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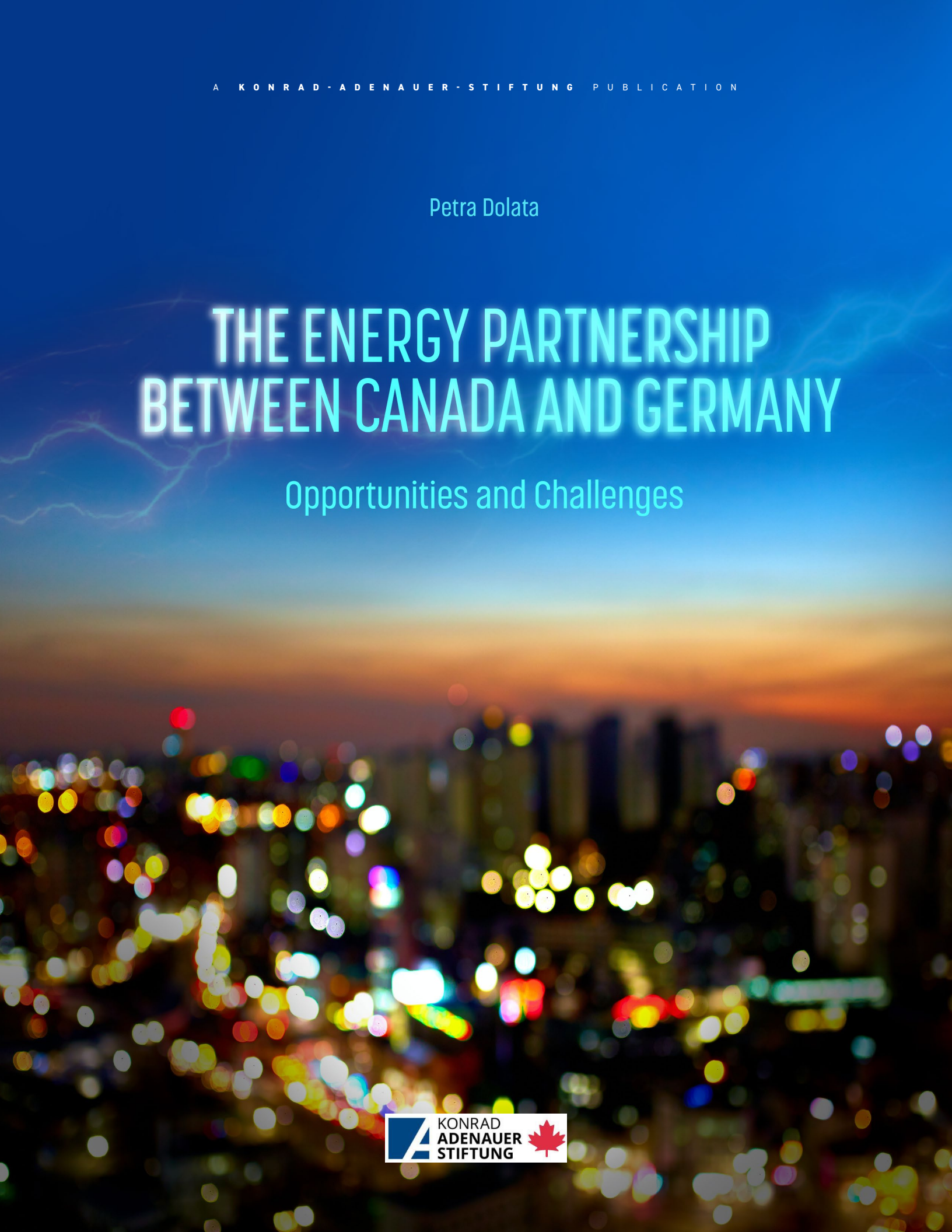
Petra Dolata

THE ENERGY PARTNERSHIP BETWEEN CANADA AND GERMANY

Opportunities and Challenges



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Dr. Petra Dolata is is Associate Professor in the Department of History at the University of Calgary. A former Canada Research Chair (Tier II) in the History of Energy, who held previous academic positions at the Freie Universität Berlin in Germany and at Kings College London in the UK, her research examines the 1970s energy crises, transatlantic energy relations and the historical connections between deindustrialization and energy transitions. She is the author of *Die deutsche Kohlenkrise im nationalen und transatlantischen Kontext* (Wiesbaden: VS Verlag, 2006), and she has published on the concept of energy security, transatlantic energy relations and Canada's Arctic policies. Dr. Dolata is the Scholar in Residence at the interdisciplinary Calgary Institute for the Humanities (2018-2023), where she co-convenes the Energy In Society working group. She has been a senior fellow at the Freiburg Institute for Advanced Studies and the Rachel Carson Center for Environment and Security in Munich. She is the editor of the University of Calgary Press series Energy Histories, Cultures, and Politics. From 2010 to 2014, she was the Research Director of the European Centre for Energy and Resource Security (EUCERS) at King's College London.

Abbreviations

BMWi	Bundesministerium für Wirtschaft und Energie / Federal Ministry for Economic Affairs and Energy
BMWK	Bundesministerium für Wirtschaft und Klimaschutz/Federal Ministry for Economic Affairs and Climate Action
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization and Storage
CER	Canada Energy Regulator (previously National Energy Board)
CETA	Canada-European Union Comprehensive Economic and Trade Agreement
EC	European Communities
ESG	Environmental, Social and Governance
EU	European Union
G7	Group of 7
G20	Group of 20
H_2	Hydrogen
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
LNG	Liquefied Natural Gas
NATO	North Atlantic Treaty Organization
OECD	Organization for Economic Co-operation and Development
R&D	Research and Development

Table of contents

At a glance

In March 2021 Canada and Germany committed to establishing an energy partnership. This was followed in August 2022 by a joint announcement of a Canada-Germany Hydrogen Alliance. As the world embarks on a transformational path toward decarbonized energy systems and wars in the Ukraine and the Middle East remind us of the complex entanglements of politics, energy, and the environment, in what follows, the bilateral energy partnership will be analyzed to determine the nature and future of this partnership.

- **Canada's and Germany's energy interests** complement each other. Canada is a net exporter and Germany a net importer of energy. As such, they also pursue similar goals, diversifying their energy export and import destinations respectively. Both are also pursuing net zero emissions policies and champion hydrogen as one of the pathways towards a decarbonized economy. However, while energy interests may be complementary, a Canada-Germany Energy Partnership faces many challenges.

- **Geography matters:** The distance between energy production sites in Canada and markets in Germany pose challenges which can only be overcome by significant infrastructure and other investments or by embedding the bilateral energy partnership into a broader transatlantic regime. While Canada and Germany have agreed to collaborate, both have other potential partners which are closer or easier to be reached through pipelines or shipping.

- **Time and timing matters:** Short, medium and long-term perspectives in both countries diverge, especially with regards to LNG. Germany needs LNG now, but only as a bridging fuel since the country's long-term plans envision an eventual phasing out of natural gas. Canada, on the other hand, will need to make long-term

investments into LNG, however, return on such investment would not be guaranteed due to the unwillingness of German partners to agree to long-term supply contracts in light of Germany's commitment to decarbonization. Thus, while there is a short-term interest in LNG which currently cannot be satisfied due to the lack of infrastructure, the only promising trade would be in hydrogen in the medium to long term. However, Germany may only be interested in blue hydrogen (based on natural gas) as a bridging technology in the medium term. In the long term, green hydrogen (based on renewable energy) will be prioritized.

- **Politics matter:** Energy relations are highly political and often driven by domestic considerations and politics. They encompass much more than trade, investment or science and technology cooperation. In particular, federalism in Canada gives provinces authority over their natural resources. Coupled with the uneven distribution of various energy resources over the vast country this disperses the relevant actors and decentralizes power. Regulatory regimes not only differ between Germany and Canada but also between provinces within Canada. The bilateral energy partnership is further complicated by the fact that German energy policy is embedded in EU strategies and priorities.

- **Society matters:** In addition, energy and energy transition have become extremely polarized and the public has very strong views on policies and technologies. Public acceptance of new infrastructure or technologies, or better the lack thereof, can also impact timelines. Hydrogen may be less contentious than fossil fuels, however transportation, either through pipelines or shipping, may face public resistance in Canada. Equally, the German public may criticize carbon capture and storage (CCS), which is an integral part of producing blue hydrogen.

- **Strategy matters:** As an energy producer whose production is still heavily relying on fossil fuels, Canada pursues a different hydrogen strategy than Germany or the EU do as energy consumers. Following overall net zero objectives, the German and European

markets for hydrogen are seen as mainly open for green hydrogen. Yet, in its hydrogen strategy Ottawa has highlighted the potential for blue hydrogen, not least to ensure that decarbonization proceeds in a way that oil and gas jobs are not immediately lost but slowly phased out. There is an inherent tension in categorizing hydrogen along these colours (Germany) or by its relative carbon intensity (Canada). Interests may not be complementary after all.

- **Hydrogen trade poses the most promising aspect of the bilateral energy partnership.** However, cooperation in energy science and technology and a common strategy to reach a multilateral agreement between hydrogen producers and consumers might prove more impactful than actual energy trade. As middle powers who champion free trade, human rights, and a rules-based international order, Canada and Germany could work together, especially within the G7, G20, the IEA and IRENA, to address the new evolving geopolitics of energy transition. The emerging international hydrogen economy needs international rules for trade and investment, certification and standardization. The 2022 Canada-Germany Hydrogen Alliance is a good starting point to foster bilateral energy relations but, more importantly, to bring together two like-minded champions of an international hydrogen regime.

