

THE POLITICAL ECONOMY OF THE GREEN HYDROGEN TRANSITION

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Abstract:

In this IPC Policy Brief, we propose a game-theoretic framework for the analysis of green hydrogen transitions. We model the strategic relationship between an energy-rich, technology-dependent dictatorship and an energy-poor, technology-producing democracy. When an exogenous shock precipitates the emergence of conflict initiated by the energy-rich dictatorship, the energy-poor democracy must choose to either fight a costly conflict or finance a slow- or fast-moving energy transition. A green hydrogen transition is an efficient policy choice for an energy-poor, technology-producing democracy that wants to break its dependency from an energy-rich, technology-importing dictatorship. Furthermore, green hydrogen has the potential to play a key role in reaching countries' net-zero emissions targets by decarbonizing various sectors and storing and transporting wind and solar energy. Russia's war in Ukraine has placed European democracies under severe economic pressure given their decade-long energy dependence from Russia. This is why we suggest that the European Union may opt for a green hydrogen transition in cooperation with Turkey. We argue that due to its geographic diversity and green technology, the Turkish economy can be a major partner in the green hydrogen transformation in Germany and the European Union.

I. Introduction

Russia's war in Ukraine and the dependence of the European Union and Turkey on Russian oil and natural gas has brought the green hydrogen transition to the forefront of energy policy debates. Hydrogen's abundance and ability to eliminate approximately 68 percent of global emissions make it attractive both for business leaders and policy makers.¹ The intermediate process of electrolysis allows the storage of wind and solar energy into liquid green hydrogen, which then can be transported through existing pipeline networks to global markets. Furthermore, clean hydrogen can diversify oil- and gas-rich economies by increasing their revenues through increased energy trade with energy-poor but overall advanced economies.²

The centrality of the Turkish economy in the global network of energy transitions constitutes an important strategic advantage for the country's perspectives in the ongoing tectonic transformation of oil and natural gas markets as a result of Russia's political and economic isolation from the West. The introduction of the YEKA (Renewable Energy Resource Areas) auction model constitutes an important regulatory forerunner for green hydrogen production, because the presence of a solar or wind power facility is a technical prerequisite for it. The YEKA auction model appears to have bolstered regional development in Turkey by creating a competitive domestic market for local production and by maximizing the efficiency of the winning bid and the effectiveness of energy capacity deployment; in the case of wind energy, the winning offer of the Siemens-Gamesa-Kalyon consortium was far below the global average for comparable offers.³ Moreover, the mixed strategy of zoning and free-location choice ensures balance between suitable geographic and resource conditions, on the one hand, and minimized project cost, on the other.⁴ The development of green hydrogen potential in Turkey is, therefore, likely to develop in tandem with the additional renewable installed capacity introduced with YEKA projects, while taking into further consideration cross-regional differences, investor interests, and sustainable financing.⁵

Globally, the BRICS economies, namely China, India, and Brazil, are the most likely to introduce green

hydrogen for electricity production, followed by a combination of advanced and emerging economies around the globe. Turkey has the potential to take the lead ahead of several European countries including France, Germany, and the Netherlands given its multifaceted geography and massive electricity demand both for industries and households. What makes renewable hydrogen different from other types of hydrogen such as blue hydrogen is its ability to reduce global emissions, while resolving the scarcity problem of energy required for automation, maritime trade, and heating buildings.⁶ In several EU countries, the main constraint to produce renewable hydrogen is the amount of green power available to produce it.⁷ Hence, Turkey with its advanced renewables capacity can not only cover its domestic demand but also play a significant role as a green hydrogen provider for European markets.

While the environmental and economic significance of green hydrogen have been established, the Russian-Ukrainian war has created new conditions for European energy security and has rendered EU member states' energy dependence on Russian supplies a major uncertainty for the political cohesion of the European Union. While green hydrogen can alleviate the European Union's energy dependence on Russia, transitions from traditional fossil fuels to green hydrogen are associated with significant infrastructure costs and domestic economic consequences, which have already been particularly dire for Europe as a result of Russia's war in Ukraine in comparison to North America or Japan. Before the Ukrainian conflict, the EU-Russian energy relationship relied on the tradeoff between the stability of oil and natural gas deliveries from Russia to Europe and the undisrupted flow of innovation and foreign direct investment from Europe to Russia. The political and military leverage of Russia in the European continent was offset by its dependence on EU FDI, and the EU's power over EU-Russian relations was minimized by Gazprom's regulatory integration into the European energy system.⁸ However, interdependence between Europe and Russia did not reduce the security tensions between the two sides; on the contrary, it led each side to seek a lower degree of relative dependence from the other, which in return created the conditions for a direct security confrontation.⁹

Today, the logic of democratic peace, which underpinned the democratization waves of the 1990s in Eastern and Central Europe and post-Soviet Eurasia and suggests that a dyad of democracies is less likely to fight against each other than a dyad of a democracy and a dictatorship, may also be aligned with green hydrogen transitions. Given that resource-rich economies are inclined to be dictatorships, green hydrogen transitions can offer an efficient policy exit for resource-dependent democracies that intend to break their energy partnerships with authoritarian regimes. An increase in the size of renewable technologies that produce complementarities with traditional depletable resources such as oil and natural gas may facilitate closer cooperation between energy-rich dictatorships and advanced capitalist economies. Nevertheless, dictatorships with a very high energy endowment may be difficult to collaborate with, as has been the case with Russia; however, economies with moderate energy endowments in Africa and the MENA region are more inclined to use energy trade as a driver for their development. This suggests that using oil or natural gas infrastructure for the transportation of green hydrogen or using oil and natural gas for purposes of green hydrogen production may reduce the profit margin of highly extractive energy-rich dictatorships. While the robustness of the democratic peace theory has been shown also with non-parametric empirical tests,¹⁰ it is also important to suggest that a consolidated dictatorship following a failed democratization process is more likely to be belligerent than a dictatorship that never faced an existential threat of termination.¹¹

Turkey's dilemma between stronger energy dependence on Russia and a tighter integration into Western economies and their energy production patterns may constitute a major geopolitical challenge for policy-makers in Ankara.¹² At the same time, the degradation of global ecosystems including Turkey necessitates a thorough change of ecological behavior, which makes green hydrogen an informed policy choice also from a normative standpoint.¹³ It is also important to point out that the perspective of EU-Turkey cooperation in the production and transportation of green hydrogen would generate a new bond of interdependence and, that way, could advance bilateral policy coordination despite the various political setbacks.

The paper is structured as follows. Section 2 explains the role and uses of green hydrogen as the fuel of the future. Section 3 proposes and solves a game-theoretic model on green hydrogen transitions and it explains why a green hydrogen transition is an efficient policy choice for Germany and the EU. Section 4 presents our policy outlook for green hydrogen in Germany and the European Union in light of Germany's hydrogen diplomacy. In Section 5, we discuss the policy options for Turkey and make related policy recommendations. Section 6 concludes.

