COMPLICATING THE TRILEMMA: NEW EXPLANATIONS FOR ENERGY POLICY DIVERGENCE IN THE EUROPEAN UNION AND UNITED KINGDOM

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Dedication

This paper is dedicated to the people of Ukraine, for their tremendous display of courage and resilience in upholding the values of democracy, sovereignty, and freedom. It is also dedicated to all those in Europe who have sacrificed, often in the form of energy insecurity or great personal cost, to provide aid to the people of Ukraine, and fight for a future of more affordable, reliable, and sustainable energy to power our planet.

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Complicating the Trilemma:
New Explanations for Energy Policy Divergence in the European Union and United Kingdom

Abstract
This paper examines the decoupling of energy policy of the European Union and the United Kingdom in the decade preceding 2022. Previously on a tightly aligned path to an energy union, the two polities' responses to the COVID-19 pandemic and Russia's invasion of Ukraine have revealed significant differences in their approaches to the "energy trilemma": environmental sustainability, energy security and energy equity. While "Brexit" offers a surface level explanation for policy change, it does not fully address divergent approaches to energy regulation, where the espoused goals are often similar across both the EU and UK. First, empirical shifts in policy along the dimensions of the energy trilemma are observed in government documents and secondary literature. This paper then complicates the energy trilemma, proposing two significant additions to the framework that explain policy changes: institutional shifts and systemic shocks. It is found that institutional decoupling emerged even during the UK's integration into the EU, enabling divergent responses to major economic, geopolitical and technological shocks. The right balance of integrated institutions and local adaptations could enable a united Europe to withstand shocks to the system, but the 2022 energy crisis may prove to be yet another decisive moment for the European project.

Zusammenfassung
Diese Arbeit untersucht die Entkoppelung der Energiepolitik der Europäischen Union und des Vereinigten Königreichs im vergangenen Jahrzehnt. Obwohl sie sich vorher auf einem Integrationsweg befunden, zeigen die Reaktionen der beiden Staatswesen auf die COVID-19-Pandemie und auf die Invasion Russlands der Ukraine wichtige Unterschiede in ihren Interpretationen der Bestandteile der „Energie-Trilemma": Nachhaltigkeit, Energiesicherheit und Energiegerechtigkeit. Während „Brexit" eine oberflächliche Erklärung für Divergenz in der Politik bietet, geht es nicht vollständig auf unterschiedliche Ansätze zur Energieregulierung ein, bei denen die vertretenen Ziele in der EU und im Vereinigten Königreich häufig ähnlich sind. Erstens werden in Regierungsdokumenten und in der Sekundärliteratur empirische Verschiebungen in der Politik entlang der Dimensionen der Energie-Trilemma beobachtet. Diese Arbeit verkompliziert dann das Energie-Trilemma, indem sie zwei bedeutende Ergänzungen des Konzepts vorschlägt, die Politikveränderungen erklären: institutionelle Verschiebungen und systemische Schocks. Es wird festgestellt, dass die institutionelle Entkopplung sogar während der Integration des Vereinigten Königreichs in die EU entstand, was unterschiedliche Reaktionen auf große wirtschaftliche, geopolitische und technologische Schocks ermöglichte. Das richtige Gleichgewicht zwischen integrierten Institutionen und lokalen Anpassungen könnte es einem vereinten Europa ermöglichen, Schocks des Systems standzuhalten, aber die Energiekrise 2022 könnte sich als ein weiterer entscheidender Moment für das europäische Projekt erweisen.

Keywords: energy policy, european integration, institutional change, sustainability, ukraine

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Introduction

In its modern history, the European project has largely been one of convergence and integration, though not without significant divergences and setbacks. Nonetheless, such challenges and crises, whether military conflict or economic emergency, have often served as pivotal moments in the continent's history that ultimately strengthened and progressed its binding institutions. The very foundations of its modern union, in particular the European Coal and Steel Community and Euratom, were born out of a need to collectively manage energy and resources following the Second World War, placing energy policy squarely in the heart of European political convergence[1]. While there are widely varying definitions for what constitutes energy policy, this paper uses the concept of the "energy trilemma", coined by the World Energy Council, to comprehensively examine three key elements which are considered difficult to balance: energy security, energy equity (or access) and environmental sustainability[2].

By 2010, European Union had largely achieved unification in its vision and implementation strategy for energy policy. Through the adoption of EU review of the Emissions Trading System (ETS) and mandatory standards in both climate policy and security, the UK and today's 27 EU member states had converged their policy approaches significantly by delegating authority to the supranational level[3]. In the period immediately following, particularly the decade spanning 2012-2022, growing divergences in the policy of the UK and EU become observable for the first time since the early 2000s, and continue to increase through early 2022. With Brexit and the rise of Euroscepticism as the backdrop, many observers viewed this period as the gravest

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[1] "Schuman declaration May 1950", Directorate-General for Communication, European Commission, EU, 2022, https://european-union.europa.eu/principles-countries-history/history-eu/1945-59/schuman-declaration-may-1950.
[2] "World Energy Trilemma Index", World Energy Council, 2022, https://www.worldenergy.org/transition-toolkit/world-energy-trilemma-index.
[3] Mateo Ciucci, "Energy policy: general principles", Fact Sheets on the European Union, EU, October, 2022, https://www.europarl.europa.eu/factsheets/en/sheet/68/energy-policy-general-principles.

threat yet to European integration, especially with the major political and economic shocks of 2022.

Today, with energy once again at the forefront of public concern and policymakers' agenda, it is critical to consider the implications of policy divergence and convergence on the future of the European project. As of November, 2022, the European Commission sees energy policy as its top policy priority alongside solidarity with Ukraine[1]. Beneath the surface, analysis shows that climate and energy collaboration between the EU and UK remains strong, even in the face of, or perhaps, because of, increasing external threats to energy security and sustainability goals. Why then, did significant portions of energy policy goals and strategies between the UK and EU diverge in the previous decade? While the purpose of this paper is not to identify whether this period has been a critical juncture or make predictions about the future, leaders would do well to understand how economic, technological, and political factors shape their governments' responses to future challenges which may well be key to the wellbeing of their citizens. Primarily, this research benefits policymakers and those working in civil society, or those working to further international collaboration, especially in the EU. In the context of energy, this research will contribute to a deeper understanding of the trade-offs relevant to developing policy advancing security, sustainability, and equity. Beyond energy, developing a better long-term understanding of how institutions may evolve and respond differently based on both their underlying structures and their exposure to major shocks will be critical to ensuring the long-term resilience within and collaboration across institutions. Such understanding will help practitioners and analysts potentially anticipate other realms of policy which may diverge or converge. In this vein, businesses and civil organizations are major stakeholders in the process of

[1] Your Gateway to the European Union: In Focus, EU, 2022, https://european-union.europa.eu/index_en.

influencing and implementing policy and can benefit significantly from better understanding the decisions facing policymakers, and in which direction difficult trade-offs may tilt.

To answer the key question of why energy policy diverged in the EU and UK, changes in the outcome variable "policy change" will be examined over a ten-year period and broken down into its three trilemma components: energy security, energy equity and environmental sustainability. Two sets of explanatory variables will be tested against this model: first, systematic differences in underlying systems and institutions that influence past and ongoing policymaking, and second, the way in which exogenous shocks both directly and indirectly affect policymaking. "Direct effects" in this context refers to the way in which an institution immediately responds to a shock, such as the implementation of a price cap in the face of rising energy costs. "Indirect effects" refers to the manner in which shocks may embed themselves into systems and institutions and become systemic factors (e.g. the rise of a populist movement can permanently change the dynamics of how policy is made).

Pulling together past research and recent evidence from EU and country-level policy actions shows that the energy trilemma model is indeed a helpful lens in explaining policy divergences. Exogenous shocks can be categorized according to which element of the energy trilemma they primarily impact, and subsequently filter through to policy decisions. Differences in underlying political and economic institutions across the EU and UK with different mechanisms for absorbing and responding to major shocks in the 2012-2022 timeframe seem to have led to the largest energy policy divergence in half a century. In summary, differences in the European governments' responses to political, economic, and technological shocks are defined by trilemma trade-offs and caused by systemic shifts, explaining much of the divergence in climate policy, such as varied approaches to balancing energy security and sustainability,

enhancing digital capabilities while ensuring equity, and navigating geopolitical implications across all three dimensions.

Four factors are considered in determining the appropriateness of the UK and EU as polities that make for an apt and valuable comparison. Firstly, these are two political entities whose energy politics were on a path of convergence and interdependence throughout the second half of the 20th century. Second, both are neighbors and advanced economies with robust and democratic institutions which have effectively been exposed to the same exogenous shocks over the past decade. Third, though not a perfect comparison, neither the UK nor the EU is a classic nation-state, as both contain multiple countries and elements of multipolar decision-making that drive policy. Finally, and perhaps most importantly, the role of the nation-state as a decision-maker is de-emphasized, and this paper is focused specifically on policymaking apparatuses within political constructs, and on comparison on the institutional level.

This paper is organized in five sections. The literature review begins by providing important background for the European context, establishing the key ways in which policies have converged and diverged over time and identifying relevant points of parity and difference to be further explored in the following section. It then evaluates the existing explanations for institutional change from both a generalizable perspective, as well as in applied political science, and defines the main concepts used in the paper. The analysis advances a hypothesis for explanatory variables and their mode of transmission into policy differences in the UK and EU is introduced. Next, case studies are used to introduce additional qualitative and quantitative evidence and better evaluate the hypothesis. Finally, a conclusion is reached and implications for future study and practitioners are elaborated.

Literature Review

Much work has been done to understand underlying drivers of government decision-making and the process of how policy comes to be, including several critical political science frameworks that have proven useful in past analyses. Combining together several larger bodies of work, there are four broad categories of explanations that contribute towards understanding shifts in energy policymaking which will be covered in this section:

1. First, the literature covers the applications of the "energy trilemma" as a useful framework in understanding the constraints and trade-offs facing policy makers when confronted with issues in the realm of energy.
2. Second, this section covers the body of work establishing that policy differences did indeed emerge after a "period of convergence", or the post-war period in European history in which dynamics of economic and political integration pulled policy together across previously divergent nation states.
3. Third, this literature review accepts past work showing that policy decisions can change substantially due to evolutions in institutional structures alone. That is, while substantive changes in economic and environmental conditions affecting the basis of decision-making may change, shifts in the political processes themselves have, in some cases, instigated significant policy shifts. However, because issues of energy policy in the European Union and the United Kingdom's departure from the EU are recent and ongoing topics, direct scholarly commentary on the question of which factors influence recent policymaking decisions is relatively shallow.
4. Fourth, this section synthesizes past explanations for energy policy change through the lens of the trilemma. As such, this literature review begins by introducing a framework,

conducting a high-level analysis of differences between key institutions' policies within the case regions, then goes on to explore existing explanations in theoretical literature, before synthesizing all three.

This section concludes that while all these explanations are useful for establishing a baseline understanding of policy change, both in a generalizable manner as well as in the realm of energy specifically, the field lacks a unifying explanation for how all of these dynamics interact. That is, how did systemic change coincide with significant shocks to produce policy divergence after such a strong and long-established trend of policy integration?

The Energy Trilemma: A Framework for Energy Policy Tradeoffs

Existing approaches in political science have delivered strong explanations for individual drivers of policy change. Additionally, causes and motivations for specific energy policies around the world have been analyzed and understood. However, models that cut across multiple bodies of literature, considering endogenous factors, exogenous shocks, trade-offs, and the interaction between variables have rarely been applied to the field of energy, nor to explain divergence between two states where there was once strong convergence. One model that has gained broad acceptance in the field of energy is that of the "energy trilemma", a trade-off model that describes the difficulty of balancing three pillars of energy policy[1]. This paper advances an application of existing models for institutional change on the energy trilemma to develop a new framework explaining how energy policy change emerges through interactions between institutions and exogenous shocks on elements of the trilemma. In its simplest representation, the energy trilemma implies a tradeoff between energy security (policies enabling a country to meet energy demand), energy equity (reliably providing affordable energy) and environmental

[1] "The Energy Trilemma Index", World Energy Council, 2022.

sustainability, as measured primarily by CO2 emissions[1]. In the sample depiction below, policy forgoes some measure of energy security to prioritize the axis of sustainability and equity.

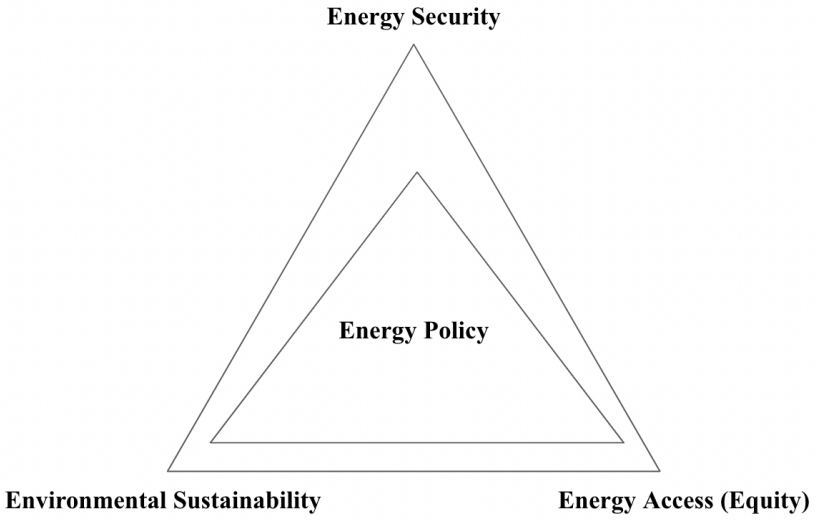

Figure 1: Basic representation of the energy trilemma in its original form[2].

