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External Hydrogen Relations of the European Union: Framing Processes in the Public Discourse Towards and within Partner Countries

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Abstract: With the need to decarbonize sectors that have hard-to-abate emissions, hydrogen as an energy carrier has increasingly gained attention. Within the European Union (EU) and its member states, hydrogen is assumed to be key for decarbonizing different sectors in the fight against climate change. Hence, state and private actors have engaged in a variety of attempts, strategies, and interests. However, energy security in Europe cannot be managed by European energy supply alone, despite high targets for the expansion of renewable energies. Rather, the EU will have to continue to rely on energy imports from partner countries. Against this backdrop, this paper seeks to provide an analysis of frame promotion processes generated by the EU's bet on hydrogen. Drawing on a discourse analysis that is based on more than 32,000 media reports generated through the database Nexis, it conceptualizes the media debate as a carrier of frame alignment efforts by actors with a specific focus on the debates concerning external partner countries. It thus focuses on the discourses on the EU's hydrogen approach in a complex environment with diverging interests of stakeholders from inside and outside the EU, thereby examining debates that still need further empirical research.

Keywords: European Union; green energy trade; hydrogen; frame analysis; external partner countries



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1. Introduction

The global commitment to decarbonize industrial and private sectors in the fight against climate change has grown stronger in recent years, with the signing of the landmark Paris Agreement in 2015 and major economies across the world passing laws to reach net-zero CO₂ emissions in the next forty years. The Russian invasion of Ukraine and Moscow's policy of reducing and cutting off gas supplies to European Union (EU) member states such as Bulgaria, Poland, and Germany have increased the awareness of reducing energy dependency on Russia as well as energy vulnerabilities in fossil fuels in Europe. With the need to decarbonize sectors that have hard-to-abate emissions, hydrogen as an energy carrier has increasingly gained attention globally and in the EU as the largest economic organization specifically. With a dedicated hydrogen strategy published in July 2020, the EU has placed its bet on hydrogen as an energy carrier to decarbonize sectors such as iron and steel production, high-temperature heat for industrial processes, aviation, shipping, long-distance road transportation, and heat for buildings [1], which are sectors that account for over one fourth of all global CO₂ emissions [2]. Equally, several member states such as Spain, France, Portugal, and Germany have published their own national hydrogen strategies and launched specific support mechanisms. Overall, hydrogen has become a key energy carrier for the EU's ambitious plans to achieve net-zero emissions in the future and this receives high attention across European politics, economics, and societies today.

With the growing salience of hydrogen for the global and European energy transition, academic research has equally acknowledged hydrogen as a relevant field of interest and

investigation beyond energy governance more generally [3]. While research has focused on implications for regional economies [4] or geopolitical relations [5], a specific EU approach to hydrogen has also been the focus of research. Besides general investigations and scenarios for the EU's hydrogen approach that have led to rich findings [1,6], scholars have investigated the EU's hydrogen policy frameworks [7,8], public attitudes and understandings towards hydrogen usage [9,10], potential policy structures such as tax favors [11], and hydrogen policies on the regional level [12,13]. Researchers have likewise engaged with hydrogen policies in specific European states [14–16].

Given the fact that the EU is very likely to continue to rely on energy imports generally and on hydrogen as an energy carrier specifically, the EU's bet on hydrogen will certainly considerably affect its external energy relations with potential partner countries for governing green energy trade. Since a substantial part of the EU's hydrogen market will be dependent on hydrogen imports and with the growing salience of hydrogen partnerships with third countries, their potential and risks have been the focus of research and were examined by recent studies [17–21].

Against the background of a growing European interest in this energy carrier and the foreseeable need to import substantial amounts of hydrogen from external partners, this study embarks on an analysis of framing processes on external partner countries by actors engaged in the public discourse generated by Europe's bet on hydrogen. In doing this, it will focus specifically on the years 2019 to 2021—the period around the publication of the EU's hydrogen strategy. Drawing on an assessment of this public discourse as an arena in which framing processes unfold, our qualitative examination is based on more than 32,000 media reports generated through the database Nexis. Drawing on a conceptual framework of framing processes which puts forward a public discourse approach with a macro focus, it examines the framing processes with regard to external partners in the EU by means of a two-step analysis: In the first step, we identify key actors before analyzing frame promotion processes with the media as an indicator for the public discourse in the second step.

We argue that an engagement with the hydrogen discourse and framing processes in the EU is relevant for several reasons. From a theoretical perspective, we seek to provide a conceptual framework for analyzing framing processes in this specific environment and with an emphasis on frame promotion through media, focusing specifically on frame alignment processes. Our contribution thus seeks to bridge the gap in the literature on the EU's external energy policies and framing as a conceptual endeavor to capture schemata of interpretation. Through our detailed analysis of public discourse as an arena in which actors debate hydrogen as an energy carrier, we can analyze frame promotion through media as carriers of frames and conceptualize frame alignment processes. Methodologically, a frame analysis seems well suited for engaging with the still-emerging field of hydrogen. Whereas many studies have analyzed discourses on EU energy policies [22,23] or in the context of energy transitions in specific member states [24], an examination of the framing of EU hydrogen policies in the context of external partner countries has, to our knowledge, not been undertaken so far. Through our endeavor, we hope to contribute to theory development in the field as well as to provide a first mapping of the discourse and frame promotion by relevant actors. Empirically, such an analysis generates sound knowledge on hydrogen debates in a complex environment with diverging stakeholder interests, and thus provides insights into processes that still need further empirical research.