II. Green Hydrogen as a Commodity of the Future

Hydrogen is a chemical with a high energy density (about 2.5 x gasoline). It does not emit harmful by-products when burned, thus making it a potentially attractive clean fuel resource for mitigating climate change. Although it is an abundant chemical in nature, it is almost exclusively bonded to other elements, notably in water and fossil fuels. This requires processing to extract hydrogen and consequently the energy from it.¹⁴ The current state-of-the-art technology for producing green hydrogen utilizes a chemical process called electrolysis, where electricity (fueled by renewable resources such as wind or solar) is used to split water into hydrogen and oxygen with an apparatus called an electrolyzer. The levelized cost of hydrogen production from renewable electricity is USD 3 to 8 per kg (compared to USD 0.5 to 1.7 per kg with production from natural gas).¹⁵ Green hydrogen is not yet commercially competitive against hydrogen produced from fossil fuels. This remains to be a major obstacle for its widespread adoption. According to the International Energy Agency (IEA), hydrogen demand was at 90 Mt in 2020. Practically all of this was used for refining and industrial applications and produced mostly from fossil fuels, resulting in approximately 900 Mt of CO₂ emissions.¹⁶

Green hydrogen is a compelling commodity for countries with greenhouse gas emission reduction targets. Despite recent advances in battery and storage technologies, electricity cannot be stored in large quantities. Solar and wind power technologies have high variabilities during the day and throughout the seasons of the year. Storing excess

renewable energy in the form of hydrogen can assist in stabilizing the grid, reduce transmission line investments, and advance the deployment of solar and wind power. Other uses of hydrogen include oil refining, ammonia and methanol production, heating, glass purification, semiconductor manufacturing, coolant in power plant generators, and hydrogenation of unsaturated fatty acids in vegetable oil. Emerging applications include the use of hydrogen fuel cells in vehicles and synthetic fuels for ships and airplanes. The steel industry is experimenting with using hydrogen to substitute a share of coal and gas in furnaces and heating in ancillary units.¹⁷

Hydrogen can be transported in liquefied form or as ammonia in ships or trucks or by blending into natural gas transmission lines. Ongoing research findings indicate that if less than 20% is blended into natural gas, current gas transmission lines may be utilized without major additional investments. Blending would have the advantage of eliminating energy losses during its conversion to liquid form and ammonia. Another benefit would be the reduction of the need for pressurized storage tanks.

III. The Model

Proposing a strategic interaction between an energy-rich, technology-dependent dictatorship and an energy-poor, technology-producing democracy captures historical and contemporary realities in the economic and political relations between advanced economies and developing economies. Reiter and Stam¹⁸ confirm that dictatorships are more likely to challenge democracies than vice-versa. Furthermore, military coups are much more likely to trigger higher levels of conflict and underdevelopment while providing the basis for autocracy support.¹⁹ It is important to also keep in mind that a high endowment in natural resources such as oil or natural gas can be an obstacle to democratization or democratic consolidation, particularly under the additional conditions of low labor productivity, short-termist politicians, and strong political competition.²⁰ While the literature points at a non-monotonic relationship between democracy and peace,²¹ a large endowment in natural gas or oil can increase the coercive leverage of an energy-exporting dictatorship over an energy-dependent democracy (see the related discussion on civil conflict by Powell²²).

We propose a dynamic conflict game between a dictatorship and a democracy to delineate different efficient policy choices for the EU and explain under what conditions the green hydrogen transition may compensate for the welfare losses in European economies incurred by Russia's war in Ukraine. The development of the EU/German-Russian energy partnership constitutes the primary case underpinning our formal analysis given its centrality for European energy security. In our model, the authoritarian government is dependent on technology transfers from the democratic government, whereas the democratic government is dependent on energy supplies from the authoritarian government. The dictatorship is more dependent on its revenues from its energy trade with the democratic government than the democracy is dependent on its revenues from its technology transfers to the authoritarian government. Hence, there is an asymmetric interdependence between the two partners in favor of democracy.

Consider a static game in which a dictatorship tries to make this interdependence more symmetric in its favor by attacking a third country, whose interdependence with the dictatorship's democratic partner is even larger. The adoption of green hydrogen technologies can work in the following ways: 1. It can offer a democratic government a speedy path toward energy independence from an authoritarian government; 2. It can create a new framework for energy cooperation between the two partners through the gradual democratization of the authoritarian partner; 3. It can maximize the economic performance of the democratic partner by facilitating energy abundance.

The *green hydrogen transition game* is therefore defined in the following form:

- 1 | Players: a democracy Δ and a dictatorship A , such that $N = \{\Delta, A\}$
- 2 | State: $\zeta_t \in \{\zeta_t^L = \delta, \zeta_t^H = \zeta + \delta\}$.
- 3 | Strategy sets: $W^k, \forall k \in N$.
- 4 | Payoffs: $u^k, \forall k \in N$.
- 5 | Transition probabilities: $P = \{v, 1-v\}$.
- 6 | Discount rate: β s.t. $\beta \in (0, 1)$.
- 7 | The state variable ζ_t proxies the degree of global political risk, which can be either high

or low. The payoffs for the democracy and the dictatorship can be defined as follows:

$$u^{\Delta} = \tau \ln \kappa + (1 - c) \ln(1 - \varepsilon) - J^{\Delta}(g; \varepsilon, \kappa)$$

$$u^{\Lambda} = \tau \ln \varepsilon + (1 - d) \ln(1 - \kappa) - J^{\Lambda}(g; \varepsilon, \kappa)$$

where $\tau \in (0, 1)$ denotes the tax rate, $\kappa, \varepsilon \in (0, 1)$ denote the per capita technological and energy endowments of the democracy and the dictatorship, respectively, $c, d \in (0, 1)$ the marginal costs of energy and technology acquisition, respectively, and $J^{\Delta}(\cdot), J^{\Lambda}(\cdot)$ the cost functions of providing a per capita public good g in a democracy and a dictatorship, respectively, such that $\frac{\partial J^{\Delta}}{\partial g}, \frac{\partial J^{\Lambda}}{\partial g} > 0$.

Proposition 1: *Interdependence is costly both for a technology-producing democracy and an energy-rich dictatorship. If*

$$\left| \frac{\partial J^{\Delta}(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa} - \frac{\partial J^{\Delta}(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon} \right| > \left| \frac{\partial J^{\Lambda}(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa} - \frac{\partial J^{\Lambda}(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon} \right|$$

then interdependence is relatively costlier for the democracy rather than for the dictatorship; otherwise, it is more costly for the dictatorship rather than for the democracy.

It becomes obvious that the impact of energy and technology endowments is different on the provision of public goods in democracies vs. dictatorships. Empirically, the provision of public goods is costlier for dictatorships rather than for democracies; nevertheless, the presence of the accountability constraint for a democracy, which is not the case for a dictatorship, sets a higher reservation threshold for the delivery of public goods (see the proof of proposition 1 in the Appendix).