Establishing & Describing Policy Evolution

Before examining the academic literature, a trend of policy divergence in the case region is established and described, so that existing explanations for change can be discussed in context. As discussed, this paper primarily advances the energy trilemma, combined with existing institutional explanations, as the main lens of analysis. As such, its three components, energy security, energy equity and environmental sustainability, are broken out as pillars of energy policy to establish key differences in the case regions. The policymaking institutions of the UK and EU are used as the primary case studies and unit of analysis in this paper, with occasional references to country-specific institutions. However, as EU energy policy in 2022 is a shared

[1] "The Energy Trilemma Index", World Energy Council, 2022.
[2] *Ibid*.

responsibility between EU bodies and member state governments[1], this paper generally assumes that EU-wide policy is implied unless otherwise mentioned.

It is important to begin by mentioning that within the global context, energy policy is, on the whole, quite similar across the EU and UK. As close allies having undergone more than 50 years of integration, it should not come as a surprise that headline policy goals are roughly aligned. This paper does not serve to measure the magnitude of difference, but instead observes a recent reversal in the direction of divergence rather than convergence, and attempts to explain the trend of change relative to the baseline of the early 2000s. Many of the shocks to be discussed, whether Brexit or the energy crisis, are still underway, and there is still significant parity of energy policy across the two regions, especially when observed on an outcome goal level[2]. The purpose of this comparison is not simply to note similarities but also to acknowledge that magnitudes of differences are small, but the very fact that policies are diverging in a region typically noted for its close collaboration is remarkable. For example, both the UK and EU place significant emphasis on investment in renewables. However, though the UK has specific goals for wind and tidal energy, some experts believe current policy is not enough to meet goals[3]. The EU's banner sustainability goal, 55% emissions reduction by 2030, is less ambitious than the UK's 68%, and its current path towards this is unclear due to the current crisis[4]. These nuances, in comparison, are important in drawing out the underlying drivers.

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[1] Ciucci, "Energy policy: general principles", 2022.

[2] "Post-Brexit relations on energy fall under the EU-UK Trade Cooperation Agreement and the Euratom-UK Agreement.", European Commission, EU, 2022, https://energy.ec.europa.eu/topics/international-cooperation/key-partner-countries-and-regions/united-kingdom_en.

[3] Sarah George, "Report: Most energy execs don't believe UK will meet 2030 renewables capacity targets", Edie, Oct 12, 2022, https://www.edie.net/report-most-energy-execs-dont-believe-uk-will-meet-2030-renewables-capacity-targets/.

[4] "Climate Action Tracker: Country Reports", The Consortium, 2022, https://climateactiontracker.org/countries/uk/#:~:text=We%20rate%20the%20UK's%202030,target%20and%20its%20climate%20finance.

Historical Overview: 1951-2012, a Period of Convergence

Before going into how and why policy diverged in the regions of focus, it is useful to lay out a brief overview of some of major policy trends leading up to the last decade in European energy in which the dynamics of the energy trilemma were first documented. As some spectators may argue that policy has remained aligned or that convergences outweigh divergences, this section primarily serves the purpose of arguing that policy did indeed diverge significantly. Many such counterarguments note that the trade of energy in Europe can be traced back to the beginnings of the industrial revolution, but recognize only the autarkic years of European fascism in the 1930s and 40s, as major policy divergences[1]. Indeed, the post-war 1950s are often seen as the beginning of modern Europe, with resource unions such as the European Coal and Steel community serving as the starting points for European treaties[2].

In the period following, the tradeoffs of the energy trilemma are clearly notable. Modern energy policy can be said to have its roots in the oil crisis of the 1970s. With the oil embargo motivated by Western support for Israel during the Yom Kippur war, a major instance of politically motivated energy policy and shock to the *energy security* element of the trilemma is observable[3]. As such, the 1973 oil crisis was also the first among a series of empirically documented modern recessions bookended by at least one energy price shock. In this period, as in 2022, policymakers in the UK and Europe were faced with economic tradeoffs, ultimately deciding in favor of an oil price cap which led major shortages throughout the continent and taught leaders perhaps their first lesson about the trilemma[4]. Coincidentally, the UK joined the

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[1] Astrid Kander, Paul Warde, Henriques Teive, Sofia Nielsen, *et al*, "International Trade and Energy Intensity During European Industrialization", 1870–1935, *Ecological Economics*, 139, issue C (2017), p. 33-44, https://EconPapers.repec.org/RePEc:eee:ecolec:v:139:y:2017:i:c:p:33-44.
[2] "Schuman declaration May 1950", 2022.
[3] Gavin Bridge, "Energy (in)Security: World-Making in an Age of Scarcity." *The Geographical Journal* 181, no. 4 (2015): 328–39. http://www.jstor.org/stable/43868664.
[4] *Ibid.*, p.234.

EU that same year, so 1973 can be viewed as both the beginning of modern dynamics in energy policymaking, as well as the beginning of the formal convergence of EU and UK energy policy as a whole.

Throughout the 1970s and 1980s, the UK, especially its Conservative governments participated heavily in European integration, within only minimal opt-outs, none of which applied directly to energy. Ratification of the Single European Act in 1992 established a single market, including for energy and energy commodities[1]. This major revamp of the EU's founding treaty (Treaty of Rome, 1953), in turn paved the way for the creation of the EU's Internal Energy Market in 1996, of which the UK was then a part[2]. The EU considers liberalization of energy markets as both one of its greatest requirements and achievements under this new paradigm, aligning cleanly with then Prime Minister Margaret Thatcher's domestic priorities at the time[3].

Finally, by the early 2000s, the EU had aligned member states not only on market liberalization and integration (contributing to improved *energy equity* and *energy security*), but also on *environmental sustainability*, the third pillar of the trilemma. The 1997 Kyoto Protocol bound not only European Nations but also most of the world to emissions reductions until 2012, the year at which this paper begins to consider policy decoupling between the EU and UK[4]. In the final years of policy convergence, beginning in 2006, the European Commission's green paper *A European Strategy for Sustainable, Competitive and Secure Energy* laid out intentions

[1] Ina Sokolska, "Developments up to the Single European Act", Factsheets on the Eurpean Union, May, 2002, https://www.europarl.europa.eu/factsheets/en/sheet/2/developments-up-to-the-single-european-act.
[2]Amato, G., Bribosia, H., De Witte, B., Genesis and destiny of the European Constitution, Bruylant, Brussels, 2007, p. 14.
[3] Nicholas Sowels, "From the "Thatcherisation of Europe" to Brexit", Revue Française de Civilisation Brittanique, XXIV-4, 2019, https://journals.openedition.org/rfcb/4819.
[4] "Memo: Kyoto Protocol", European Commission, Brussels, March 4, 2004, https://ec.europa.eu/commission/presscorner/detail/en/MEMO_04_43.

for a common energy policy across all three dimensions of the trilemma, as its title suggests[1]. In addition to the sustainability proposals which form the EU's core climate policy today, this proposal laid out policy priorities such as "improving relations with the EU's neighbors including Russia", to be counterbalanced by the unbundling of energy supply from distribution networks to improve security[2]. Finally, the plan heavily emphasized the importance of technology investment as a planned positive shock to environmental sustainability, including smart grid planning and carbon capture and sequestration[3].

A Turning Point: 2012-2022, A Decade of Divergence

The existing literature and retrospective analysis make clear that by the early 2010s, signs of potential policy fragmentation had emerged, though no single event appeared to be a major threat. Ironically, the major systemic risks were perhaps enabled by a major treaty intended to strengthen the union and drive additional convergence. The Lisbon Treaty came into effect in 2009 and planted the seeds for the possibility of a British exit from the European Union through the introduction of an exit clause for the first time[4]. Additionally, energy and environment were explicitly established as "areas of shared competence", providing for member state independence in areas where the EU has not ruled, such as managing their own national energy mix. Gas markets, for example, were left non-fungible and not governed by the EU[5].

In the following period, the UK, beginning in 2010, began pursuing its largest domestic energy policy changes since its liberalization push in the 1980s and 1990s as part of the EU

[1] "Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy", European Commission, Brussels, August 3, 2006, https://europa.eu/documents/comm/green_papers/pdf/com2006_105_en.pdf
[2] *Ibid.,* 5.
[3] *Ibid.*, 13.
[4] Eeva Pavy, "The Treaty of Lisbon", Fact Sheets on the European Union, May 2022, https://www.europarl.europa.eu/factsheets/en/sheet/5/the-treaty-of-lisbon.
[5] *Ibid.*

Internal Energy Market[1]. On the energy equity dimension, the UK also began to offer more targeted support for households and structural remedies around this time, compared with the EU's market-based approach. With the 2010 Energy Act and supporting studies by the Office of Gas and Electricity Market (Ofgem) in the form of the "Energy Supply Probe" and Retail Market Review", access and affordability began to emerge as a major tenet of UK energy policy. Studies revealed structural barriers to affordability for UK consumers; despite attempts to tackle these through the Fuel Poverty Strategy, home fuel prices continued to increase more than 10% through 2015[2]. That year, the CMA's finding of overcharging led to a structural remedy imposing price caps for some customers[3]. Parallelly, the UK's approach to the *environmental*-to-*security* axis of the energy trilemma focused significantly on supply side solutions, aiming to maintain reliability of supply through investments in flexible capacity and green energy generation. The Energy and Climate Change Select Committee, for example, recommended both investments in storage and energy efficiency[4].

A major divergence in this period was the two regions' approach to nuclear energy and energy mix overall. The UK effectively tightened the linkages between its environmental and security policies, using nuclear energy as a means of improving economics among that axis of the energy trilemma. While Germany commenced its nuclear phase-out plan in 2011, the UK remained open to new nuclear build, a member of the House of Lords summarizing the approach as "however we do not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon targets"[5]. Shortly thereafter, the UK's 2013

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[1] "Energy White Paper: Meeting the Energy Challenge", *UK Department of Trade and Industry*, May, 2007.
[2] "Energy Supply Probe – Initial Findings Report". Ofgem, October, 2008, ofgem.co.uk
[3] "Consultation on a proposal to make a market investigation reference in respect of the supply and acquisition of energy in Great Britain", Ofgem, 2014, ofgem.co.uk.
[4] *Ibid.*
[5] Lord Jordan, British House of Lords, 2014, https://publications.parliament.uk/pa/ld200304/ldhansrd/vo040115/text/40115-21.htm

Energy act aimed to close a number of coal power stations over the following two decades, reduce dependence on fossil fuels and provide financial incentives to reduce energy demand[1]. The construction of a new generation of nuclear power stations would be facilitated, helped by the establishment of a new Office for Nuclear Regulation[2].

By 2020, Brexit marked the most palpable milestone in policy decoupling, effectively removing the UK from the Internal Energy Market and unshackling it from EU climate targets. Still, the UK continues to benefit heavily from trade with the EU, and which would remain an important energy supplier even if the contours of trade change[3]. Focusing purely on fossil fuel energy security, the declining productivity of the North Sea oil fields motivated the UK to place an early emphasis on energy independence while the EU continued to foster its relationship with Russia. However, the UK already had a much higher "base" energy sufficiency compared to the EU, which imports about 50% of its energy compared to the UK's 8%[4]. Similarly, the UK had a relatively low percentage of imported natural gas, but also low reserve levels, putting pressure on prices. The EU, by contrast, was more dependent on bilateral negotiations with Russia, Ukraine, and Middle East states[5]. Logically, both the UK and EU would benefit from a reduction of bilateralism and continued creation of a common market given their largely aligned political interests, though it was precisely those political interests that were questioned in the lead-up to Brexit. Today, the EU's policy of increasing transparency and cooperation effectively allows the

[1] "Five Year Review of the Energy Act 2013", UK Department for Business, Energy and Industrial Strategy, 2013, https://assets.publishing.service.gov.uk/government /file/1075058/energy-act-2013-five-year-review.pdf
[2] *Ibid.*, 13
[3] "Post-Brexit relations on energy fall under the EU-UK Trade Cooperation Agreement.", European Commission, 2022.
[4] "From where do we import energy?", European Commission, 2022, https://ec.europa.eu/eurostat /infographs/energy/bloc-2c.html
[5] *Ibid.*

UK to "ride the coattails" of multilateralism without developing a formal relationship or policy around this.

Finally, on the sustainability component of the trilemma, the EU is targeting a 55% reduction of 1990 carbon emissions levels by 2030, in line with the Paris Agreement objectives to limit warming to 1.5 degrees[1]. Additionally, European Parliament has adopted binding legislation to make member states collectively climate neutral by 2050[2]. The UK Government climate change targets are to produce 30% of electricity from renewable sources by 2020, to cut greenhouse gas emissions by 50% on 1990 levels by 2025 and by 80% on 1990 levels by 2050[3]. It will also likely use nuclear energy for a longer period to achieve this. Finally, the overarching frameworks to measure targets differ: the UK developed a "Carbon Budget" approach, creating a total allowance for emissions, vs. while the EU focuses more on a percentage reduction[4]. Finally, the technological mechanisms targeted to achieve transformation vary as well. There is also lower emphasis placed on hybrid or alternate fuel cars in UK, which now has less funding due to Brexit restricting access to EIB funds[5]. Overall, the past decade of policy has shown significant divergence in the approaches of the UK and EU; in addition to the above analysis, the table below provides supplementary detail in a concise overview using the same sources.

