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Title:
Repositioning Energy Geographies in a time of crisis: Arguments from a subdiscipline on the margins of Geography

Abstract:
While a range of rapidly proliferating crises shaped by anthropogenic climate change is profound and generating a raft of spatially-centered energy research, energy geographies does not occupy a central position within emergent climate scholarship, nor within broader disciplinary confines of human geography. The centrality of energy is undeniable, and even in light of the considerable history of scholarship combined with the fundamentally spatial nature of energy systems and transitions, energy geographies endure an occluded existence subsumed. This paper offers a critique of the subdiscipline's ongoing marginality while articulating its salience before offering strategies to help advance the repositioning of energy geographies from the periphery towards a more central position.

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Introduction: On positioning as peripheral

Energy plays a fundamental role in both socioecological systems and nature-society relations, ubiquitous across disparate geographies and ecosystems. The centrality of energy in human-environment interactions is undeniable. Synergistic processes coupling generation, transmission, distribution and consumption of energy are inextricably linked to the underlying causes and urgent interventions towards mitigating and adapting to a complex, accelerating, intensifying and disruptive climate crisis. Humanity, biota and non-human systems are all enduring various consequences of anthropogenic climate change, historically produced and currently sustained by fossil-based energy regimes, policies, infrastructures and resultant geographies (Carr, 2023). It is simply not tenable to discount the functional and multidimensional impacts of energy in shaping a multitude of environmental impacts, nor to downplay its centrality in mitigation, adaptation or resilience pathways. Lower-carbon energy regimes are similarly consequential. Purported as a means to rescue humanity from planetary peril, so-called "renewable" energy systems are largely still reliant on hydrocarbons, scarce metals and minerals, also fraught with extractive and exploitative production relations and value chains (Dunlap et al, 2024; Tornel, 2023a; Hesketh, 2022; Dunlap, 2021). Electrical currents animate the built environment and sustain modes of production—veritable lifeblood and opium of the imperal mode of living (Brand & Wissen, 2021)—the absence of which could transform erstwhile comfortable and profitable centers of production and reproduction into static structures subjected to environmental hazards of increasing frequency and intensity. Energy deficiencies may work to revert mechanical transportation to animal-based mobilities and exacerbate food insecurities, threatening human lives and livelihoods. Energy flows are manifest across all planetary spaces and their impacts extend across multiple human and non-human realms and relations. Vivifying ontologies, spatialities and temporalities, energy is everything, everywhere, all at once.

In parallel with implications of unavoidable human-energy relationships, the academic field of human geography has experienced a remarkable efflorescence in energy-centered scholarship. A keyword search of the term "energy geographies" in scholarly platforms such as Google Scholar or ResearchGate will reveal a significant number of recently published peer-reviewed research articles, policy briefs, white papers and conference proceedings. Keyword searches in human geography journals, however, do not generate a high number of manuscripts, indicating either a lack of energy geographies scholarship or a lack of scholarship framed as energy geographies. The fundamentally spatial nature of contemporary energy systems has inspired a renaissance of energy scholarship illustrating the immense value of geographic approaches, concepts, tools and techniques. Akin to energy itself, energy scholarship flows everywhere. Extending the metaphor, as with energy resistors, there are spaces where energy scholarship encounters resistance and friction, still struggling with embodied incumbency. Almost infinitely pluralistic, scholars and practitioners pursue energy work across an expansive range of infrastructures, institutions, actors, policies, practices, economies, assemblages, ecosystems and inhabitants. While the vast array of disciplines and subdisciplines pursuing energy as a matter of scholarly inquiry are generally well defined and understood, energy geographies are not.

There is a well-established history of geographic inquiry illuminating the diverse ways geographers pursue salient questions and interrogate spatial dimensions of energy-related

phenomena and problematics (Chapman, 1961). Even in light of the rapid escalation in spatially centered climate research, energy geographies do not occupy a central position within climate scholarship, nor within the broader realm of human geography. Although energy systems are fundamentally spatial and a considerable history of geographic inquiry exists (Linton 1965), energy scholarship is largely subsumed within human geography and endures an occluded existence. Societal dependency on energy is undisputed, the primacy of energy to our lives unassailable. However, energy is curiously perceived inversely—an object of concern rather than a field of study. Despite energy being relational, spatial, social and central to sustaining more-than-human and planetary systems, energy geographies have been frequently relegated to mere sustenance or symptoms of a 'modern' world-system in crisis. Energy is so omnipresent that it is literally hidden in plain sight (analogous to circulating charged electrons), often evading critical academic inquiry within human geography despite frequently comprising the circuitry by which it hums.

While the broader discipline of geography is commonly framed and functions as an integrative and convergent field, the subdiscipline of energy geographies is not widely conceived as fertile terrain for disciplinary or conceptual cross-pollination. Energy geographies largely occupies a peripheral and marginal position. Yet many major themes characterizing contemporary human geography scholarship are directly related to energy—e.g. power (political and energetic), vulnerability, resilience, justice and democracy—a perplexing peripheralization of a uniquely situated and relevant field of study. However, the vast potential of energy geographies to foster robust and novel geographic inquiry is impeded not by its own deficiencies; it is largely due to a lack of willingness by scholars to frame empirical and conceptual work as energy geographies and thus build a foundational literary canon.