Introduction

In March 2021 Canada and Germany officially committed to pursuing a bilateral energy partnership by signing a memorandum of understanding. More than a year later during a high-profile three-day visit of Canada by German Chancellor Olaf Scholz and Vice-Chancellor Robert Habeck in August 2022 a new Canada-Germany Hydrogen Alliance was announced. These two declarations of intent to collaborate in energy matters mark the latest developments in the long history of energy relations between Canada and Germany. Their bilateral energy cooperation goes back fifty years when during the 1970s oil price crises Germany was looking toward Canada for potential alternative supplies and the West German government was instrumental in creating closer and institutionalized ties between Canada and the European Communities. While the resultant 1976 Canada-EC Framework Agreement for Commercial and Economic Co-operation never brought the anticipated transatlantic energy trade, it did help solidify shared norms and values and initiate broader international and global energy governance. Fifty years on, the world has changed and even though the search for alternative energy supplies re-emerged as a goal of German foreign (economic) policy, especially in light of Russia's invasion of Ukraine, climate change has added a different rationale to the desirability of bilateral energy relations with Canada as the ideal energy imports are now considered to be green hydrogen and renewable energy. Germany's many energy partnerships, only one of which is with Canada, combine these two goals of energy security and green energy transition and they are specifically mentioned in the Canada-Germany Hydrogen Alliance (Government of Canada 2022).

In a recent annual report on Germany's energy and climate partnerships and energy dialogues German Minister for Economic Affairs and Climate Action Robert Habeck warned that as a result of the war in

Ukraine Europe was facing "an unprecedented energy crisis" and that Germany was "experiencing a turning point in time at which we are having to reorient ourselves" (BMWK 2023a). That reorientation included a view over the Atlantic and manifested itself in the Canada-Germany Energy Partnership. Initially, Germany was looking for a short-term solution to its natural gas supply problem by casting its eyes on Canadian LNG. However, the August 2022 Chancellor visit to eastern Canada highlighted the difficulty of quickly importing Canadian LNG to Germany. Instead, and in the course of discussions on closer bilateral energy relations, hydrogen has now become the focus of closer transatlantic collaboration. Hydrogen constitutes an integral part of Germany's and Canada's net zero emissions goals and is considered crucial for decarbonizing hard-to-abate sectors such as heavy and chemical industries, aviation, road haulage, and maritime transport.

In the following pages, the Canada-Germany Energy Partnership and the Hydrogen Alliance will be contextualized, and a number of questions will be addressed. How realistic are these plans for bilateral, transatlantic energy trade? What are the goals of the energy partnership? How can it support energy and climate policies of both partners? What are the opportunities and what are the challenges?

The Canada-Germany Energy Partnership

The Canada-Germany Energy Partnership was established between the Canadian Department of Natural Resources and the German Ministry for Economic Affairs and Climate Action (BMWK) in March 2021. Both partners pledged to "collaborate on clean hydrogen, its derivatives and potential applications, and identify potential cooperation projects on the production, usage and trade of clean hydrogen" (Natural Resources Canada 2021). In order to foster energy transition, in the memorandum of understanding the two

partners agree to collaborate in five areas: energy policy, planning, and regulations; resilient electricity systems that can integrate high shares of renewables; energy efficiency; sector coupling and low carbon fuels; innovation and applied research. The partnership's steering committee, which is tasked with strategic oversight and establishing thematic working groups is chaired by high-ranking representatives from both departments (Canada-Germany Energy Partnership 2022). Its meetings are integrated into the German-Canadian High Level Steering Group on Bilateral Cooperation which started meeting annually in 2022 to discuss bilateral collaboration in three key areas, namely peace and security; climate change, energy and natural resources; and innovation, digitalization and the economy (Government of Canada 2023). So far, the Energy Partnership steering committee has met three times, most recently in June 2023, when it endorsed an action plan that prioritized "bilateral cooperation on hydrogen, mineral[s] security for energy transition and climate, energy security, and clean energy technology" (Canada-Germany Energy Partnership 2023). This differed in only one aspect from the 2022 action plan, which included a focus on just transition but not on clean energy technology (Canada-Germany Energy Partnership 2022). While these priorities are related to the original areas of cooperation listed in the 2021 memorandum of understanding, they shift some of the emphasis to more specific areas of collaboration. The first of these priorities, hydrogen, is also the most developed. A bilateral working group on hydrogen was formed and met in December 2021 and February 2022. In addition, three workshops focused on hydrogen and heavy industry (March 2022), ports and hydrogen trade (December 2022) and hydrogen standards and certification (June 2023). Six new network and exploration

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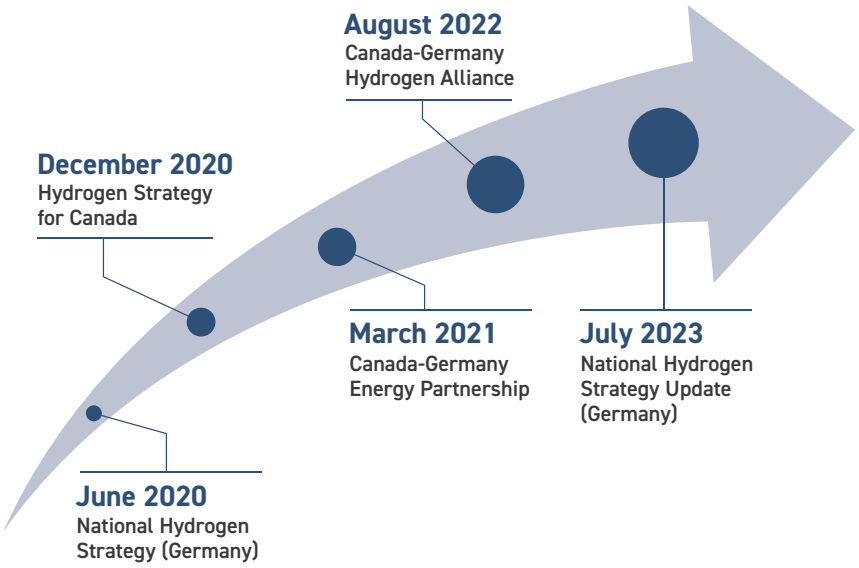
projects on green hydrogen were initiated between Canada and Germany in 2021 (BMWi 2021). In August 2022 a Renewable Hydrogen Expo took place in Stephenville in Newfoundland at which the Canada-Germany Hydrogen Alliance was announced. Co-hosted by the Energy Partnership and the Atlantic Hydrogen Alliance, which brings together energy organizations in Atlantic Canada who support the creation of a clean hydrogen value chain, the expo provided a venue for these organizations to exhibit their projects to the German and Canadian political leaders. According to the Canadian government the hydrogen alliance aims to establish a transatlantic Canada-Germany supply corridor with first exports expected to arrive in Germany by 2025. The Canada-Germany Energy Partnership itself considers the alliance's main goal to be the establishment of "a supply chain for renewable hydrogen derivatives from Canada to Germany" (Canada-Germany Energy Partnership 2023).

To date, there is only one other working group, on minerals security for energy transition and climate. This constitutes a new focus which was introduced at the June 2023 meeting of the steering committee. Canada and Germany pledged to work together along the value chain for critical minerals by "advancing bilateral trade and investment partnerships, collaborating on R&D and advancing ESG standards in supply chains" (Canada-Germany Energy Partnership 2023; Government of Canada 2023). The topics of energy security and clean energy technology are currently not supported by specific steering committees. Apart from plans to jointly focus on cleantech deployment, energy security collaboration includes renewables and potential short-term cooperation based on LNG. As will be argued below, LNG will most likely not feature at the center of Canada-Germany energy trade relations.

While the Canada-Germany Energy Partnership is an initiative by two federal ministries, for the German partner it is officially housed at the Canadian German Chamber of Industry and Commerce in Toronto reflecting one of the stated objectives of the partnership, namely "to promote business-to-business exchanges between Canada and Germany" (Government of Canada 2021). It is supported by the

FIGURE 1: TIMELINE



Berlin-based *adelphi* think tank and policy consultancy which "leads and coordinates the implementation [of the energy partnership] on behalf" of the Chamber and the federal ministry (Canada-Germany Energy Partnership 2023). They support the Canada-Germany Energy Partnership through partner offices in Montreal and Toronto. In anticipation of the signing of the energy partnership and as part of a previous BMWK-funded project on energy dialogues with Australia, Canada, New Zealand and the United States, *adelphi* published a report in German on hydrogen potential in Canada (Teichmann et al. 2021). Since then, besides a hydrogen fact sheet for Canada (Honnen, Eckardt & Piria 2022), two additional studies have been produced, one on transatlantic hydrogen trade (Honnen & Piria 2022) and the other one on supporting just transitions in Canada and Germany. The last study is particularly interesting. It constituted one of the foci of the 2022 action plan of the energy partnership and as such was listed in the Canadian entry in the 2022 BMWK annual report on existing energy partnerships and dialogues (BMWK 2023a). Hence the publication maintains that "[t]hrough their Energy Partnership, Germany and Canada are collaborating on the just transition" (Honnen et al. 2023,

2). However, the Canadian side remained rather quiet on this focus and no longer mentions just transition as part of the remit of its energy partnership with Germany. Since the term just transition has become a contentious approach within Canada – it has been highly criticized by the premier of Alberta – it is not surprising that the Canadian side would not emphasize this aspect. It is equally of note that the work on the Canada-Germany Energy Partnership at *adelphi* is part of an ongoing project on energy partnerships with the United States and Canada and to date most publications and reports listed for that project focus on the United States. The location of these supporting institutions is important to understand specific geographical emphases and possible limitations of the consultancy work.