Figure 2: Summary of EU and UK Policy Divergence

By 2010

	Security	**Climate**	**Access**
EU	Strengthens pre-existing cross-state energy security measures, for example	Near full unification of member state climate policy. Aiming for full	The *Energy Union Strategy* emerges from the EC green paper on providing secure,

[1] "Renewable Energy Targets", EU, 2022.
[2] *Ibid.*.
[3] "BEIS Outcome Delivery Plan", Department for Business, Energy & Industrial Strategy, July, 2021, https://www.gov.uk/government/publications/department-for-business-energy-and-industrial-strategy-outcome-delivery-plan/beis-outcome-delivery-plan-2021-to-2022
[4] *Ibid.,* 5.
[5] *Ibid., 19.*

	clarifying that the" EU's Oil Stocks Directive, requires Member States to maintain minimum oil stocks, corresponding to either 90 days of average daily net imports or 61 days of average daily inland consumption, whichever is greater."	implementation of the UN Climate Change Convention to strengthen the Kyoto protocol and emissions trading system. Renewable Energy Directive set a 2020 res target. Green Climate Fund established.[1]	sustainable, affordable energy. In particular, an integrated European energy market is intended to provide equity through an expansion of the market through increased fungibility and flexibility[2].
UK	Security was a primary focus of policy during this period, using Electricity Market Reform to attract private sector investment to upgrade infrastructure and make prices competitive.	Due to the UK's EU membership, the nation was legally committed to meeting 15% by 2020 targets.	Attempted to address inequities through the Fuel Poverty Strategy (investment & subsidy) rather than additional fungibility with EU markets.[3]

By 2016

	Security	**Climate**	**Access**
EU	Launch of the Energy Union "to provide secure, affordable and clean energy for EU citizens and businesses."	Paris Agreement is adopted, legally binding member states to the 2-degree proposal. Proposal of the "Clean energy for all Europeans' package" by EC. 2030 standards adopted to meet Paris commitment.[4]	Accelerated integration with foreign (i.e. Russian) oil and gas markets to account for key losses driven by nuclear and fossil fuel divestment.
UK	Introduced the default tariff energy price cap to improve equity and security, opposed by the EU.[5]	Paris Agreement adopted, but took an "energy budget" approach to implementation.	Strategic investment in nuclear and renewables to boost supply-side economics[6].

By 2022

	Security	**Climate**	**Access**

[1] "Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy", European Commission, Brussels, August 3, 2006, https://europa.eu/documents/comm/green_papers/pdf/com2006_105_en.pdf
[2] "Flexibility Markets", European Commission, 2020, https://energy.ec.europa.eu/topics/research-and-technology/flexibility-markets_en.
[3] *Ibid.*
[4] *Ibid.*
[5] "BEIS Outcome Delivery Plan", Department for Business, Energy & Industrial Strategy, July, 2021, https://www.gov.uk/government/publications/department-for-business-energy-and-industrial-strategy-outcome-delivery-plan/beis-outcome-delivery-plan-2021-to-2022
[6] "Energy Supply Probe – Initial Findings Report". Ofgem, October, 2008, ofgem.co.uk.

EU	Gas supply regulation act of 2017 provides for Crisis action due to situation in Ukraine. Russian imports are largely shut off, nuclear and fossil fuel phaseout is slowed. Recent joint statement with the US to increase security.	Climate Emergency declared by EU Parliament. Package of proposals to "deliver the European Green Deal" setting both 2030 to reduce emissions 55% and 2050 targets to become neutral.	Demand-side policy discourages road use and supply-side policy encourages alternate fuels such as firewood[1]. Household subsidies introduced in the form of direct payments[2].
UK	Acceleration of nuclear power investment, increasing from 15-25% of its total energy mix.	10-point plan for a Green Industrial revolution introduced.	Furlough-sized subsidy in the form of an energy price cap for households and businesses.

Systemic Change as a Foundation for Policy Shifts

Providing a foundation for the two-part analysis described in the introduction, this section will review several existing analyses that explain policymaking both within and, critically, outside of the realm of energy. As this paper is essentially a study of change over time, it makes sense to begin with perspectives on political change as its own phenomenon. Without testing the assumption that there must be a cause that creates a specific impetus for policy change, asking the question of what influenced change in a particular instance is useless. While this paper will argue that exogenous shocks play a large role in explaining policy divergence, the literature review begins by accepting a perspective that gradual and endogenous change can shift policy without the need for exogenous shocks.

Extensive work has been done in the historical, social and political sciences to ask questions about the emergence and implementation of state policy, arguing that states create policy through a collective reasoning process that moves in paradigms. Peter Hall's early work on policy paradigms and social learning offers a valuable starting point for a political science

[1] "Energy crisis: Germany sees rising trend in wood burning stoves to save on gas", Euronews, November 14, 2022, https://www.google.com/search?q=euronews+germany+firewood&oq=euronews+germany+firewood
[2] "German German experts set out 2-stage energy subsidy package", DW, 2022, https://www.dw.com/en/germany-experts-set-out-controversial-2-stage-energy-subsidy-package/a-63392201

approach to this question[1]. The agency of a state is not identical to those of political institutions in responding to "national interests", nor does it respond directly to societal pressure (as explained, for example, in Converse's model of *Mass Politics*[2]*)*. In other words, whether these state-centric or institution-centric argument makes sense, neither of these two paths explain any major policy direction holistically. It is worth considering Hall's third path of "social learning": the idea that "policymaking is a form of collective puzzlement" is tempting as a means of reconciling the two previous theories – but does it hold up in the face of drastic exogenous shocks, such as those seen in Europe in the 2012-2022 period?

In order to answer this, explanations of institutional change and the role of path dependency must be examined. Path dependency establishes that past developments influence future decision-making ability by constraining choices to those available to institutions[3]. As mentioned above, Europe had been on a significant path of convergence until the 2010s primarily driven by large institutions, so understanding what enabled change, whether a critical juncture or underlying, systemic shift, is critical. Mahoney and Thelen build on Hall's work, narrowing in on the role of policymaking apparatuses in their "theory of gradual institutional change" by laying out how institutions can change even without seemingly strong influences[4]. Overall, while imperfect, this paper takes an institutionalist rather than state-centric approach to enable comparison of complex state and supranational bodies in the context of the UK and EU.

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[1] Hall, Peter A. "Policy Paradigms, Social Learning, and the State: The Case of Economic Policymaking in Britain." *Comparative Politics* 25, no. 3 (1993): 275–96. https://doi.org/10.2307/422246.
[2] Philip E. Converse, The nature of belief systems in mass publics, 2006, Critical Review, 18:1-3, 1-74, DOI: 10.1080/08913810608443650
[3] Mahoney J, Schensul D. Historical Context and Path Dependence. In The Oxford Handbook of Contextual Political Analysis. Oxford University Press. 2006 doi: 10.1093/oxfordhb/9780199270439.003.0024
[4] James Mahoney, Kathleen Thelen, *Explaining Institutional Change: Ambiguity, Agency, and Power,* Cambridge University Press; 0 edition, October 30, 2009.

This paper also rejects that large policy change must be accompanied by "punctuated equilibria", or the idea that significant shifts must be punctuated by pivotal changes in society or government[1]. While this paper accepts that the political lock-in often attributed to path dependance is an important part of the explanation, the decade leading up to 2012 can largely be seen as a period of stasis, not change; Europe was on a path to integration, and geopolitics were relatively stable. In other words, while path dependency might suggest that only critical junctures can influence significant policy change as seen in the post-Brexit period, this paper partially rejects that explanation as it cannot account for the complexity of decision-making in energy in recent years even before the current crisis. Instead, answering the questions asked in this paper require a reconciliation between both endogenous and exogenous factors, that is, both the underlying shifts in the UK and EU's political systems and their reactions to exogenous shocks in recent years. Indeed, the institutionalist body of work leaves open the question of what features of institutions allow them to be exposed to change in the first place. Germany's phase-out of nuclear, for example, in the face of rising geopolitical tensions, is difficult to justify through the lens of the rational choices of institutions alone[2].

The Kuhnian view of societal change, or the idea that change moves within and across paradigm shifts[3], could explain the larger shift from a narrative in the UK of "integration is good", to an environment where EU membership was questioned, in both cases driven by the Conservative Party. This would explain how the European integration process did not necessarily occur linearly, but by unlocking new modes of thinking, or paradigms, which imposed a set of

[1] Paul Pierson, *Politics in Time: History, Institutions, and Social Analysis*. Princeton: Princeton University Press: 2004.
[2] Peter Hall, *et al*., "Political Science and the Three New Institutionalisms". *Political Studies*, 44(5), 936–957. https://doi.org/10.1111/j.1467-9248.1996.tb00343, 1996.
[3] Thomas Kuhn, The structure of scientific revolutions. University of Chicago Press: Chicago, 1962.

assumptions, ideas and ideological constraints that force thinking forward[1]. Hall's 'social learning' framework offers a potential explanation, but has limited applicability in this context[2]. The implied constructivist argument that ideas are central to policymaking might be overly simplistic in this model, as ideas alone do not explain how underlying institutional dynamics change, as clearly occurred during the negotiations of the Treaty of Lisbon and the subsequent domestic legislation described in the previous section. However, Hall's concept of first, second and third order paradigms offer a compelling resolution with the punctuated equilibria model[3]. While first and second order changes reflect "normal policymaking", in which new policies are developed by existing institutions within their usual scope, third order changes are "marked by radical changes in the overall policy discourse"[4]. Specifically, energy policymaking, because of its often slow-moving and complex nature, can be seen as moving within paradigms, with significant divergences occurring only during (third order) paradigm shifts. However, the divergences between the EU and UK's policies covered in the previous section span all three orders of changes, so sweeping paradigm shifts alone cannot explain their emergence. Synthesizing these viewpoints, it makes sense to re-affirm institutionalism as the best baseline framework for understanding complex, comparative policy change, recognizing that it requires adjustment to explain how changes occur across borders even in cases where underlying institutional structures appear similar and integrated on the surface.

As the previous section highlights the difficulty of establishing a comprehensive framework for explaining energy policy change through the rational choices of institutions alone, this section seeks to argue that significant divergence can also occur even in the face of shocks,

[1] Thomas Kuhn, The structure of scientific revolutions. University of Chicago Press: Chicago, 1962
[2] Peter Hall, "Policy Paradigms, Social Learning, and the State", 277.
[3] *Ibid.,* 278.
[4] *Ibid.,* 279.

in part because of those shocks. A "self-reinforcing" institution, as the European Union is sometimes referred to[1], can be strengthened through shock[2]. Greif and Laitin argue, for example "a self-enforcing institution is one in which each player's behavior is a best response. The inescapable conclusion is that changes in self-enforcing institutions must have an exogenous origin". As Thelen herself argues in *Beyond Continuity*, in response to Halls work, neither path-dependency nor the 'exogenous shock' explain the full spectrum of pace and severity of change; instead, incorporating both the process of change (was it incremental or abrupt?) and its result (was it continuous or discontinuous?) offer much more apt explanations[3]. Therefore, this paper will advance a theory that proposes a convergence between a sort of path-dependent institutional change and its interaction with exogenous shocks. Namely, policy change must be a function of two things: underlying institutional change, and "normal" policy change in response to exogenous shocks. Building on the existing literature, this paper will advance a theory that unifies these explanatory lenses and proposes several concrete explanatory variables on the empirical level. Before doing so, it is important to understand which empirically supported explanatory factors have already been proposed in the applied social sciences, specifically in the literature on energy policy.

Past Explanations Using the Energy Trilemma

Because it is potentially broad-reaching, energy policy as a concept must be scoped to include and exclude specific policy goals. "Energy policy" can be as applicable as ensuring powerplant safety or community autonomy for energy production, and implementation levers can

[1] Johannes Lindner, "Conflict and Change in EU Budgetary Politics" in *Advances in European Politics*, Routledge, 2017, 13.
[2] Avner Greif, David Laitin, "A Theory of Endogenous Institutional Change", Center on Democracy, Development, and the Rule of Law Stanford Institute for International Studies, 15, August 2004, 11.
[3] Wolfgang Streeck, Kathleen Thelen, *Beyond Continuity*, 1st, ed., Oxford University Press, May 2005, 9.

be as diverse as the Iran Nuclear Deal or funding for exploratory climate-change combatting research. Most analyses break energy policy down into multiple components, including sustainability, stability, equity, affordability, and other strategic goals[1]. For purposes of this paper, the latter goals (after sustainability) are jointly defined as "security", so that the lens of the energy trilemma can be consistently applied throughout the analysis.

Perhaps the most salient in the popular discourse on energy is the supposed tradeoff between environmental sustainability and economic growth. Trade-offs have long been used to describe decision-making on energy policy, and many of them have significant validity. Iversen's work, for example, illustrates a classic socio-economic trilemma considering the challenges of balancing equality, employment, and budgetary restraint[2]. A problem with trilemmas, as illustrated in his paper, is they are effectively an economic optimization problem that assume static coefficients associated with various explanatory that are negatively correlated with one another. In reality, these coefficients can change; in other words, trilemmas are not permanent, and only apply as long as the relevant economics are in place. Therefore, some elements of the framework will be empirically evaluated in the analysis section to further test their validity.