Energy geographies could serve as an interdisciplinary interface synergizing multiple geographic fields, theoretical and methodological approaches while wrestling with timely and critical challenges. Further, the paucity and peripheralization of energy-focused geographic scholarship represents an imprudent lacuna that imperils the broader field of geography's ability to acutely diagnose socio-ecological crises and prescribe holistic, sustainable and equitable solutions. To the detriment of our broader subdiscipline of human geography, we have not paid enough attention to energy geographies.

One of the likely pretexts resulting in the sustained peripheralization of energy geographies has been the absence of a concise understanding of what precisely defines the subdiscipline and more broadly what could be considered energy geographies. This dearth of understanding has produced some confusion and stymied the development and evolution of a subdisciplinary identity. The overlooked or ignored identity also likely corresponds to misgivings around the value of energy geographies as a focus of spatially-centered inquiry. *Energy* itself suffers from reductionist conceptions, insofar as "the ability to do work" focuses solely on the productivity of materials in motion (Bridge et al. 2018). This definition inadequately encompasses the panoply of core and cognate aspects of energy—e.g. relational entanglements, discursive articulations—that traverse space and transcend scale. Energy remains dialectically articulated; capital accumulation through (neo)colonial dispossession, value-making potentialities through waste-

making propensities, affluence and access in excess afforded through ecocide and genocide (Stock & Sovacool, 2024; Dunlap, 2018). Illuminating origins and afterlives, energy's dynamism warrants interrogation: it is borne of imperial conquest and colonial dispossession (Lohmann, 2021; Daggett, 2019), comprises the lifeblood of capitalism that coagulates statecraft and sutures political economy through the accretion of necropolitical eschar (Huber, 2013; Luke & Huber, 2022; Cederlöf, 2021; Power & Kirshner, 2019; Shokrgozar et al, 2024), "fixing" sociological impediments to profit (McCarthy, 2015; Kennedy & Stock, 2021), thereby sustaining the growth paradigm and imperialist appropriation (Hickel, 2020; Hickel et al, 2022), assembling and entrenching geopolitical power geometries (Kuzemko et al, 2024), as it irrevocably transforms entire landscapes (Nadai & van Der Horst, 2010), reconfiguring labor arrangements and altering livelihoods (Stock & Nyantakyi-Frimpong, 2024). Echoing Illich (1974: 14): "Beyond a certain point, more energy means less equity." Indeed, energy is the *ouroboros* of the Anthropocene.

With the goal of mitigating any lingering uncertainty about subdisciplinary identity or importance, we offer a concise definition followed by a broad detailing of the depth and breadth covering energy geography scholarship:

> **Energy geographies:** *an integrative and inclusive academic subdiscipline of geography utilizing a wide diversity of theoretical lenses and methodologies to critically analyze, evaluate and comprehensively investigate relationships coupling energy and space.*

Contra recent characterizations that currently electrify our subdiscipline (Baka & Vaishnava 2020; Calvert 2016), we argue energy geographies should not be conceived as a frontier or borderland; frontiers are largely perceived as empty spaces and borders often serve to demarcate differences. While borders are often imagined, the resultant discriminations and conflicts are not. Consequently, we view energy geographies as an integrative force, a magnetic field of study functioning as a generator of convergent scholarship. Our view is reflected in much of the contemporary energy geographies literature, which draws on a plurality of subfields, theoretical approaches and methods. Similar to the manner our broader discipline of geography exudes inclusivity, rather than exclusivity, so too does energy geographies.

Tracing the contours of a dynamic and established subdiscipline, we aim to illuminate the peripheralization of energy geographies to wrest it from a figurative darkness and in doing so illuminate its salience. This paper is inspired by the following research question: *Why do energy geographies continue to occupy a marginal, if not peripheral, position in human-centered geography?* This paper aspires to respond to this pertinent question while also eliciting provocations for future academic endeavors in energy geographies.

The paper consists of four additional sections. First, we proceed by offering a historical view of energy geographies by interrogating its extractive and colonial origins, before detailing both the scholars and scholarship responsible for birthing and burdening the subdiscipline. Then, we document the rapid proliferation and progression of the subfield in recent years, brightening and blurring the boundaries of a constantly evolving field of study. Thereafter, the paper highlights the disconnections and peripheralization of energy geographies, situating the subdiscipline

within the broader contemporary geographic milieu in academia. We conclude the article by charting a path forward for energy geographies, asserting its presumed prominence within the broader subfield of human geography and establishing its normative relevance for advancing critical, salient and solution-focused scholarship.

Embers of empire: On origins and Othering

Energy is anything but apolitical. Energy geographies have historically been embedded within geography's colonial legacy and currently extends geography's neocolonial reach. Common perceptions of energy today actually reflect the proclivities and preferences of a privileged population within fossil fuel-powered patriarchy with disproportionate resources and influence to enact energy systems in accordance to their interests and ideals, largely privileged white propertied men of the 19th century (Daggett, 2019; Lohmann, 2021). The imperial ambitions of elites reframed as 'progress' and 'development', justifying a capitalist 'modernity' afforded through infrastructural violence that enabled grotesque inequalities in material access and comfort (Rodgers & O'Neill, 2012; Brand & Wissen, 2021; Hickel et al, 2022), sustained through greening capitalist extractivism as well as agitation against elite climate crimes (Stock, 2021; Hickel, 2020; Lohmann, 2020). Invoking Illich's insights on energy's genesis of the modern world-system, "Radical monopoly is first established by a rearrangement of society for the benefit of those who have access to the larger quanta; then it is enforced by compelling all to consume the minimum quantum in which the output is currently produced" (Illich, 1974: 18).