We proceed as follows: In a first step, we present a conceptual framework for analyzing framing processes in this specific environment and outline the methodological approach as well as our data acquisition before we engage with hydrogen as an energy carrier and the EU's approach towards this technology. Secondly, our detailed analysis of framing processes in the EU's public discourse on hydrogen partners identifies key actors before it proceeds by examining framing processes. Finally, we conclude by discussing our findings, reflecting on their implications, and providing avenues for further research.

2. A Conceptual Framework for Policy Framing of the EU's External Hydrogen Partners

In this section, we present our conceptual framework through which we seek to analyze framing processes regarding external partners in the hydrogen debate within the EU. It builds on a social constructivist perspective, which assumes that the influence on social reality is not limited to state actors and that other actors such as non-governmental organizations, private-sector organizations, social movements, or epistemic communities shape and frame policy processes as well [25]. Framing is considered a prominent concept of communication research as well as a “fractured paradigm” [26] (title) which has been frequently applied to several research strands and areas, including political science. The term describes “schemata of interpretation” through which individuals “locate, perceive, identify, and label” occurrences in their private lives and in the world [27] (p. 21). They help to attach meaning to such occurrences but also guide action, by simplifying and condensing our understanding of the world [28]. Frames thus constitute “interpretative schema” given that, for instance, they define policy options and decisions for policymakers [29]. With the help of frames, actors weigh considerations and arguments over others. Most importantly, frames are “intended to mobilize potential adherents and constituents, to garner bystander support, and to demobilize antagonists” [30] (p. 198).

Drawing on communication research, we hold that framing involves a horizontal and a vertical dimension. In this model, frames occur in different arenas such as the media system, political system, society, or counter publics (horizontal dimension) [31] (p. 111). Moreover, frames can be located on different levels such as a cognitive, discursive, or textual level (vertical dimension). Following these assumptions, we argue that agents and frame entrepreneurs “[...] promote specific frames in order to gain public support for their interests, positions, and concerns” [31] (p. 111). We thus apply a public discourse or social movement approach with a macro focus [32,33]. Through this lens, we identify political actors and examine to what extent these can (successfully) launch their frames in the media. The latter are merely seen as carriers of frames promoted by specific agents. Our approach thus considers the content of media as an indicator for the public discourse which affects public support (see Figure 1). In this arena, actors engage in frame promotion through media outlets in order to gain public support. These promotion processes are inspired by the interests, positions, and concerns these actors have. Likewise, actors engaging in these framing processes are shaped, as we assume, by the interests, positions, and concerns present in the public and understanding of the recipients of framing processes feeds back into the senders’ (actors’) understanding.

Overall, this approach refers to strategic processes that are deliberative, utilitarian, and goal-directed. Actors develop and deploy frames “to achieve a specific purpose—to recruit new members, to mobilize adherents, [or] to acquire resources” [30] (p. 624). Research has identified actors’ strategic efforts to link their interests and interpretations to those of their constituents, (potential) supporters, or resource providers as “frame alignment processes” [34]. These are strategic in character and involve four elements: frame bridging, frame amplification, frame extension, and frame transformation (see Table 1).

It is important to note that an actor’s frame alignment processes do not necessarily yield the desired results and are usually contested by other actors [30] (p. 625).

Overall, an actor’s specific strategic interests, positions, and concerns feed into frame promotion. However, actors may disagree on an issue while sharing the same interpretive frame. As Nisbet points out, climate activists have built on the frame of economic consequences put forward by skeptical conservatives through emphasizing the opportunity for economic growth furthered by investments in clean technologies [35]. It is, moreover, important to note that actors are acting within a public discourse and are thus themselves shaped by frame promotions, for instance by other actors. Likewise, public support might generate another avenue that affects the frame promotion of actors. Specifically, our study embarks on two steps to assess frame promotion in the public hydrogen discourse. First, we seek to identify and map relevant actors in the EU external hydrogen market. Second, we

aim to examine the frame alignment processes actors embark upon to gain public support for their interest, positions, and concerns with reference to partner countries. This approach thus includes inductive accounts for frames and their clustering in a subsequent step [36].

Public discourse as arena

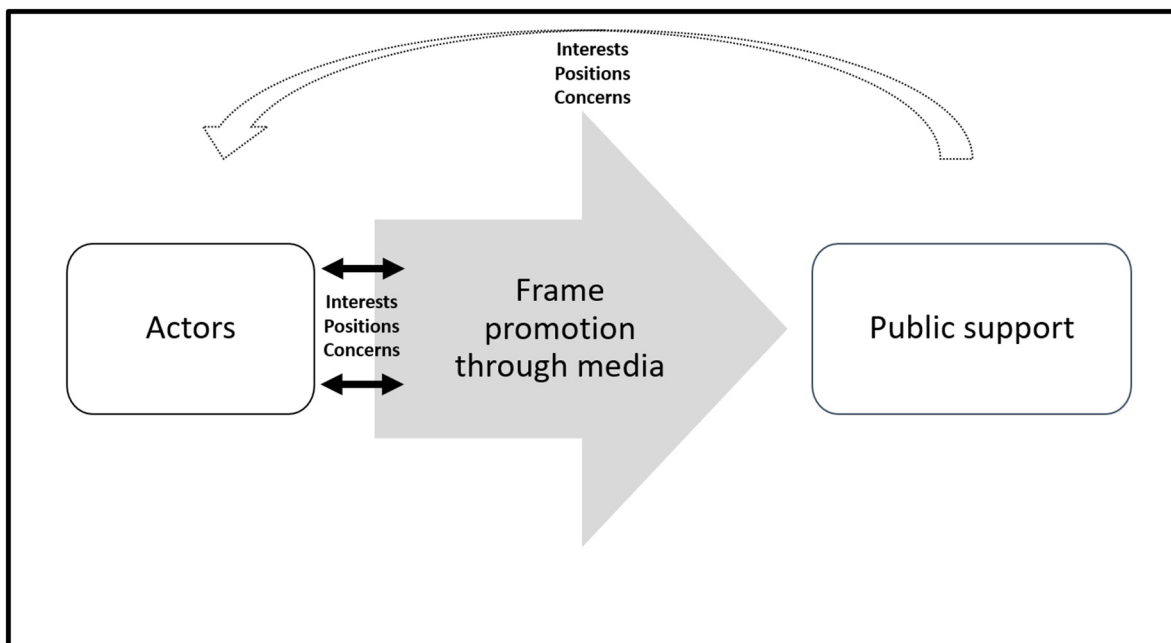


Figure 1. Conceptual framework (own elaboration).