One exemplary shock to the framework that has been studied at length in the literature is that of the energy markets' liberalization beginning in the late 1980s through the 2010s. How, for example, did market liberalization affect environmental sustainability policy? Questions of public-private coordination become especially important in a world where industrial policy is again considered a viable pursuit for states, who now face a more bifurcated decision path

[1] World Energy Council, 2022.
[2] Torben Iversen, Anne Wren, "Equality, Employment, and Budgetary Restraint: The Trilemma of the Service Economy." *World Politics* 50, no. 4 (1998): 507–46. doi:10.1017/S0043887100007358.

between free market approaches and state-driven approaches[1]. While one may normally expect liberalization to allow domestic factors to drive divergence based on local market factors, the evidence discussed in the previous section shows that the goals of climate policy remained largely aligned in the EU and UK, whereas the mechanisms to achieve results were the primary area in which differences emerged. Michael Pahle's work on 'sequencing' could help to partially explain this, largely in line with the path dependance arguments accepted in the previous section[2]. In the case of the EU and UK's varying approaches to achieving climate results, constraints imposed by varying energy security situations perhaps enhanced sequencing effects by forcing governments down a particular path (investment in nuclear vs. investment in green technology) as a means of achieving results. This explanation is interesting insofar that it does not rely on paradigm shifts, but instead explains the value of smaller, practical step changes, as shown below:

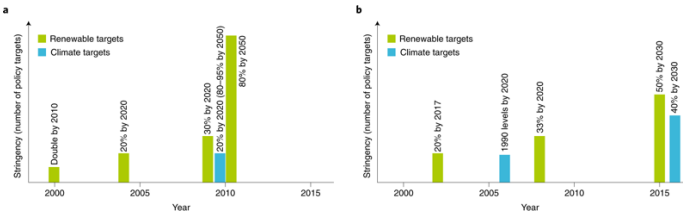

Figure 3: Step Changes in Number of Policy Targets in Europe[3]

A final argument worth revisiting is that market liberalization fundamentally changed the economics of the trilemma so that sustainability, affordability, and security are no longer trilemmic trade-offs. For example, there are those who argue that lack of affordability can be solved by the market, incentivizing the development of sustainability technology or simply

[1] Cathie Jo Martin, Duane Swank, *The Political Construction of Business Interests: Coordination, Growth, and Equality*, (Cambridge University Press: 2012), p.24.
[2] Michael Pahle, *et al.* Sequencing to ratchet up climate policy stringency. *Nature Clim Change* 8, 861–867 (2018). https://doi.org/10.1038/s41558-018-0287-6.
[3] *Ibid*., 682.

lowering prices to capture more demand. Unfortunately, while there has been significant success in improving the economics of green technology by lowering the price of solar[1], it has not yet been empirically observed that this can cause governments to neglect the importance of affordability and abandon fossil fuels entirely. Thus, the economic realities of the trilemma suggest that tradeoffs are not yet at a point where they can be ignored by policymakers.

Analysis

Until now, analysis of energy policy change in Europe, and policy change as a whole, has provided disparate and often conflicting explanations for institutional change and the creation of new policy. To answer the question of why policy began to diverge in institutions as similar and convergent as the UK and EU governing bodies, this paper advances a unified framework for how institutions respond to shocks by creating policy and changing themselves to adapt, using the energy trilemma as a baseline. There are two proposed sub-hypotheses and one unifying framework advanced in this section. The first hypothesis to be tested is that systemic change emerged as a normal part of democratic functioning, which nonetheless prepared institutions to react differently to upcoming shocks. The second hypothesis is that those shocks occurred in a way which impacted specific elements of the energy trilemma, transmitting into different policy decisions based on the institutional changes proposed in the first hypothesis.

As a unifying framework, the energy trilemma is amended to account for the way in which it is shaped by underlying institutional responses to exogenous shocks and filters their effects into policy decisions. Ultimately, these differences in underlying political and economic institutions across the EU and UK, with different mechanisms for absorbing and responding to major shocks in the 2012-2022 timeframe, led to the largest energy policy divergence since the

[1] "Renewable Energy Market Update", IEA, May 2022, https://www.iea.org/reports/renewable-energy-market-update-may-2022.

beginning of the post-war period. In summary, differences in the European governments' responses to political, economic, and technological shocks are defined by trilemma trade-offs and caused by systemic shifts, explaining much of the divergence in climate policy, such as varied approaches to balancing energy security and sustainability, enhancing digital capabilities while ensuring equity, and navigating geopolitical implications across all three dimensions.

Two sets of explanatory variables will be evaluated for each of the proposed hypotheses: first, causes of systemic change will be evaluated for their ability to explain institutional change in political systems as similar as those of the EU and UK. Second, the trilemma components and their corresponding exogenous shocks will be evaluated in terms of how they directly and indirectly affected policymaking. As discussed in the introduction, "direct effects" refers to an institution's response to a short-term shock, while "indirect effects" refers second order effects, including the way that shocks may alter systems themselves.

Proposed Outcome Variable: Policy Change, As Measured by Trilemma Components

As the change in outcome documented by this research is an observed divergence in policy, the dependent variable in this analysis is defined as the total increase in differences in energy policy between the EU and UK over the period from 2012-2022 (abbreviated to "policy divergence"). As established the previous sections, policy is still largely overlapping[1], so what requires attention are the non-overlapping details in policy goals and their implementation. The shape of overall policy is determined by policymakers' prioritization of the three components of the trilemma, i.e., as policy emphasizes or de-emphasizes elements of the trilemma, the total shape of policy changes. This is visualized in the diagram below, which is purely illustrative.

[1] European Commission, "Energy: The EU-UK Trade and Cooperation Agreement", 2022, https://energy.ec.europa.eu/topics/international-cooperation/key-partner-countries-and-regions/united-kingdom_en#the-eu-uk-trade-and-cooperation-agreement.

Policy divergence is represented by the total surface area of the non-overlapping portions of the trilemma triangles. In the below example, the UK's shift away from energy access and EU's contraction of energy security created increased divergence in total policy, illustrated by the double-sided arrows indicating a growth in the non-overlapping areas of the policy triangle which were previously smaller.

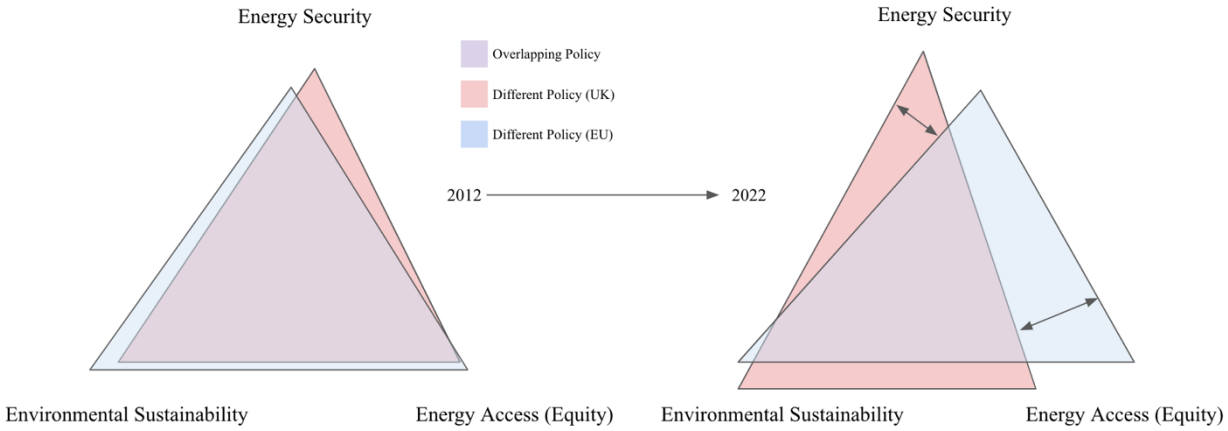

Figure 4: Visualization of Outcome Variable (Composite Policy Divergence)

Where possible, this will be measured using the official definition of the Energy Trilemma: The Energy Trilemma Index, as measured by the World Energy Council, measures national governments' emphasis on three key policy choices: energy security, energy equity, and environmental sustainability[1]. The term "the Energy Trilemma" has attempted to explain some of the choices that governments make in addressing energy issues, and has long described challenges in implementing sustainable, inclusive energy policy (though it was first officially codified and indexed by the World Energy Council in 2008)[2]. Due to its longevity and widespread practitioner use, the Energy Trilemma framework is an important consideration in

[1] World Energy Council, 2022.
[2] World Energy Council, "World Energy Trilemma: Assessment of Energy Policies and Practices", 2008, https://www.worldenergy.org/publications/entry/world-energy-trilemma-2008-assessment-of-energy-policy-and-practices.

thinking about classical tradeoffs in energy policy making. While trade-offs are important to evaluate, they, too, are overly simplistic in answering the question at the heart of this paper. Additionally, they easily fall apart in the face of counterexamples. For instance, rising energy prices have recently changed economic incentives for European countries, making investment in equitable, secure, and renewable energy not only feasible, but imperative.

Finally, it is important to recognize and emphasize that is somewhat unusual that this paper centers policy as an outcome variable. Policy, even "policy change", makes for an at times confusing outcome variable, as in the social sciences it is often thought of as an input, or independent variable. Indeed, in real life, policy is often a leading indicator, as many state institutions effectively exist in order to set policy, and it is strange to think of them as influenced by outside forces. However, as discussed in the introduction and literature review, past work has established that there is a degree of path dependance and constraint when it comes to setting policy. This paper further advances that policy change often comes as a reaction to long-term underlying systemic shifts, and short-term shocks, and therefore is analyzable as an outcome. Thus, it follows that the components of energy policy, in this case energy security policy, environmental sustainability policy and energy access policy can be analyzed as outcome variables as well. As such, the independent variables in this study are precisely those causes of policy reactions. Following this paper's hypothesis, the triggers of the aforementioned policy change being evaluated fall into two categories:

Variable 1: Systemic Change

The first category of variable proposed is underlying structural change to policymaking ecosystems. As established in the literature review, evolution and systemic change among key institutions likely acted as a major catalyst of policy divergence, changing how state and private

sector institutions shaped ongoing policy initiatives and reacted to unexpected shocks. These changes could appear in the form of overarching regulation/de-regulation, the functioning of political systems, or economic dynamics among the components of the trilemma. One way to conceptualize this is as "operating system" of the state's energy policymaking, rather than specific shocks or reactions. There will be three systemic changes argued in this section: first, shifts driven by the European integration process, second, the phenomenon of voter "calcification" in the UK, and finally, disparate processes of market liberalization.

Variable 2: Disparate Shocks

The second major category of variable considered is disparate shocks. While ostensibly one would expect previously convergent neighboring regions to experience shocks similarly, this paper argues that the variables in 'category 1' above changed systems to the point where shocks not only produced differing reactions by the relevant countries, but also that these shocks were actually experienced differently by the people living there. For example, when increased public spending and supply bottlenecks led to a surge in inflation, the effects were nearly double in Eastern European EU member states compared to the UK[1]. Many recent events documented in the popular media as driving policy change, such as Russia's invasion of Ukraine, major advances in technology or unpredictable macroeconomic shifts, have not yet been properly examined in academic literature. This study proposes that the dominant observable influences over the last ten years map appropriately to the components of the energy trilemma, as follows:

2a: Technological shocks to environmental sustainability policy

Technology, especially on the supply side, has consistently been a focus for those working on issues of environmental sustainability, as it offers perhaps the clearest path forward

[1] Philip R. Lane, "Inflation Diagnostics", The ECB Blog, European Central Bank, November 22, 2022, https://www.ecb.europa.eu/press/blog/date/2022/html/ecb.blog221125~d34babdf3e.en.html

for reducing emissions without the economic impact of decreased consumption. While not the only variable impacting large shifts in scope for potential sustainability policy, technology makes for an easily analyzable outside shock as policymakers and markets cannot often plan for specific results in advance, and the diffusion of technology over time and location allows for even comparison.

2b: Economic shocks to energy access policy

In the context of the free-market capitalist societies in this study, populations vulnerable to a lack of access to energy are significantly impacted by energy economics[1]. Energy access (or equity) policy is often designed with these populations in mind. Any shock to the economics of the system, such as those of the 1973 and 1979 oil crisis, tend to spur changes in policy to ensure continued access. This section will further examine whether and how economic shocks may impact access policy differently across the EU and UK.

2c: (Geo-)political shocks to energy security policy

Finally, political shocks, especially in the geopolitical realm, ostensibly raise the most important impact worth analyzing for energy security. Because security policy is effectively an insurance policy for times of crisis, absent political constraints, policymakers may be less incentivized to pay attention to it. Political shocks offer clear cases in which different entities may respond differently to energy security policy, whether due to internal shifts or external threats such as those currently present in Europe.

Framing the Argument: Advancing a Unified Theory of The Trilemma

Before dissecting the individual components of the unified framework for policy change advanced by this paper, that framework is first visualized (Figure 5, below) and argued in detail

[1] "World Trilemma Index Report", World Energy Council, 2022, https://www.worldenergy.org/assets/downloads/World_Energy_Trilemma_Index_2022.pdf?v=1669839605

at the conceptual level. The already established schema of the energy trilemma serves as the foundation to explain the interaction of institutions, policymaking, and exogenous shocks. In its fundamental interpretation, the energy trilemma is simply defined as the tradeoff between the three components of energy policy already discussed at length[1]. The new framework developed in this paper takes that framework several steps further by not only acknowledging that there are important challenges in the field of energy that are often at odds with one another, but also explaining how decisions are made, and, ultimately, how policy evolves.

