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LOW-EMISSION HYDROGEN ON THE BACKGROUND OF "CARBON CURTAIN"

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Interview with ***Branko Milicevic***
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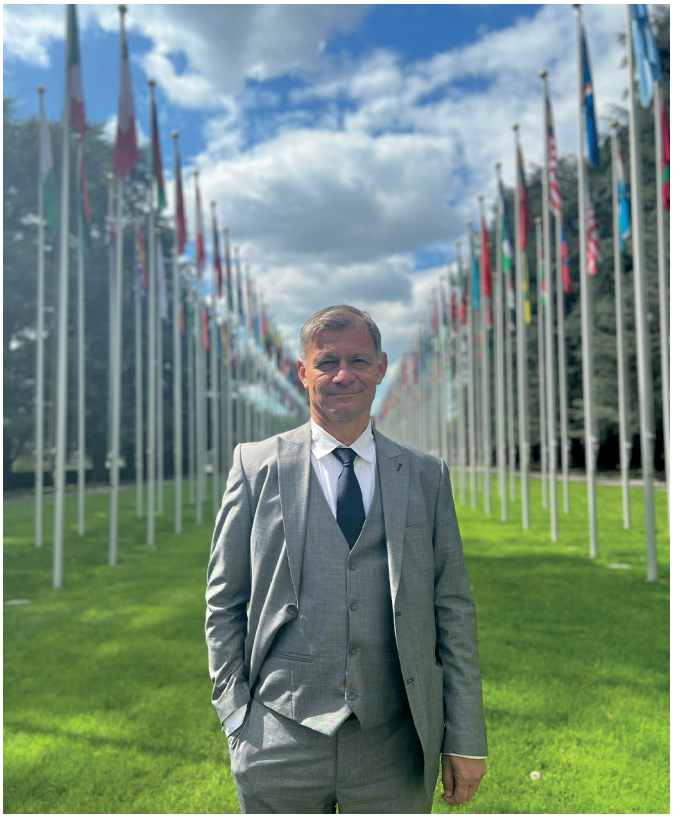

Abstract:

In this interview, we speak with Mr Branko Milicevic, a leading expert on energy transition and hydrogen at the United Nations Economic Commission for Europe (UNECE). As a Secretary of the Group of Experts on Gas and of the UNECE Hydrogen Task Force, Mr Milicevic offers invaluable insights into the crucial role hydrogen will play in shaping the future energy system. We delve into the critical role of sustainable hydrogen in facilitating the energy transition and discuss the impactful work of the UNECE Hydrogen Task Force in promoting hydrogen as a viable and essential component of a cleaner, more sustainable energy future.

Keywords: "carbon curtain", decarbonisation, hydrogen economy, low-emission hydrogen, UNECE Committee on Sustainable Energy, UNECE Hydrogen Task Force

Водород с низким углеродным следом на фоне «углеродного занавеса»

Аннотация: В этом интервью мы поговорили с Бранко Миличевичем, ведущим экспертом Европейской экономической комиссии ООН (ЕЭК ООН) по энергетическому переходу и водороду. Будучи секретарём Группы экспертов ООН по газу и Рабочей группы ЕЭК ООН по водороду, Бранко Миличевич поделился своим мнением о роли водорода в формировании энергетической системы будущего. Мы подробно обсудили важность водорода с низким углеродным следом для энергетического перехода, а также деятельность Рабочей группы ЕЭК ООН по водороду в контексте продвижения водорода как важного компонента устойчивого энергетического будущего.