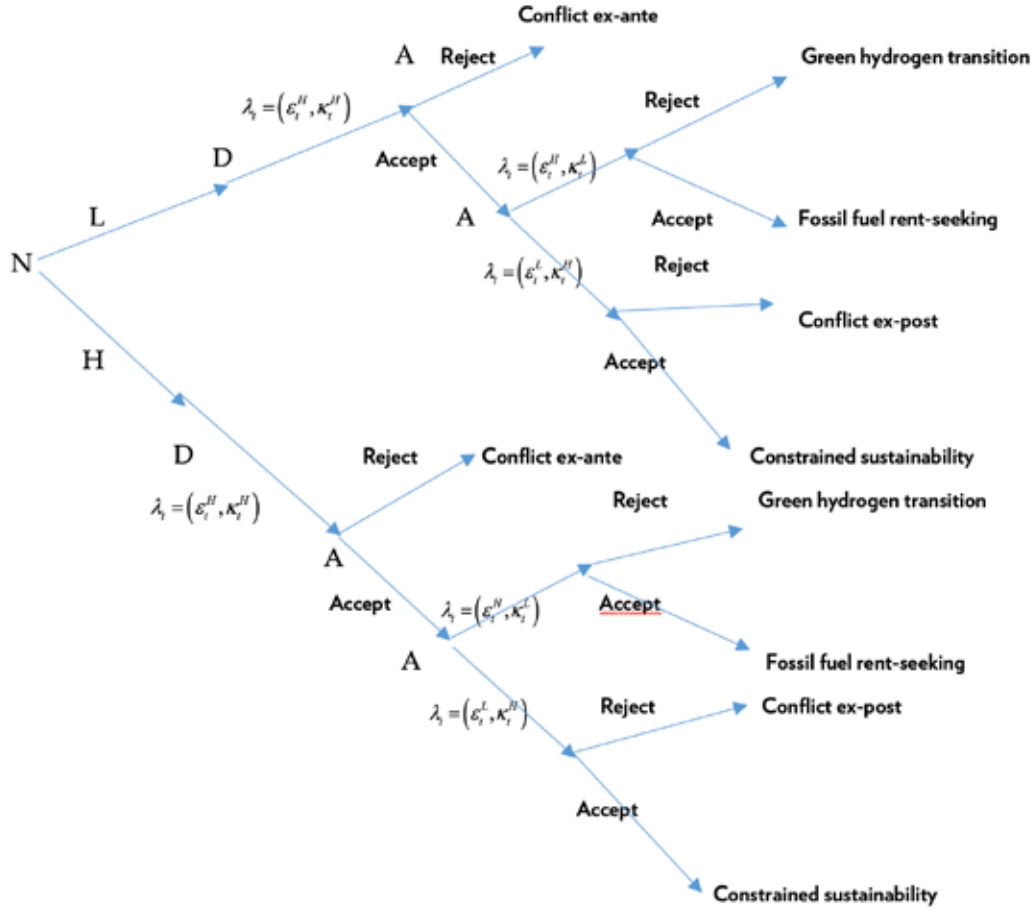
The logic of the green hydrogen transition relates to the state variable of global political risk ζ_t . Under conditions of high global political risk, the opportunity cost of the green hydrogen transition becomes significantly low, and the production of blue hydrogen or the import of natural gas and oil from centralized economies with a revisionist political agenda becomes associated with high levels of aggregate uncertainty, which may hamper economic performance and the tenure of elected democratic governments. The continuation of an asymmetric interdependence between a democ-

racy and a dictatorship may render the military conflict option more attractive for the dictatorship compared to the democracy; authoritarian leaders are not held accountable for the costs of the war that they provoked by their political constituents. Furthermore, technology transfers from democracies to dictatorships may generate significant political spillovers in favor of civil society and citizen mobilization against the incumbent regime.

The dynamic logic of the game allows us to propose a multitude of equilibrium outcomes: conflict, green hydrogen transition (fast-moving energy transition), constrained sustainability (slow-moving energy transition), and fossil fuel rent-seeking. By transitioning from a static to a dynamic game, we propose the following timing structure (see Figure 1 below):

- 1 | The state $\zeta_t \in \{\zeta_t^L, \zeta_t^H\}$ is revealed.
- 2 | The democratic government proposes a vector of policies $\lambda_t = (\varepsilon_t^H, \kappa_t^H)$.
- 3 | The authoritarian government provisionally accepts or rejects the proposal of the democratic government. In case of rejection, the outcome is **conflict ex-ante**, and the stage game is over.
- 4 | The authoritarian government makes a counteroffer based on the prior offer of the democratic government. This can be either an extractive offer, where the democracy is disproportionately dependent on the dictatorship such that $\lambda_t = (\varepsilon_t^H, \kappa_t^L)$, or a moderate offer, where the dictatorship is disproportionately dependent on the democracy such that $\lambda_t = (\varepsilon_t^L, \kappa_t^H)$.
- 5 | In case of an extractive counteroffer, the democracy can either accept or reject it. In case of rejection, the outcome is the **green hydrogen transition**. In case of acceptance, the outcome is **fossil fuel rent-seeking**. The stage game is over.
- 6 | In case of a moderate counteroffer, the democracy can either accept or reject this. In case of rejection, the outcome is **conflict ex-post**. In case of acceptance, the outcome is **constrained sustainability**. The stage game is over.

Figure 1: Stage Game



We now set up the Bellman payoffs for each of the aforementioned outcomes in order to derive our equilibrium proposition.

Conflict ex-ante:

$$\Theta^A(C, \zeta^H = \zeta + \delta) = \frac{\zeta + \delta}{1 - \beta}$$

$$\Theta^A(C, \zeta^H = \zeta + \delta) = 0$$

Fossil Fuels Rent-Seeking:

$$\Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon_t = \varepsilon^H, \kappa_t = \kappa^L) = u^A + \beta \left[v \Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon^H, \kappa^L) + (1 - v) \Theta^A(F, \zeta^L = \delta) \right]$$

$$\Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon_t = \varepsilon^H, \kappa_t = \kappa^L) = u^A + \beta \left[v \Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon^H, \kappa^L) + (1 - v) \Theta^A(F, \zeta^L = \delta) \right]$$

Constrained Sustainability:

$$\Theta^A(S, \zeta^H = \zeta + \delta, \varepsilon_t = \varepsilon^L, \kappa_t = \kappa^H) = u^A + \beta \left[v \Theta^A(S, \zeta^H = \zeta + \delta, \varepsilon^L, \kappa^H) + (1 - v) \Theta^A(S, \zeta^L = \delta) \right]$$

$$\Theta^A(S, \zeta^H = \zeta + \delta, \varepsilon_t = \varepsilon^L, \kappa_t = \kappa^H) = u^A + \beta \left[v \Theta^A(S, \zeta^H = \zeta + \delta, \varepsilon^L, \kappa^H) + (1 - v) \Theta^A(S, \zeta^L = \delta) \right]$$

Green Hydrogen Transition:

$$\Theta^A(H, \zeta^H = \zeta + \delta) = \frac{\tau \ln \kappa^n - J^\Delta(g; \kappa, 0)}{1 - \beta}$$

$$\Theta^A(H, \zeta^H = \zeta + \delta) = 0$$

Conflict ex-post:

$$\Theta^A(P, \zeta^H = \zeta + \delta) = 0$$

$$\Theta^A(P, \zeta^H = \zeta + \delta) = \frac{\zeta + \delta}{1 - \beta}$$

Proposition 2: The solution of the green hydrogen transition game that has the following form:

- 1 | If $\zeta \leq \zeta^*$ and $n \geq n^*$ then **green hydrogen transition** occurs.
- 2 | If $\zeta > \zeta^*$ and $n \geq n^*$ then **conflict ex-post** occurs.
- 3 | If $\zeta \leq \zeta^*$ and $n < n^*$ then **fossil fuel rent-seeking** occurs: $\lambda_t = (\varepsilon_t^H, \kappa_t^L)$
- 4 | If $\zeta > \zeta^*$ and $n < n^*$ then **constrained sustainability** occurs: $\lambda_t = (\varepsilon_t^L, \kappa_t^H)$

The agreement between the democracy and the dictatorship, the two players of our proposed game, can lead either to fossil fuel rent-seeking or constrained sustainability. This depends on the economic significance of hydrogen and its leverage over the technological endowment of the democracy (see the proof of proposition 2 in the Appendix). If this is below the derived critical threshold that makes the democracy indifferent to either a green hydrogen transition or constrained sustainability, then the democracy and the dictatorship will continue their cooperation. The equilibrium solution is likely to be fossil fuel rent-seeking under below-threshold levels of global political risk, which minimize the incentives for energy transitions under a dictatorship. However, if the level of global political risk rises above the threshold, then conflict becomes an attractive choice for the dictatorship. Then, the democracy can prevent the dictatorship from provoking conflict by proposing the equilibrium of constrained sustainability, which fits the interests of both players. Particularly in the case of the dictatorship, constrained sustainability appears to be a compromise between fossil fuel rent-seeking and conflict ex-post under conditions of significantly high global political risk.