In *The Birth of Energy*, Daggett (2019) argues that common perceptions of energy today actually reflect the proclivities and preferences of a privileged population within fossil fuel-powered patriarchy with disproportionate resources and influence to enact energy systems in accordance to their interests and ideals, largely white cisgendered heterosexual propertied men of the 19th century. While Daggett unpacks this in relation to an argument centered on petro-masculinity, a contemporaneous pop culture account that famously captures the battle for electricity is Alfonso Gomez-Rejon's 2019 film 'The Current War', starring Benedict Cumberbatch as Thomas Edison locked in battle with George Westinghouse and liaising with Nikola Tesla to bring modern electricity into being. Unfortunately, the demographic dominance of privileged white men continues to characterize our subdiscipline. Decolonizing and diversifying our subdiscipline is an overdue imperative, discussed in more depth below.

A decade before this battle peaked as the 'City of Light' Columbian Exposition at the Chicago World Fair 1893 to convince 27 million visitors that alternating current would be the future of electricity, Sultan Barghash bin Said's House of Wonders (Beit-al-Ajaib) in Zanzibar's Stone Town became East Africa's first electrified building, its electric elevator embodying modernity. Electricity may not have been the sole preserve of white men, but it was certainly a colonial co-constituting force 'tamed' by controlled by wealthy and powerful Western elites. Prominently perceived in the form of electricity, so-called *energy* emerged during a time of accelerated colonial exploration, expansion, imagination, extraction and erasure. Europe would be the site of World War I and II during the first half of the 20th century, wars fought between industrial powers with conscripted colonized forces. The end of World War II was marked by the infamous announcement

of nuclear innovations, wherein the pitfalls are evident in the annihilatory weaponization for geopolitical hegemony with the promise of ostensibly clean electrification in a carbon-constrained future.

That this historic and historical period of expansion and dominion continues to capture popular imagination is no coincidence. As Mitchell (2009; 2013) argues in *Carbon Democracy*, energy forms and political power are inextricably linked. The 19th and 20th centuries were certainly 'the white man's centuries' in terms of control over critical energy sources in the form of fossil fuels, and battles that characterise them centered on forms of political power (e.g. capitalism vs communism during the Cold War). Perhaps most prominently among human geographers, Michael Watts has spent a career illuminating the lifeworlds linked to oil, specifically its political significance and expression. Work by such luminaries has documented and made sense of shifts in energy geographies in the long journey from a world where colonialism reigned as mundane, to one where colonialism's evolution, afterlives and offspring routinely take subtler forms in energy systems.

Schivelbusch (1995) makes an irresistible case for how industrialisation has irreversibly recast many mundane aspects of human existence. Nearing the close of the 20th century, the landmark work by Nye (1992) begins sensemaking of the electrification of the United States as a global superpower—a tale of transmission transpiring through alienation (Wellstone, 2003). Kale (2014) and Montaño (2021) are examples of more recent books working through similar implications for (parts of) other significant, complex countries such as India and Mexico respectively. During this time, geographers were engaging explicitly with natural resource geographies, where energy predominantly appeared in relation to resource extraction and human displacement, and through attention to land use changes with evolving territorialisation linked to material geographies.

These geographical focus areas today form seminal pillars from which energy geographies as a recent field borrows and adapts its conceptual toolkit. If forms of governance are at the heart of political scientists' interest in energy, then the sociospatial expression of governance – across scales, spaces and places of energy resource use – is the chief concern of scholars of energy geographies. Contributions from work on cognate sectors (such as Frances Cleaver's (2012) work on institutional bricolage linked to water governance) and from a scholarly focus on a given spatial scale (notably work in urban studies and by urban political ecologists), as well as recent contributions in transition studies with a relational approach to ontologies of change, serve as planks for engagement as energy geographers seek to bridge fields of enquiry.

All of which brings us to the early 21st century, when energy geographies truly emerge. The other trend to note in this moment is the shifting of forces from fossil fuels to lower-carbon energy sources. Even as fossil fuels remain deeply embedded in many political economies worldwide, with trillions of dollars in complex subsidies channeled to them – the 2020s mark a decade when the largest energy capacity being added by source every single year is solar energy, despite path dependency and any number of barriers already overcome. While energy geographies have examined this global shift over the past decade (as we detail in the next

section), we wish to emphasize the long-running trajectory of scholarly inquiry serving as the launchpad for the subdiscipline is worth considering to contextualize its unfolding evolution. The evolution is not only colored by climate coloniality (Sultana 2022), but also by the wealth of early scholarship that informs human geographers' and other scholars' forays into constituting this field. While our brief and selective characterization is by no means comprehensive, it signals the relevance of precisely such deeper consideration for all contributors. This is particularly salient as energy geographies evolve during a geopolitical era where energy has gained more significance than ever in light of recent conflicts, particularly Russia's invasion of Ukraine and targeting of energy installations (Ptak and Brooks, 2025. Moreover, China has taken a global lead on many critical resource geographies and manufacturing facilities in an ever more electric and digital world. The future, however, is low-carbon, and resulting geographies must be understood to effectively navigate outcomes of energy transitions – which are necessarily uneven in an unequal world.