Ключевые слова: водород с низким углеродным следом, водородная экономика, декарбонизация, ЕЭК ООН, Комитет ЕЭК ООН по устойчивой энергетике, Рабочая группа ЕЭК ООН по водороду, «углеродный занавес»

ENERPO Journal: ***Today we are glad to welcome Mr Branko Milicevic, Secretary of the Group of Experts on Gas and of the UNECE Hydrogen Task Force at the United Nations Economic Commission for Europe (Sustainable Energy Division). Our first question concerns the scope of the UNECE Hydrogen Task Force's work. Why was this group of experts created? What are its ultimate goals and current initiatives?***

Branko Milicevic: The UNECE Hydrogen Task Force was formally launched in June 2023, in response to the request by the UNECE Committee on Sustainable Energy. The Committee noted the importance of defining criteria for low-emission hydrogen that strike a balance between the emissions associated with its production and the sufficient flexibility needed to scale-up a nascent industry. Our Hydrogen Task

Force supports ongoing policy dialogue on hydrogen projects, classification and development of the full value chain.

The Task Force is just one of many hydrogen initiatives and mechanisms in Europe. Its goal is not to duplicate already existing initiatives, but to complement the ongoing efforts, by exploring whether and how our United Nations Framework Classification for Resources (UNFC) and the United Nations Resource Management System (UNRMS) could be applied to hydrogen projects, and by serving to all non-UN actors as a gateway to the UN family of organisations (the Economic and Social Council, other Regional Commissions, UNEP, UNDP, etc.).

Since 1974 — that is, in the past 50 years — we have witnessed several hydrogen booms and busts. For example, the hydrogen boom of early 2000s focused on the use of hydrogen in fuel cells, to generate electricity, or develop hydrogen-powered cars. It has been more than 20 years since, and it has not materialised at scale.

Lately we focus on hydrogen in the hard-to-abate sectors, such as steel, ammonia, or cement production, where hydrogen is used as a feedstock (and not as much as an energy carrier).

ENERPO: ***Could you please clarify for our readers, what is the difference between energy carriers and feedstocks?***

Branko: An energy carrier, or a vector, is anything that contains energy and can be used to transport it. For instance, gasoline, petrol, diesel, coal, natural gas are all energy carriers. You burn them, get heat, and then convert this heat into other forms of energy, say, electrical energy in a power plant. From this heat you get mechanical movement of turbines, and from mechanical movement you get electric energy. This is how power plants operate. In this case, natural gas or coal are energy carriers.

On the other hand, hydrogen and natural gas can be used as feedstocks in the chemical industry. For instance, to produce ammonia — and from ammonia fertilisers, such as ammonium nitrate and other chemicals — one needs hydrogen as a feedstock. Hydrogen stays in the product; it is not emitted in the form of water if you burn it. The current hydrogen story is about feedstocks.

ENERPO: ***Speaking about today's hydrogen boom, can we say that the energy transition agenda makes a difference and somehow influences this "wave"?***

Branko: Now the focus is on how the use of hydrogen in hard-to-abate sectors can help achieve the energy transition. Before, we talked mostly about electricity production from stationary and mobile fuel cells, even about the use of hydrogen fuel cells in mobile phones; however, hydrogen lost that battle against lithium-ion batteries.

Following the Paris Agreement and the efforts to reach net zero emissions, the focus turned to the so-called hard-to-abate sectors, that is, to all the industries that use chemicals to reduce, for example, iron oxide into iron. This is not combustion but reduction — carbon takes oxygen away from iron, and carbon dioxide is emitted. If hydrogen is used as a reducing agent, there are much less carbon dioxide emissions. The same applies to cement, ammonia and some other sectors.

However, the problem is that hydrogen is not a typical energy source. It is not a source; it is a manufactured good. There is no hydrogen in nature, in its molecular form. For all practical purposes, hydrogen exists in the form of its compounds, such as water or hydrocarbons, from which it is produced — either via electrolysis of water or steam reforming of hydrocarbons, primarily methane.

ENERPO: ***It is interesting you said that hydrogen does not exist in nature. And what about "hydrogen economy" as one of the main focuses of the UNECE and Hydrogen Task Force? Today many see it as a key solution for a sustainable energy future. But what does the concept of a "hydrogen economy" practically entail?***

Branko: The "hydrogen economy" refers to a system where hydrogen takes the place of hydrocarbons by serving as both an energy carrier and an industrial feedstock, as we progressively decarbonise the economy towards reaching net zero. The concept was born in 1974 when the Hydrogen Energy Society was launched. Prof Nejat Veziroglu was its Chair, and he coined the expression. There have been many ups and downs since then, but a hydrogen economy is yet to materialise.

