific and industrial communities to realize above possibilities.

The event will discuss the scientific and technological perspectives deriving from new developments to contribute to new STOA thematic area (A) Green Deal, and specifically to the topic "Innovative energy technologies and raw materials". The proposed event will also have impact on other relevant aspects of thematic area (A), namely those of Sustainable development goals, and of Waste, pollution and circular economy. Based on the specific findings, it will also serve to explore policy options for contributing to the transition to a carbon-neutral EU economy by 2050.

3. Welcome

3.1. Tiemo WÖLKEN, MEP and STOA Panel Member

Tiemo Wölken has been an MEP since 2016. He has been active in local politics since 2003 in his home region in northern Germany and holds a LL.M. in International Law from the University of Hull, England.

Tiemo is the S&D Coordinator in the Committee on Legal Affairs and a Member of the Committee on Environment, Public Health and Food Safety. Tiemo's areas of expertise are environmental and climate issues, healthcare, legal affairs, and digital questions across committees.

He is working on all energy-related files in the ENVI-committee. Hydrogen combines many questions and regulatory and implementation areas in energy policies, being both a hope for decarbonisation and a very complex topic. Tiemo worked as a shadow rapporteur on the hydrogen opinion of the ENVI committee.

Key message

We must already now think about how we can decarbonise the energy and industrial applications that we can not electrify. Hydrogen therefore is a fundamental piece of our climate neutrality promise. If we are serious about that promise, we also have to be aware of the fact that only hydrogen from renewable energies helps us.

We also have to talk more about energy efficiency and sufficiency. Even with hydrogen applications, we live in a world with limited resources. Therefore, we have to choose wisely where to apply hydrogen.

In steel production, hydrogen is essential for decarbonisation in my opinion. When we all agree on this, the work only begins: How to produce the necessary hydrogen, how to transport it to the steel factories, who pays what? I am very glad that we can contribute to these discussions with STOA studies and with through this workshop.

3.2. Patrizia TOIA, MEP and STOA Panel Member

Patrizia Toia worked as Director of the Planning Service at Lombardy Region. She served as regional councillor, Member of the Chamber of Deputies and of the Italian Senate as well as Undersecretary of State for Foreign Affairs and Minister for European Affairs and for Relations with Parliament.

In 2004 she was elected at the European Parliament. Member of the S&D Group, she is Vice-Chair of the ITRE Committee.

Patrizia Toia was born in Pogliano Milanese (Milan); she is graduated in Political Science at the University of Milan. She worked as Director of the Planning Service at Lombardy Region. She was regional councillor in Lombardy, with different responsibilities (Health, Budget).

She was Member of the Chamber of Deputies and in 1996 she was elected at the Senate of the Republic. She held various institutional positions: Undersecretary of State for Foreign Affairs with responsibility for Latin America, Asia and Oceania, Relations with the United Nations, Human Rights, Migration and Italians abroad, in 1999 she was appointed Minister for European Affairs and Minister for Relations with Parliament.

In 2004 she was elected at the European Parliament, confirmed in 2009, 2014 and 2019. Member of the Group of the Progressive Alliance of Socialists and Democrats (S & D), she is Vice-Chair of the Committee on Industry, Research and Energy. She is also substitute member of the Committee on Development, Committee on Transport and Tourism and of the Special Committee BECA.e.

Key message

Breakthrough innovation is key if the EU wants to achieve its climate goals by, among other things, decarbonizing heavy and energy-intensive industries.

Research in innovative materials, processes and technologies will play a crucial role in this endeavour and sufficient resources should be dedicated to the common effort of both public authorities and private companies. Putting the EU at the forefront of such an industrial revolution will ensure growth, wealth and competitive advantages to our economies.

With this event, STOA brings together the best-placed actors to facilitate a fruitful exchange between scientists and policy makers. We aim to contribute as an active part of the ongoing debate concerning the best solutions for decarbonization and put the EU on the right and successful path.