Jennifer Baka and Saumya Vaishnava (2020) offer a broad overview of the contours of energy geographies. Other than the unsurprising fact that energy geographies literature is largely global North focused, they raise three important points. First, there is an overwhelming focus on "phases of energy transformation", largely "extraction and production" of energy. The focus is related to the legacy and (perhaps) continuing dominance of political ecology and political economy approaches in energy geographies while research was historically subsumed within resource geographies. They also outline how poststructuralism, justice, territory and politics, space and scale are the key conceptual levers dominating energy geographies. Usefully, they identify three 'frontiers' that energy geographers could contribute to geographical enquiry: enquiring the process of knowledge production, materialities of energy, and progressing geographical thought. For our enquiry on why energy geographies endure in a marginal space, how energy studies could advance geographic thought is the most prescient. They identify scale as a key area of contribution, also highlighting the urgency of investigating the understudied energy-water nexus, flagging the "research on the politics of scale and rescaling within water governance" as a useful template. Research on water and sanitation (albeit largely urban focused) seems more central within geography than energy, although this stream of energy geographies scholarship is steadily increasing (Blair et al, 2024; Stock, 2021). Engagement with critical cartography to animate discussions of landscape and political ecology is another recommendation (see; Howell and Baylis 2014). Yet, one wonders, how central critical cartography itself has been to human geography? Energy geographies and critical cartographies then, might benefit from working synergistically to advance a central position and offer new perspectives not possibly independent of each other.

Flares from the periphery: On productivity and proliferation

Starting towards the end of the first decade of the new millennium, there was a notable increase in the quantity of energy geographies scholarship. A catalyst for this surge might be traced back to early work of Solomon and Pasqualetti who produced two key pieces in 2004, highlighting the salient role of energy in geographic inquiry. Their article titled *History of Energy in Geographic Thought* defined the field of energy geography (as it was considered singular then) as "the study of energy development, transportation, markets, or use patterns and their determinants from a

spatial, regional, or resource management perspective" (Solomon and Pasqualetti, 2004: 831). This definition, although brief, provided a useful point of departure and added weight to a growing narrative detailing the salient coupling of energy in geography and resultant energy geographies. They also co-authored a chapter along with Luchsinger simply titled *Energy Geography* in the edited volume *Geography in America at the Dawn of the 21st Century* (Gaile & Willmott 2004). These two pieces worked to raise the profile of what was then a comparatively lesser-known subdiscipline undergoing the start of a profound and dynamic transformation.

In 2011, the *Annals of the Association of the American Geographers* published a special issue focused on energy geographies. While the special issue was largely a collection of empirically-based case study articles and bereft of any theoretical or critical advances to the field, it did raise the subdisciplinary profile and signaled the early stages of this boom (Zimmerer 2011). In a book review from this collection, Pasqualetti articulated how "the mix of energy and geography is so common it escapes casual notice," an argument interpreted by Calvert (2016) as "we take for granted the fact that, when it comes to energy, geography always matters." Calvert's article, reflects a foundational piece of scholarship emanating from this boom period. A major contribution of Calvert's article can be derived from the title, "from energy geography to energy geographies." Calvert identifies a form of reductionism when considering the field as energy geography, arguing "that while 'energy geography' is arguably a pragmatic shorthand with which to communicate to the broader energy studies community, geographical studies of energy have expanded in scope and theoretical plurality so that 'energy geographies' is a more appropriate label." Calvert asserts the need to recognize the subdiscipline itself has undertaken a transition and energy geographers need to frame their scholarship through lenses illuminating and supportive of plurality. Calvert also warns, however, that scholars should not automatically link everything energy to geography, as doing so would suggest the discipline does not offer anything specific and in effect is "nothing in particular (p.3)." Referencing prior work by Gavin Bridge (2012), Calvert expounds his argument by highlighting how linking energy and geography everywhere could result in irrelevance through ambiguity and redundancy while obfuscating both the validity and value of contributions by geographers.

Another significant contribution during this period was Bridge et al. (2013) who articulated the need to critically examine energy transitions as inherently spatial processes. While not explicitly advocating for consideration of energy geographies per se, they are implicit and draw on six fundamentally geographic concepts (location, landscape, territoriality, spatial differentiation, scaling, spatial embeddedness) to position them as salient tools for assessing implications of low-carbon energy transitions. Bridge (2018) was more direct in arguing for the need to consider space as fundamental in social science-based energy research. In fact, Bridge argued: "it is no longer tenable for social science research to understand energy systems without some consideration of space," (P.1). The article rightfully illustrates how the coupling of energy and space has reached a point where is it observable and thus, can be viewed through a figurative map which details relational elements. Moreover, and more importantly, Bridge argued how the coupling is yet to realize its full potential. As we argue and illustrate in this paper, the potential identified by Bridge and others, is still nascent and remains unrealized to a large extent.

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The 2014 annual meeting of the American Association of Geographers was, according to Saska Petrova "taken over by energy geographers" (2014). Petrova detailed how over one hundred papers across twenty-five sessions demonstrated a growing importance of geography to energy studies. It is critical to note that while supported largely by the Energy and Environment Specialty Group, many papers were presented as a part of thematically broader sessions in collaboration with (or hosted by) other specialty groups. In March of the same year, *Energy Research and Social Science* published its first volume. While the launch and rapid emergence of the journal has radically reshaped the landscape of social-science based energy research, it has also provided a space for energy geographies scholarship, and thus helped to advance the subdisciplinary evolution. Featuring in the first set of published articles, Pasqualetti and Brown (2014) draw on fundamentally spatial concepts to detail how energy geography matured from a nascent adolescence, and articulate how scholars or policy makers can use geography across a range of contemporary energy-society challenges.