The green hydrogen transition is modeled as a break from the fossil fuels-technology trade between the democracy and the dictatorship. The democracy is able to compensate for the discontinuation of its fossil fuel dependence from the dictatorship through the exponential effects of green hydrogen on its technological endowment, while the dictatorship needs to seek alternative markets to compensate for the lack of technology transfers from the democracy or follow the democracy in its

green hydrogen transition path. The latter option would require a drastic change in the economic structure of the dictatorship and the subsequent use of traditional fossil fuels for sustainable energy production.

The Russian-German energy partnership is similar to several aspects of the aforementioned model. The Russian-Ukrainian war has shown that the likely discontinuity in Russian natural gas supplies to the European Union is equivalent to the *conflict ex-post* equilibrium. A departure from this suboptimal and unsustainable equilibrium may occur in the direction of either constrained sustainability or the green hydrogen transition. Constrained sustainability, nevertheless, would require the cooperation of Russia, which is not going to be likely in the near future. Hence, the green hydrogen transition seems to be the only sustainable solution forward for Germany and the European Union given that the Russian-Ukrainian war is going to continue in the foreseeable future. In the sections below, we discuss German and EU policies toward green hydrogen with respect to the status of the European Union as a global leader in the green hydrogen transition. Furthermore, we identify Turkey as a global driver of the green hydrogen transformation in the developing world, while pointing out the positive externalities that its green hydrogen transformation may have for the socio-economic performance of Turkish provinces and districts.

IV. German Hydrogen Diplomacy and Policy Scenarios for the European Union

The German federal government has placed hydrogen diplomacy at the core of its relations with several emerging markets around the globe such as the United Arab Emirates, Saudi Arabia, Russia, Ukraine, and Nigeria. While Russia's war in Ukraine has practically eliminated the perspective of German-Russian hydrogen cooperation, this is not the case for the other countries that Berlin has identified as crucial for the future security of its energy supplies. As the German Federal Foreign Office underscored upon the announcement of the opening of its second hydrogen diplomacy office in

Riyadh, Saudi Arabia, green hydrogen constitutes an important component of the new international energy strategy of the German government, which is likely to transfer its technological know-how to partners at both the central and subnational levels.²³ The ThyssenKrupp Group is the leading German company in green hydrogen technology, while the European Union has already invested more than USD 4.5 billion in the development of green hydrogen technologies.²⁴ According to government estimations, Germany's hydrogen demand until 2030 will reach 90-110 TWh; this would require a green hydrogen production share of 14 TWh and an additional component of renewable electricity production of 20 TWh.²⁵ The unstable global political environment and the fact that the majority of the expected hydrogen supplies will have to be imported indicate that the prospects of German industrial growth are heavily connected to carefully designed alliances within the European Union as well as with the countries of the Eastern Partnership and the Southern (Mediterranean) neighborhood.²⁶ The role of Turkish foreign policy in that respect can be instrumental for German and EU interests given the significant leverage and

established trade and FDI relations of Turkey with the countries of both the Eastern Partnership and Southern Neighborhood.

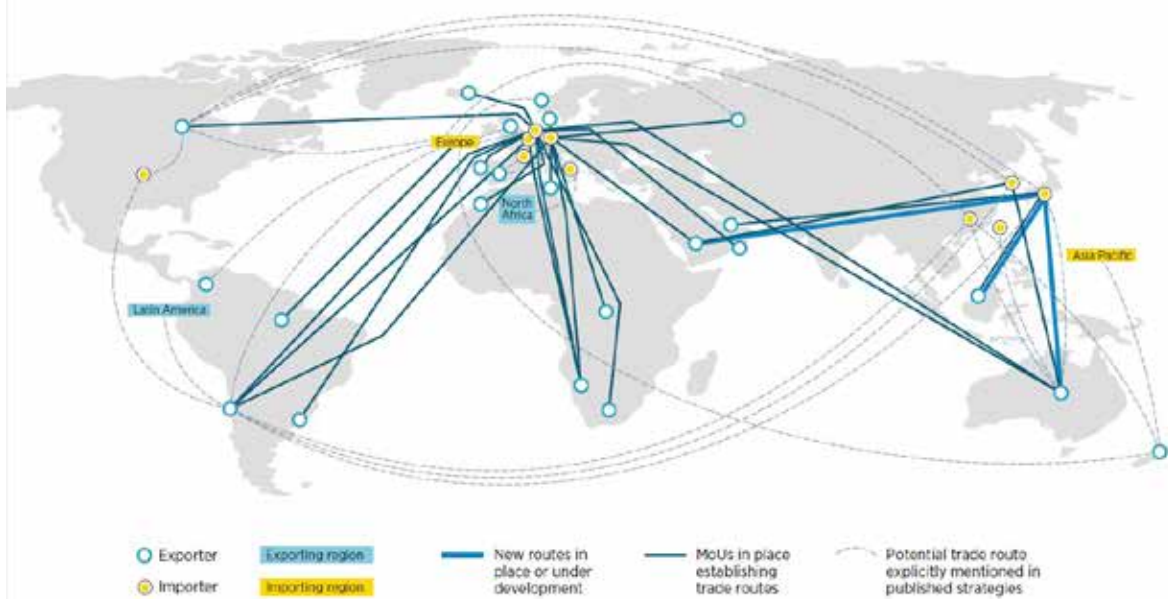
Hence, Berlin's hydrogen diplomacy may not only accelerate the German government's climate neutrality goals, but it may also facilitate a more comprehensive inclusion of the green energy transformation in the economic policy agenda of several EU governments.²⁷ The European Commission's hydrogen strategy identifies the production of green hydrogen as a key priority for the European Union; nevertheless, it also acknowledges that the transition to green hydrogen will occur through the extended use of blue hydrogen.²⁸ The European Clean Hydrogen Alliance is the policy platform that will implement the decarbonization of EU industries, and in that way it sets a revolutionizing element in the EU's New Industrial Policy.²⁹ However, the most crucial phase remains the period between 2025 and 2030, the time in which the European Union should install 40 GWh of green hydrogen electrolyzers that would have the capacity to produce 10 million tons of green hydrogen.³⁰

Figure 2: Hydrogen Strategies (October 2021)