4. Speakers

4.1. Birgit HONÉ, Rapporteur for the European Committee of the Regions' opinion on clean hydrogen, Minister of Federal and European Affairs and Regional Development of Lower Saxony, Germany

Since 2017, Birgit Honé is the Minister for European and Federal Affairs and regional development in the German federal state of Lower Saxony. The tasks of the ministry include, among others, the representation of the state of Lower Saxony at the German federal level and the European level. In addition, the Ministry is responsible for the regional development and, related to this, for the management and delivery of EU funding such as the European Fund for Regional Development.

The topic of hydrogen assumes a central role in the ministry's work, for example, Minister Honé was nominated in 2019 the rapporteur for an opinion on clean hydrogen in the European Committee of the Regions (CoR). With regard to the regional level, the Ministry supports numerous initiatives and projects, for instance through the Interreg programme, with the aim of establishing Lower Saxony as a central player in the field of renewable energies. Minister Honé also represents Lower Saxony in the European Clean Hydrogen Alliance and the Euro-pean Hydrogen Valleys Partnership.

Minister Honé started her career in 1990 as adviser to the SPD parliamentary group in the Parliament of Lower Saxony. Among others, further key roles in her professional career include as Senate Member at the Lower Saxony Audit Office (2004-2013) and as Permanent Secretary for Europe and state development in the Lower Saxony State Chancellery (2013-2017). Minister Honé holds a degree in law.

Key message

The European Committee of the Regions (CoR) supports the European Green Deal with the aim of achieving climate neutrality in the EU by 2050. In particular, green hydrogen produced from renewable energy provides the opportunity to decarbonise those areas where hydrogen is already used as a raw material or where energy efficiency measures and direct electrification are not viable solutions. A substantial expansion of renewable energy in electricity genera-tion in the EU is needed for this.

Decarbonising the EU's steel industry with hydrogen from renewable sources creates opportunities for regional development – in particular when located in hydrogen valleys, where the whole or large parts of the hydrogen value chain can be developed in spatial proximity. The 'wind energy' region Lower Saxony with the Salzgitter Steel SALCOS project is an example of this. Hydrogen valleys with energyintensive industries are predestined as anchor points for the development of a European hydrogen infrastructure.

Many European regions are developing their own hydrogen strategies. They support networking between business, science and government and cooperate in the European Hydrogen Valleys Partnership. As recognised by the EU hydrogen strategy, hydrogen regions are indis-pensable partners for the EU in the development of the hydrogen market.

The CoR has recommended a set of measures to be taken by the EU to strengthen EU-wide demand and production, to provide a supportive legal framework for market development and infrastructure, to support investment and address taxation and state aid, to promote research, innovation and education and to support the EU's hydrogen regions. In 2021, the „Fit for 55" legislative package, the new TEN-E regulation and the Hydrogen and Gas markets' Decarbonisation Package will need to deliver on driving forward hydrogen from renewable energy sources.

4.2. Sarah Nelen, Deputy Head of Cabinet of Executive Vice-President Frans Timmermans at European Commission

Sarah Nelen is Deputy Head of Cabinet of Executive Vice-President Frans Timmermans responsible for the Green Deal, the EU's growth strategy to become the world's first climate-neutral continent by 2050.

Sarah has almost 20-year experience in European policy making, mainly in the areas of sustainability and justice and home affairs.

Before joining this Cabinet, she was Head of Unit in the European Commission's Environment Department where she was responsible for waste management & secondary materials and negotiated the EU's single use plastic legislation.

She already worked for Frans Timmermans before, advising him on the circular economy, sustainable development and gender equality. From 2010 to 2014, she worked in the team of the first President of the European Council, Mr Herman Van Rompuy.

Before joining the European Commission in 2001, she was a researcher at the Katholieke Universiteit Leuven where she obtained previously a Master in Political Science. She also studied at the Facultés Universitaires Saint Louis in Brussels, the University of Leicester and she is a College of Europe alumnus.