ENERPO: ***Hydrogen is a key player in the sustainable energy landscape, offering an alternative to traditional fossil fuels. Could you elaborate on the different types of hydrogen and how they vary in terms of production and carbon footprint? Which type of hydrogen can be labelled as "sustainable" and has the most potential?***

Branko: I do not think there are different types of hydrogen. There is one and only hydrogen molecule, and its production, transport, storage and use — could result in various greenhouse gas emissions and other environmental and social impacts. It is difficult to say what a label "sustainable" could mean. We at UNECE refrain from using qualifiers such as sustainable, green, blue, grey, etc.; we prefer "low-emission" hydrogen. In our work, we are trying to develop a classification for hydrogen that goes beyond colours, one that would address the full life cycle of hydrogen production and transport.

ENERPO: ***Green or, as you call it, "low-emission" hydrogen is gaining prominence due to its minimal carbon emissions. Last year, BloombergNEF published a report[1] claiming that this type of***

[1] "2023 Hydrogen Levelized Cost Update: Green Beats Gray", BloombergNEF, published July 25, 2023, https://about.bnef.com/blog/2023-hydrogen-levelized-cost-update-green-beats-gray/.

hydrogen will become competitive with existing gray H2 plants by 2030. Do you consider this outlook well-grounded? Is there a trend toward scaling up sustainable hydrogen production and distribution?

Branko: Yes, there is certainly a trend toward scaling up low-emission hydrogen production and use, with many announcements lately. In our recent publication "Towards a Hydrogen Economy in the UNECE Region"[2], we noted that in the past two years, numerous supportive policies have been implemented, and numerous low-emission hydrogen projects have been announced, both in the UNECE region and beyond. Yet, according to the International Energy Agency, a mere 4% of these projects have reached a final investment decision, while low-emission hydrogen still constitutes less than 1% of overall hydrogen production and use.

Achieving the scale and pace of hydrogen deployment necessary to bridge the gap between the current status quo and our climate objectives requires more decisive actions from policymakers and the emerging hydrogen industry.

ENERPO: ***In November 2023, you participated in a discussion on future energy at the V International Municipal BRICS+ Forum in Saint Petersburg[3]. One key message from this panel was that, given the challenges associated with hydrogen, natural gas remains the real energy resource of the future. Do you agree with this opinion? Can hydrogen emerge as a winner in the inter-fuel competition?***

Branko: Natural gas and hydrogen are not necessarily competitors. Our view is that we will continue to rely on gaseous energy carriers and feedstocks, as well as their infrastructure — pipes, compressors, storage, etc. — needed to contain and manage them. Our goal is to progressively decarbonise what is in the pipe. This can be done by harnessing synergies between hydrogen, natural gas, biogas and other gases.

When it comes to an end use of energy, we want to electrify everything that can be electrified. For instance, we replace a petrol-fuelled car with an electric one. But there are sectors that cannot be cheaply or easily electrified. In hard-to-abate sectors, in principle, you can produce steel like you produce aluminium, that is, via electrolysis, but it may be cost prohibitive. We talk about millions of tons of steel for low-tech applications to build homes, roads and bridges. Technically, it can be done, but it is simply too expensive.

ENERPO: ***This brings us to the issue of financing. The hydrogen endeavour necessitates substantial investment, with the IEA estimating a requirement of approximately $15 trillion by 2050[4]. Is this volume of investment even feasible?***

Branko: Before I answer, let me just explain certain differences in metrics we use. Often when we talk about hydrogen production, we refer to either electrolyser capacity (in Watts installed) or the quantity (kg of hydrogen produced per year).

To convert between these two metrics, we should make some assumptions on electrolyser efficiency and utilisation, but the rule of thumb is: for each kg of hydrogen produced, one needs a 10W-electrolyser, and have it on for a year. If the current cost of electrolysers is, say, several $US per Watt, it means that to produce one million ton of hydrogen we would need 10GW installed that cost $30—50 billion.