In 2018, the journal recognized the key role played by geography and geographers and published *Spatial Adventures in Energy Studies* edited by Castán Broto & Baker (2018), a special issue which further highlighted the importance not only of spatial perspectives, but the salient work of energy geographies. They announced energy research had embarked on a 'spatial adventure' evidenced by a "growth of relational perspectives on space and energy" (P.3). Further, they posited that "analysis of visual representations of different energy features demonstrate the empirical importance of a grounded understanding of relational space" (P.1). In so doing, they emphasized "the importance of interdisciplinary work to examine the concept of space in energy studies" (P.3). This conversation is not one way; as they explain that since Hoare's (1979) indication that geography lacks engagement with energy issues, "geographers and other spatially-concerned social scientists increasingly engaged in energy studies." While this is indeed true and there are many more energy geographies studies and many more energy geographers, energy still seems to skirt the peripheries of geography, and indeed human geography research.

Bridge (2018: P. 16) offered insights into why this might be. While energy geographers should take pride in bringing "spatially-sensitive research" to energy studies, in-fact they/we have *only* brought energy studies "up to speed with developments in human geography over the last three decades". As such "energy geographies have largely been an importer of concepts and approaches" and "not been a core locus of innovation for human geography during a long period (30 years or so) of far-reaching conceptual development". Another problem faced by energy geographers working at the intersections of technology and society could be that they are caught in a space where research agendas "at once seeks a form of interdisciplinarity that is concerned with overcoming 'gaps' between disciplines and which positions social science as facilitating the uptake of scientific knowledge in policy and society" (Bulkeley, 2019: P.10). In a sense, (many) energy geographers might be caught in a cycle where societal (and disciplinary) imagination of their work might frame them as facilitating social acceptance of energy technologies. We can draw parallels to Bulkeley's (2019: P.11) summary of this imagination: "as if climate change were a given thing, and the task of social science, in this case human geography, is to seek to analyse society's responses towards it".

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To make energy geographies matter more for geographers, Bridge (2018: P.6) outlined the need for "paying attention to geographies of knowledge production, and processes of differentiation and disassembly". They usefully sketch out three ideas for energy geographies to make productive and profound contributions to geographical research. So, engaging with Other(ed) geographies of knowledge production which have been marginalized at the peripheries of mainstream Anglophone and city-based knowledge production (and energy studies perhaps already does this) and drawing conceptual lessons to disrupt existing conceptual tools of geographers is one way forward. There are many Othered geographies that must necessarily inform the 'map' which guides energy geographies and originates from large scale networks, industrialized economies, formal actors, rule of law and research shaped (if not directed) by policy concerns such as spatial planning, energy security, and energy transition. Yet, alternative scales, particularly the urban, have complemented an initial national focus and, over the past few years there has been an increasing exploration of energy geographies in national and urban settings beyond the industrial core. These developments are unsurprising because urban spaces have a distinct hegemony within the broader discipline of geography. Similarly, there is inspiring geographical scholarship in dialogue with liberation struggles in Latin America (Haesbaert and Mason-Deese (2020) which merits greater attention in Anglophone scholarship, by those able to take up texts in Spanish, as well as other globally widespread languages such as Portuguese and French. We acknowledge our own limits in this respect, despite being an ethnolinguistically and geographically diverse author team, as we are not conversant in these languages and hence not adequately positioned to address these contributions to energy geographies. However, scholars such as Halvorsen (2019) and Tornel (2023b) have pointed to this territoriality of knowledge production and brought some of this work to bear within Anglophone scholarship as well.

Outcries on the peripheral position of energy geographies resonate with challenges for climate geography that Bulkeley (2019) outlines. While we as self-identified energy geographers identify energy on the peripheries of geography, Bulkeley highlights that climate change is positioned as "occupying the 'middle' of the discipline, which leads it to be primarily a concern of those who (self) identify as 'environment and society' scholars". This middle ground is very different from climate change becoming "a central preoccupation across human geography's wide range of subfields" (ibid). Again, Bulkeley usefully lays out the problem that climate change could have been a victim of continuing "disciplinary structures, agendas and practices that assume a distinction and can readily be drawn between that which is natural and that which is social, despite the emergence of radical critiques of such a philosophy within the discipline." This for a discipline that is famous of being open and bound(ary)-less. While straddling the natural-social does offer opportunities for energy geographies, at the same time it also raises challenges, such as the notion posited by Calvert (2016) that scholars should avoid automatically linking everything energy to geography simply because of energy's intimate coupling with climate change.

During this period, Matt Huber developed two critical pieces of energy geography scholarship. The first argues for the need of geographers to better engage in debates grounded in critical social theory related to energy (2015). Huber detailed how conceptual understandings of energy and its role in the social production of space—once central, has been peripheralized largely

through political ecological approaches narrowly focusing on resources, rather than energy. Consequently, energy has largely become viewed and approached through empirical analyses, rather than conceptual inquiry and debate. Huber was effective in his critique regarding the empiricism of energy geographies, and while his articulation of pathways to further theorize energy geographies was pertinent (Huber & McCarthy 2017), our evaluation is unfortunate in that it has not become manifest. In the same year, a group of prominent energy geographers from the United Kingdom and United States published a series of articles in the *Journal of Geography in Higher Education* (see Thoyre & Harrison, 2015; Delgado, 2015; Graybill, 2015; van der Horst et al., 2015; Huber, 2015). In their introduction, Thoyre & Harrison point out how the rise of energy geographies scholarship has not translated to a corresponding rise in scholarship on teaching and pedagogy. As the vast majority of scholars combine research and teaching responsivities, it seems evident that a dearth of focus on teaching and pedagogy is an enduring shortcoming for the subdiscipline.