Key message

The European Green Deal has introduced a comprehensive strategic vision for a carbon-neutral, circular and more sustainable European economy. The long-term goal of climate neutrality in 2050 requires a forward-looking approach to the future energy supply in Europe. In order to achieve climate neutrality in 2050, the right investment decisions into clean technologies have already to be taken today – especially as investment cycles in industries are long.

The European Commission has embraced such a forward-looking approach and published an ambitious EU Hydrogen Strategy in July 2020. The aim of this strategy is to support the market readiness of hydrogen-based technologies. Hydrogen will play a key role in the decarbonisation of the European energy system – most notably in sectors where emissions remain hard to abate and to balance variable renewable energy flows. The EU Hydrogen Strategy foresees the installation of at least 6 GW of renewable electrolysers until 2024, 40 GW until 2030, and a large-scale deployment thereafter.

The goal of the EU Hydrogen Strategy is to kick-start investments across Europe. To deliver on this objective, the European Commission also initiated the European Clean Hydrogen Alliance. The Alliance brings together industry leaders, civil society members, national and regional ministers, and other stakeholders. The large general interest by the industry in the initiative clearly shows that there is a growing momentum for hydrogen in Europe. The European Commission will support this momentum by providing a regulatory framework that will facilitate cross-border collaborations on hydrogen and by supporting the necessary investments. The Resilience and Recovery Funds of NextGenerationEU will also provide funding for hydrogen projects in Europe.

4.3. Session 1: Close the carbon cycle through substitution of fossil fuels

4.3.1. Gabriele CENTI, President of ERIC aisbl (European Research Institute of Catalysis), INSTM and University Messina

Gabriele Centi is President of the European Research Institute of Catalysis (aisbl), full professor of Industrial Chemistry at the University of Messina (Italy) and was vice-President of the Italian Consortium of Science and Technology of Material (INSTM). He is member of the Hydrogen Working Group of the Italian Ministry of University and Research (MUR). He is President of IACS (International Association of Catalysis Societies) and Scientific Advisor of the EU Cluster of Catalysis. He is also part of the board of SUNERGY, a large initiative for fossil-free fuels and chemicals for a climate-neutral Europe.

He coordinated or was involved in many EU projects dealing on novel solutions for decarbonising European industry. Centi's areas of expertise are environmental and climate issues, CO2 utilization (CCUS), technologies for sustainable energy and chemical processes, use of renewable energy in chemical processes and to close the carbon cycle. He received several awards, among which recent Humboldt Research Award and Chinese Academy of Science President's International Fellowship Initiative as Distinguished Scientist, he is involved in various editorial activities, between which co-editor in chief of Journal of Energy Chemistry and has chaired several international conferences on catalysis and green processes. He published various books including on Sustainable Industrial Chemistry, Green Carbon Dioxide and Catalysis for Renewables.

Key message

Energy-intensive industries (EIIs) indicates the production sector (iron and steel, refineries, cement, petrochemicals and fertilizer) responsible for about 70% of the total CO2 emissions in the EU ETS - Emissions Trading System.

Closing the carbon cycle in EIIs requires a regime transition, where hydrogen can play an important role when properly integrated in smart value chains with technologies that are flexible enough to be adapted to a broad range of solutions and that maximize replicability. Meet the EU targets in terms of greenhouse gases requires to develop family of technologies adaptable to the different cases, rather than developed for specific situations, and that well integrate in the full value chain, exploiting synergies and symbioses. This requires a different approach from those in use, and to act on a global scale, including establishing a renewables economy substituting that based on fossils.

The long-term vision is to integrate the direct and indirect (via carriers such as H2) use of renewable energy sources, together with the use of alternative carbon sources and technologies to close the carbon cycle to progressively phase-out the use of fossils.

This vision requires an innovative science and technology effort which can be achieved only by addressing a large TRL that goes beyond specific industrial cases. Such a systemic approach will allow to constitute a portfolio of adaptable solutions for an eco-innovation hub, able to foster a lasting eco-community that progressively introduces next generation technologies for closing the carbon cycle in EIIs.