Table 1. Frame alignment processes [30] (pp. 624–625).

Frame Bridging	Frame Amplification
Actors link two or more congruent but unconnected frames	Actors idealize, embellish, or clarify existing ideas and beliefs
Frame Extension	Frame Transformation
Actors extend frames beyond their own interests to attract potential adherents	Actors change old meanings and generate new meanings

In this context, it is also important to note what we are not focusing on. Given the nascent character of the hydrogen discourse in the EU and its member states, we specifically focus on processes of frame promotion within the public discourse. We do not, however, examine the emergence of frames within those actors, nor the effects of such frame promotion. Hence, this study constitutes a first “mapping exercise” in this newly developed discursive sphere in which we intend to grasp the complex and still evolving specifics of the debate on hydrogen.

A look at previous studies illustrates the nascent character of the focus applied in this study. Although the analysis of framing processes has featured quite prominently among scholars in international relations more broadly, and studies on the EU’s external policy specifically [37–40]—with work also focusing on the EU’s energy policy [22] the discourses on green energy trade generally have not been examined with reference to framing processes. Although scholars have embarked on discourse analyses, including network analysis, in national contexts and have thus shown the specific and complex features of the recently evolving hydrogen market [16,41], research on framing processes in these debates is still underdeveloped. Against this background, we argue that framing constitutes a process of high relevance to the EU’s and its member states’ energy transformation plans. These unfold in a discourse of high (attributed) salience, a multitude of actors with different

interests, and an evolving debate in which those actors seek to gain public support for their positions and concerns. The next section will outline how we approach this endeavor from a methodological viewpoint.

3. Methodological Approach and Data Analysis

This study seeks to analyze frame promotion processes in the public discourse on external hydrogen partnerships in the EU (see Figure 1). Consequently, it embarks on a systematic examination of this discourse specifically for identifying the key actors and how they engage in frame promotion through media. There exists a wide range of literature on how to capture discourses [42,43]. For instance, scholars embark on the linguistic characteristics of a discourse, their power relations, or engage with the language in a critical manner. What these approaches have in common is that they seek to illustrate how “textual and social processes are intrinsically connected and to describe, in specific contexts, the implications of this connection for the way we think and act in the contemporary world” [44] (p. 191). Drawing on Gerhards [45] (pp. 334–335), this study will place an emphasis on discourses understood as publicly held conversations of actors about topics and positions, reasoning, and interpretations that relate to these topics. These conversations take place in public arenas, with the mass media being the most prominent of those arenas. Discourse, in turn, is a set of relationships existing between discursive events and text in context [46] (p. 5). Discourses are relevant for the purpose of this study in that we assume that framing processes take place within public discourses as arenas [32,33]. Rather than embarking on a critical discourse analysis or a detailed account of power relations within the discourse, this study seeks to grasp framing processes within the specific discourse on a recently developing topic—namely, external hydrogen partnerships. This serves merely to map and capture the essentials of such framing processes before we can subsequently conduct more extensive research in a finer-grained manner.

We hold that the EU constitutes a crucial case for examining the discourse on hydrogen. As a major organization in the world economy with an ambitious program to fight climate change and decarbonize various sectors ranging from industry to private transport, the EU constitutes a main player in a (future) hydrogen market [1]. Accordingly, the EU has published a dedicated hydrogen strategy in July 2020 that mirrors the key role the EU attributes to hydrogen. Focusing specifically on the period around the publication of this strategy, our analysis shall generate empirical insights for assessing how framing processes on external hydrogen partnerships unfold in the EU and its member states.

The covering of the public discourse arena is based on 32,231 reports generated by the database Nexis. Nexis is the largest media database in the world and provides access to a wide variety of more than 40,000 global media sources in multiple languages [47]. It includes news from international news agencies such as Agence France-Presse (AFP), Associated Press (AP), Reuters, Deutsche Presse-Agentur (DPA), Interfax, or the Xinhua News Agency, major international broadcasters such as the British Broadcasting Corporation (BBC), the Cable News Network (CNN), or the Deutsche Welle (DW), national and local newspapers, market outlooks, firm reports, energy reports, and other written publications. This collection therefore captures the main advantages of using media reports, since they include a reflection of the social mainstream and a dissemination to large audiences [48]. Nexis is also likely to display patterns of access and the power of single actors and frame entrepreneurs to affect public support—a process that has also been highlighted by previous research [49]. Despite this linkage, our limited knowledge on its effect is also noteworthy: “Because salience is a product of the interaction of texts and receivers, the presence of frames in the text, as detected by researchers, does not guarantee their influence in audience thinking” [26] (p. 53). In the context of the potential effect of power politics for our analysis, we will consider such processes when we reflect on our findings.

All available reports were searched for on a broad basis to capture a full picture of the discourse. As we used the query “[European Union] AND [Hydrogen]” for the period from January 2019 until August 2021, the mostly English reports gather the discourse during

a period in which the EU published its hydrogen strategy (in July 2020), and show the growing emphasis put on the energy carrier. During this period, the salience of hydrogen increased—with a small peak around the publication of the EU’s hydrogen strategy—and further increased in the following months and years (see Figure 2).