Despite a strong regional focus on Atlantic Canada, the information of the energy partnership website provides a much broader remit for the bilateral cooperation. Tapping into an existing discourse of shared values and norms with regards to global energy and climate governance, the energy partnership highlights its contribution to energy transition more generally maintaining that "Canada and Germany work together to accelerate the transition to a safe, secure, reliable, affordable, and sustainable energy system in both Canada and Germany, and around the world." This points to a much more high-level political agenda to work towards international governance of these sustainable energy systems. It continues to affirm that the partnership "support[s] high-level and multi-stakeholder dialogue on energy issues including through the exchange of best-practices and lessons-learned to support the energy transition" (Canada-Germany Energy Partnership 2023). However, the partnership is also based on strong national energy interests and trade relations which are considered complementary. As was so aptly stated by energy analyst Frank Umbach in a comment in a recent joint study by the Atlantik-Brücke Kanada, Konrad-Adenauer-Stiftung Canada and Nanos, "Canada has the resources and Germany the market" (Atlantik-Brücke Kanada, Konrad-Adenauer-Stiftung Canada & Nanos 2023, 12). Thus, the partnership combines bilateral corporate relations with broader foreign policy goals to establish multilateral governance in a changing international energy market.

A short history of transatlantic energy relations

Transatlantic energy relations encompass a broad range of possible entanglements across the ocean: energy governance, energy trade and energy diplomacy, including in science and technology. Some of these connections are bilateral, others are multilateral including international engagements which go beyond the shared transatlantic space. Canada's energy relations with (West) Germany were early on embedded in larger transatlantic contexts either through the European Communities, NATO or the OECD. They have historically been driven by hopes for complementary trade and like-minded international positions, especially once international energy governance took on urgency in the 1970s. While not always prominent, energy has formed an integral part of Canadian involvement with Germany and Europe ever since the end of the Second World War. Through the European Recovery Program, better known as the Marshall Plan, to which Canada contributed funds, Western Europe was supported in reconstructing its economies after World War II while switching its coal-based energy systems to oil, constructing refineries through targeted dollar-supported programs. During the Cold War, these energy relations went well beyond economic considerations and took on political and strategic significance. As Canada became a considerable energy producer and exporter in the 1970s, who no longer shared the energy vulnerability of its European NATO and OECD partners, Ottawa acknowledged the strategic significance of oil and the Middle Eastern region and agreed on the necessity of a joint transatlantic approach to dealing with energy security.

During the 1973/74 oil price crisis which highlighted West Germany's and Western Europe's dependence on oil and more generally natural resources, Canada became a highly sought-after supplier for West Germany and the European Communities. Famous for its abundance in raw materials it was coveted as an ideal and complimentary partner. Europeans hoped that through institutionalizing relations with Canada they would obtain guaranteed access to these raw materials,

including energy resources. Canada, on the other hand, was more interested in diversifying its economic relations away from the United States and adding value before exporting any resources. With West German diplomatic support, a "contractual link" was finally achieved in July 1976, when Canada and the European Communities signed a Framework Agreement for Commercial and Economic Co-operation, which came into force in October 1976. It was the first formal agreement of its kind between the European Communities and an industrialised third country. Under this agreement, Canada and the EC committed "to develop and diversify their reciprocal commercial exchanges and to foster economic co-operation" (European Communities, 1976). However, it really only established a more formal forum for discussing economic relations including resource diplomacy between the two signatories. At least the agreement facilitated trust and provided opportunities for open discussions in its first years. Despite the broader nature of the 1976 Framework Agreement, for a long time Canada's engagement with the EC/EU was dominated by economic matters, since strategic and security questions were the remit of NATO. The Framework Agreement itself was more important for trust-building and symbolized collaboration than directly addressing trade between the two partners. It failed in diversifying Canada's trade flows away from the U.S. market. It was, however, followed by several agreements that were intended to deepen existing transatlantic ties.

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As energy questions took on more urgency in the mid-2000s, Canada and the EU established a High Level Energy Dialogue in 2007, which was revitalised again in the wake of the Ukraine crisis in 2014 and incorporated into the Strategic Partnership Agreement, which the EU and Canada signed in 2016. In the agreement Canada and

the EU "recognise the importance of the energy sector to economic prosperity and international peace and stability" (European Union 2016), formalizing the High Level Energy Dialogue, which meets annually to discuss energy policy issues. Its key areas reflect the dual challenges of planetary climate change and geopolitical energy dependence. The dialogue focused on renewable energy and energy efficiency but also on energy security and more specifically LNG trade. Starting in 2015, Canada and the EU held various joint energy-related workshops culminating in a series of five Canada-EU exchange webinars. After the conclusion of the Comprehensive Economic and Trade Agreement (CETA) between Canada and the EU in 2014, the second EU-Canada workshop on CETA opportunities in late March 2021 was dedicated to the clean technology sector. That same year a series of five Canada-EU exchange webinars covered financing, efficiency data and building policies. In 2022, two EU-Canada Dialogues on Hydrogen took place followed by an EU-Canada Dialogue on Methane in September 2023.

While it took until the 2007 Lisbon Treaty for EU competences to be established in energy, (West) Germany often pursued energy relations with Canada through larger EC/EU initiatives rather than on its own. This included cooperation between the EU and Canada in science and technology as the example of the 1990s Euro-Quebec hydro-hydrogen pilot project with participation from European and Canadian industry shows and which was institutionalized through the 1996 Agreement for Scientific and Technological Cooperation between the European Communities and Canada. However, against this trend of supranational EU approaches to energy relations, Germany is now pursuing more pro-actively bilateral energy dialogues and partnerships to address its energy dilemma. It needs to wean itself off natural gas supplies from Russia while fulfilling its and the EU's ambitious net zero emissions goals.

Complementary interests

As the short historical sketch shows, Canada and Germany have always considered and continue to consider their energy interests complementary as well as embedded in broader shared values and norms. The bilateral agreements as well as the supporting studies, including from *adelphi*, do not tire to highlight these matching goals. The tenor is that Canada has the resources which Germany needs. For both, the other country could help diversify energy trade. However, diversification has become important for Ottawa and Berlin for quite different reasons. Ever since the early 1970s, Canada has episodically embarked on a diversification strategy that would redirect some of its exports away from their dominant destination, the United States. In recent years that has become more salient in the area of energy trade because the shale revolution in the United States made Canada's southern neighbour less dependent on outside energy production, including from Canada. As a net exporter of both conventional and unconventional oil and natural gas, Canada has played a significant role in German imaginations whenever there was a wish to diversify energy needs away from less reliable energy suppliers such as Russia in the 21st century or the Middle East during the 1970s oil price crises. In response to these perceived complementary interests, Canada began to actively position itself as a secure supplier of energy to the EU and Germany. For example, in a July 2007 statement at the Canada-EU summit in Berlin then Prime Minister Stephen Harper touted Canada as an energy superpower, a claim he repeated in following years and, cognizant of the emerging energy-climate nexus, changed it into Canada being a clean energy superpower (Government of Canada, 2007). More recently, the Minister of Natural Resources, Jonathan Wilkinson promised to help out "Canada's European friends and allies [who] are experiencing an

Canada has played a significant role in German imaginations whenever there was a wish to diversify energy needs.

energy security crisis" (Natural Resources Canada 2022). He promised that Canada could supply Europe with alternative deliveries of oil and especially natural gas through LNG. Not surprisingly, EU-Canada summits and EU-Germany meetings in the first two decades of the 21st century included discussions on energy and energy security. The war in Ukraine has revived those discussions initially advocating for Canadian LNG shipments to Germany to replace Russian gas. However, as will be discussed below, this was not supported by any existing infrastructure, and in the meantime, attention has shifted towards hydrogen, which is heralded to play a core role in energy systems of the future.

Hyped as the "new oil" (Van de Graaf et al. 2020) hydrogen has become the focus of plans to decarbonize energy systems and received a lot of attention from governments all over the world, who have published their hydrogen strategies in the past few years, including Canada (December 2020) and Germany (June 2020). Hydrogen also introduced a new transatlantic complementarity. According to the updated German hydrogen strategy (BMWK 2023b, 6), Germany will require up to 70 percent of its hydrogen needs to be imported. As one of the top ten hydrogen producers in the world, Canada is already one of the leading hydrogen countries and has announced ambitious plans to extend that role and provide hydrogen exports in the near to medium future (Natural Resources Canada 2020). One recent study by the German Institute for International and Security Affairs labelled Canada as one of two natural choices for becoming a hydrogen importer to Germany, the other being Norway (Ansari & Pepe 2023, 4). Beyond this perceived complementarity, as players in an emerging hydrogen economy, Canada and Germany have much in common. In terms of existing technology and knowhow both can be considered early movers who can boast years of research and application of hydrogen and are expected to be able to ramp up their hydrogen economy quicker than other countries (Ansari & Pepe 2023, 4).