In addition to the boom of scholarship in peer-reviewed journal articles, between 2015 and 2018 two edited volumes and one co-authored volume of immense value to the field were also published. In 2015, Barry Solomon and Kirby Calvert published the *Handbook on the Geographies of Energy*. At 544 pages, this volume exhibits both theoretical and empirical contributions from most prominent contemporary energy geographers through six distinct sections. Then, in 2017, Bouzarovski, Pasqualetti and Castán Broto (*eds*) published the *Routledge Research Companion to Energy Geographies*. A more compact piece structured across three distinct sections, this volume focuses on empirical, rather the theoretical contributions. Finally, in 2018, Bridge et al. launched *Energy and Society: A Critical Perspective*. This volume is positioned to advance perspectives across broader scales and while deploying contemporary geographical concepts and approaches, is not narrowly disciplinary. However, all seven authors contributing to the work are geographers by training or position. Indebted to the aforementioned energy geographies scholarship for generating new ideas, directions and salient questions, we remain perplexed by its peripheral position.

Blackouts and blindspots: On mattering and marginalia

The pertinent question we must consider then: why after the raft of scholarship and trajectory of energy geographies during the aforementioned boom period has progression stalled? Energy geographers have proliferated spheres of academia, government and industry in recent years. Despite these accelerated and astounding efforts, however, energy geographies remain a curiously eclipsed academic field. Suffering not from a dearth of topically diverse, defensibly robust and conceptually rich scholarship, energy geographies is often discursively rendered as fertile or fallow borderland (Baka & Vaishnava, 2020; Calvert, 2016). Numerous reasons exist for the ongoing marginal position of energy geographies despite salient academic production and praxis. We identify three prominent reasons and each are elaborated in the following section: 1) Colonial-capitalist politics of knowledge and production relations; 2) Definitional ambiguity and discursive disarmament; 3) Disciplinary silos and selective categorization.

Energy geographies has been infiltrated and occupied by systems of oppression and differentiation endemic to all academia. Energy studies arose in parallel with scientific

breakthroughs—structured by colonial-capitalist ideologies, furthered by modalities of gendered and racialized violence and funded by extractivist, exploitative and ecocidal exploits in the global South. Systematic inquiries into the petroracial technological innovations and the exclusive enclosure of environmental expertise has had the effect of peripheralizing Othered people and their pluriversal energy imaginaries as well as their alternative and autonomous energy relations. In a classic rebuke of Althusserian Marxism, EP Thompson (1978: 3) cautions in *The Poverty of Theory*: "Historians should know that freaks, if tolerated—and even flattered and fed—can show astonishing influence and longevity." The history of energy geographies has been overdetermined by global North, colonial-capitalist systems of oppression, who hold an inordinate influence over the field of study even today (Tornel, 2023b; Lohmann, 2021; Cederlöf, 2021; Daggett, 2019). Unfortunately, and inconveniently, (neo)colonial production relations persist in lower-carbon energy transitions (Müller, 2024; Stock and Sovacool, 2023; Tornel, 2023b; Gergan, 2020; Dunlap, 2018). Energy geographies are Janus-faced, dualistically characterized by emancipation and erasure (Kumar, 2022). Fossil capitalism exudes racial capitalism and lower-carbon energy transitions remain racialized energy regimes. Ironically and tragically, the failure of geographical scholarship to unearth or expose the powerlines variously connecting and disconnecting energy studies further peripheralizes subalterns within an already marginal subdiscipline. Energy geographers already integrate justice considerations in their scholarship (Jenkins 2018; Jenkins et al, 2021; Hoicka 2023). In fact, our subdiscipline is currently blessed with a veritable avalanche of novel scholarship conceptualizing pluralistic emancipatory frameworks for advancing energy justice that include feminist, Indigenous, postcolonial and decolonial, antiracist, postcapitalist and anticapitalist, abolitionist, anarchist and solidaric approaches (Siamanta, 2024; Tornel, 2023b; Sovacool et al, 2023; Dunlap & Tornel, 2023; Sareen et al, 2023; Stock, 2023; Bell, 2020). While energy geographies may occupy a marginal position, and regrettably a historical and occasional hinterland, it is increasingly a frontline for advancing equity and justice.

Disciplinary definitions can function to enclose or gatekeep what normatively should be an open and omnivorous subdiscipline. Appending the "ies" to energy geograph*ies* scholarship, while an appreciated and more accurate update to the grammar of spatially-informed energy scholarship and practice, accomplishes little more than opening spaces for numerous and nuanced interpretations rather than illuminating our efflorescence. Notwithstanding the oft-celebrated novelty and notoriety of contemporary foundational works—Zimmerer (2011), Bridge et al (2013), Huber (2015), Calvert (2016), Baka and Vaishnava (2020), Kumar (2022), a necessarily incomplete list of efforts, all of which arguably consist of abridged syntheses, reviews and provocations—fail to represent conceptually and empirically rich scholarship. Theoretical advances and methodological approaches in our subdiscipline are largely borrowed or derivative, infinitely assorted but not *avant-garde*. While periodic touchstones and pulse checks may sustain the subdisciplinary status quo, they are yet to generate enlightening or innovative advances or movement towards the center. Broader fractures and fault lines in geography are evident and fought on the frontlines of energy inquiries. However, a dogmatic refusal of insular discovery and reflection have largely achieved victories on adjacent academic fields.