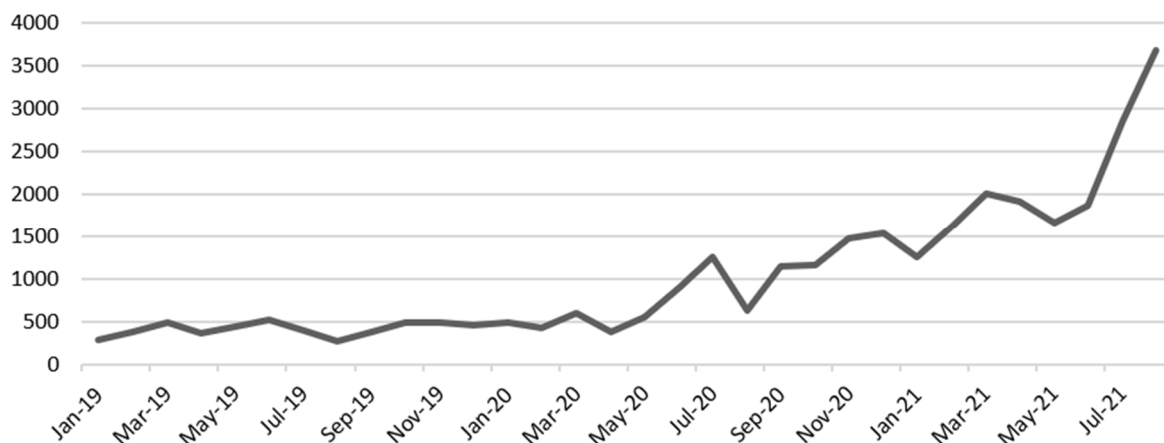


Figure 2. Number of Nexis reports collected (n = 32,231).

To engage with the discourse on hydrogen in terms of external partners, the reports were structured for each month and coded using the software atlas.ti, version 23. Based on a coding system that draws to some extent on previous research [15,16,41] and includes both inductively and deductively collected accounts, 350 codes on actors and various aspects of debates on hydrogen such as its application, color, or generation were developed [41]. Most of these codes refer to actors that have engaged in the debate (n = 247). The codes are generated and applied to enable a systematic analysis of the text material while also providing space and flexibility to include framing processes. For the purpose of this analysis, codes on external partner countries and relations to them are particularly relevant.

4. Hydrogen as an Energy Carrier and the EU’s Bet on Hydrogen

Besides other innovative energy carriers such as iron [50], hydrogen has increasingly gained attention when it comes to the decarbonization of the EU’s industry. Hydrogen is a highly flexible energy carrier and currently an intermediate in several processes. Worldwide, around 94 million tons of hydrogen were produced in 2021, with only a very limited part produced in a CO₂-neutral manner [51]. CO₂ is produced in these various processes, which leads to emissions unless it is captured and stored. Hydrogen from renewable sources, on the other hand, is key for the transformation from a fossil-fuel-based economy to a sustainable hydrogen economy [52,53], and thus a cornerstone of the energy transition. So-called green hydrogen is produced by the electrolysis of water, i.e., the decomposition of water into hydrogen and oxygen. The electricity used in this process stems exclusively from renewable ‘green’ sources such as wind and solar energy; therefore, green hydrogen is considered CO₂-free. Other hydrogen production processes (grey, blue, turquoise) are not considered CO₂-neutral at all or only under certain conditions in the overall balance. For example, blue hydrogen is CO₂-neutral because the CO₂ is entirely captured and stored (Carbon Capture and Storage (CCS)) [53].

The EU as a major economic integration project and a key market in the energy sector has put forward hydrogen to fulfil its ambitious goals to fight climate change. Many countries have published dedicated hydrogen strategies [54,55] and the EU has likewise placed its bet on the energy carrier. Its dedicated hydrogen strategy, published on 8 July 2020, has laid the ground for a European hydrogen market that spans globally [8]. The strategy makes a clear reference to renewable hydrogen:

“The priority for the EU is to develop renewable hydrogen, produced using mainly wind and solar energy. Renewable hydrogen is the most compatible option with the EU’s

climate neutrality and zero pollution goal in the long term and the most coherent with an integrated energy system". [56] (p. 5)

Only in the "short and medium term, however, other forms of low-carbon hydrogen are needed" [56] (p. 5). The strategy only expects EUR 3 to 18 billion in investment for low-carbon hydrogen until 2050, whereas the total investment in renewable hydrogen capacity is estimated at EUR 180 to 470 billion. The strategy further sets the target of 6 GW electrolyzers by 2014, 40 GW by 2030 with 40 GW imported from external countries, and 500 GW by 2050, making the investment in hydrogen production a major effort [56] (pp. 5–7). These goals already include those set by the EU member states [54]. Brussels' strategy further envisages the construction of a hydrogen infrastructure, the creation of dedicated alliances such as the European Clean Hydrogen Alliance (ECHA), and several financing and support instruments [8]. On an international dimension, the EU seeks to develop cooperation with its southern and eastern neighborhood, community neighborhoods such as Ukraine, and a dedicated cooperation framework for renewable hydrogen with the African Union (AU) within the Africa–Europe Green Energy Initiative. Energy security in Europe cannot be managed by European energy supply alone, despite high targets for the expansion of renewable energies. Rather, the EU as a whole will have to continue to rely on energy imports, even if the individual member states have different margins for these imports. This is why European decisionmakers have increasingly engaged in (negotiating) partnership agreements with third countries [57].