However, the complementarity also hides significant differences, some of which are actually generated through the matching relationships. One has to do with the supply chain. As a developed country, Canada aspires to become more than a supplier of energy resources to partner

countries. Becoming more like Germany, it hopes to move along the value chain and through industrial energy processes provide more value-added. This, however, leads to direct competition with countries like Germany. While the details are more nuanced and complex and play out differently for each energy carrier, the issue seems to have already entered the discussion around hydrogen. In its hydrogen strategy Germany takes pride in the many German companies which "are already among international leaders in hydrogen technologies, for example in the field of electrolysers for hydrogen production and the manufacturing of fuel cells" and pledges to support and "expand its strong position in hydrogen technologies" (BMWK 2023c, 2023b, 4). The Canadian government in its hydrogen strategy equally reminds readers of the "ingenuity and innovation" of the Canadian hydrogen industry who are "pioneers in fuel cell technology" as well as an "R&D and technology leader in the sector" (Natural Resources Canada 2020, ix).

The second difference is centred around the question of availability of renewable energy resources. Experts expect an international seller's market for hydrogen (Ansari & Pepe 2023, 4) which would allow Canada to choose between a number of countries who are interested in a privileged energy partnership. Germany is only one of many potential buyers, Japan and other Asian markets may look much more interesting (for reasons outlined below) and have already been targeted in Canada's hydrogen strategy. Finally, as mentioned above, on the German side the Canada-Germany Energy Partnership is only one of many. Currently Germany has more than twenty energy partnerships, some of which are energy and climate partnerships, including the agreement with the United States. The bilateral energy partnership with Canada does not include climate. In 2022, Berlin not only announced a hydrogen alliance with Canada but developed hydrogen partnerships with Egypt, Namibia, and Saudi Arabia. Coordinating energy policies, building trust, and facilitating the transfer of knowledge lie at the heart of Germany's energy partnerships. Canada may find that it is only one amongst many partners.

Geography matters

If the aim of the energy partnership between Canada and Germany is to increase bilateral energy trade, complementary interests only go so far. As will be discussed in this section, geography and distances as well as geology and topography can play limiting roles. In the past, these have already locked in continental energy flows and created path dependencies, which are not easy to overcome. Canada is one of the world's largest energy producers and due to its small population large amounts of electricity, oil and gas are exported, most prominently and, until recently, almost exclusively into the United States. Geography and geology have made the southern neighbour an ideal customer, especially since the 1970s when the United States needed more oil than it produced. Coincidentally, Canada was ramping up its production at that time in part due to the advent of commercial oil sands production in Alberta. Geological formations such as the Canadian Shield and the Rocky Mountains constituted major barriers to pan-Canadian east-west energy trade, although there are a few interprovincial pipelines connecting oil and gas fields in the Canadian Prairies with refineries and customers in the Pacific west and in eastern parts of the country. However, most big pipelines connect the oil- and gas-producing province of Alberta with the United States. Pipelines down south have been easier to construct than infrastructure to connect landlocked Alberta with energy hungry markets in Asia or Europe. Ever since the 1970s there have been ill-fated attempts to create infrastructure corridors through the Arctic. Even the more realistic supply of Asian markets from Alberta through pipelines to export terminals in British Columbia took a long time to emerge beyond the planning stage and met vocal public resistance. Thus, despite Japan's long-time interest in receiving LNG shipments from Canada, Canada is still awaiting the completion of the first LNG terminal at Kitimat, British Columbia.

Based on the complementarity of energy needs with its neighbour to the South, who can be reached overland, and due to the large role of U.S. capital in Canadian energy projects, Canada has a long history of sharing an informal but highly integrated (economic) energy

space with the United States. After a few unsuccessful attempts this continental energy space along with its close economic and corporate ties was formally institutionalized through the 1987 Canada-U.S. Free Trade Agreement which contained a separate energy chapter. This chapter continued to apply through the subsequent broadening into the North American Free Agreement (NAFTA) between the Unites States, Mexico, and Canada and the renewed and renamed United States-Mexico-Canada Agreement, which came into force in July 2020.

Canadian crude oil exports, which accounted for 14.1 percent of Canada's total exports in 2019, were almost exclusively destined for the United States. In 2020, three quarters of the total crude oil production in Canada were exported to the United States, 21 percent were refined in Canada and only 4 percent of the overall production were directly exported to other countries. This means that 95 percent of all crude oil exports were directly delivered to the United States and overwhelmingly through pipelines. And while the shale revolution has decreased some of the U.S. demand, Canada still supplies more than half of all U.S. crude oil imports and the American market remains by far the most important for Canadian oil and gas exports. Equally, electricity markets are integrated across the border. As a net exporter of electricity, 60 percent of which is generated through hydropower, Canada exports 10 percent to the United States, which is the exclusive recipient of Canadian electricity exports. There are thirty-four major active transmission lines connecting the two North American neighbours. While the bulk of the oil and gas trade happens between Alberta and the United States, electricity trade occurs between the United States and those provinces which mainly generate their electricity through hydropower, Quebec, Manitoba, and British Columbia, and from Ontario, which largely generates electricity through nuclear and hydropower (CER 2023).

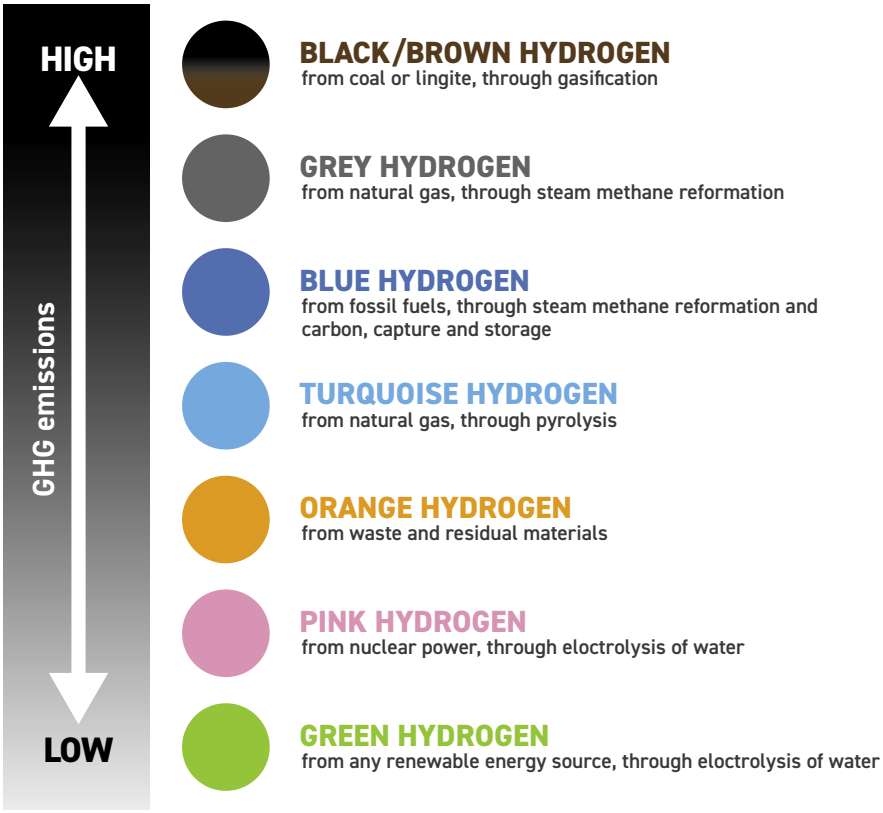
As was alluded to above, in the past, Canada has attempted to diversify its energy export dependency from the United States with little success. Thus, it remains to be seen whether the new energy partnership with Germany will achieve what previous policies have not. It might be easier to retrofit the many existing natural gas pipelines to carry hydrogen to the United States and even transportation of derivatives might be easier

across the land border than across the Atlantic, especially when using trucks or trains for transportation.

The different locations of oil and gas production and electricity generation through hydropower also highlight the extreme geographical variety of energy carriers and energy mixes in Canada, which is reflected in the complex discussion of hydrogen in a federal context. Canada is one of the largest countries in the world and is rich in different energy carriers, but these are geographically widely dispersed. For example, the province of Quebec is a leading producer of electricity through hydropower and pursues an ambitious electrification policy through its 2030 Plan for a Green Economy (Gouvernement du Québec 2020). The province of Alberta is the leading oil and natural gas producer accounting for 80 percent of Canada's total crude production and 63 percent of natural gas production. While its electricity mix is changing especially as it moves away from coal-fired electricity, it still relies heavily on fossil fuels, mainly natural gas (CER 2023). For these reasons, both provinces have very different hydrogen trajectories with Quebec looking towards producing green hydrogen (hydrogen produced by the electrolysis of water, using renewable electricity) and Alberta championing blue hydrogen (produced mainly from natural gas and carbon dioxide is captured and stored). In a 2022 joint study by EPICO KlimaInnovation and the Macdonald-Laurier Institute on the Canadian-German hydrogen partnership the authors maintain that because Alberta enjoys cost advantages in the production of blue hydrogen that this "pathway is the likeliest and most competitive path forward for hydrogen exports." However, these exports would not be cost-competitive if destined for Europe, although much would depend on electricity costs in Europe and demand for low-carbon hydrogen (Runge et al. 2022, 16). While substantial hydrogen expertise exists

Alberta is the leading oil and natural gas producer accounting for 80 percent of Canada's total crude production and 63 percent of natural gas production.