4.3.2. Carl De Maré, Arcelor Mittal - VP, Head of Technology Strategy

Civil Engineer, Master (Specialisation Electro-Mechanical Engineer) – University Gent 1985 Joined the company on September 1988 - site of ArcelorMittal Gent. Active in different areas as IT developments, Research centre for steel applications, quality responsible for the finishing area. Was from 2002 to end 2006 general manager of the Steelplant department of ArcelorMittal Gent Moved end 2006 to the segment level of ArcelorMittal, first as Continuous Improvement responsible for Flat Europe and was since May 2008 nominated to Vice-President of ArcelorMittal as CTO of Flat Carbon Europe, responsible for technology, strategy, innovations and continuous improvement Since 2014, he was nominated to Vice-President ArcelorMittal as Head of Technology Strategy. In this function he is responsible for the global program on Low Impact Steel technologies. In April 2017, Carl De Maré also became Chairman of the European Steel Technology Platform (ESTEP). ESTEP represents the European steel stakeholders.

Key message

To transform our operations to become carbon neutral, we need to move the primary (iron ore-based) steel production away from a reliance on fossil fuel energy, towards the use of "clean energy". To enable us to use these "clean energies", we are pioneering two breakthrough carbon-neutral technology routes: the first, we call Smart Carbon Blast Furnace route and the second is an Innovative DRI-based route.

Both routes will benefit from a shift towards hydrogen in the long term. Last years Green hydrogen got a lot of attention and Europe has high ambitions to scale up the Hydrogen economy and hopefully bring down the costs. However the real constraint for the European Climate plan will be the constraint on large scale, affordable, renewable energy which is based when we all move to hydrogen-based processes. Europe will become a net importer of renewable power which put at risks their industrial footprint. We can't afford to wait before this happens and need to be smarter.

Therefor ArcelorMittal is investing today more than €250 million to try to close the carbon cycle : we call this the Smart-Carbon route. Indeed Carbon is essential for the production of chemicals, but plays also a key role in steel and agriculture. One of the most attractive elements of the Smart Carbon route is that it features a number of complementary technologies which creates additional value as the recycling of waste into high value products at large scale and the lower dependency of imported renewable power.

The road ahead to become carbon-neutral is for sure not straightforward, but with cross-sector collaboration and supportive public policies, to scale up the technologies and ensure the large-scale deployment of clean energy infrastructure, we know we can transition to carbon-neutral steelmaking and play a significant role in helping Europe achieve its climate ambitions.

4.3.3. Imke Lübbeke, Head of Climate and Energy WWF European Policy Office

Imke Lübbeke is Head of the Climate and Energy team at WWF European Policy Office. She is a European policy and advocacy expert with more than 10 years of experience in European Climate, Energy, Agriculture and rural development Policy. Imke studied agricultural science and she successfully graduated on advanced studies on renewable energy in Switzerland, St. Gallen. Since 2016, Imke has been on the CAN Europe board and has represented the WWF Europe network in the Europe beyond coal campaign. Her main areas of work over the last five years have been on climate governance, long-term climate strategies and clean energy.

Key message

The climate emergency, and the EU commitment to climate neutrality, mean industry must decarbonise. Europe's energy intensive industries - cement, steel and chemicals - are responsible for around 16% of EU emissions, and 60% of all EU industrial emissions. However, for some energy intensive industries, like basic chemicals and steel, high energy density is required for production, meaning electrification is not the solution. This is where renewable hydrogen can help reduce greenhouse gas emissions, provided it is produced through sustainable wind and solar energy.

For certain industrial sectors, 2040 is just one investment cycle away. To achieve climate neutrality in line with IPCC requests and by 2040 at the latest as requested by science, it is clear that the phase-out of fossil fuels (including gas) should start directly. Hydrogen should not be used as a Trojan horse to promote gas infrastructure and business as usual with a high risk of locking in future investment into developing fossil fuel infrastructure for decades to come. However, the so-called low-carbon hydrogen does not exclude fossil-based hydrogen as it refers mainly to blue hydrogen (hydrogen produced from Steam Methane Reformation with CCS/U). The objective of the Commission's Hydrogen Strategy is to contribute to achieving climate neutrality through the support of renewables-based hydrogen and relevant infrastructure (e.g. electrolysers). Therefore only renewables based hydrogen (or so called "green" hydrogen) should be supported through public funds.