Energy scenarios and academic research clearly indicate that a substantial part of the EU's hydrogen market will be dependent on hydrogen imports from abroad. This implies not only a growing importance of hydrogen partnerships with third countries but also a (growing) dependence on third countries in terms of the European energy supply—and notably, reliability/security of supply. It is not only after the Russian invasion of Ukraine and the looming energy crisis in Europe that external partner countries as suppliers of hydrogen to the EU have been a focus of research. Several recent studies analyzed the potentials and risks of such countries, thus assessing their 'value' as reliable and sustainable external partners [17–21].

Against this background, the EU's bet on hydrogen has been accompanied by an increased interest and awareness of this highly combustible element as an energy carrier. Accordingly, an intense discourse has developed among many stakeholders in Europe on external partners in the developing hydrogen market.

5. Empirical Analysis: Framing Processes and the EU's External Hydrogen Partners

As outlined above, our analysis will first engage in an identification of key actors that embark on framing processes in the discourse on external hydrogen partners. Thereafter, we analyze frame alignment processes that actors embark on in the hydrogen media discourse.

5.1. First Step: Identifying Key Actors

The debate on hydrogen in the EU frequently refers to partners as potential exporting countries of hydrogen or with a view to (future) cooperation attempts [58,59]. It is assumed that 15 percent of the hydrogen needed to reach net-zero will have to be imported [60]. This figure is set to increase in the wake of Russia's invasion of Ukraine and a debate is growing on the necessity of diversifying energy imports, in which the salience of hydrogen is particularly high [57].

To begin with, the analysis points to specific partner countries that are referred to, to varying degrees. Concerning the frequency of such countries mentioned in the discourse on hydrogen, three observations are relevant. First, the examination points to Ukraine, Russia, Saudi Arabia, Morocco, and Australia as the main partner countries. Canada, South Africa, Chile, the United Arab Emirates, and Oman also feature in the discourse (see Figure 3). Second, we find that partner countries of different regions play a role. This specifically refers to partner countries in the EU's eastern neighborhood, in the Middle East, and in the Global South, most notably on the African continent. Third, the analysis also points to partner organizations such as the African Union (AU) or the Southern African Development

Community (SADC), i.e., regional entities with which the EU has already developed close ties—including on energy policies [61].

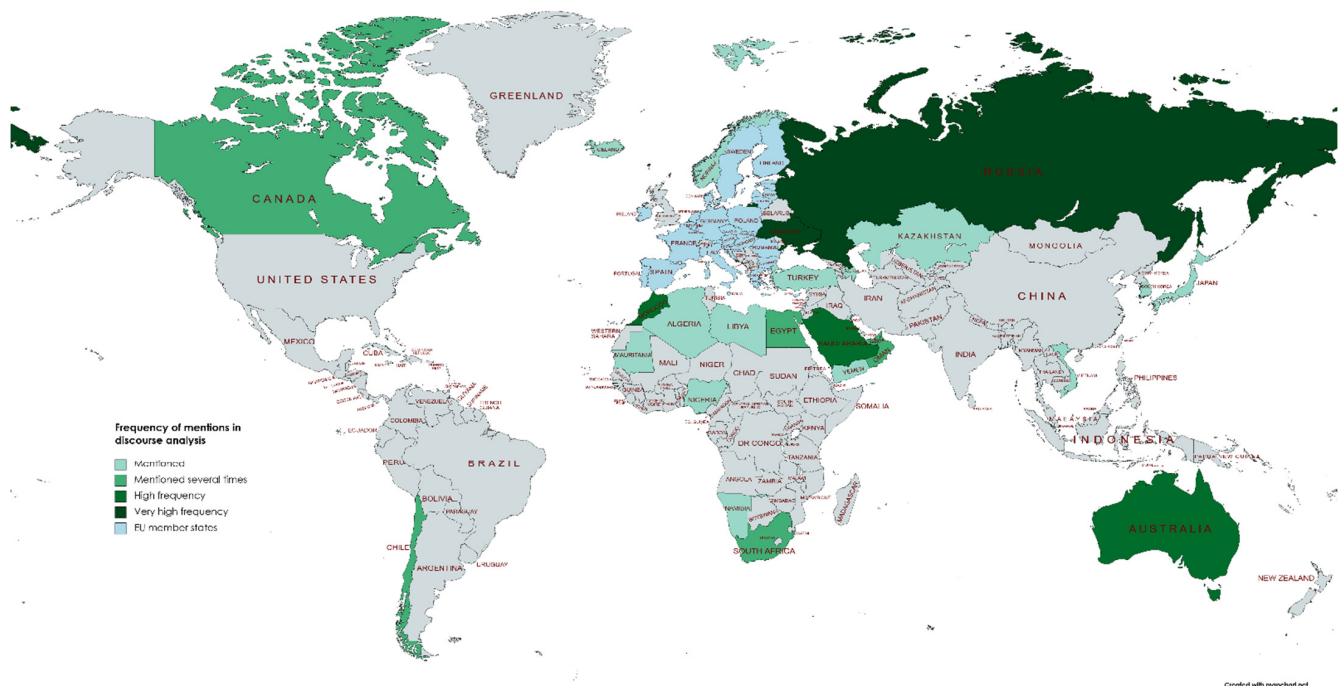


Figure 3. Frequency of external partners mentioned in discourse analysis (n = 119).