FIGURE 2: THE COLOURS OF HYDROGEN



in Canada, the type of expertise may vary geographically, and this also includes fuel cell research, which is particularly well advanced in Quebec and British Columbia. Atlantic Canada which has been singled out to spearhead the Canada-German Hydrogen Alliance has not necessarily been known to be a leader in hydrogen technology, but it does have many untapped renewable energy resources, especially wind power and tidal energy and its ports are closest to Germany and Europe to ship green hydrogen or its derivatives (Tscherning 2021).

While plans are in place to start shipment of hydrogen derivatives from Atlantic Canada to Germany in 2025, like LNG export facilities, to date there is no infrastructure in place in Canada to export hydrogen. And the question remains whether there could be any trade between the other Canadian hydrogen hubs, mainly Quebec and Alberta, and

Germany. Following the geographical discussion above, it would be more likely for Alberta to export blue hydrogen to the United States or supply Asian markets. Quebec might be a possibility, but it seems that a preference was communicated for now by signing the Canada-Germany Hydrogen Alliance in Atlantic Canada. Currently there is only a limited international market for grey hydrogen (derived from natural gas or methane gas using steam methane reformation) and no global or regional market for clean hydrogen. So, it is difficult to predict with certainty what will happen. The Hydrogen Council, an organization which brings together international corporate hydrogen interests, looked at the future of international hydrogen trade and predicted a cost-competitive North American regional market for hydrogen (both renewable and low-carbon) through continental pipelines. The only international trade the study anticipated for North America was in clean methanol to Asia and ammonia and green steel to Asia and Europe (Hydrogen Council 2022).

At this formative stage, we cannot exactly predict international hydrogen flows. However, it is clear that both partners may have other geographical options available. Germany may find hydrogen suppliers closer to home. The German hydrogen strategy endorses a preference for European suppliers due to shorter transport distances, but it also states that energy partnerships to secure hydrogen should be sought out with countries outside Europe based on their high potential for renewable energy (BMWi 2020). Germany currently has a number of hydrogen alliances in place some of which are located in the EU neighbourhood. Pursuing those would also follow political priorities that are tied to EU neighbourhood policies. In its February 2023 Green Deal Industrial Plan for the Net-Zero Age the EU pledges to work closer with the African Union and the Mediterranean Union "to promote co-operation on renewable energies and green hydrogen" (European Commission 2023a, 18). During numerous visits to Africa, the most recent by Chancellor Olaf Scholz in late October 2023, German government officials have confirmed that Africa constitutes a focus for German energy and hydrogen policies. Chancellor Olaf Scholz reiterated Germany's interest in receiving hydrogen imports from African partners at the November 2023 G7 Compact with

Africa conference in Berlin. A recent publication by H_2Diplo, an initiative by the German Foreign Office which focuses on global hydrogen diplomacy, sees new economic and export opportunities emerging for North African countries such as Morocco, Tunisia and Egypt which have considerable renewable energy potential (H_2Diplo 2023, 11). Already in its fall 2021 Report on the Implementation of the National Hydrogen Strategy, Germany reports partnerships that focus on potential hydrogen production in western and southern Africa and future exports to Germany (BMWi 2021). First results of the so-called H_2Atlas-Africa which started in 2020 and is funded by the German Federal Ministry of Education and Research (BMBF) shows the "enormous potential for hydrogen production in the region" (BMBF 2023).

The unpredictable nature of the emerging hydrogen flows also means that from a North American perspective, there is no reason to believe that the proposed transatlantic hydrogen corridor between Atlantic Canada and Germany is the only possible transatlantic passageway, even though the idea has already received traction. There are similar initiatives in the United States that aim to connect U.S. producers to consumers in Europe hoping to grow transatlantic hydrogen trade to three million metric tons per year by the end of the decade (Mission Possible Partnership 2023). So, rather than focusing on a bilateral hydrogen corridor connecting Atlantic Canada to Germany it might make more sense to broaden it to a transatlantic hydrogen space connecting North America (Canada and the United States) with Europe (and not just Germany). After all, Germany itself confirmed in its 2020 hydrogen strategy the necessity of "a strong European framework" acknowledging that "[k]ey challenges can only be meaningfully addressed in the context of the EU" (BWMi 2020, 11).

Dealing with Canada in a bilateral energy partnership is complicated by the fact that the Canadian federal government has never successfully implemented a pan-Canadian energy strategy. And even though there are hopes that hydrogen would finally create a national energy policy which would also be strongly connected to climate policy (Senate Canada 2022), energy mixes and interests are too diverse to

be captured in one comprehensive approach. Instead, the federal government becomes more of a mediator between divergent domestic energy interests and facilitator for any foreign trade engagements. The diversity of energy interests within Canada and the considerable powers of provinces in energy matters would also necessitate a presence of the energy partnership beyond central and eastern Canada. Currently, the institutions who coordinate the energy partnership for the German partner are based in Toronto (Canadian German Chamber of Industry and Commerce) or have partner offices in Montreal and Toronto (*adelphi*). While this makes sense for the business-to-business approach which lies at the heart of the collaboration, it may not be as attractive to the Canadian federal government which needs to cater to all provincial interests in establishing a hydrogen economy. It will not be interested in creating a divided Canadian hydrogen economy which is geographically broken up between eastern and western provinces which are not only separated by their market destinations (Europe versus United States/Asia) but also the type of hydrogen (green versus blue hydrogen) produced as these would require different bureaucratic support structures and industrial policy priorities.

Time and timing matters

Another challenge to the energy partnership and undercutting the complementary energy interests of Canada and Germany are the different time horizons both countries are pursuing as producers and consumers of energy. This has been illustrated by the example of liquefied natural gas (LNG). In an attempt to replace gas deliveries from Russia, Germany entered into talks with Ottawa over the construction of two east coast LNG export terminals in New Brunswick and Nova Scotia. German Chancellor Olaf Scholz and Canadian Prime Minister Justin Trudeau discussed the issue at the June 2022 G7 meeting in Bavaria. Canada promised to look into ways to expedite the projects

of the multinational Spanish company Repsol and Calgary-based Pieridae Energy (Alkousaa, Rinke & Rashad 2022). However, when the German chancellor and Canadian prime minister met in Canada in August 2022, LNG was no longer a top priority. While championed by governments, these are mainly corporate decisions which may or may not go forward. Due to the lack of Canadian LNG export facilities, it was the United States who stepped up to the plate and increased their LNG shipments to Europe (Dolata 2022). According to industry experts, it takes decades before there are returns on investment. Only long-term contracts can give LNG producers the security that they need to invest in projects (Calnan 2022). However, Germany has no appetite to lock-in what can only be considered a bridging technology to a net-zero future based on renewables and energy efficiency. Germany is only interested in LNG as a short-term remedy. Ottawa-based German diplomat Gerhard Schlaudraff cautioned in May 2022 that "[i]f the typical offtake agreement in the LNG business is 20 years, and we want to be out of gas in 2045, there is not so much time for any of these projects to come online" (Beer, 2022). It is also noteworthy that the ambitious REPowerEU plan from March 2022, through which the EU aims "to make Europe independent from Russian fossil fuels well before 2030" (European Commission 2022), does not list Canada as one of the LNG sources it hopes to tap. The timing between Canada and Germany with respect to LNG does not align. Germany needs LNG imports now; Canada can only deliver in the medium to long term.

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While hydrogen trade between Atlantic Canada and Germany looks more promising for the medium term, there is a danger that timings could also be slightly out of sync between the two transatlantic partners. While in its updated hydrogen strategy Germany has made concessions and is accepting blue hydrogen as a bridging technology in the short to medium term, much will depend on EU standards (BMWK 2023b, 4). Currently they champion the importation of green hydrogen. This

would not constitute a problem for Canada as long as most hydrogen trade is between Atlantic Canada and Germany or Quebec and Germany which would be based on renewable energy. However, in case blue hydrogen from Alberta should enter European markets that could also be impacted by incompatible time horizons. While Germany may be willing to accept these kinds of shipments in the medium term, this willingness would most likely not extend to the long term. But from an investment standpoint such a longer-term commitment might be necessary to incentivize considerable financial support to ramp up production now.

The case of LNG has shown how important the existence or timely construction of infrastructure will be for ramping up hydrogen production, consumption, and trade. There will be considerable challenges to the building of hydrogen pipelines within Canada. Long distances, regulatory obstacles and popular resistance need to be overcome. Even using and retrofitting existing pipelines to transport hydrogen may not be as easy as in Germany where hydrogen historically was part of the natural gas mix and piped as part of town gas (Tscherning 2021, 17). The construction of terminals would need to be prioritized. We have seen that Germany was able to quickly build up LNG infrastructure by passing legislation in June 2022 that fast tracked the approval process. Already in December 2022 the first so-called floating storage and regasification unit was completed at the German coast near Wilhelmshaven. Three more are expected to be completed by 2024/2025. Again, it looks like Germany was ready before Canada could supply LNG. Such mismatched timing should be avoided for the proposed transatlantic hydrogen trade. However, the federal Canadian government may not be able to fast track application processes the way Germany has done because it faces a more complicated domestic political environment.