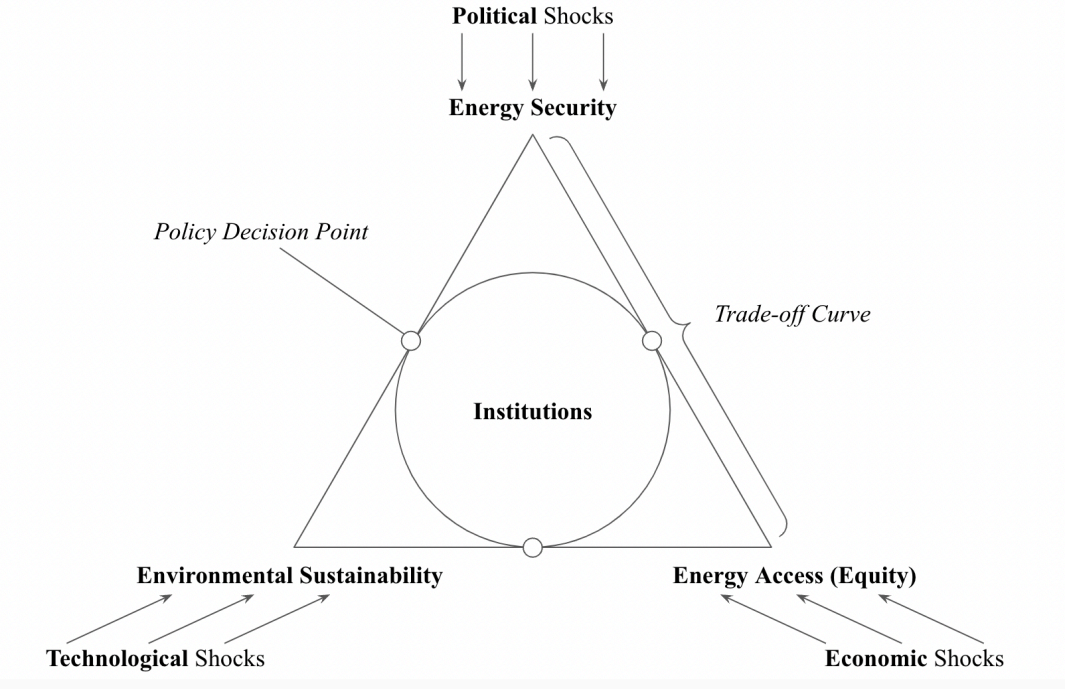

Figure 5: "Enhanced" Energy Trilemma centering the role institutions in shaping its dynamics and responses to outside shocks

First, each axis of the trilemma represents a tradeoff between two policy priorities, and it is implied that no unified energy policy framework can maximize all three simultaneously. This new variant of the framework, however, places institutions at the center of that tradeoff decision process. Not only that, but, as will be elaborated in the next section, the shape, size and strength

[1] "The Energy Trilemma Index", World Energy Council.

of the relevant institutions inform which decisions are possible. Where the interest and capacity of institutions meet the corresponding point in the tradeoff curve, policy can be made. Furthermore, the contours of the energy trilemma are subject to outside shocks. Primarily, the three policy areas are more vulnerable to specific kind of shocks than others; as discussed in the previous section, energy security is heavily impacted by political events, energy access is affected by economic shocks and sustainability policy is driven by technological phenomena. Strong institutions, like the internal skeleton of a house, can make the overall policy more resilient to outside forces. However, they also have the space and flexibility to adapt to changing conditions. Thus, changing institutional structures can elicit major changes in policy, and, in turn, will react differently to shocks. This summarizes the new combined institutional change energy trilemma advanced in this paper, which will next be applied in greater detail to research hypothesis and specific case studies.

Narrative Violation: Causes of Systemic Change within Western Europe

The argument that systemic change ("Variable 1") can emerge gradually and subtly yet impact policy in substantial ways violates the traditional path dependance narrative that change must be punctuated by major events[1]. While Thelen develops the significance of gradual change[2], there is no model that reconciles it with outside shocks ("Variable 2"; discussed below), nor has it been applied to energy policy in the EU. The existing literature supports the idea that political dynamics and institutions are the foundation for how governments absorb and respond to international events and shocks[3]. Institutions respond to but also reinforce and reproduce domestic political dynamics, so that changes in underlying opinion significantly influences

[1] Pierson, *Politics in Time,* 45.
[2] Mahoney, Thelen, *Explaining Institutional Change,* 21.
[3] Mahoney, Thelen, *Explaining Institutional Change,* 68.

policy in democratic republics[1]. Arguably, as will be analyzed below, these two principles apply in the realm of energy policy as well and can help explain how policy can naturally diverge even within integrated economic and political systems such as the internal energy market of the EU and UK. Specifically, this section argues that this occurs via structural changes, such as the way in which the state interacts with other stakeholders (e.g. voters, businesses, etc.), as well as shifts in institutional capacity and scope, that influence institutions' reactions to specific shocks. In the context of the above graphic (Figure 5), these systemic shifts essentially refer to the features of the institutions which sit at the center of policymaking, and how their strength, capacity, constraints, and other features define their decision-making within the trilemma framework.

The first such systemic dynamic worth examining is the European integration process itself. With the UK firmly part of the European energy network and a leading participant in sustainability politics[2], one might expect the ongoing integration process to reinforce the nation's role among EU member states. Paradoxically, it was arguably the 2007 Treaty of Lisbon which laid the groundwork for a decoupling. While the goal of the Treaty of Lisbon was to accelerate the integration process by strengthening institutions (among others, EURATOM, EU Parliament and the European Council Presidency)[3], it also created new potential paths for de-integration and divergence.

Two constitutional amendments which created such paths are the Withdrawal Clause, defined in the Treaty of Lisbon for the first time, and Shared Competence for Energy[4]. Per the

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[1] Hall, *Policy Paradigms,* 276.
[2] The UK's Climate Change Act of 2008 was the first legislation among EU members to make emissions reductions legally binding, a model which the EU later followed.
Source: OECD, "The United Kingdom's pioneering Climate Change Act", 2018, https://www.oecd.org/climate-action/ipac/practices/the-united-kingdom-s-pioneering-climate-change-act-c08c3d7a/.
[3] Eeva Pavy, "The Treaty of Lisbon".
[4] Huhta, K, "The Scope Of State Sovereignty Under Article 194(2) TFEU and the Evolution of EU Competences In the Energy Sector". *International and Comparative Law Quarterly, 70*(4), 991-1010. 2021 doi:10.1017/S0020589321000269.

institutionalist framework advanced by this paper, if policy paths are created by the constraints of institutions, the Treaty amendments represent two important loosenings of constraints that allowed policy possibilities to shift. This does not constitute a "punctuation" in the path dependance sense, as the Treaty represented a continuation of the integration path that the EU (and hence the UK) were already on. Instead, an expected and planned evolution in the EU as an institution resulted in a new "operating system", that created the potential for paths such as Brexit and the UK's own domestic Climate Change Act through the shared competence clause[1]. In the context of the above "enhanced trilemma" framework, this could be visualized as increased touchpoints between institutions and policymaking choices along the contours of the trilemma, whereas before it would have been defined by a single institutional pathway. It is worth noting that all EU member states now operated in this new environment that allowed for withdrawal and shared energy policy, so this alone cannot explain the UK's divergence. It is however, in combination with other systemic shifts, an important factor in shaping how the UK and EU would respond differently to shocks in the 2012-2022 timeframe.

One other such systemic shift is a change in domestic political dynamics in the UK, especially on the level of party politics. One example of such a political dynamic is that of voter "calcification". Calcification is an emerging field of study among political scientists often discussed in conjunction with voter polarization[2]. While polarization refers to an increase in extreme views compared to moderate ones, calcification refers to a decrease in the willingness to change views or vote for a different party[3]. In an interview conducted for this paper, a senior

[1] *Ibid.,* 2.
[2] Thomas Patterson, *The Vanishing Voter,* 1st ed (Random House: 2003), 122.
[3] *Ibid.*

fellow at the London School of Economics Data Science Institute[1] shared research indicating that voter party switching in the 2019 UK Parliamentary election was 25%, down from nearly 30% in the previous election[2]. In EU member states, such as Germany, Italy and the Netherlands, the average around the same time was around 39%[3]. Sides, Tausanovitch and Vavreck (though drawing from data in the US) successfully argue that calcification (and other significant changes in underlying political dynamics) can come from within institutions, such as democratic elections and the executive branch (in their US example)[4]. In the UK, a reduction in interparty switching (and hence an increase in calcification) resulted in the staying power of the Conservative party in the 2012-2022 period. Additionally, along Sides *et al*'s line of reasoning, polarizing figures such as Boris Johnson, can increase divineness and calcification, further reinforcing extreme views. These views, of course, can be directly linked to phenomena such as Brexit and other direct antecedents to energy policy divergence in the UK.

A third systemic evolution worth understanding is that of market liberalization. Like the case of new political frameworks under the Treaty of Lisbon, liberalization represents another trend furthered and encouraged by EU institutions, that may have actually weakened aspects of them in the long run. Alongside harmonization, liberalization was a major goal of the EU's 1996 Internal Energy Market initiative[5]. For example, between 1998-2008, EU member states were expected to unbundle state monopolies of sectors such as electricity, oil and gas, with the ultimate goal of working towards a fully integrated European energy market[6]. While these

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[1] The source requested to go unnamed due to the political nature of the question but specializes in comparative social science data analysis.
[2] Interviewee 1. Interview Conducted by the Author on November 11, 2022, via Zoom.
[3] *Ibid.*
[4] John Sides, Chris Tausanovitch, Lynn Vavreck, *The Bitter End: The 2020 Presidential Campaign and the Challenge to American Democracy*, Princeton University Press, 2022.
[5] Ciucci, "Internal Energy Market", Fact Sheets on the European Union, 2022, https://www.europarl.europa.eu/factsheets/en/sheet/45/internal-energy-market.
[6] *Ibid.*

initiatives did drive positive outcomes for the EU and members states, including lower prices through increased competition, this serves as yet another example of a major integration milestone that actually represented a loosening of institutional constraints on the domestic level. Whereas before, state and business actors effectively had one path towards influencing the prices of energy (i.e. by regulating the activities of the monopoly firm), they now had to contend with the complex dynamics of larger private markets not only within their own states, but also as influenced by energy companies and institutions in other countries.

While the Internal Energy Market initiative would seem to cause policy convergence across EU member states, and ostensibly did so, it also laid the foundation for new pathways through which member states' energy markets, and hence policies, could actually diverge. This should not come as a surprise; according to the rule of comparative advantage[1], by creating a wider, internal energy market across Europe, member states' economies would be expected to specialize in production for which they have a comparative advantage, and export that resource to the rest of the market. So, what policymakers at the EU level perhaps failed to consider, is that even though they created "standard rules" for liberalization that created a converged, integrated market across states, they also created the conditions that created political pressure for states to create new policies (e.g. labor policy) to protect industries which were now exposed to competition from across the continent[2]. The rise of populism and protectionism within conservative parties, which were traditionally the parties of liberalization, perhaps both explains this, and ultimately larger divergences such as Brexit.

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[1] Ricardo, David, *The Principles of Political Economy & Taxation*. London : New York :J.M. Dent; E.P. Dutton, 1911.

[2] Delia Vasilica Rotaru: "A Glance at European Energy Market Liberalization", CES Working Papers, ISSN 2067-7693, Cuza University of Iasi, Centre for European Studies, Iasi, Vol. 5 (2013), Iss. 1, pp. 100-110

Finally, how do we reconcile these three systemic shifts (a new treaty framework, voter calcification, and liberalization), all of which paradoxically emerged from a gradual strengthening of institutions? What impact do they have on energy policy in aggregate? Martin and Swank offer a useful approach of understanding this through the lens of government-business coordination[1]. Applying the assumption that institutions are needed to align the interests of the public and private sectors, ten years of EU liberalization and UK Conservative governments' de-regulation can be understood as further driving a decoupling of public and private interests[2]. Without tight constraints, dynamics that perhaps go unaccounted for in EU policymaking can drive policy convergence on the domestic level. For example, Martin and Swank argue "an aversion to cooperation appears bred in the bone in the Anglo-liberal lands of the United States and Great Britain…In the process of nationalizing political engagement, the "virtuous circles" of coordination failed to thrive beyond the community level in the Anglo countries, even while they ultimately took hold in continental Europe."[3] If a loosening of constraints through new frameworks and market liberalization allow a greater set of policymaking choices, and the culture of the UK differs significantly from that of mainland European countries, this indeed offers a compelling explanation for the mode in which system shifts, even towards integration, can actually lead to policy divergence through an increase in potential policy pathways.

Martin and Swank's work confirms that the UK two party system solidified over time while the European system more fractious, both through the strengthening of the EU parliament layer as well as within the national systems of the largest member states. According to them

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[1] Martin, Swank. *The Political Construction of Business Interests: Coordination, Growth, and Equality*, 2012.
[2] *Ibid.,* 39
[3] *Ibid.*, 45

> "Second, federal multiparty systems are likely to produce high levels of employer coordination at the industry level (sector coordination), but have weaker peak associations and less state involvement. Federal multiparty systems have difficultly producing dedicated national business parties, because sectional cleavages remain salient; moreover, even though business-oriented politicians have incentives to delegate political authority to social partners, the absence of a single national business party makes employers more resistant to state oversight. Whereas federalism should, ceteris paribus, impede the development of nonmarket coordination and macro-corporatist associations, in combination with high multipartyism, federalism should foster relatively high sectoral cooperation."