Moreover, a multitude of actors have emphasized green energy trade relations between the EU and external partner countries. The need for hydrogen imports has been put forward by government officials such as former German energy minister Altmaier [62,63] but also by the European Commission [64]. For instance, Commissioner Simson highlighted the strategic character of such relations for EU external policy more broadly [65]. Likewise, officials from partner countries such as Morocco [66] or South Africa [67] have pointed to the potential of such energy partnerships, including projects and programs that are developing. For example, the energy minister of Saudi Arabia, Prince bin Salman, was quoted as follows:

“If Europe would like to buy more hydrogen, Saudi green hydrogen, we would be more than happy, and even, if the economics allow for it, even piping it all the way to somewhere in Europe”. [68]

It is noteworthy that private actors have also engaged in these debates. For instance, engineering firms such as ILF Beratend Ingenieure [69], associations such as the German Bundesverband der Energie- und Wasserwirtschaft (BDEW) [70] and Gas Infrastructure Europe (GIE) [71], energy think tanks such as Aurora [59], consultant firms such as Deloitte [58], or the Port of Antwerp [72] have engaged in the debate. Moreover, private actors such as pwc have referenced the continental AU as a potential hub for exploring hydrogen cooperation between Africa and the EU [73]. However, private actors from the potential partner countries have been referenced to a lesser extent. Apart from some external actors such as Australian Global Energy Ventures (GEV) [69], the Kazakh Invest National Company [74], or Naftogaz of Ukraine [75], the discourse is mainly driven by European entities.

5.2. Second Step: Frame Alignment Processes

In the second stage of our analysis, we examine frame alignment processes that have unfolded in the debate on external partners for hydrogen. Our analysis shows that actors indeed generate frames as interpretative schemata “to mobilize potential adherents and

constituents, to garner bystander support, and to demobilize antagonists” [30] (p. 198). We will focus on frame alignment processes as referred to in Table 1: frame bridging, frame extension, frame amplification, and frame transformation. We will also analyze frame contestation efforts linked to these processes.

First, actors have engaged in *frame bridging* efforts and linked congruent but unconnected frames, most notably with reference to linking existing gas infrastructure and thus the specific interests of stakeholders to hydrogen. This concerns the question of which color of hydrogen should be used. Whereas green hydrogen is considered CO₂-free, other hydrogen production processes (grey, blue, turquoise) are not considered CO₂-neutral at all or only under certain conditions. Hence, the color of hydrogen is considered one major aspect of the debate [41]. *Grey hydrogen*, generated from natural gas or methane, is merely considered as a starting technology for green hydrogen. *Turquoise hydrogen* has been referenced, meaning that instead of CO₂ emissions stemming from the use of fossil fuels (grey hydrogen), the production with methane separation will result in solid carbon as a by-product that could be used as fertilizer. *Purple hydrogen* refers to hydrogen produced through electrolysis powered by nuclear energy. Moreover, *blue hydrogen* refers to hydrogen generated from the steam reduction of natural gas. Finally, *green hydrogen*—as the main avenue for the market ramp-up of the energy carrier as mentioned in the EU’s hydrogen strategy—is produced in the electrolysis of water, i.e., the decomposition of water into hydrogen and oxygen. The electricity used in this process comes exclusively from renewable sources such as wind and solar energy. Therefore, green hydrogen is considered CO₂-free.

It is in this context that actors—including stakeholders from partner countries that have been mentioned quite prominently in the discourse—emphasize turquoise [76,77], purple [78], or grey hydrogen as pushed for by Gazprom [79]. In particular, blue hydrogen has been referenced in the context of Russia as a partner country [80], specifically when it comes to using the existing gas infrastructure for hydrogen [81]. These bridging efforts linking hydrogen and gas infrastructure have featured prominently across the Russian key companies Gazprom, Rosatom, and Novatek [82]. Hence, Russia’s prominent status as an exporter to the EU is merely linked to its (former) role as a main supplier of natural gas to the Union. This shows the emphasis key Russian (state) companies in the energy sector place on frame bridging. This then also involves the use of this existing infrastructure as a ramp-up of the hydrogen market in the EU. Russian companies such as Rosatom or Gazprom lobby for exporting turquoise or grey hydrogen [77–79]. This has, most prominently, involved the export of blue hydrogen to the EU [81] or the build-up of hydrogen infrastructure close to existing gas pipelines [82]. This emphasis on Russia has also been put forward by some actors in the EU’s private sector—most prominently by German associations such as the Eastern Committee of German Industry, which came up with a dedicated hydrogen partnership between Russia and the EU [77], and the German-Russian Chamber of Commerce, which lobbied for the export of blue hydrogen to Germany and the EU [76]. The German push towards Russia as a partner country is also mirrored in the proposal of then-Foreign Minister Heiko Maas to open dedicated hydrogen offices of the German state in Moscow [83].

Moreover, it is noteworthy that the analysis finds frame bridging processes linking hydrogen imports to energy dependency and thus putting forward a rather diverging frame promotion. This debate centers on whether the EU actually needs imports from external partner countries. Specifically in the context of a debate on hydrogen imports in the European Parliament, critics such as Michael Bloss, environmental politician of the Greens, raised the issue of dependency:

“Sending the European Commission ahead to make Europe go from one fossil fuel dependency to the next is foolishness [...]. The EU should instead focus on reducing energy consumption and expanding renewables in Europe. This will also make us less dependent on authoritarian regimes like the one in Russia”. [58]

It is very likely that this debate has since intensified with a view to the war Russia inflicted on Ukraine together with the growing debate on the EU’s dependencies in the

energy sector. It is moreover noteworthy that these efforts also constitute contestations of the frame alignment processes that bridge gas infrastructure and (blue) hydrogen imports.