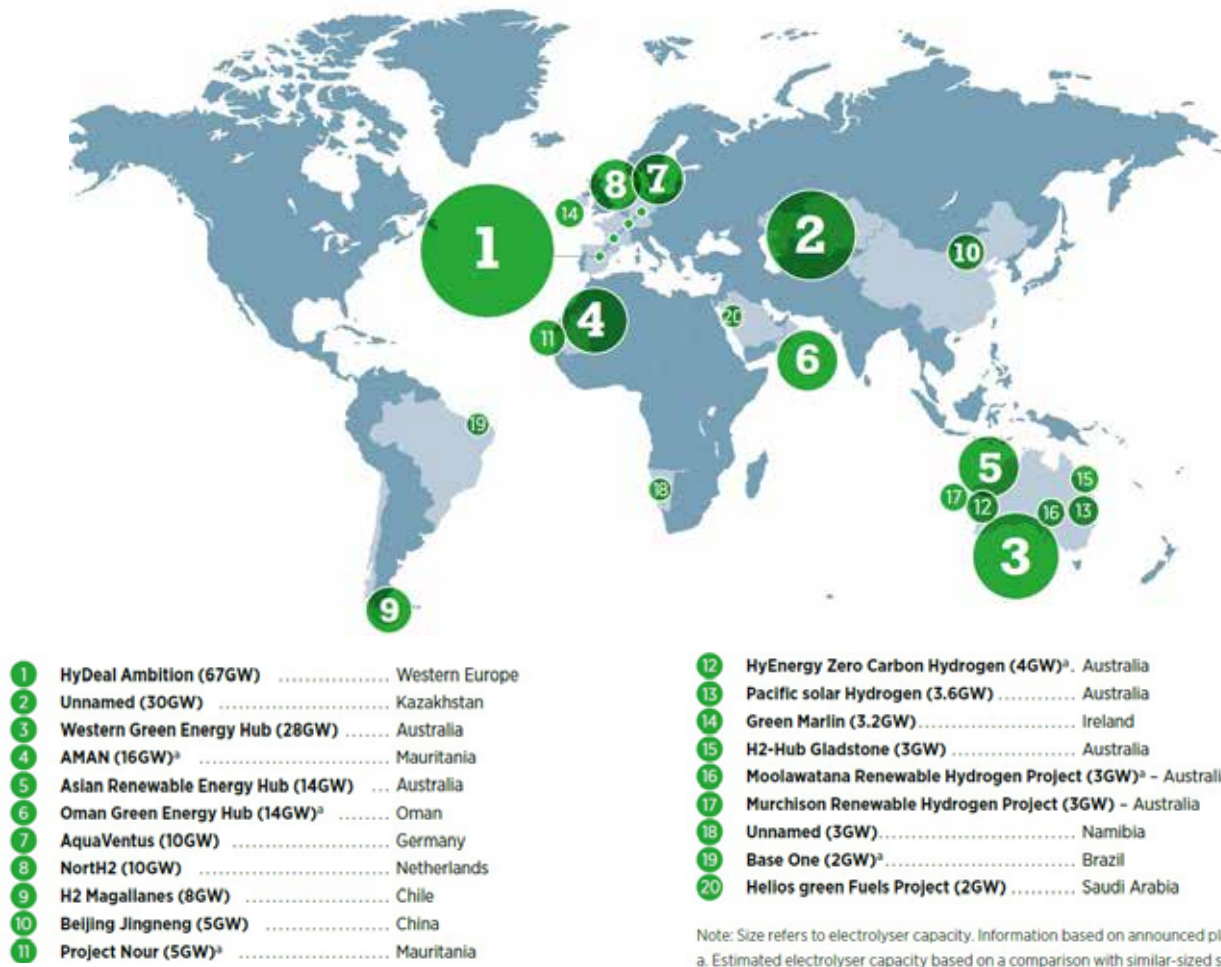
Source: IRENA, 2022.³¹

Figure 3: Hydrogen Trade Routes, Plans & Agreements



Source: IRENA, 2022.³²

Figure 4: Largest Green Hydrogen Projects



Source: IRENA, 2022.³³

Figure 5: Heat Map of Water Stress Levels



Source: IRENA, 2022.

It is obvious that the EU remains the epicenter of global developments on green hydrogen, while being followed closely by China and its strategic energy portfolio (see Figure 2). Figure 3 illustrates the strategic significance of Europe and the Asia-Pacific when it comes to the key destinations of global hydrogen supplies: Africa, the Middle East, and North Africa as well as Latin America. Western Europe, including the EU, Norway, and the UK, hosts the largest green hydrogen projects followed by Kazakhstan, Australia, and Mauritania (Figure 4). This empirical reality underscores the collaborative nature of green hydrogen transitions: both advanced economies such as those of Western Europe and Oceania and emerging markets in Eurasia and the Middle East and North Africa are expected to contribute to the global hydrogen transition and thus global energy security. Green hydrogen will transform energy pricing and the logic of international cooperation. It is not just exporters who will profit from this but also the importers who develop the required green hydrogen technology to maximize profits from the transformation of the world energy system. Water stress levels may constrain the technological progress of advanced economies

in Western Europe, as Figure 5 indicates. This is why Africa, Latin America, and Eurasia should also be part of the EU and Germany's global hydrogen diplomacy: traditional fossil fuel-rich economies may contribute to the production of blue hydrogen and the transport of green hydrogen using their existing networks.

The regionalization of energy relations as a result of the rise of green hydrogen in global energy markets will create new opportunities for the Turkish economy due to its strategic location between East and West and the projected hydrogen competition between China and the European Union.³⁴ Furthermore, a shift in European energy policy away from Russia and in the direction of Central Asia, the Middle East, and North Africa as well as sub-Saharan Africa will consolidate the renewed Cold War between Russia and the West as a result of Moscow's attack on Ukraine. Turkey's low-cost renewable power could transform it into a regional leader in green hydrogen production assuming that its water stress challenge is alleviated through the introduction of desalination infrastructure. Hence, the strategic convergence of energy policies between

the European Union and Turkey may produce important spillover effects in other policy areas such as security policy and regional economic cooperation. However, the drafting of a new trade strategy and the 15-point action plan intend to strengthen the political conditionality of EU trade agreements given the EU's strong normative commitments.³⁵ EU conditionality when it comes to democracy and the rule of law may generate challenges for extensive cooperation with Turkey in the area of energy trade.

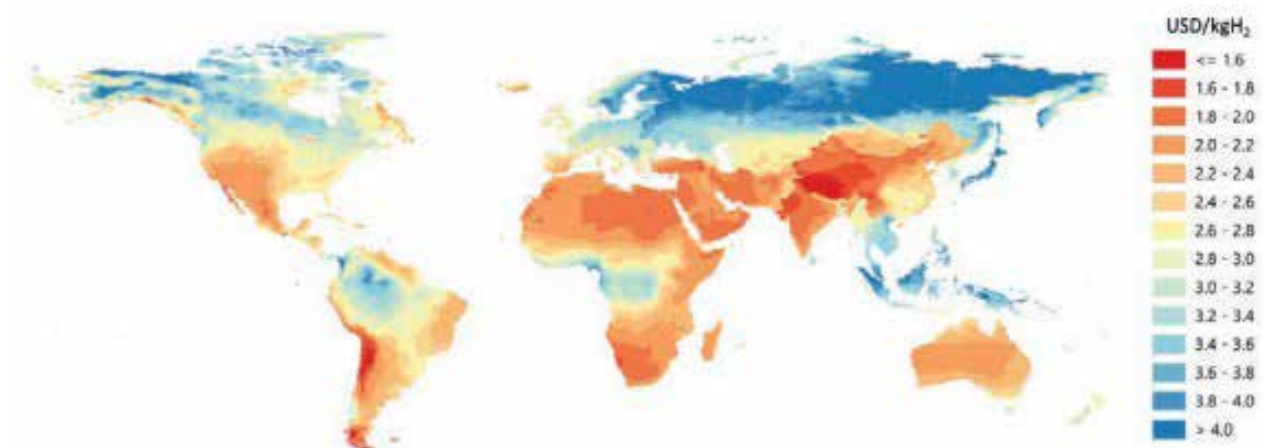
V. Hydrogen Perspectives and Policy Recommendations for Turkey