While it is true that hydrogen made from renewable energy can play a role in decarbonising sectors where emissions are hard to bring down, like shipping, steel or chemicals, its direct use for heating or transport on a large scale is problematic because it comes with many uncertainties linked to the scalability, costs of its production and inefficiencies. Thus, renewable hydrogen is not a silver bullet for decarbonisation and must been seen as a solution for sectors that have no other alternatives to fully decarbonise. Electrification and energy efficiency can help decarbonise heating systems and transport sector today.

4.4. Session 2: Carbon-free steel: Cost reduction options and usage of existing gas infrastructure

4.4.1. Frank Meinke-Hubeny, VITO/EnergyVille

Frank Meinke-Hubeny has a multi-disciplinary background in Urban Planning and Energy Economics. As a research group leader and project manager at VITO/EnergyVille he focuses on long-term energy transition scenarios and related model applications. Current responsibilities encompass the project management of the DG Energy project 'AIDRES - Advancing industrial decarbonisation by assessing the future use of renewable energies in industrial processes' and work package leadership of the EU-funded projects SmILES (Smart Integration of storage in Local Energy System), ESTMAP (Energy Storage Mapping and Planning), the Belgian Energy Transition funded project Bregilab (Balancing the Belgian electricity system for maximal use of Renewable Energy generation) and the several private sector funded studies, such as 'Energy Transition in Belgium - Choices and Costs during the nuclear phase out till 2030' and 'Worldwide Resource Efficient Steel Production'.

For the European Environmental Agency, he was engaged in the European Topic Centre for Air Pollution and Climate Change Mitigation (EEA ETC/ACM) as a co-author of the annual publication 'Renewable energy in Europe'.

Frank holds a master's degree from the Leibniz University Hannover, Germany, and a master's degree in economics from the University of Maastricht, Netherlands, where he specialized on (EU) policy evaluation in the field of climate action and energy policies.

Key message

The steel sector is one of the most challenging to decarbonize sectors and has recently received special attention due to the potential use of low-carbon hydrogen to reduce its fuel combustion and process-related carbon emissions.

The sector is one of the pillars of the European industry and job market, supporting approximately 2.7 (direct and indirect) million jobs. In 2019, the production of crude steel in Europe was 157 Mt, which accounted for 4% of the GHG emissions in Europe. Investment decisions are challenging since margins are tight and competition is high. Additionally, manufacturing sectors such as car companies, are including carbon neutrality in their strategies, which results in steel producers having the pressure and the need to keep up with such commitments to remain competitive and maintain their place in the supply chain.

60 % (or 94 Mt of steel) of the total steel produced in Europe originates from the coal-based BF/BOF route and is more suitable for the hydrogen direct reduction route (H-DRI). One can estimate that 94 Mt of 'green steel' would require approximately 37-60 GW of electrolyser capacity, producing approximately 6.6 Mt of hydrogen per year. As a reference, the EU Hydrogen Strategy aims to have 40 GW of electrolyzer capacity installed within the EU by 2030. The authors estimate that these electrolyzers would consume approximately 296 TWh of green electricity per year; as a reference, Germany produced in total 176 TWh of green electricity in 2020.

Several H-DRI projects are backed across Europe by iron and steel producers. The involved companies expect the technology to reach commercialisation at large capacities by 2035. Thus, this transition will create demand for low-carbon hydrogen. This H2 could be supplied by installing electrolyser on-site or

by the use of pipelines to link the hydrogen production sites with the consumption locations. Both methods are challenging and the prevalence of one over the other depends strongly on the location of the steel plant and the access to low cost and renewable energy.