An October 2022 Hydrogen Council study provided some additional insights that are relevant for predicting actual hydrogen trade between Canada and Germany. This report, which looks at the future of international hydrogen trade, makes the distinction between the "neighborhood business" of pure hydrogen which would preferably

be piped and the regional and global trade in derivatives which would be shipped. According to their forecast shipping costs would be low (Hydrogen Council 2022). Other studies agree that the main costs occur during conversion for transportation, the actual shipping constitutes only a small share of the overall costs of exporting and importing (Ansari & Pepe 2023). This is why the Canada-Germany Hydrogen Alliance currently plans transportation of ammonium for the short term and Germany generally expects hydrogen imports until 2030 to be mainly based on shipping.

Energy experts anticipate the development of regional and global hydrogen markets over the next decades (Ansari & Pepe 2023; Pepe, Ansari & Gehrung 2023; H_2diplo 2023; Van de Graaf et al. 2020). Due to the many hydrogen pathways, which include different processes and technologies to produce and transport hydrogen or its derivatives, new complex supply chains as well as different geopolitics are expected to emerge. As Dawud Ansari and Jacopi Maria Pepe have pointed out in a recent paper (Ansari & Pepe 2023), there will most likely be countries that are able to provide a short-term market ramp-up kicking off the hydrogen transition and creating economies of scale and others that will not be immediately involved in hydrogen trade but may instead focus on technological, regulatory, and political aspects of the emerging regional and global hydrogen markets. Canada is considered to belong to the first tier of countries, which the authors label accelerators and other publications call key enablers (Hydrogen Council 2022) or pioneers (Westphal, Dröge & Geden 2020). They also expect an early shift toward a seller's market and thus recommend that Germany and the EU move quickly to ensure binding trade arrangements. In their eyes, declarations of intent such as the Canada-Germany Energy Partnership and the Hydrogen Alliance will not be sufficient. Recent decisions by the EU and Germany have highlighted the urgency of locking in and diversifying hydrogen supplies. With the May 2022 REPowerEU plan the European Commission established an annual renewable hydrogen import target of 10 million tons by 2030 (European Commission 2022). In its Green Deal Industrial Plan for the Net-Zero Age it proposes a "massive switch to fossil-free hydrogen as a storage medium, fuel and feedstock [in order to] speed up net-zero industrial transformation at

home" (European Commission 2023a, 2). Germany, which committed to reach net zero greenhouse gas emissions by 2045, initially targeted an increase in electrolysis capacity of 5 gigawatt by 2030, but in its updated 2023 hydrogen strategy had already doubled this target. These additional capacities will have to be covered by imports. Estimating that up to 70 percent of Germany's hydrogen needs, which are expected to range between 95 and 130 terawatt hours in 2030, may have to be imported, the German government has also committed to pursuing a targeted hydrogen import strategy (BMWK 2023b, 3, 6, 9).

A comparison of the 2020 German Hydrogen Strategy with its 2023 updated version shows how important geopolitical considerations have become for Germany which was significantly impacted by the Russian invasion of Ukraine in February 2022. The war and its adverse impacts on the availability of fossil fuels have brought home the urgency of diversifying Germany's energy suppliers and mixes. Recognizing the need to reduce dependence on Russian natural gas – and to a lesser extent oil – has led to a resurgence of the energy security narrative. In its updated hydrogen strategy, the German government acknowledges how the Russian invasion of Ukraine had highlighted Germany's "excessive dependence on energy imports from individual countries" jeopardizing its energy security. It goes even further by emphasizing how integral energy security is to the country's national security strategy (BMWK 2023b, 1). One might argue that the immediate urgency of finding replacements for Russian natural gas supplies is one of the main reasons for increased German interest in energy trade with Canada. When the Canada-Germany Hydrogen Alliance was signed in August 2022, the Canadian government publicized it as an "agreement to enhance German energy security with clean Canadian hydrogen" (Government of Canada, 2022). Thus, the Trudeau government followed the example of its predecessor and used similar imagery of Canada as an energy savior making energy security a bipartisan issue in Canada.

While this particular timing may explain the desirability of an energy partnership between Canada and Germany another layer of time is provided by the exigency of the climate change agenda complicating the

energy partnership between the two transatlantic partners. Ever since the 2000s a linkage has emerged between energy security and climate change, reframing what was meant by energy security and what would constitute adequate and acceptable responses to energy dependencies. Thus, while the current energy crisis caused by the Ukraine war may tip the balance to the natural gas supply side in the short term, longer-term trajectories remain driven by net zero commitments. For example, in its already mentioned REPowerEU action plan the EU announced plans to become independent from Russian fossil fuels. Focusing on natural gas and combining shorter and longer-term energy policy goals, it committed to diversifying its supplies and increasing the use of what it calls "renewable gases," but ultimately it also aims to completely shift away from natural gas accelerating what the EU had already promised in its European Green Deal. Concluding the REPowerEU Communication with the statement that "[t]he need for greater security of supply is adding a new impetus to the objectives of the European Green Deal," the EU frames the current crisis as an opportunity to speed up the decarbonization agenda (European Commission 2022). This interpretation which sees energy security and climate action as compatible can also be found in recent G7 communications, in which member countries agreed "to work together to accelerate a clean and just transition towards climate neutrality, while ensuring energy security" (G7, 2022b). As a result, in the long term, developments and commitments to greening and decarbonizing Europe's and Germany's energy will necessarily lead to challenges for Canada which depends to a certain degree on their oil and gas industries for jobs and revenues, especially since these are concentrated in one province, Alberta, presenting political challenges for the federal government.

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Politics matter

Canada is one of the leading energy producers in the world producing large quantities of fossil energy – foremost oil and natural gas – but also hydropower, which makes the country's electricity grid one of the cleanest in the world with respect to greenhouse gas emissions. Petroleum makes up half of Canada's energy production, natural gas almost one third (30 percent), followed by hydropower (6 percent), coal (5 percent), nuclear power (5 percent) and bio energy (3 percent). According to the latest IEA country study, Canada's energy production contributes about 10 percent of its gross domestic product (IEA 2022). Because the country produces roughly double the amount it consumes, it is one of the few IEA member states who is able to export considerable amounts of energy. As can be gleaned from these numbers, the energy industry plays a substantial role in Canada's (foreign) economic policies and politics. Considerable revenue as well as jobs depend on it. As an energy producer, Canada also faces foreign policy challenges as it tries to navigate two different roles in the international system, that of a hydrocarbon energy producer and exporter and that of an advocate of global climate change action and transatlantic partner in energy transition.

With the emergence of a hydrogen economy new political challenges may emerge. Hydrogen policy is situated at the intersection of energy, climate, industrial, and science policies, blurring policymaking responsibilities. There is always the risk of bureaucratic politics whereby government decision makers disagree on strategies or policy goals based on their bureaucratic roles and interests of the institutions they represent. Different federal ministries and departments are involved and because there are so many different hydrogen pathways bureaucratic interests may not always align. For example, the Department of Natural Resources may prioritize hydrogen as a way to transition the oil and gas industry while the Department of Environment and Climate Change focuses on the renewable hydrogen potential. As we have already seen from the German example, hydrogen policy may be incorporated into the country's foreign policy toward the Global South, be part of its EU or

its economic and climate policies. To address these different functions, the German government created a State Secretaries' Committee on Hydrogen which brings together all relevant ministries to manage and oversee Germany's hydrogen strategy.

Beyond the federal level, energy policies in Germany and Canada are located at the complex intersection between substate, state, and supra-state levels. Both countries are federally organized, but there are significant differences in the ways that power is separated and shared. In Canada, energy jurisdiction is shared between federal and provincial governments. With the exception of federal and Indigenous lands, provinces own their ground resources and within their borders they are responsible for electricity. They may levy royalties and taxes on energy production within their province. The federal government mainly regulates interprovincial and international movement of energy and energy goods through the Canada Energy Regulator (CER). Based on these rights, the federal government entered the energy partnership and hydrogen alliance with Germany. However, since the agreements emphasize business to business approaches and many important decisions in the energy field with regards to pricing, technologies, and production reside in the provinces, a successful Canada-Germany Energy Partnership would have to be extended to include important provincial players, most of which have their own hydrogen strategies. So far, and for obvious reasons, this seems to have only been done for the Atlantic provinces. However, in order to evaluate all trade potential but also to cooperate in hydrogen science and technology, the partnership needs to find better ways to include Quebec, Alberta, and British Columbia in order to avoid tensions between the provinces and Ottawa which could negatively impact Canada's energy relations with Germany.