Finally, hydrogen trade has been bridged to cooperation and technology, for instance in the context of countries such as South Korea [84] and the United Arab Emirates [85], or with reference to partner organizations such as the African Union [72]. Officials from these countries have to some extent themselves argued for exchange and technology transfer, such as the energy minister of the United Arab Emirates, Suhail Al Mazroui:

“We look at Europe with excitement seeing all of these (hydrogen) projects and plans by the European Union and by several of our allies in Europe and I think together we can exchange the learnings and enable large scale projects to contribute to reducing the cost of hydrogen in the future”. [85]

Second, our analysis points to *frame extension* as another avenue in the discourse through which actors extend frames beyond their own interests. This also applies to the debate on potential comparative disadvantages emanating from the import of hydrogen. Specifically, since mid-2021, some EU member states and private sector actors have voiced their skepticism towards such imports, pointing in contrast to the need to boost hydrogen production in Europe. For instance, at a meeting of the EU’s Energy Council in June 2021, the ministers of Estonia, France, Hungary, and Poland spoke out against hydrogen imports, maintaining that the priority should be to produce hydrogen manufactured in Europe [86,87]. They were backed by Europe’s hydrogen industry: “Since we are currently importing oil, gas and coal as raw materials, why does this pattern need to continue with hydrogen? Well, it doesn’t”, said Luc Grare from French hydrogen producer Lhyfe. Likewise, Jorgo Chatzimarkakis, secretary general of Hydrogen Europe, stated:

“Decarbonising existing hydrogen production and promoting the development of clean hydrogen are strategic objectives of the EU. If the EU decides to implement clean hydrogen quotas on materials and products, while other countries and regions outside the EU do not, there will be no level playing field”. [86]

Other private actors have also openly criticized hydrogen imports based on fossil fuels and thus extended the frame to the discussion on climate transition more generally. Among others, energy firms such as EDF (France), EDP (Portugal), Enel (Italy), Iberdrola (Spain), McPhy (France), and Ørsted (Denmark), as well as ESB Energy for Generations Fund and the European Association for the Storage of Energy (EASE) have emphasized the alleged competitive disadvantage of the EU’s hydrogen production in case of such imports [86]. Thereby, they extended the debate to the competitiveness of the energy market as well as the energy transition. Specifically, the debate has centered around claims that the EU should impose a carbon tariff on hydrogen imports coming into Europe, since “such imports would introduce an unfair competition with the nascent EU based clean hydrogen production thus hampering the development of an EU hydrogen industrial value chain” [86]. Actors additionally extend the frame of hydrogen imports to the need for green hydrogen as proposed by the EU’s Green Deal [86].

These findings are also mirrored in the debate on Ukraine as a prominent hydrogen partner that has been put forward by the EU [56]. Key EU officials have referenced Ukraine as a priority partner [88]. In addition, private companies such as RWE or Hydrogen Europe have argued in the same manner [89,90]. The fact that Ukraine is the most-mentioned potential partner country in the analysis reflects a process in which the country presented and positioned itself as a key partner to the EU. It achieved this through various statements and workshops in which Ukrainian government officials emphasized the high potential of cooperation. “The EU has hopes for Ukraine as one of the priority partners in the supply of hydrogen to Europe. We worked on this result, because it corresponds to the potential and European ambitions of Ukraine”, Foreign Minister Dmytro Kuleba was quoted [91]. Besides actors in the energy ministry and energy state-agencies [92], Prime minister Denys Shmyhal referred to this prominent status of Ukraine as well:

“Our country has the potential for the production of clean energy and was identified as one of the potential partners of the EU regarding production and supply in the EU’s Hydrogen Strategy. Therefore, we are committed to the development of hydrogen technologies and the creation of a hydrogen ecosystem. This is one of the most important fields in negotiations with the European Commission”. [93]

Ukrainian energy companies such as GTS Operator of Ukraine or Naftogaz have also expressed their interests. One specific reference is made to the existing infrastructure that Ukraine already possesses [89,92], such as the gas pipeline Druzhba. Moreover, Ukraine and its companies are merely referred to as exporters of green hydrogen and thus have extended the frame towards a status of a green hydrogen exporter [89,93].

Third, **frame amplification** as an idealization or clarification of existing ideas has featured especially with reference to specific partner countries. A main emphasis of the debate is on importing green hydrogen from Morocco [59,94] or Australia, since both countries have substantial potential for renewable energy. The framing processes here serve as clarifications and specifications of import options for the EU while also idealizing the import of green hydrogen. Besides the finding that the partner countries themselves emphasize this focus on green energy trade [66,85], the import of green hydrogen has been referenced by many stakeholders from the private sector as well. Whereas RWE, for instance, engaged in projects in Australia [95], the Port of Rotterdam plans to import green hydrogen from South Africa in the near future [96]. In particular, Morocco has been mentioned and discussed as a partner country in the EU’s southern neighborhood to quite some extent. This mirrors academic research that has analyzed EU-Moroccan energy relations and the country’s potential for (green) hydrogen cooperation and export [18,19,21]. In the discourse, Morocco is primarily referred to as a potential exporting country of hydrogen to the EU. First, political officials in both Morocco and the EU have engaged in highlighting the kingdom as a partner. Key officials such as Commissioner Simson [64] or Commissioner Timmermans [97] have referred to Morocco as a main partner for exporting green hydrogen to Europe and thus idealized the potential of this partnership, which still faces challenges as well [21]. As one reference, potential competitive advantages in terms of renewable energy prices have been mentioned, for instance, by Commissioner Timmermans [97]. Moreover, officials point to dedicated agreements and programs with Morocco. With reference to the collaboration statement between Germany and Morocco, potentially cheap energy prices have also been emphasized by then German energy minister Altmaier [62]. The discourse specifically points to the EU neighborhood instrument as empowering Morocco to become an exporter of green hydrogen to the EU [98]. This program includes expanding European support for the kingdom’s efforts to meet its ambitious renewable energy and energy efficiency targets, while also considering water use and resource efficiency. The EU’s overall aim, as highlighted by the European Commission, is to accelerate the production of green hydrogen for export to the EU. Hence, besides support in the neighborhood program via EUR 1.4 billion in the period from 2014 to 2020, the country has also been referenced as a “strategic partner” of the EU in the energy sector [98]—another aspect that highlights the idealized character of the partnership as a frame amplification process. Other specific EU programs dedicated to Morocco are also put forward by Commissioner Simson [72]. Likewise, Moroccan officials participate in the discourse. For instance, the Director General of the Moroccan Agency for Energy Efficiency (AMEE), Said Mouline, highlighted the salience of producing green hydrogen in Morocco and the established basis in political, legal, and economic terms to export hydrogen to the EU [66].