More in-depth analysis is required to gain a deeper understanding of the barriers and enablers of the up-take of hydrogen in Energy Intensive Industries (EIIs) in general and the iron and steel sector in particular. Here the author would also like to refer to the project "AidRES - Advancing industrial decarbonisation by assessing the future use of renewable energies in industrial processes", managed by Frank Meinke-Hubeny (Vito NV) and coordinated by DG ENER (project officer Eric Lecomte).

4.4.2. Heiko Reese, IG Metall

Heiko Reese has been working at IG Metall in various functions since 1999. IG Metall is Germany's largest trade union with over 2.3 million members. It represents employees in various sectors, e.g. in the automotive industry, mechanical engineering and the steel industry.

Mr. Reese has headed the branch office of the IG Metall board in Düsseldorf since 2015. The branch office is responsible for the branch work in the IG Metall and Mr. Reese for the branch steel industry. He is also a member of the supervisory boards of thyssenkrupp Steel Europe and GMH. At European level he is chairman of the Base Metals Sector Committee at IndustriAll Europe and alternating chairman of the Sectoral Social Dialogue Steel of the European Commission.

Key message

The steel industry has the highest CO2 emissions in the industrial sector. Accordingly, there are also the best ways to reduce CO2 and thus achieve the climate targets. So that coal can be replaced by hydrogen, immense investments in so-called direct reduction plants are necessary, which will replace the blast furnaces. In addition to investments in the systems, there will be a second major cost factor. These are the increased production costs for green steel, mainly driven by the high price of hydrogen. In order to achieve a reasonable price level here, the rapid scaling of hydrogen for industrial use is very important. The development of hydrogen capacities and the corresponding infrastructure for the transport of green hydrogen are essential for the decarbonization of the steel industry. Both the electrolysis capacities and the infrastructure in the form of line networks must be considered. Using the existing natural gas infrastructure for hydrogen transport is very useful, 90% of the existing natural gas network can be used. The expansion of electrolysis capacities must be subsidized separately. Clustering must be carried out here and hydrogen centers must be specifically located across Europe. The choice of location should be based on consumers and the availability of renewable energy. In addition, it should be considered whether a quotation of hydrogen can deliver the desired effects.

4.4.3. Professor Carlo Mapelli, Politecnico di Milano

Carlo Mapelli was born on 23rd October 1973 and graduated in Materials Engineering (mechanical orientation) in 1998 at the Politecnico di Milano. In 2001 he obtained a PhD in Meta di Milano, where he carries out his research and teaching activities. Since 2011 he has been full professor at the Politecnico di Milano, where he holds courses of Materials Engineering Recycling & Environmental Impact and Applied Metallurgy. In 2009 the FEMS (Federation of European Material Societies) awarded him the Best European Lecturer Award. He is currently coordinator and head of the research line of Steelmaking & Metallurgical Processes of the Department of Mechanics of the Politecnico di Milano, collaborates with the main European steel groups, he was advisory consultant of the Special Commissioner for Ilva and he is a member of Board of Director of Finarvedi, Siderweb and Elsafra II.

Key message

The production and use of hydrogen is considered as a mean to eliminate the carbon neutrality and also as a useful technique to storage the energy from renewable energies when they cannot be consumed.

As a consequence of its high reactivity with oxygen hydrogen should be consumed near the production site. The present gas distribution network fits the requirements for the distribution of natural gas that can be enriched by a maximum of 15%-20% of hydrogen. For further hydrogen increase the steel used for the pipes has to be featured by a lower volume fraction of defects (i.e. non -metallic inclusions) to avoid the embrittlement of hydrogen that diffuses at the interface between the defect and the metal matrix.

In order to provide a high degree of integrity at flanged joints a gasket that consists of a serrated solid metal ring sandwiched between a soft and deformable sealing material. Another consideration in system integrity is the valving; leaks around valve stem packing are a real concern and an effort to prevent this is needed. The correct selection of bellows seal valves and/or diaphragm valves is recommended. The usual steel grades can be applied and the specialty steels for the transport of hydrogen are required only at high temperatures. However, significant investment and time are needed to perform such change to the infrastructure to adapt it for hydrogen transport. For this a reason the achievement of the carbon neutrality has to take into account not only production and distribution of hydrogen but also other technological routes for capture and treatment (i.e. splitting) of CO2 that can be less critical from a point of view of safety and energy consumption if compared to the hydrogen route.