In contrast to Canada, the German state has more powers over energy policy than its substate jurisdictions (*Länder*), although the example of the blocking of grid expansion and halting of the construction of electric transmission lines from coastal windfarms through Bavaria has shown how these substate jurisdictions can hinder national energy goals. Plans for the German *Energiewende* fundamentally restructured

substate energy mixes. With the decisions to phase out coal and nuclear power German *Länder* in the southwest had to reorganize their energy systems and were promised to become connected to wind power from the northern Germany. However, the linking of the northern and southern power grids ran into problems when Bavaria reacted to popular protests and refused to have those transmission lines built (Knight 2022). This was only recently resolved when the construction of an underground line was announced. In addition to the substate level, national German energy policy is embedded in a multilevel system of competencies on the EU level. Article 194 of the 2007 Lisbon Treaty gives the Community competencies over an EU energy policy, even though individual EU member states keep the right to choose between different energy sources and decide on a national energy. While this still gives member states some autonomy in energy policy, it is practically curtailed by much stronger supranational competencies in areas of climate policies. In particular, for hydrogen it means that any strict EU rules defining renewable hydrogen would apply to Germany as well. In February 2023, the European Commission had announced plans for new rules to ensure that renewable fuels such as hydrogen are produced from renewable electricity. A so-called additionality rule was introduced whereby green hydrogen production can only be generated from newly installed renewable energy and a second launched a "methodology for calculating life-cycle greenhouse gas emissions" (European Commission 2023b). These rules would apply for EU internal production as well as imports and would directly apply to the bilateral energy partnership thus impacting Canada's ability to export hydrogen to Europe. Legislation in other jurisdictions also impact the EU, Germany, and Canada. All three face stiff competition from the U.S. Inflation Reduction Act of 2022

In February 2023, the European Commission had announced plans for new rules to ensure that renewable fuels such as hydrogen are produced from renewable electricity.

which gives generous tax credits to qualified green hydrogen. It has already led Canada to announce a similar, although not as generous, Clean Hydrogen Investment Tax Credit (CHITC).

Beyond national and regional politics, hydrogen also has the potential to transform current energy geopolitics as it becomes an internationally traded commodity. Increased maritime border trade, emergence of new suppliers as well as demand for key raw materials along the supply chain and technological and geo-economic competition will potentially transform the global energy trade. The more hydrogen is traded the higher the probability that new dependencies are created. Increased maritime shipping may face new risks as well. In addition, if blue hydrogen plays a significant role this would allow states which mainly produce and export fossil fuels to remain powerful as the world decarbonizes (Van de Graaf et al. 2020, 3). Due to the more even spread of renewable energy in the world, there are many more potential suppliers in the long run. However, in the short and medium-term supply bottlenecks are expected with regards to electrolysers creating new dependencies (Ansari, Grinschgl & Pepe 2022). Since this is an emerging international market, the establishment of a hydrogen governance regime should be a priority, also to provide a framework for the increased hydrogen diplomacy, for which the Canada-Germany Hydrogen Alliance is but one example. Through regional and global road maps the difficulties encountered in establishing a fully functioning global natural gas market may be avoided (Van de Graaf et al. 2020, 1). First attempts have been made through the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), the Clean Energy Ministerial (CEM) and Mission Innovation (MI), the G7 Hydrogen Action Pact, all of which Canada and Germany are members of and the European Clean Hydrogen Alliance. On the corporate side, hydrogen companies have founded the Hydrogen Council at the World Economic Forum in Davos in January 2017.

A first step for such cooperation would be international certification for hydrogen, covering, for example, proof of origin for electricity from renewable energy. Commenting on the publication of the

German Hydrogen Strategy in 2020 Kirsten Westphal, Susanne Dröge and Oliver Geden recommended that German and EU energy diplomacy should be aligned. The EU should assume leadership and advocate for certification standards (Westphal, Dröge & Geden 2020, 4). Like many others, they propose utilization of so-called Carbon Contracts for Difference, a financing tool used in renewable energy projects. They recommend that the EU closely cooperate on multilateral hydrogen governance with countries which they label green hydrogen pioneers because they are implementing actual projects. These include Australia, Japan, South Korea, California, and Chile. Canada is not mentioned. Since these are all located at quite a distance, to them Norway and the UK are the EU's "partners of first choice" (Westphal, Dröge & Geden 2020, 5). Combined with the above-mentioned foci on the Mediterranean and Africa they see the EU in a central position to shape global cooperation in the emerging international hydrogen economy. Much more sobering for Europe is the latest analysis by Jacopo Maria Pepe, Dawud Ansari and Rosa Melissa Gehrung who through scenario planning look at three possible future global hydrogen worlds, namely a new order, in which the power moves to Afro-Eurasia and China, a fragmented world of dependencies, and a dystopian world with a hydrogen hegemon (Pepe, Ansari & Gehrung 2023). All of these highlight the importance and urgency of like-minded states to get together now and create a multilateral, rules-based hydrogen governance structure. Based on their long history of collaboration in energy governance and science and technology Canada and Germany could use their partnership to become a norm entrepreneur in this area and lead global discussions in the relevant fora.

All of these highlight the importance and urgency of like-minded states to get together now and create a multilateral, rules-based hydrogen governance structure.

Society matters

In recent years, questions of energy have become extremely polarized. This may also impact the Canada-Germany Energy Partnership. The publics in both countries have very strong views on policies and technologies. For example, many Germans do not approve of nuclear power or oil production from oil sands. Hydrogen may be less contentious, but only on the face of it. First of all, it may be a clean energy source and help decarbonize our economies, but historically people have feared hydrogen. Recounting the famous Hindenburg disaster of 1937 people question the safety of hydrogen. The German government addressed these fears in its hydrogen strategy promising that it would ensure that "the use of hydrogen applications is safe" and acknowledging that "[n]egative events and accidents can undermine public acceptance of hydrogen technology" (BMWi 2020, 7-8). Second, if Canada were to export blue hydrogen to Germany it may face resistance since there is low public acceptance of carbon capture and storage (CCS) in the country, which is mainly based on earlier plans to use the technology as a lifeline for coal power (Braun et al. 2018). Now that it may be part of an emerging hydrogen economy, the German government has embarked on setting guidelines for CCS, but it remains to be seen whether societal acceptance for the technology increases. The very low acceptance of nuclear power, however, would prevent any potential importation of pink hydrogen, if there ever were some, for example, from Ontario.

Public acceptance of new infrastructure or technologies, or better the lack thereof, can also impact timelines. Hydrogen may be less contentious than fossil fuels, however transportation, either through pipelines or shipping, may face public resistance in Canada. As recent examples of pipeline controversies have shown this will potentially delay or even halt construction. In addition, regulatory regimes which cover environmental and other assessments have made regulatory approval more complex and sometimes more time consuming. Thus, German partners should be wary of promises about quick construction of hydrogen infrastructure.

Strategies matter

Even before Russia invaded the Ukraine in February 2022, hydrogen was hailed as the fuel of the future. With it, the world could bring about the clean energy transition while addressing energy security issues (G7, 2022a). The EU (European Commission 2020), Canada (Natural Resources Canada 2020), Germany (Federal Ministry for Economic Affairs and Energy 2020), and the provinces of Quebec (Gouvernement du Québec 2022), British Columbia (Government of British Columbia 2021), Alberta (Government of Alberta 2021) and Ontario (Government of Ontario 2022) have all announced hydrogen strategies over the last few years. Equally, all of the German *Länder* have published individual or joint hydrogen strategies. Lucas Flath, Jörg Kemmerzell and Michèle Knodt have shown how these differ in their discussion of the objectives (environmental impact, economic viability and security of supply) and the focus of hydrogen policies. In the northern Länder they note a preference for green hydrogen and imports via seaports. Lignite coal-producing Länder in the eastern part of the country prioritize the production of green hydrogen replacing coal production and central and southern Länder focus on the production of hydrogen-related components and services (Flath, Kemmerzell & Knodt, 2023). Like in Canada, substate approaches to hydrogen are fragmented and based on existing energy mixes and different industrial strength. Out of the four Canadian provincial strategies only the one from Ontario mentions Germany when it commits "to continue to participate on a hydrogen working group under the Canada-Germany Energy Partnership" (Government of Ontario 2022, 51). Even though the Canada-Germany Hydrogen Alliance was signed in Atlantic Canada promising hydrogen derivative shipments from there to Germany, to date none of the

Like in Canada, substate approaches to hydrogen are fragmented and based on existing energy mixes and different industrial strength.

Atlantic provinces has published a hydrogen strategy, although Nova Scotia had announced a green hydrogen action plan to be published in 2023.

A comparative study of the German and Canadian hydrogen strategies, which were published in 2020, shows similarities but also different nuances and priorities which can be partly explained by the different interests as hydrogen exporters and importers (see Table 1). Both highlight how hydrogen plays a considerable role in broader net zero strategies and how hydrogen will help create jobs. Reflecting the impact of the Pandemic in 2020 there are references to economic recovery through an emerging hydrogen industry. In addition, they see an international role for their respective industries and propose to ramp up their domestic hydrogen economies. The main difference can, of course, be found in whether hydrogen needs to be imported (Germany) or exported (Canada) on a large scale. Canada espouses the ambitious goal of becoming a top three global producer of clean hydrogen. Germany only articulated its ambitions with the 2023 updated hydrogen strategy in which the country announced that it would become a lead market for hydrogen technologies.

Despite obvious overlaps and complementary interests, neither of these hydrogen strategy documents contain much reference to the transatlantic energy partner. The Canadian strategy mentions that there is a proximity to Germany as a hydrogen import market and that Germany will need hydrogen. There are references to technological applications of hydrogen for energy storage and heat, as well as hydrogen blending and Germany is listed as one of the countries with four percent of the world's fuel cell facilities. Apart from these references which do not directly address transatlantic energy relations, there is only general mention of formalized collaboration with Germany through bilateral agreements.