The two main contributors to the production cost of green hydrogen are: (1) the cost of electricity from renewables (50 to 90% of the levelized cost of hydrogen); (2) initial investment costs and efficiency of electrolyzers (USD 1,000–1,400/kW for alkaline electrolyzers). Other important considerations are the availability of fresh water (or sea water with incurred desalination costs estimated at USD 0.01–0.02/kg H₂) for electrolysis and adequate infrastructure for its transportation. According to the IEA, the global capacity of electrolyzers doubled over the last five years to reach just over 300 MW by mid-2021. The EU has set a target to increase electrolyzer capacity to 80 GW (40 GW in Europe, 40 GW in neighboring countries) by 2030.³⁶

Under these conditions, Turkey has the potential to become a country capable of feasible green hydrogen production and an exporter of the commodity to Europe (Figure 6). The country's key strengths are its potential renewable energy sources, geographic proximity to Europe, and its transportation infrastructure (e.g., ports and gas pipelines). The largest cost in the production of green hydrogen is the renewable electricity required to power the electrolyzer. Therefore, regions with higher potential for renewable energy will be more competitive in green hydrogen production. At 11 GW of installed capacity mostly in the Aegean and Marmara regions, wind power delivers about 10% of Turkey's electricity. The wind power potential of the country is estimated at 48 GW. Turkey ranked among the top five countries in Europe with EUR 1.6bn in new investments in wind energy in 2020 and is the fifth largest equipment producer exporting into 45 countries on six continents.³⁷

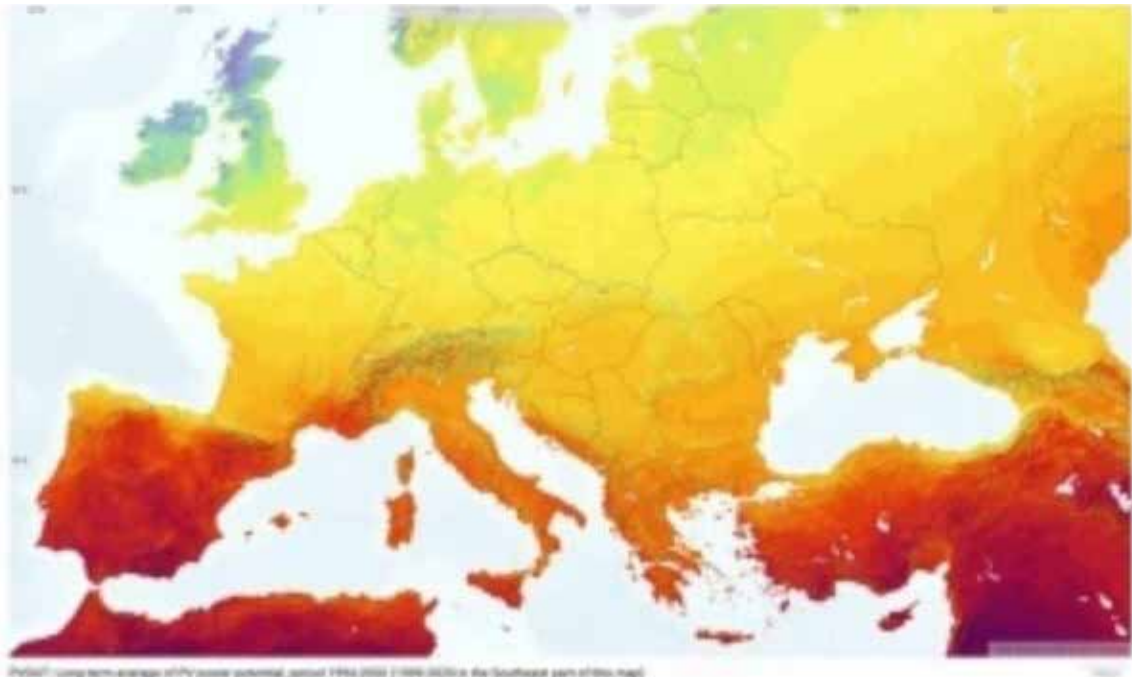
Turkey has 8 GW of installed solar power capacity, delivering about 4% of the country's electricity demand. Turkey's overall photovoltaic electricity potential is notable and peaks along the southern sea line (Figure 7). The Trans-Anatolian Gas Pipeline (TANAP) is a major corridor that links the South Caucasus Pipeline (SCP) and the Trans Adriatic Pipeline (TAP) (Figure 8). It was constructed to transport natural gas extracted from Azerbaijan's Shah Deniz Region initially to Turkey and then to Europe. Moreover, Turkey has about 8,000 km of coastline and 50 ports.

Figure 6: Hydrogen costs from hybrid solar PV and onshore wind systems in the long term



Source: IEA, 2019.³⁸

Figure 7: Photovoltaic Electricity Potential of Europe



Source: www.solargis.com.

Figure 8: Trans-Anatolian Natural Gas Pipeline



Source: www.tanap.com.

Turkey ratified the Paris Agreement in 2021 and committed to a zero-emissions target by 2053. It held its first Climate Council in February 2022 to discuss the country's road map to meet this objective. The conference was the first of its kind. The final declaration of the five-day assembly recom-

mended a national hydrogen strategy and road map before the end of the year.

It is also important to point out that more than 40% of Turkey's exports are to the European Union. The passing of the Carbon Border Adjustment

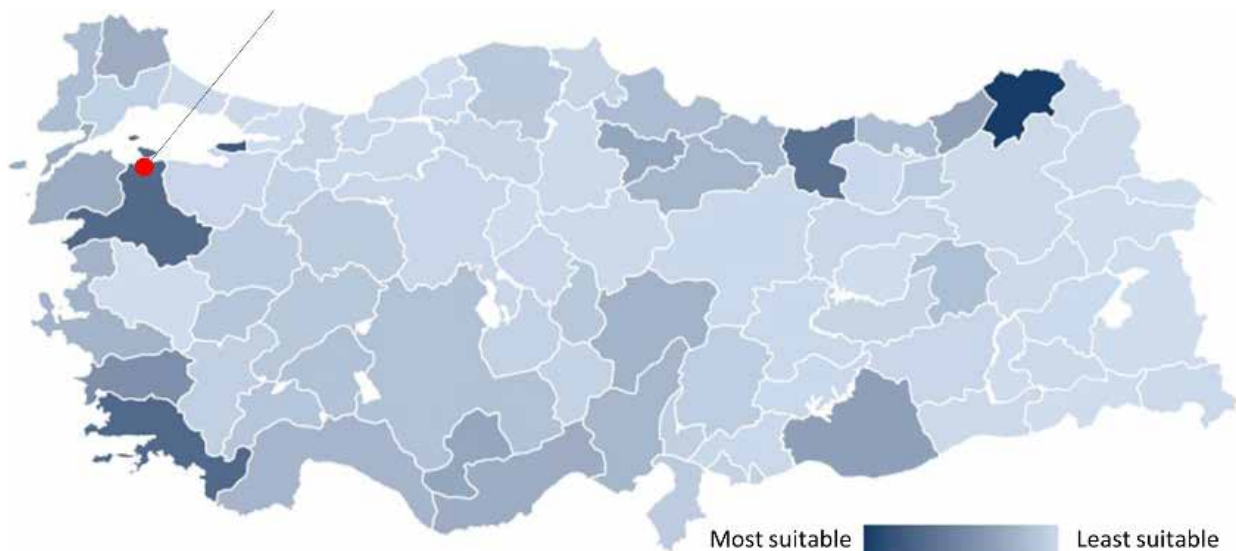
Mechanism (CBAM) legislation by the European Commission in 2022 will primarily tax businesses that export products to the EU based on the amount of their emissions. Currently, five groups of products (cement; iron and steel; aluminum; fertilizers; and electricity) are listed for environmental taxation purposes, but the scope may expand in the future to include hydrogen, as well. Developing green hydrogen production capacity will certainly be decisive for the achievement of the 2053 objective. In tandem, the adoption of green hydrogen in emission-intensive sectors such as cement and steel production will enable those businesses to remain competitive exporters to the EU. The strategy for Turkey to become a major player in green hydrogen production should include the following two short-run goals:

- 1 | Lower emissions with green hydrogen utilization
- 2 | Research and development of hydrogen production and transportation (pipelines and vessels).