6. About STOA

4.5. Mission

The Panel for the Future of Science and Technology (STOA) forms an integral part of the structure of the European Parliament. Launched in 1987, STOA is tasked with identifying and independently assessing the impact of new and emerging science and technologies.

The goal of its work is to assist, with independent information, the Members of the European Parliament (MEPs) in developing options for long-term, strategic policy-making.

The STOA Panel

The STOA Panel consists of 27 MEPs nominated from eleven permanent parliamentary committees: AGRI (Agriculture & Rural Development), CULT (Culture & Education), EMPL (Employment & Social Affairs), ENVI (Environment, Public Health & Food Safety), IMCO (Internal Market & Consumer Protection), INTA (International Trade), ITRE (Industry, Research & Energy), JURI (Legal Affairs), LIBE (Civil Liberties, Justice and Home Affairs), REGI (Regional Development) and TRAN (Transport & Tourism).

Ewa KOPACZ is the European Parliament Vice-President responsible for STOA for the first half of the 9th parliamentary term. The STOA Chair for the first half of the 9th parliamentary term is Eva KAILI with Christian EHLER and Ivars IJABS elected as 1st and 2nd Vice-Chairs respectively.

The STOA approach

STOA fulfils its mission primarily by carrying out science-based projects. Whilst undertaking these projects, STOA assesses the widest possible range of options to support evidence-based policy decisions. A typical project investigates the impacts of both existing and emerging technology options and presents these in the form of studies and options briefs. These are publicly available for download via the STOA website: www.europarl.europa.eu/stoa/.

Some of STOA's projects explore the long-term impacts of future techno-scientific trends, with the aim to support MEPs in anticipating the consequences of developments in science. Alongside its production of 'hard information', STOA communicates its findings to the European Parliament by organising public events throughout the year. STOA also runs the MEP-Scientist Pairing Scheme aimed at promoting mutual understanding and facilitating the establishment of lasting links between the scientific and policy-making communities.

Focus areas

STOA activities and products are varied and are designed to cover as wide a range of scientific and technological topics as possible, such as artificial intelligence, blockchain, 5G, genetic engineering, antibiotics resistance, internet addiction, face recognition, pollution, sustainable agriculture, COVID-19 and health in general.

These activities are clustered within three main thematic areas: Artificial intelligence & other disruptive technologies, The new Green Deal, and Quality of life. In addition, STOA's work addresses four cross-cutting policy areas: Science, technology and innovation; Societal and ethical challenges; Economic challenges; and Legal challenges.

ESMH

The European Science-Media Hub (ESMH), operating under the political responsibility of the STOA Panel, is a platform to promote networking, training and knowledge sharing between the European Parliament, the scientific community and the media. The ESMH creates a network among policy-makers, scientists and media involving science, academia, educational and research entities, and professional associations of journalists and scientists.

For journalists and media representatives, the ESMH organises training sessions and workshops on current technological developments, both as subjects of their reporting and as means of facilitating their work. Via media monitoring and media intelligence tools, the ESMH follows the most popular topics in the field of science and technology on different platforms including journals, newspapers and social media.

The ESMH makes information available to journalists, other media and citizens about new scientific developments, as well as about scientific topics that attract media attention, and promotes information based on evidence.

4.6. STOA Panel members

	Panel Member	Committee		Panel Member	Committee
	Ewa KOPACZ (EPP, PL) **EP Vice-President STOA Bureau member**			Herbert DORFMANN (EPP, IT)	**AGRI**
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	Ivars IJABS (Renew Europe, LV) **2nd STOA Vice-Chair - STOA Bureau member**	**ITRE**		Alexis GEORGOULIS (GUE/NGL, EL)	**CULT**
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	Francesca DONATO (ID, IT)	**AGRI**		Marina KALJURAND (S&D, ET)	**LIBE**

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4.7. STOA administration

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