Taking all of this together, one could summarize the influence of gradual "operating system" shifts on the divergence of energy policy in Europe as a loosening of constraints which allowed underlying differences in the economics (i.e. trilemma), culture and political systems of the UK compared to mainland EU countries to exert greater influence on policymaking. While steps such as market integration and a new treaty framework were intended to strengthen EU institutions and hence converge policy, these steps allowed unexpected political phenomena such as calcification to drive new political alignments in the UK, leading to the rise of the Brexiteer movement, which ultimately succeeded due to a clause in the Treaty of Lisbon itself.

Testing the New Trilemma: Applying Shocks to the Proposed Framework

The underlying changes discussed in the previous section provide the groundwork for policy change. However, subtle structural divergences are most apparent when the system is exposed to a shock, as systemic changes create differing responses to shocks at the institutional level. On the whole, this section argues that crises such as the twin shocks of peak inflation and Russia's invasion of Ukraine are sharpening the "trilemma" – the balance between security, sustainability, and equity – by forcing institutions to make even larger tradeoffs than usual. However, it also analyses the role of the potentially positive technological shock on cracking the traditional trilemma. As discussed above, these three shocks (technology, inflation and war) are

mapped to the proposed explanatory variables to further explain how underlying shifts in the UK and EU's policy system led to divergent energy policy over the 2012-2022 period:

- Variable 2a: Influence of technological development and supply-side capacity
- Variable 2b: Influence of inflation and the macroeconomic shift
- Variable 2c: Influence of geopolitical crisis and its interplay with domestic politic shifts

Where possible, this section examines policy change on the institutional level in order to enable comparison between the EU and UK. However, where necessary, arguments will focus primarily on Germany as a country-level case study, for example to examine energy trilemma data.

Variable 2a: Influence of technological development and supply-side capacity

As a component of broader energy policy, there are a number of potential influences on environmental sustainability policy in particular. For purposes of continuing the analysis along the lines of the trilemma, this section focuses on the role of advances in "green technology" specifically on setting climate policy. Here, it is important to distinguish among several relevant categories of technologies. Kelly Sims Gallagher's work offers a useful segmentation[1]:

> A distinction is often made between energy-supply technologies, meaning those used to bring energy forms to a point of final use, and energy end-use technologies, meaning those applied at this point of use to convert an energy form to a service such as light or motive power (1). The supply technologies usually receive more attention in discussions of energy-technology innovation (ETI), but the end-use technologies are no less important in principle and in practice often offer greater potential for improvement. It should go almost without saying, finally, that we understand energy technology to mean not only hardware but also the software, practices, and knowledge relating to its effective use (2)."

Due in part to the constraints of the trilemma, energy supply technologies tend to be most favored by public institutions, while end use technologies are left marginalized[2]. In the 1970s, at the outset of the modern era of energy policy, policymakers saw greater backlash from trading

[1] Kelly Sims Gallagher, John P. Holdren, Ambuj D, "Energy-Technology Innovation", *Sagar Annual Review of Environment and Resources,* 2006 31:1, 193-237.
[2] Gallagher, "Energy-Technology Innovation".

off energy equity in favor of sustainability and security, as consumers are hesitant to give up comfort, and economic stakeholders fear the consequences of decreased economic growth associated with lower energy use[1]. Two such categories of energy supply technologies are (1) electrification and (2) digitalization. Electrification, in this context, refers to "replacing technologies that use fossil fuels (coal, oil, and natural gas) with technologies that use electricity as a source of energy."[2] Electrification policy, for example, to what extent governments invest in and encourage the development of electrical heat sources versus burning of fossil fuels, directly impacts the sustainability component of the trilemma. Electrification is primarily associated with building the capacity of the energy grid, while digitalization primarily impacts efficiency and demand-side mechanisms[3]. Both are recognized as critical initiatives to improving the sustainability of the energy sector, as energy generation accounts for about 25% of total greenhouse gas emissions[4].

A primary example of a shock on the side of electrification is the plummeting price of solar. As shown in Figure 6, prices of electrified power sources, especially solar, have collapsed over the past decade, falling by about 80% over a ten-year period[5]. In the UK, this has had a direct impact on sustainability policy. While the UK's 2013 Electricity Market Reform Plan, priced the cost of nuclear energy (and their subsidies) below that of wind and solar[6], by 2019 energy from wind farms had become so affordable that they did not require subsidies at all[7]. The

[1] Hyunsoo Kang, "An Analysis of the Relationship between Energy Trilemma and Economic Growth", 2022.
[2] Resources for the Future, "Electrification 101", 2022 https://www.rff.org/publications/explainers/electrification-101.
[3] *Ibid.*
[4] World Energy Council, "The Energy Trilemma Index".
[5] "Renewable Power Generation Costs in 2020", IRENA, 2021, https://www.irena.org/publications/2021/Jun/Renewable-Power-Costs-in-2020.
[6] "Electricity Market Reform Plan", IEA, 2022, https://www.iea.org/reports/electricity-market-reform
[7] Jillian Ambrose, "New windfarms will not cost billpayers after subsidies hit record low", The Guardian, September 20, 2019.

structural shifts enabled by the Treaty of Lisbon a decade prior, enabling energy market decoupling and eventually Brexit, enabled the UK to take advantage of improved economics. Rather than being folded into the EU's Climate Targets framework (had they remained part of the EU), withdrawing from the energy union enabled the UK to develop their own approach based on Carbon Budgets[1]. With a focus on reducing total emissions rather than only reaching renewables targets, the UK was able to keep their nuclear and fossil fuel power plants active, while using renewable sources such as wind and solar to effectively offset this. In the EU, because electrification of the grid had not achieved the same levels as those in the UK, sources such as solar have been slower to come online, meaning countries like France or Italy have not been able to take advantage of cheap solar energy to the same extent as the UK, despite its greater abundance[2].

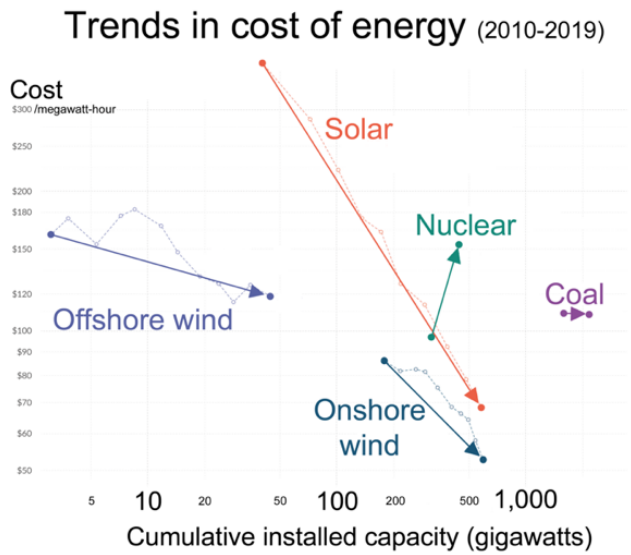

Figure 6: Trends in Cost of Energy[3]

[1] "Carbon Budgets", Government of the United Kingdom, GOV.UK, https://www.gov.uk/guidance/carbon-budgets.
[2] According to the World Energy Forum, in Italy, for example, "simplification in the authorization process to build new REN power plants will boost the transition but not at the required pace. Similar problems will arise in the transport sector where so far, the electrification of vehicles is far from sufficient."
[3] "Renewable Power Generation Costs in 2020", IRENA, 2021, https://www.irena.org/publications/2021/Jun/Renewable-Power-Costs-in-2020.

Another shock to sustainability policy worth considering is the second order effects of the Fukushima Nuclear Disaster. This can ultimately be tied back to one or more of the key systemic shifts discussed in the previous section; while in the UK calcification had led to stability in leadership through a decline in voter switching, the rise of the Green Party in Germany through a more fractious voting population led to a rejection of nuclear power as a renewable energy source[1]. The phasing out of nuclear, in turn, has led to a relative increase in the use of fossil fuel plants to make up for lost supply, especially in the face of recent geopolitical events[2]. In this case, the UK has been able to hold their climate policy stable, while Germany has had to sacrifice on this component of the Trilemma to prioritize security and access.

In addition to electrification, improvements in digital technology have led both the EU and UK to approach sustainability policy differently. Both governments target a high degree of grid digitalization, which effectively means building programmable grids that enable virtual communication between consumers and producers to more efficiently allocate energy[3]. For example, as shown in Figure 7, digitalization can be used to create more tightly integrated networks in which multiply systems "talk" to another rather than relying on centralized institutions. In part, digital solutions aim to address elements of energy trade-offs, but also create new ones. For example, as European governments work to increase the supply and efficiency of electricity, the expected consumer and business response is increased consumption (i.e. people work or drive more because electricity is cheaper)[4]. While perhaps counterintuitive (and granted,

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[1] American Institute for Contemporary German Studies, *The Conflict over German Nuclear Power and Renewables Rages On,* Jan 31, 2022.
[2] Rob Schmitz, "Amid an energy crisis, Germany turns to the world's dirtiest fossil fuel". NPR, September 27, 2022.
[3] "Digitalisation of the Energy System", European Commission, https://energy.ec.europa.eu/topics/energy-systems-integration/digitalisation-energy-system.
[4] EU Joint Research Centre, The Twin Digital and Green Revolutions, https://joint-research-centre.ec.europa.eu/jrc-news/twin-green-digital-transition-how-sustainable-digital-technologies-could-enable-carbon-neutral-eu-2022-06.

during the current crisis consumers and businesses are encouraged, via additional policies, to save energy), the World Energy Council projects "Germany's electricity consumption is likely to increase significantly from 562 terawatt hours annually in 2021 to a projected range of 680-750 terawatt hours in 2030", especially as the role of electric vehicles and electrification overall grows, with the goal of making electricity cheaper. Some have proposed technology as a means to improve distribution and reduce the impact of fluctuations in consumption to the point where the economics of the trade-off change, and emissions or equity issues are no longer unmanageably large.

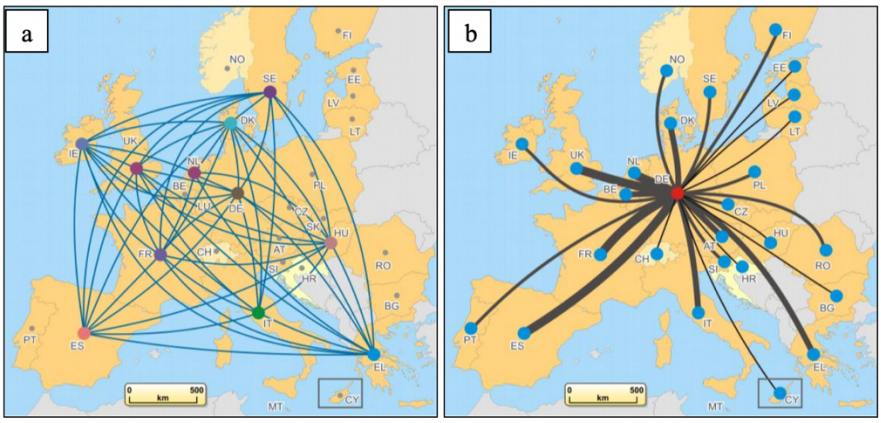


Figure 7: Map of European energy grid showing a virtualized network (a) compared to the old model of cross-border energy trading (b)[1]

The intermingling of digital and Green technology creates new headaches for EU countries that the UK does not have to contend with at the moment. A data privacy expert interviewed for this paper in Berlin questioned the inclusion of political or legal goals (e.g. antitrust) in the regulation

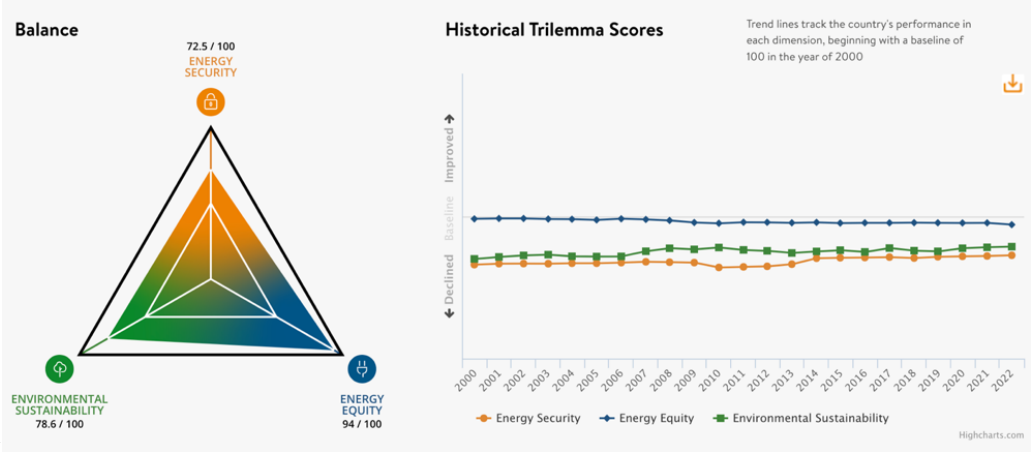
[1] "New digital energy system map shows the power & potential of energy digitalization", Energy Networks Association, October 15, 2021, https://www.energynetworks.org/newsroom/new-digital-energy-system-map-shows-the-power-potential-of-energy-digitalisation

of energy technology[1]. Calls for interoperability of devices and privacy look closely tied to other elements of the EU's digital agenda[2]:

> "More data also means more privacy concerns. These must be addressed by anonymising data collection and data minimisation, gathering only as much data as strictly necessary. During the Digital Decade, Europe faces two important challenges: the green transition and the digital transition. These might seem like two distinct issues, but really, they are twin challenges: neither can succeed without the other. And, they are both equally important for Europe's future."