Moreover, the private sector has also increasingly referred to Morocco as a green hydrogen exporter [99] and engaged in the above-mentioned frame amplification processes. Actors particularly highlight that the lower the prices for wind and solar energy in the country, the more Morocco becomes relevant for exports [94,100,101]. A similar assessment is expressed by energy think tanks such as Aurora. They idealize Morocco as a green hydrogen exporter that will be cheaper than other exporting countries when it comes to green hydrogen, whereas blue hydrogen might be cheaper in the short term [59]. Indeed,

Aurora states that Morocco's green hydrogen cost will be competitive with European green hydrogen, pointing specifically to Germany and the Netherlands, by 2030:

"Even for a country a sizeable as Germany, it would be challenging to meet all future hydrogen demand domestically from renewables—hence a natural question is whether imports could also provide a cost-effective option". [59]

Private actors have likewise referred to large projects that have already been developed, such as the Noor solar park on the Ouarzazate plateau, the world's largest solar complex [58]. Our analysis also indicates an emphasis made by private sector actors such as consultancy group Sia Partners on the infrastructure developing for hydrogen export to the EU [94]. As another advantage that has been repeatedly highlighted, private actors such as the development bank Natixis reference the political stability in Morocco [99], although the conflict in the Western Sahara has been identified as a potential problem as well [72].

Other states such as Australia have also been emphasized as partner countries, amplifying cooperation between key markets for the hydrogen economy such as the Australian company GEV:

"GEV has identified Europe as a key market for the company's C-H₂ shipping and supply chain with the renewable energy sector growing at a rapid rate for some years and the transport of green hydrogen using compression highly suitable given the short to medium distances to future demand centres such as Germany". [69]

Moreover, government officials have amplified the cost-effectiveness of potential partnerships with Australia as being able to produce "[...] the cheapest clean hydrogen in the world", as put forward by Australian Prime Minister Morrison at the signature of a bilateral alliance between Germany and Australia [63].

Finally, *frame transformation* processes as changes of old and/or the generation of new meanings have rarely been found in our analysis. This also relates to the nascent character of the debate, which is still evolving. To some extent, the references to problematic interdependencies accompanying the import of hydrogen, which have been outlined above, might be worth mentioning. They mirror a debate on energy imports more broadly that is, to some extent, transferred to the hydrogen discourse imminent in the media analysis.

6. Conclusions

Starting from the observation that hydrogen plays a key role in the EU's efforts to decarbonize sectors that have hard-to-abate emissions, this study has engaged in a frame analysis of the debate on hydrogen in the EU with a specific focus on external partner countries for a hydrogen economy. Analyzing the media discourse as a carrier of framing and focusing specifically on the identification of key actors as well as frame alignment processes, this study has produced the following key findings. First, several external partners are mentioned, with associations mainly centering around the import of hydrogen to the EU. In particular, government agents as well as private sector companies engage in the discourse, with some self-positioning and enhancing of one's own potential for cooperation also coming from external actors from third partner countries. Second, actors have engaged in several frame alignment processes, potentially "to mobilize potential adherents and constituents, to garner bystander support, and to demobilize antagonists" [30] (p. 198). Based on our conceptualization of such processes as frame bridging, frame extension, frame amplification, and frame transformation, we find that actors have particularly bridged frames, extended their scope, and engaged in idealization and clarification strategies. Frame bridging processes have, according to our analysis, specifically centered around the debate on whether to import blue hydrogen and the use of existing gas infrastructure, or whether this might create energy dependencies and disadvantages for the market ramp-up in the EU. Frame extension processes have also featured the latter aspect and extended existing frames towards relations with Ukraine. Frame amplification has been salient with reference to importing green hydrogen, idealizing avenues with countries that have a high potential for green energy generation. As an interesting finding, these frame alignment processes

refer to specific partner countries that also position themselves in the discourse and engage in such framing processes—Russia in the context of frame bridging, Ukraine when it comes to frame extension, and Morocco and to a lesser extent Australia as idealized partners. In contrast, our analysis has not pointed towards frame transformation processes.

Against the backdrop of the complex environment in which the discourse unfolds, these findings need to be reflected critically. Here, it is relevant to reflect on the methodological approach used. Rather than a full-fledged frame analysis, this study has focused on capturing and mapping the debates and analyzing frame alignment processes. It will thus be necessary to engage in a more thorough manner with the contexts, power relations, and languages of this discourse in future studies. Moreover, the Nexis search has to some extent also included state-owned media agencies, such as WPS in the case of Russian media reports. While the output generated from these agencies is rather limited, a future data analysis should have a detailed look on potential effects and biases.

Finally, we have sought to engage with a first mapping and analysis of the discourse on hydrogen in the EU more generally and framing processes specifically. As next steps, we seek to enlarge the period of investigation to include the time since the Russian invasion of Ukraine, engage with an examination that is linked in a more thorough manner with recipients of such framing processes and potential effects, and embark on discourse analyses in specific EU member states. The latter might then also be used to generate network analyses in the EU and its member states on who is engaging in the discourse to what extent, on which topics, and in which contexts.

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