However, the real problem is not the cost to build electrolysers and other equipment needed to produce hydrogen. The real problem is that the demand is low. For this reason, in June this year we held a webinar on demand creation[5]. We felt that the discrepancy between projected demand of low-emission hydrogen slows down the development of the hydrogen value chain. We noted that the unwillingness of end-users to embrace hydrogen as a feedstock reflected their anxiety about costs, technological challenges, risks and their perception, regulatory environment, and geopolitical uncertainties. This is a problem we still need to address.

ENERPO: ***What can be done, in your opinion, to make hydrogen a business case? Is it possible now or in the near future?***

Branko: In the discussion about hydrogen today, there are too many proponents and opponents, with rather firm views of what and how should be done. In my view, we need to make more informed decisions based on good science and reliable technical and economic data. We should avoid confirmation biases that sometimes dominate the narrative and drive or prevent action and innovation.

ENERPO: ***Let us shift our focus to the international arena. Do the current geopolitical tensions, such as an "iron curtain" between East and West as a result of the conflict between Russia and Ukraine, influence hydrogen development agenda?***

Branko: I won't comment on that, yet one could imagine a "carbon curtain", such as the EU's Carbon Border Adjustment Mechanism, to emerge between those who embrace decarbonisation and those who do not. The hydrogen development agenda could be hugely impacted by such a curtain.

ENERPO: ***That is an excellent expression, and we will certainly highlight it in the interview! To conclude, it would be insightful to gain a broader perspective on your vision and potential chal-***

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[2] Daria Nochevnik, Andrei Tchouvelev, and Branko Milicevic, *Towards a Hydrogen Economy in the UNECE Region*, ECE Energy Series No. 79 (Geneva: United Nations, 2023), https://unece.org/sites/default/files/2024-03/ECE_ENERGY_151.pdf.

[3] Anastasiya Oshchepkova. "V International Municipal BRICS+ Forum 2023. Future Energy: Alternative Sources for Sustainable Development", ENERPO Journal, November 26, 2023, https://enerpojournal.eusp.org/2023/11/v-international-municipal-brics-forum-2023/.

[4] Nina Chestney, "$15 Trillion Global Hydrogen Investment Needed to 2050-research", *Reuters*, April 27, 2021, https://www.reuters.com/business/energy/15-trillion-global-hydrogen-investment-needed-2050-research-2021-04-26/.

[5] "Opportunities for Hydrogen Demand Creation in Hard-to-abate Industry", UNECE, published 2024, https://unece.org/info/events/event/391474.

lenges regarding hydrogen as part of the future energy system. Looking ahead, what are your biggest concerns about the future of sustainable hydrogen?

Branko: I have two concerns. The first is whether the business case for hydrogen as an agent of decarbonisation is built on sound foundations on a truly global scale. I do not know the answer to this. Yet, if the answer is yes, my second concern is that the whole concept might nevertheless fail to materialise, or gain traction, because the world is a complicated place with too many distractions and competing priorities. The energy transition requires a persistent effort and policy action over decades, yet due to our political cycle that operates on shorter timescales — typically 3 to 4 years — there is a risk we fail to see the big picture, and lose focus, momentum and time. But I do hope this will not happen.

ENERPO: ***We hope for this as well. Thank you, Branko, for sharing your insights. Your perspective is invaluable for our readers to understand the crucial role of hydrogen in shaping a more sustainable future.***

About Branko Milicevic

Branko Milicevic is the secretary of the Group of Experts on Gas and of the Hydrogen Task Force of the United Nations Economic Commission for Europe (UNECE) in Geneva. Prior to joining UNECE, Branko worked at the United Nations headquarters in New York, in the Department of Economic and Social Affairs, where he was responsible for the indicators of sustainable development, and energy and environment statistics. A chemical engineer by training, he was also involved in development and commercialisation of hydrogen fuels cells in the United States.

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