So, what has been the outcome of this series of technological shocks and the way in which different economic and political institutions in the UK and EU process them? Using the World Energy Council's trilemma scoring tool (below)[3], it is possible to compare across countries, as well as before and after the period in this study (2011 vs. 2022). In 2011, the UK achieved a rating of 75.8% for its environmental sustainability policy; by 2022, it had improved ever steadily to achieve a rating of 83.2%, a 7.4 percentage point improvement representing placing it in the top 10 in the world[4]. While there is no composite rating for the EU, analyzing its three largest economies, Germany, France and Italy, reveals an opposing trend. While all three had a similar or higher rating than the UK's in 2011 (75-80%), the trend through 2022 for all three was either a flat line or decline in environmental sustainability.

[1] Interview with Aline Blankertz, Conducted on November 23, 2022 at Wikimedia Deutschland.
[2] "The twin green & digital transition: How sustainable digital technologies could enable a carbon-neutral EU by 2050", JRC/European R&I Update, August 27, 2022, https://euraxess.ec.europa.eu/worldwide/asean/twin-green-digital-transition-how-sustainable-digital-technologies-could-enable
[3] "The Energy Trilemma Index", World Energy Council.
[4] "2022 Energy Trilemma Report", World Energy Council, 22.



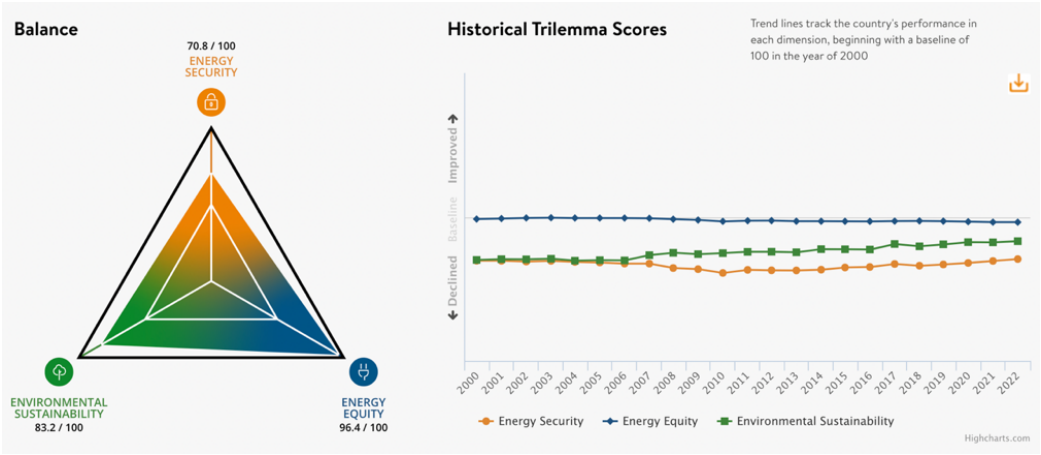


Figure 8: Germany (above) and UK (below) historical energy trilemma scores[1]

Variable 2b: Influence of inflation and the macroeconomic shift

As European energy markets have become more liberalized, so have consumers become more exposed to energy prices and the overall macroeconomic environment influencing them. As energy is a need for all members of society, consumers with less spending power tend to feel the pressure of high prices most. For this reason, this paper argues that changes in market conditions, including macroeconomic shifts, most heavily impact the *energy equity* component of the trilemma, also called access or affordability. This element of the framework assesses institutional emphasis on policy directed at providing reliable access to affordable energy[2]. As

[1] "The Energy Trilemma Index", World Energy Council.
[2] *Ibid.,* 10.

visible in Figure 9 below, the economic shocks stemming from the COVID-19 pandemic and war in Ukraine caused the price of gas to skyrocket, creating economic hardship for many and forcing governments to aim to save gas[1]. The lessons of the 1979 oil crisis are still applicable in 2022. Examining the choices European governments are making surrounding natural gas as triggered by Russia's war in Ukraine, the German government, for example, has had to ration during this crisis, already warning citizens of possible rolling blackouts in the winter of 2022[2].

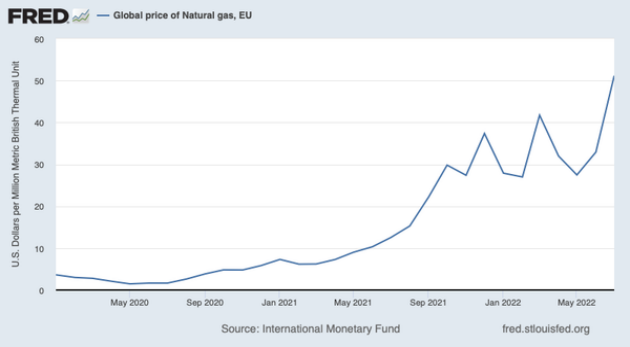


Figure 9: Energy Price Supply Shock[3]

Changes in economic indicators such as inflation rates, interest rates, GDP growth and employment, have distorted energy markets differently in EU member states compared with the UK, to the extent that diverse approaches will be required to stay on track to meet equity goals[4]. This has forced different approaches to price controls in the UK compared to EU member states (Figure 11, page 46)[5], though because British gas pipelines are still entangled with Europe's, there has been a decoupling of consumer and wholesale prices, and UK citizens have wound up less exposed to the high prices facing EU consumers[6]. In the EU, by contrast, large swaths of the

[1] "Global Price of Natural Gas, EU", FRED via International Monetary Fund, July, 2022, fred.stlouisfed.org
[2] Eva Macht, "Energiesicherheit: Was tun, wenn der Strom ausfällt*",* Das Erste, https://www.tagesschau.de/inland/stromausfall-faq-101.html.
[3] "Global Price of Natural Gas, EU", FRED via International Monetary Fund, July, 2022, fred.stlouisfed.org.
[4] Philip R. Lane, "Inflation Diagnostics".
[5] Sgaravatti et al, "National Policies".
[6] "New digital energy system", Energy Networks Association.

population would be unable to afford gas, but with full subsidies, gas runs out, leading to the price gap tradeoffs pursued by governments there (Figure 10)[1].

The EU has played a minimal role in providing for energy affordability, but efforts are increasing through the creation of an EU Energy Platform for the trading of gas, liquified natural gas and hydrogen. Simply noting the diversity in magnitude[2] and policy of EU member states' responses to the energy price spikes of 2022 (Figure 10, 11) reveals that policy is far from converged in the realm of how to drive energy affordability, and shocks such as the price spikes of 2022 can certainly have a major disrupting effect on unification of institutional approaches to energy equity. While there is an EU response, most policy is still handled at the national level, which is where divisions are most visible. Not only is the size of response varied; the types of economic measures put in place vary vastly both within the EU and in comparison with the UK[3].

Country / Policy	Reduced energy tax / VAT	Retail price regulation	Wholesale price regulation	Transfers to vulnerable groups	Mandate to State-owned firms	Windfall profits tax / regulation	Business support	Other
Austria	✅	✅		✅			✅	✅
Belgium	✅	✅		✅		☑	✅	✅
France	✅	✅	✅	✅	✅		✅	✅
Germany	✅	✅		✅		☑	✅	☑
Greece	✅			✅	✅	☑	✅	
Hungary	✅	✅				✅	✅	
Ireland	✅			✅		✅	✅	✅
Spain	✅	✅	✅	✅		✅	✅	
Sweden	✅			✅				✅
United Kingdom	✅	✅		✅		✅	✅	📋

Figure 10: Select European governments' responses to energy price spikes in 2022; Green check = implemented, Grey check = proposed, Calendar = scheduled

[1] Sgaravatti et al, "National Policies".
[2] *Ibid.*
[3] *Ibid.*

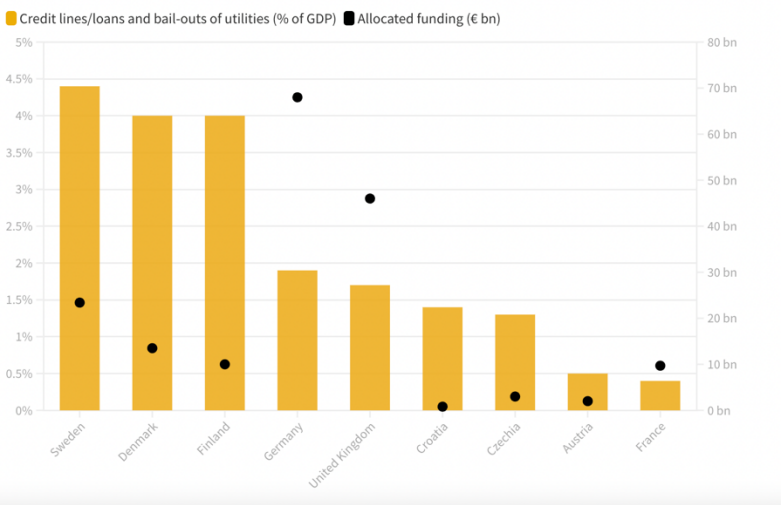


Figure 11: Magnitude of assistance programs as % of GDP[1]

At a surface level, the UK's policy response seems to fall in line with that of EU member states. However, a closer look reveals the mechanisms are actually significantly different. While most country use "feed-in tariffs" to govern maximum energy prices, the UK is managing tariff caps much more actively as the primary mechanism for controlling prices, while the German government, for example is relying much more on direct payments to consumers[2]. In the UK, for example, from 1 April 2022, Ofgem declared is would raise the price cap for tariffs from £1,277 to £1,971 for an average household[3]. The UK has also been much more liberal in its use of windfall profits taxes on energy corporations to finance this, expanding its rate from 25% to 35% in November of 2022.

Overall, due to liberalization, institutional ability to influence the energy equity component of the trilemma seems to be the weakest of the three, at least without making

[1] Giovanni Sgaravatti, Simone Tagliapietra, Georg Zachmann, "National fiscal policy responses to the energy crisis", Bruegel, November 29, 2022, https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices
[2] Sgaravatti, G., S. Tagliapietra, G. Zachmann (2021) 'National policies to shield consumers from rising energy prices', Bruegel Datasets, first published 4 November 2021, available at https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices
[3] *Ibid.*

significant tradeoffs on other economic indicators such as inflation. Some analysts argue that coordination among member states at the EU level is critical to mitigating disruptions in order to avoid a break-up of the EU internal gas market with "potentially serious political repercussions"[1]. Evidence that the UK was subject to different energy economics arose as early as 2000, when the government launched the Fuel Poverty Strategy to combat unaffordable consumer energy prices for low income households[2]. As discussed in the literature review, Ofgem's Supply Probe findings were that structural economic elements (i.e. market concentration) were a primary cause. Here again, it is evident that the energy market liberalization initiatives, driven by a convergence in UK and EU policies in the 1990s and 2000s, laid the groundwork for divergent energy economics, and eventually, energy equity policies. Referring to Figure 8 on page 42, the trendline is slightly more difficult to perceive, but evidence does point to more rapidly declining ability to Germany to manage the energy equity component of the trilemma compared with the UK.

It is also arguable that these differences are traceable to an earlier exogenous economic shock: Brexit, or the UK's departure from the European Union. Some experts claim that if the UK were in the EU, price increases in both regions would not be as drastic because both regions have differing energy specializations, such as the strength of nuclear and renewables in the UK, or the capacity to store gas in Germany[3]. Sovereignty and immigration are cited as two major factors behind the UK's breakup with the EU[4]. Thus, Brexit can be viewed as a reflection of the

[1] Sgaravatti et al, "National Policies"
[2] UK Department for Business, Energy and Industrial Strategy, 2000. https://beisgovuk.citizenspace.com/home-local-energy/fuel-poverty-strategy-for-england/
[3] "2022 World Energy Trilemma Index", World Energy Council.
[4] Matthew Goodwin, Oliver Heath, "Brexit vote explained: poverty, low skills and lack of opportunities", Rowntree Foundation, August 31, 2016, https://www.jrf.org.uk/report/brexit-vote-explained-poverty-low-skills-and-lack-opportunities.

UK's more conservative political skew compared with the average of the EU27, and potentially traceable back to the underlying political shifts (e.g. calcification) discussed in the previous section.

More recent evidence suggests that economic paradigms differ not just within energy markets, but in capital markets as a whole. This divergence, too, may have originally emerged from the UK's underlying political shifts. Former Prime Minister Truss's "mini budget" announcement makes for a prime "mini case study": in the wake of a proposed budget of high tax cuts paired with spending cuts, the British pound collapsed, and bond yields spiked, which many attributed to a lack of trust in British economic institutions[1]. Others, however, argue that it was actually a lack of political support, and hence political uncertainty, that concerned markets[2]. In other words, investors feared there was little political support for a socially liberal Prime Minister who advocated for traditionally conservative economics in a time of crisis. This is a notable shift from Boris Johnson's administration, which was notably more populist and economically liberal in spending. This highlights a decoupling in UK vs. EU market dynamics in two ways: first, that the British pound is perhaps much more sensitive to economic conditions than the Euro, and second, that the same calcification that created stability at the party level in the UK may have loosened constraints too much on the economic level, considering the volatility in policymaking from leader to leader.