Bandırma Energy Base

Shura³⁹ has published a comprehensive analysis on Turkey's outlook as a green hydrogen producer and exporter. The report identified the Artvin, Yalova, Muğla, Balıkesir, and Giresun districts as the most suitable candidates for green hydrogen exports and underlined the need for further investment (Figure 9). In January 2022 a five-party protocol was signed among pivotal enablers of hydrogen production in Turkey: Enerjisa Üretim (Turkey's largest private power generator), TÜBİTAK (Turkish National Science Foundation), Aspilsan (Turkish Military Battery Industries), Eti Maden (world's largest Boron producer), and the South Marmara Development Agency. The protocol aims to utilize Enerjisa Üretim's Bandırma Energy Base as a launching pad to produce green hydrogen, green methanol, and ammonium for research and development (Figure 9).

Figure 9: Province Suitability Rating (Green Hydrogen) and Enerjisa Üretim Bandırma Energy Base



Source: Shura, 2021.⁴⁰

The site has several strategic advantages. First, the Base holds two natural gas power plants (Bandırma I and Bandırma II operated by Enerjisa Üretim) at a total of 1,583 MW of installed capacity that feeds the most industrialized Marmara region of the country. These power plants are expected to remain in operation and stabilize the grid during the transition of the country to new wind and solar power capacity. The green hydrogen produced in the Base has the potential to be blended into the gas used by these two power plants without incurring extra transportation costs. Moreover, the Marmara region of Turkey is home to 16 of the top 30 natural gas power plants by installed capacity in the country. Secondly, the site is positioned in such a way to conveniently export green hydrogen to Europe. The TANAP line crosses the site, raising the potential to explore the possibility of blending. Furthermore, the Base is on the Marmara Sea shore and is licensed for port operations.

Policy Recommendations

- There is a need for a clear strategy with specific targets and a timeline to deploy green hydrogen in Turkey. The main policy objective should be to transform Turkey into a green hydrogen hub that can supply the European Union and possibly also the MENA region.
- In this context, it is crucial to establish the regulatory framework for the green hydrogen value-chain in order to eliminate uncertainties for investors in Turkey.
- Catalyzing the installment of additional renewable power generation capacity via regulatory adjustments would bolster green hydrogen production.
- The promotion of long-term power purchase agreements would offer sufficient financial guarantees so that European export credit agencies would support and therefore accelerate the deployment of green hydrogen in Turkey.
- Electrolyzer deployment is a key factor in green hydrogen production. Turkey is already a major manufacturing partner

for the EU and contributes to European supply chain resilience. Investment in electrolyzer manufacturing in Turkey should be supported to meet the upcoming demand domestically and in other countries.

- The EU and Turkey should jointly consider the installment of a direct hydrogen delivery infrastructure in the form of a pipeline that could consolidate the EU-Turkey hydrogen partnership in the long run.

VI. Concluding Remarks

In this policy brief, we discuss the potential role of green hydrogen for the EU and Turkish economies in light of the Russia-Ukraine war. Modeling a strategic game between a resource-poor, technologically advanced democracy and a resource-rich, technologically backward dictatorship indicates that a green hydrogen transition may compensate for the welfare losses incurred by the German and EU economies due to Russia's aggression in Ukraine and Eastern Europe. At the same time, Turkey appears to have the consolidated strategic potential to competitively supply green hydrogen to the EU and in that way strengthen its regional as well as global strategic leverage. The EU/German and Turkish commitments to a zero-emissions target create new political-economic conditions for the advancement of EU-Turkish relations and the strengthening of Turkey's position in the global security architecture.

Appendix

Proof of Proposition 1

Before providing a dynamic equilibrium solution, we propose static first-order conditions for both players:

$$\nabla u^A = \begin{bmatrix} \frac{\tau}{\kappa} \frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa} \\ \frac{1-c}{1-\varepsilon} \frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow \frac{\tau}{\kappa} = \frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}, \frac{1-c}{1-\varepsilon} = -\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon} \Rightarrow \kappa^* = \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}}, \varepsilon^* = 1 + \frac{1-c}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}}$$

$$\nabla u^B = \begin{bmatrix} \frac{1-d}{1-\kappa} \frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa} \\ \frac{\tau}{\varepsilon} \frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow \frac{1-d}{1-\kappa} = -\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}, \frac{\tau}{\varepsilon} = \frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon} \Rightarrow \kappa^* = 1 + \frac{1-d}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}}, \varepsilon^* = \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}}$$

To derive a static equilibrium solution, we proceed as follows:

$$\kappa^* = \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}} = 1 + \frac{1-d}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}} \Rightarrow \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}} - \frac{1-d}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}} = 1$$

$$\varepsilon^* = 1 + \frac{1-c}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}} = \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}} \Rightarrow \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}} - \frac{1-c}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}} = 1 \Rightarrow$$

$$\frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}} - \frac{1-d}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \kappa}} = \frac{\tau}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}} - \frac{1-c}{\frac{\partial J^A(\cdot)}{\partial g} \frac{\partial g}{\partial \varepsilon}}$$

The optimal share of technological endowment is monotonically increasing with the tax rate in a democracy; the same observation holds for the optimal share of energy endowment in a dictatorship. Interdependence between a democracy and a dictatorship, however, becomes less attractive when the marginal cost of public goods provision is rising. The optimal share of energy endowment in a democracy is monotonically decreasing with the marginal cost of public goods provision; similarly, the optimal share of technological endowment in a dictatorship is falling with the marginal cost of public goods provision, as well.

Proof of Proposition 2

To identify the equilibrium solution to this dynamic game, we need to provide threshold conditions for the key exogenous variables of our model. The first one is the level of global political risk ζ_t and the second one is the parameter $n \in (1, +\infty)$, which defines the positive impact of green hydrogen transition on the utility of the democracy. Therefore, to derive the threshold conditions for our equilibrium solutions, we compare the payoffs from fossil fuel rent-seeking and conflict ex-post for the dictatorship, as well as the payoffs from the green hydrogen transition and constrained sustainability for the democracy:

$$\begin{aligned}
 & \Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon_t = \varepsilon^H, \kappa_t = \kappa^L) \geq \Theta^A(P, \zeta^H = \zeta + \delta) \Rightarrow \\
 & u^A + \beta \left[v \Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon^H, \kappa^L) + (1-v) \Theta^A(F, \zeta^L = \delta) \right] \geq \frac{\zeta + \delta}{1-\beta} \Rightarrow \\
 & \Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon_t = \varepsilon^H, \kappa_t = \kappa^L) = \tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon, \kappa) + \\
 & + \beta \left[v \Theta^A(F, \zeta^H = \zeta + \delta, \varepsilon^H, \kappa^L) + (1-v) \Theta^A(F, \zeta^L = \delta) \right] \Rightarrow \\
 & \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) - \Theta^A(F, \zeta^L) = \tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) - \tau \ln \varepsilon^H - (1-d) \ln(1-\kappa^H) + J^A(g; \varepsilon^H, \kappa^H) \Rightarrow \\
 & \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) - \Theta^A(F, \zeta^L) = (1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \left[J^A(g; \varepsilon^H, \kappa^L) - J^A(g; \varepsilon^H, \kappa^H) \right] \Rightarrow \\
 & \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) - \Theta^A(F, \zeta^L) = (1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \Rightarrow \\
 & \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) = \tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) + \beta v \left[(1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right] + \\
 & + \beta \left[\Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) - (1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right] \Rightarrow \\
 & (1-\beta) \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) = \tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) + \beta v \left[(1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right] - \\
 & - \beta \left[(1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right] \Rightarrow \\
 & (1-\beta) \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) = \tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) + \beta(v-1) \left[(1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right] \Rightarrow \\
 & (1-\beta) \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) = \tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) + \beta(v-1) \left[(1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right] \Rightarrow \\
 & \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) = \frac{\tau \ln \varepsilon^H + (1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) + \beta(v-1) \left[(1-d) \left[\ln(1-\kappa^L) - \ln(1-\kappa^H) \right] - \Delta J^A \right]}{1-\beta} \Rightarrow \\
 & \Theta^A(F, \zeta^H, \varepsilon^H, \kappa^L) = \frac{\tau \ln \varepsilon^H + (1+\beta(v-1)) \left[(1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) \right] + \beta(v-1) \left[J^A(g; \varepsilon^H, \kappa^H) - (1-d) \ln(1-\kappa^H) \right]}{1-\beta}
 \end{aligned}$$

Therefore, we rewrite as follows:

$$\begin{aligned}
 & \frac{\tau \ln \varepsilon^H + (1+\beta(v-1)) \left[(1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) \right] + \beta(v-1) \left[J^A(g; \varepsilon^H, \kappa^H) - (1-d) \ln(1-\kappa^H) \right]}{1-\beta} \geq \frac{\zeta + \delta}{1-\beta} \Rightarrow \\
 & \zeta \leq \tau \ln \varepsilon^H + (1+\beta(v-1)) \left[(1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) \right] + \beta(v-1) \left[J^A(g; \varepsilon^H, \kappa^H) - (1-d) \ln(1-\kappa^H) \right] - \delta \Rightarrow \\
 & \zeta^* = \tau \ln \varepsilon^H + (1+\beta(v-1)) \left[(1-d) \ln(1-\kappa^L) - J^A(g; \varepsilon^H, \kappa^L) \right] + \beta(v-1) \left[J^A(g; \varepsilon^H, \kappa^H) - (1-d) \ln(1-\kappa^H) \right] - \delta
 \end{aligned}$$

This derivation shows us that for below-threshold levels of global political risk such that $\zeta \leq \zeta^*$, the fossil fuels rent-seeking equilibrium is preferable to conflict ex-post for the dictatorship. If, however, the levels of global political risk surpass the de-

finied threshold ζ^* , then conflict ex-post becomes more attractive for an energy-rich dictatorship.

Similarly, we derive a threshold for the magnitude of the green hydrogen transition:

$$\begin{aligned} \frac{\tau \ln \kappa^n - J^\Delta(\mathbf{g}; \kappa, 0)}{1-\beta} &\geq \Theta^\Delta(\mathbf{S}, \zeta^H, \varepsilon^L, \kappa^H) = u^\Delta + \beta \left[v \Theta^\Delta(\mathbf{S}, \zeta^H, \varepsilon^L, \kappa^H) + (1-v) \Theta^\Delta(\mathbf{S}, \zeta^L) \right] \Rightarrow \\ \frac{n \tau \ln \kappa - J^\Delta(\mathbf{g}; \kappa, 0)}{1-\beta} &\geq \Theta^\Delta(\mathbf{S}, \zeta^H, \varepsilon^L, \kappa^H) = u^\Delta + \beta \left[v \Theta^\Delta(\mathbf{S}, \zeta^H, \varepsilon^L, \kappa^H) + (1-v) \Theta^\Delta(\mathbf{S}, \zeta^L) \right] \Rightarrow \\ \Theta^\Delta(\mathbf{S}, \zeta^H, \varepsilon^L, \kappa^H) - \Theta^\Delta(\mathbf{S}, \zeta^L) &= (1-c) \left[\ln(1-\varepsilon^L) - \ln(1-\varepsilon^H) \right] - \left[J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) - J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) \right] \Rightarrow \\ \frac{\tau \ln \kappa^H + (1+\beta(v-1)) \left[(1-c) \ln(1-\varepsilon^L) - J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) \right] + \beta(v-1) \left[J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) - (1-c) \ln(1-\varepsilon^H) \right]}{1-\beta} & \end{aligned}$$

In the same pattern as above, we rewrite as follows:

$$\begin{aligned} n \tau \ln \kappa^H - J^\Delta(\mathbf{g}; \kappa, 0) &\geq \tau \ln \kappa^H + (1+\beta(v-1)) \left[(1-c) \ln(1-\varepsilon^L) - J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) \right] + \beta(v-1) \left[J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) - (1-c) \ln(1-\varepsilon^H) \right] \Rightarrow \\ n \tau \ln \kappa^H &\geq J^\Delta(\mathbf{g}; \kappa, 0) + \tau \ln \kappa^H + (1+\beta(v-1)) \left[(1-c) \ln(1-\varepsilon^L) - J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) \right] + \beta(v-1) \left[J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) - (1-c) \ln(1-\varepsilon^H) \right] \Rightarrow \\ n &\geq \frac{J^\Delta(\mathbf{g}; \kappa, 0) + \tau \ln \kappa^H + (1+\beta(v-1)) \left[(1-c) \ln(1-\varepsilon^L) - J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) \right] + \beta(v-1) \left[J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) - (1-c) \ln(1-\varepsilon^H) \right]}{\tau \ln \kappa^H} \Rightarrow \\ n &\geq 1 + \frac{J^\Delta(\mathbf{g}; \kappa, 0) + (1+\beta(v-1)) \left[(1-c) \ln(1-\varepsilon^L) - J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) \right] + \beta(v-1) \left[J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) - (1-c) \ln(1-\varepsilon^H) \right]}{\tau \ln \kappa^H} \Rightarrow \\ n^* &= 1 + \frac{J^\Delta(\mathbf{g}; \kappa, 0) + (1+\beta(v-1)) \left[(1-c) \ln(1-\varepsilon^L) - J^\Delta(\mathbf{g}; \varepsilon^L, \kappa^H) \right] + \beta(v-1) \left[J^\Delta(\mathbf{g}; \varepsilon^H, \kappa^H) - (1-c) \ln(1-\varepsilon^H) \right]}{\tau \ln \kappa^H} \end{aligned}$$

For values of $n \geq n^*$ the green hydrogen transition constitutes a preferable equilibrium solution to constrained sustainability, whereas the opposite holds for $n < n^*$.

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The Istanbul Policy Center-Sabancı University-Stiftung Mercator Initiative aims to strengthen the academic, political, and social ties between Turkey and Germany as well as Turkey and Europe. The Initiative is based on the premise that the acquisition of knowledge and the exchange of people and ideas are preconditions for meeting the challenges of an increasingly globalized world in the 21st century. The Initiative focuses on two areas of cooperation, EU/German-Turkish relations and climate change, which are of essential importance for the future of Turkey and Germany within a larger European and global context.

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