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Energy scholarship exists in many disciplines and subdisciplines. For example, anthropologists Boyer and Howe (2015) make important contributions to the emergent field of energy geographies. We do not argue for epistemic gatekeeping, but rather authored this article as an earnest attempt to puzzle through implications of the particular developmental trajectory of contributions to a field that really began to feel the force of engagement by human geographers with energy starting somewhere around 2010. Yet, too often do energy geographers bracket their academic expertise and identities, banishing geographical inquiries within the caveated asterisks of other or kindred subdisciplines *en vogue* or politically urgent. Currently, many energy geographers examine the energy dimensions of nature-society relations at the confluence of political economy and environmental justice, yet choose (not incorrectly) to situate their work within the big tent of political ecology. Energy geographers also choose to situate their work within other disciplines or subdisciplines with hopes of elevating or amplifying their efforts based on topical proximity or adjacent subdisciplines.

However, the aggregate categorical evasion of energy geographies creates an incorrect perception that scholarship is not concerned with such matters, thereby delimiting its scope and significance. As we argue in this article, energy geographies remain insufficiently preoccupied with studying (in)justice in marginalized groups, albeit slowly improving. Politically strategic decisions to not identify emancipatory or praxis-oriented scholarship with energy geographies may be valid and/or necessary. Yet the accumulated absence of self-identified energy geographies scholarship has unintentionally denuded or stymied the fertility of our peripheralized field—irrespective of enduring in a frontier, borderland or hinterland.

Radiant agendas: On potentialities and pathways

Out of the darkness and into the light, energy geographies reflect an applied and integrating subdiscipline well-positioned to produce relevant scholarship and astute solutions to manifold and intersecting contemporary crises and exigencies. Torches are lit as we gather intently and sojourn swiftly, we must first illuminate these spaces of critical scholarship and convivial collaboration. In the years since Bridge's (2018) provocation "the map is not the territory," energy geographers have thoroughly traversed 'the territory' utilizing, updating and eliding 'the map.' While the path forward for our subdiscipline may be uncertain, consider the sagacious maxim from Myles Horton and Paolo Freire's (1990) pedagogically diagnostic exchanges on social change: "we make the road by walking." Territory traversed with or without the map, it is incumbent upon energy geographers to recount our *spatial adventures in energy studies* while walking the road forward; our studies and scholarship merit more attention.

Centering energy geographies within broader human geography inquiry will necessitate focused interrogation and earnest efforts to address the underlying reasons for peripheralization. As such, the path forward must ameliorate the following aforementioned vulnerabilities of our subdiscipline: 1) Colonial-capitalist politics of knowledge and production relations; 2) Definitional ambiguity and discursive disarmament; 3) Disciplinary silos and selective categorization. Based on these problematics, we outline three potential pathways that will work to advance and center energy geographies:

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Pathway one: Illuminate the value of Energy Geographies for scholars whose work is fundamentally or tangentially spatial, encourage them to situate work within the subdiscipline. The challenge endures as thus the question remains; what is required in order for energy geographies to achieve full potential and emerge from the shadows of its nascent adolescence into a mature subdiscipline? The first and most prominent challenge is to convince geographers (and others) whose work is either fundamentally spatial, but not articulated as energy geographies, or tacitly identified as energy geographies, to situate their work within the subdiscipline, rather than another distinct field of study. A deep body of spatially centered energy scholarship is positioned within domains of political ecology, see for example; Christophers (2021), Cederlöf (2021), Cantor, Turley & Maxfield (2022), Knuth et al. (2022), or political economy (Bridge & Gailing 2020).

There is a vast range of inherently spatial characteristics easily located within contemporary energy transitions. Embedded materialities of these transitions, not to mention socioecological, sociopolitical and socioeconomic dimensions, provide fertile ground to favorably position energy geographies scholarship, see for example; Truffer (2015), Hansen & Coenen (2015), McCarthy (2023). What has become manifest, however, is the emergence of a burgeoning literature centered in socio-technical and sustainable transitions augmenting the evolution of a distinct field of study (Araújo 2014, 2022). A related, but distinct and also burgeoning realm of transition scholarship can be found in the concept of 'just transitions' (Heffron & McCauley 2017; Stark et al. 2023). It is possible to identify a similar trajectory and pattern in the just transition literature, where spatially centered research and scholarship by energy geographers has been developed through frameworks of political ecology (e.g. Newell & Mulvaney, 2013) or critical resource geography (e.g. Turley et al. 2022).