Variable 2c: Influence of geopolitical crisis and its interplay with domestic politic shifts

Lastly, geopolitical events represent perhaps the most challenging shock to the trilemma to analyze. While Russia's actions in Eastern Europe, beginning with the Crimean Annexation in

[1] Sands, Suliman, Adam. "Why Liz Truss Resigned", Washington Post. October 20, 2022 https://www.washingtonpost.com/world/2022/10/20/uk-liz-truss-why-how-resignation.
[2] Paul Krugman, "Liz Truss in the Libertarian Wilderness", New York Times, October 18, 2022, https://www.nytimes.com/2022/10/18/opinion/liz-truss-uk-conservative-politics.html.

2014, through to full invasion of Ukraine in 2022, impact all elements of the energy trilemma, including environmental considerations and energy affordability, these effects are ultimately secondary to the direct shock to *energy security*. Energy security is defined as country's ability to meet its current and future energy demand[1]. From an outcome variable perspective, it makes sense to focus on two primary lenses through which to view divergences in energy security policy. The first is the short-term view: in other words, how are governments responding in the face of a crisis, and what policies are being put in place to mitigate the impact to short-term energy supply? The second is the long-term view: looking back to as early as 2012, what policy choices were made to reduce energy independence and sharpen the impact of a potential supply shock?

The difference in short-term energy security policy is staggeringly visible. While nearly all Western European nations, including the UK, saw a shock to their energy markets, energy security is being much more heavily threatened in EU member states, who are scrambling to cover their energy needs and seeing a cyclical effect between the economy and energy markets (high energy prices cause inflation, which in turn makes energy even more unaffordable within household budgets, becoming an energy equity issue)[2]. France[3] and Germany[4] have both invested significantly in public communications providing explanations to citizens of what to do in the face of energy blackouts, suggesting governments may be expecting, or at least planning for, the worst. The answer of what lies behind the divergence in response is more straightforward as

[1] "World Energy Trilemma Index", World Energy Council.
[2] *Ibid.*
[3] "Cuts, load shedding...What measures to take in the event of a power shortage?", La Redaction, French Government, November 9, 2022, https://www.vie-publique.fr/questions-reponses/287352-coupure-delestage-quelles-mesures-en-cas-de-penurie-delectricite.
[4] "Precautions for the electric power breakdown", Federal Office of Civil Protection and Disaster Assistance, 2022, https://www.bbk.bund.de/EN/Prepare-for-disasters/Recommendations/Electric-power-breakdown/electric-power-breakdown_node.html.

well. Quite simply, the UK is much better positioned in terms of energy resource endowments, energy infrastructure and trade balance[1].

The long-term view is heavily influenced by Europe's previous unpreparedness for energy independence, namely through close relationships which were intentionally fostered with Russia[2], both on the EU level as well as domestically for large countries such as Germany and Italy[3]. The EU's previous position was that Russia could be a reliable energy partner (even more so than Ukraine, who did not abide by market conditions[4]), so projects like Nord Stream 2 could benefit them along multiple axes of the trilemma, as gas-based energy, rather than oil, was considered "green"[5]. Even in the EU's most recent policy declaration regarding energy, gas was considered "clean". Today, the EU is now working to re-establish energy independence through its REpowerEU plan[6]. This plan will impose an additional 210 billion euro cost on EU taxpayers which UK citizens will not face[7].

While the impact of geopolitical destabilization on European countries' trilemmic tradeoffs has been largely focused on energy security considerations, there are significant knock-on effects to the other two dimensions. The IEA, for example, recently acknowledge the tradeoff between energy security and sustainability that would need to occur in order to meet short-term energy needs: "the faster EU policymakers seek to move away from Russian gas supplies, the

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[1] "2022 World Energy Trilemma Report", World Energy Council.
[2] Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy", European Commission
[3] *Ibid.*
[4] Andrei, R, "Natural Gas at the Frontline of the Energy Crisis and the War in Ukraine: A Material Perspective" in: *Natural Gas at the Frontline Between the EU, Russia, and Turkey*, 2022, Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-17057-7_4
[5] *Ibid.,* 34
[6] "REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition", European Commission, May 18, 2022, https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131
[7] *Ibid.*

greater the potential implication, in terms of economic costs and near-term emissions," the IEA said, in a report last week."[1]

But why was the UK better prepared to weather the impact of the geopolitical shock and stay on track with sustainability targets? One could argue the UK was perhaps more aligned towards energy independence already due to its long-term experience managing its declining oil fields[2]. In 2010, the country became an above average fuel importer compared to other OECD nations, primarily due to oncoming depletion of North Sea oil fields[3]. Ten years later, at the end of 2020, the UK formally left the EU emissions trading system, so it had to build up new, independent infrastructure for Carbon budget tracking and emissions management as well, making it perhaps more shock-resilient[4].

Indeed, it is unclear whether this trend will accelerate or derail the green energy transition within the EU. Most experts agree that member states will need to take a hit in the short-term as evidenced by the need to re-activate shut down coal plants, and coal use recently surging to record levels[5]. However, many leaders, including Germany's Finance Minister Christian Lindner, view green energy as the "energy of freedom" and see opportunities to leverage the crisis to increase investment[6]. Overall, because of the tradeoffs of the trilemma and the commitments they have made at the supranational level, EU member states have more difficult

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[1] "A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas", IEA, 2022, https://www.iea.org/reports/a-10-point-plan-to-reduce-the-european-unions-reliance-on-russian-natural-gas

[2] "Declining North Sea output means UK could soon import 80% of its gas and oil, warns OEUK report", WorldOil, March 29, 2022, https://www.worldoil.com/news/2022/3/29/declining-north-sea-output-means-uk-could-soon-import-80-of-its-gas-and-oil-warns-oeuk-report/.

[3] *Ibid.*

[4] Joel Reland, Sarah Overton, "UK and EU Greenhouse Gas Emissions Trading Schemes", UK in a Changing Europe, June 4, 2021**,** https://ukandeu.ac.uk/explainers/uk-eu-emissions-trading-schemes/

[5] John Kemp, "Global 2021 coal-fired electricity generation surges to record high", Reuters, July 21, 2022, https://www.reuters.com/markets/commodities/global-2021-coal-fired-electricity-generation-surges-record-high

[6] Stephen Milder, "Making Freedom Energy", Cambridge Core, July 29, 2022, https://www.cambridge.org/core/blog/2022/07/29/making-freedom-energies-how-1980s-struggles-over-market-access-shaped-the-rise-of-renewables-in-germany/

decisions to make about energy security, and it will be perhaps one of the largest divergences from the UK in terms of energy policy overall.

As evidenced by the case studies in this section applying the disruptions of the past several years to the trilemma, layering shocks on top of a model for institutional change within the context of policy tradeoffs provides a convincing analysis for structural shift and shock response as causes for energy policy divergence over the past decade. The energy trilemma, especially in its "enhanced" form proposed in this paper, offers a strong explanatory framework through which to view the choices institutions face and how they shape one another to produce policy. Finally, the overview of trends across its three components in Germany and the UK (below) make clear that even countries on a path towards convergence as little as ten years ago have already seen policy trends diverge in different directions[1].

Germany **UK**

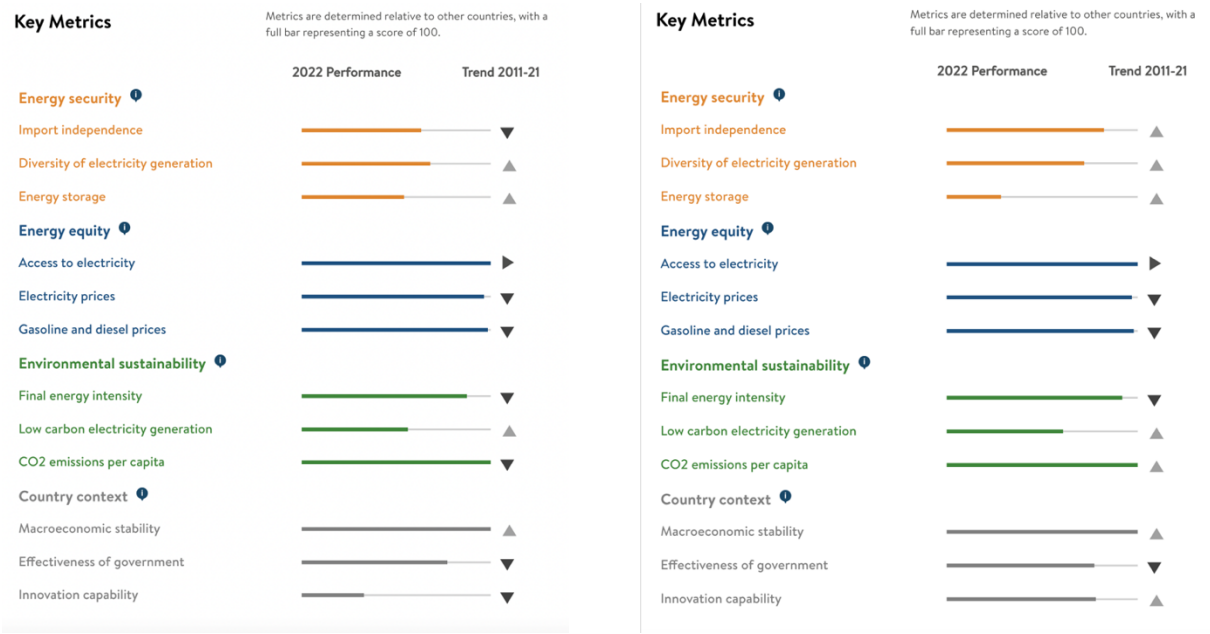

Figure 12: Detailed breakdown of Energy Trilemma components over the 2011-2021 period

[1] World Energy Council

Conclusion

This paper provided an overview and analysis of the divergence of energy policy in the EU and UK over the past decade, despite economic proximity and a strong trend of convergence in the prior 50 years. The analysis began by assessing the appropriateness of path dependance and related theory, an important feature of which is the identification of punctuated equilibria and critical junctures, as a potential explanation. While it is difficult to know if this moment in history, in the winter of 2022, is indeed a period of institutional change, or simply a reflection of gradual change leading up to it, this paper hopes to have highlighted the centrality of institutions and tradeoffs in shaping such change. By "complicating" the energy trilemma, introducing institutional influence and outside shocks, this paper allowed for a better understanding of its applicability during times of both short-term crisis and long-term systemic change. By empirically demonstrating that technological, economic and geopolitical shocks influenced particular elements of the trilemma, this framework allowed for an analysis of the underlying systemic shifts that caused differing responses to those shocks, revealing systemic differences in the influences of market liberalization, political calcification and new EU treaty frameworks in the early 2000s.

These findings have an immediate application in understanding the implications of energy policy decisions in the current crisis. Political leaders at all levels are seeing the tradeoffs of the trilemma more sharply defined than ever, but understanding what structural remedies can tilt the economics of the framework in one way versus another may define energy policymaking for a generation. On a more practical level, understanding cause and effect in the case studies presented by this paper may help future leaders avoid past mistakes. In the long-term, this paper could have implications for the future of the European project. If its findings are correct, that

actions taken along the path to integration, whether market liberalization or treaty renegotiation, actually weakened the link between EU and UK energy policies, this may imply that a better balance must be found among European allies between alignment and flexibility. In the case of the UK, some degree of independence seems to have had strong results across the dimensions of the energy trilemma.

From a qualitative standpoint, European leaders seem to be learning from past missteps, and institutions are re-aligning to provide the necessary support to respond to shocks across sustainability, affordability, and security. The EU's REpowerEU plan is a prime example, with ambitious goals to challenge the very tradeoffs of the trilemma itself. In fact, if green energy prices continue to decline and the internal energy market succeeds, the tradeoffs of the trilemma could be all but irrelevant within our lifetimes. Additionally, while the timeliness of this paper made increase its relevance, the fluctuating nature of current conditions in Europe may prove to be its weakness; only time will tell if its findings are still applicable in the future. A next step for researchers should perhaps be to strengthen the analysis with improved quantification or extend its applicability with a forecasting model. While quantitative forecasting was attempted in the process of researching this paper, developing a coherent model based on current conditions proved too difficult for the scope of this project, and the model was excluded.

Despite these limitations, international cooperation is more needed than ever to meet the needs of energy equity as a human right. Recent surges of isolationism, populism and warmongering could be just a blip in the longer arc of peace and prosperity, or a critical juncture in the liberal world order, but there is no doubt that the geopolitical events of the past year have created among the most dramatic shocks in the energy market that the world has seen in the last

century. A recent New York Times article[1] predicted the crisis may foreshadow a more extreme version of the energy transition to come:

> "But in the energy crisis of 2022, this tension [between energy affordability and sustainability] is no longer merely theoretical, an obvious crack running through a crystalline utopia. Thanks to Vladimir Putin's war and its attendant shocks, we are getting a version of the just-stop-oil world: immediate unavailability of normal flows of energy, forced transitions to alternative fuels, a price on oil and gas that's closer to what the most aggressive advocates of energy taxes would argue is appropriate, given global warming's threat."

Whether we choose to accept this version of the future, or believe in a tomorrow free from the constraints of the energy trilemma, how we learn from and apply the lessons of today is up to us.

[1] Ross Douthat, "The Contradictions of Climate Activism", New York Times, October 15, 2022, https://www.nytimes.com/2022/10/15/opinion/oil-energy-crisis-van-gogh.html.

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