Only the 2023 German Hydrogen Strategy Update mentions Canada. In the last section on research, innovation, and training of professionals it pledges to consolidate an existing R&D partnership with Canada. There is a separate section on Germany's hydrogen import strategy, which explains that German is looking to diversify imports and "avoid

new dependencies" by focusing on the EU and its neighbourhood as well as international supplier countries beyond that region. This would include Canada. However, much of the following discussion is focused on German development cooperation, and thus not particularly relevant for Canada (BMWK 2023b, 12). While Canada is not mentioned at all in the 2020 German hydrogen strategy, the German government mentions fossil fuel exporters in its measures. It sees an opportunity in using its external energy partnerships "to convert production and the export of fossil fuels to hydrogen" (BMWi 2020). In particular, measure 34 outlines Germany's reasoning:

> The integration of hydrogen into existing energy partnerships and the establishment of new partnerships with strategic exporting and importing countries creates new prospects, e.g. by making it possible for partner countries to use German technology to export hydrogen products, to make their economies less dependent on fossil fuels, and to meet Germany's need for hydrogen. (BMWi 2020, 26)

Measure 38 promises that Germany will "intensify dialogue" with current fossil fuel exporters "with a view to a gradual global energy transition including hydrogen" (BMWi 2020, 27). Most likely, this was not formulated with a country like Canada in mind. It serves as another cautious reminder that in the long run Germany may not accept blue hydrogen from Canada. The updated hydrogen strategy from July 2023 reflects the realization that green hydrogen may not cover all hydrogen needs in the short term. Even though the strategy warns that "[d]irect financial support for hydrogen is limited," it concedes that other hydrogen, specifically "low-carbon blue, turquoise and orange hydrogen" will also be used until sufficient amounts of green hydrogen are available, but only if EU sustainability requirements allow their use (BMWK 2023b, 4). Already in 2020, the Canadian hydrogen strategy warned that Canada needed to be involved in international discussions on certification and standards. It insisted that "[b]randing and promoting Canada's low carbon fuels will be important to gain market acceptance" (Natural Resources Canada 2020, 94).

Both the German and Canadian hydrogen strategies mostly speak of hydrogen in general terms. However, there is a tendency for a German emphasis on green hydrogen while the Canadian document refers to "clean hydrogen" as "a strategic priority for Canada" (Natural Resources Canada 2020, viii). Even though experts advise that both blue and green hydrogen should be imported to Germany and Europe (Dickel 2020; Layzell et al. 2020), there have been divergent perspectives on the desirability of the two different types of hydrogen. Conflicting ideas about green (renewable energy) and clean (lower carbon emissions) forms of hydrogen have emerged across the Atlantic but also within Canada. As mentioned before, Quebec champions green hydrogen, and Alberta sees blue hydrogen as a way to future proof its fossil fuel industry. The EU plans to adopt very strict rules only allowing green hydrogen to be imported. The Canada-Germany Energy Partnership took Ottawa's side and referred to "clean hydrogen" (Natural Resources Canada 2021). The G7 communiqué which launched the G7 Hydrogen Action Pact in 2022 also avoided the color-coded hydrogen categories, using the compromise wording "low-carbon and renewable hydrogen" (G7, 2022a).

It has become clear from the discussion that Germany and Canada face some challenges in the area of hydrogen trade. In the other two areas of transatlantic energy relations, namely energy governance and research cooperation they share similar interests. Both agree that there needs to be a multilateral agreement between hydrogen producers and consumers on standards and certification. As middle powers who champion free trade, human rights, and a rules-based international order, Canada and Germany should work together and provide leadership. In addition, based on their existing collaboration on science and technology Canada and Germany should expand their joint hydrogen science and technology research projects. Both are like-minded research nations who are leaders in hydrogen technologies, and they could bring together important insights as hydrogen consumer and producer.

TABLE 1: COMPARISON OF CANADIAN AND GERMAN HYDROGEN STRATEGIES

	Date	Mention of Canada or Germany	General focus	International focus
Germany	June 2020	• No	• energy transition, decarbonisation strategy • establishing domestic market for hydrogen use and production • EU framework • Action Plan: transport, industrial sector, heat, infrastructure/supply, research/innovation/ education, funding, European and international action	• EU member states (North Sea, Southern Europe) • countries with which Germany has development cooperation or energy partnerships • international role for German industry • interest in establishing global hydrogen market • hydrogen furthers diversification • imports will be necessary
Germany	July 2023	Existing R&D partnership with Canada will be consolidated (p. 31)	• emphasis on energy security • industrial policy & creation of sustainable jobs • infrastructure expansion • Germany to become lead market for hydrogen technologies • accelerated market ramp-up • national, European and international regulatory and legal conditions • expanding electrolyser capacity and renewable electricity generation	• German import strategy for hydrogen and hydrogen derivatives • European hydrogen network (European Hydrogen Backbone) • priority corridors to North Sea & Baltic Sea region, then North Africa • first shipping then pipelines from Europe & neighbouring regions • hydrogen pipelines to countries bordering the EU, such as Norway, the United Kingdom, Ukraine, Morocco, Tunisia and Algeria • H2-ready LNG infrastructure • via EU engagement with potential hydrogen producers in Southern Europe, North Sea, Baltic Sea, Mediterranean & Black Sea regions • European cooperation on non-European imports • international lighthouse projects
Canada	December 2020	Germany will need hydrogen imports (p. 90) Due to proximity Canada can be that exporter (p. x) Canada has a history of collaboration with Germany (p. 5)	• development of low-carbon hydrogen • part of achieving net zero goals • become top three global producer of hydrogen • economic recovery & creating jobs • early deployment hubs • domestic hydrogen economy • become large-scale hydrogen exporter • transforming oil and natural gas industries to net-zero emissions	• supplier of choice, high export potential • attracting direct foreign investment • global leader in technology innovation • potential export markets: USA, Japan, South Korea, China and EU, possibly South America • BC export hub to Asia, Atlantic Canada export hub to Europe • international leader in fuel cell technology • participation in establishing international standards

Conclusion

Historically, as a reliable NATO and transatlantic partner, Canada has and continues to feature in European and German searches for dependable energy suppliers. Prime Ministers of various stripes utilized the energy security argument during crises moments to highlight Canada's significant role as a reliable supplier. The current war in Ukraine has highlighted this propensity. This is also based on a belief that energy interests are complementary. However, things are never that easy nor are they exclusively based on matching economic interests. First of all, geography matters. While Canada may have the resources, bringing these to market is a different story as the landlocked oil-producing province of Alberta has experienced over decades. This was particularly visible when Germany looked towards Canada for LNG only to realize that there is currently very little infrastructure in place to allow for LNG to be exported from Canada. Added to these geographical challenges are difficulties due to different regulatory regimes and lengthy approval processes. Time, then, constitutes a second important challenge. The timing of the two complementary interests – having resources and having a market – is out of sync. For example, Germany needs LNG now, but only as a bridging fuel, since the country's long-term plans envision an eventual phasing out of natural gas. Canada, on the other hand, will need to make long-term investments into LNG, however, return on such investment would not be guaranteed due to the unwillingness of German partners to agree to long-term supply contracts in light of Germany's commitment to decarbonization. Divergent short, medium and long-term perspectives can also be discerned with regards to the actors involved. Private energy companies selling LNG or hydrogen overseas exhibit short-term priorities especially with regards to their shareholders. Recipients of energy in Germany need to ensure that they meet net zero targets and are much more focused on carbon markets. Thus, while there is a short-term interest in LNG which currently cannot be satisfied due to the lack of infrastructure,

the only promising trade would be in hydrogen in the medium to long term. Thirdly, while generally Canada and Germany are like-minded partners sharing many values and collaborating internationally on many issue areas, it is exactly the complementarity of energy interests which creates challenges for the energy partnership. As an energy producer whose production is still heavily relying on fossil fuels, Canada has a different perspective on hydrogen than Germany or the EU have as energy consumers. Combined with overall net zero objectives, the German and European markets for hydrogen are seen as mainly open for green hydrogen. Yet, in its hydrogen strategy Ottawa has highlighted the potential for blue hydrogen, not least to ensure that decarbonization proceeds in a way that oil and gas jobs are not immediately lost but slowly phased out. This points to a fourth challenge the German-Canadian Energy Partnership faces, and that is the fact that energy relations are highly political and often driven by domestic considerations and politics. They encompass much more than trade, investment or science and technology cooperation. In particular, federalism in Canada which gives provinces authority over their natural resources coupled with the uneven distribution of various energy resources over the vast country disperses the relevant actors and decentralizes power in this transatlantic partnership. In addition, energy and energy transition have become extremely polarized and the public has very strong views on policies and technologies. Public acceptance, or better the lack thereof, of new infrastructure or technologies, can also impact timelines. Finally, for all those reasons stated above, hydrogen trade poses the most promising aspect of the bilateral energy partnership, while cooperation in energy science and technology and a common strategy to reach a multilateral agreement between hydrogen producers and consumers might prove more impactful

Combined with overall net zero objectives, the German and European markets for hydrogen are seen as mainly open for green hydrogen.

than actual energy trade. As middle powers who champion free trade, human rights and a rules-based international order, Canada and Germany could work together, especially within the G7, G20, the IEA and IRENA, to address the new evolving geopolitics of energy transition. The emerging international hydrogen economy needs international rules for trade and investment. The 2023 Canada-Germany Hydrogen Alliance is a good starting point, but it could be much more than a bilateral business and trade agreement.

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