In parallel with a burgeoning sustainable, socio-technical and just transition literature has been the dramatic explosion in energy justice scholarship. Geographers have generated a prolific body of conceptually and empirically rich scholarship analyzing various spatialities coupled within energy justice policies, processes or empirics, many of which are cited above that chart the path forward for our subdiscipline (see also McCauley et al. 2013; Bouzarovski & Simcock 2017; Jenkins 2018; Jenkins et al. 2016, 2020, 2021; Sovacool, 2017, 2019; Reames, 2016, 2019; Kumar 2023). Energy geographers must work to embody applied, empirically defensible and conceptually revelatory scholarship. Such a reality and reputation would make a compelling case for emergent and salient research, particularly work by human geographers and other scholars who engage spatially-centered research.

Pathway two: Develop then bolster conceptual/theoretical foundations and innovations. Advancing the subdiscipline of energy geographies necessitates more than a congealing of academic identity coupled with a cohort of self-identified energy scholars. Culminating in years of often ignored and underappreciated scholarly outputs, energy geographies has produced numerous published works that comprise the foundation for a disciplinary canon, some of which are cited throughout this article. Brilliant as they may be, many of these celebrated works are reviews, critiques and provocations. Geographers working on energy issues, energy infrastructures, energy spaces and energy politics have made important contributions to

geography's political repertoire. For example, Mabel Gergan's work examining effects of climate change and development of hydropower in the Indian Himalayas contributed to novel understandings of Indigenous agency beyond Western contexts which simultaneously contributed to sub-fields of political geography, development geography, cultural geography, more-than-human geographies and decolonising geography (2017, 2020; Gergan and Curley, 2021).

Sarah Knuth's work on energy transitions in the United States has opened up debates on left populism and labour organising within industrial scale energy transitions and introduction of new financial instruments to foster such industrial scale transformation thereby contributing to economic geography, labour geographies, and urban geography (2019b, 2019a, 2023). Kathryn Yusoff's (2018) interrogation of energy and its extraction in multiple forms have been crucial to the understanding of Anthropocene geographies and the central role of energy, race and colonisation within it (see also Kumar, 2022). However, the subdiscipline still suffers from a dearth of novel theoretical and conceptual frameworks that are uniquely our own. An insufficient engagement with theory constitutes a loss for the wider geographical thinking. On the paucity of theory, energy geographers must challenge orthodoxy to generate novel ideas and expand scholarly reach to effectively communicate nuanced insights regarding salient, contemporary challenges and global change.

Pathway three: Create cohesion and strengthen community through heterogeneity.
Cohesion of energy geographies can be an outcome of building new academic programs at universities and colleges. New departments could support the evolution of energy geographies on a longer time horizon, a herculean feat when considering the specter of austerity looming over geography programs globally. Structurally nesting academic programs of energy geographies within existing departments or institutes may prove to be an easier undertaking. Where crafting new academic programs is unviable, energy geographers may also consider centering energy geographies within departments, degree programs or courses that focus on environmental social sciences. Generative spaces for energy geographies can also be forged within transdisciplinary academic spaces across and within academic institutions, as many diverse assemblages of scholars, practitioners, policymakers and stakeholders are being assembled to tackle global environmental issues at the local scale. Networked nodes that span physical and virtual space can also serve as spokes connecting to an oscillating yet accelerating academic hub. Certainly, the paucity of available degree programs and courses in energy geographies is contributing to the enduring marginality. Pipelines that transport undergraduates into graduate programs and the structured scaffolding of energy education and training is largely absent, undermining the collective academic future. One example warranting consideration of replicability is the Empowered Futures Research School. The program assembles yearly interdisciplinary cohorts of PhD students, postdoctoral fellows and faculty that are connected across several universities and research centers in Norway, supplementing energy and sustainability coursework with policy-relevant training and experiences geared towards the *in situ* application of knowledge and expertise. New or transformed programs specifically centering energy geographies in the curriculum could provide a strong and sustained foundation upon which new generations of energy geographers emerge and evolve.

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Further edifying and exalting energy geographies is also advanced through energy-focused conferences or energy sessions within larger conferences, colloquia, symposia, speaker series and workshops. For example, the Energy and Environment Specialty Group (EESG) of the American Association of Geographers (AAG) convenes an annual online Energy Geography Conference. The EESG also hosts a diverse array of engaging energy-focused sessions, presentations, events and meetings at the AAG's Annual Meeting, as well as a virtual speaker series in the fall and spring each year showcasing the work of energy geographers at the cutting edge of the subdiscipline. Similarly, the Energy Geographies Research Group (EnGRG) of the Royal Geographical Society hosts a multitude of relevant scholarship at the RGS-IBG Annual International Conference, in addition to speaker series and workshops throughout the year. We do recognize these two entities reflect Global North systems of power and histories of oppression. Therefore, the challenge is to use the platforms offered by these entities to advance scholarship and provide opportunities for scholars from and located in the Global South. While efforts have been undertaken in this regard, much remains to be achieved.

Increasingly, there is no shortage of academic spaces for energy geographers to share salient work. Dedicated journals—such as *Energy Research and Social Science, Energy Policy*—and special sections within established journals (e.g. *GEO: Geography and Environment's* Geographies of Energy Futures) constitute integral components of scholarly output. Even new energy journals could easily thrive given publication bottlenecks that warehouse submitted manuscripts and restrain new ideas and impact. Moreover, academic gatherings in the global South (such as the International Geographical Union's Thematic Conference on "Connecting Geographies from the Global South" in Quito in 2024), as well as degrowth and political ecology conferences which convene a wider spread of scholars and activists in a variety of geographies, offer useful venues to diversify energy geographies. That said, these latter conferences and gatherings do not have an explicit annual focus on energy, nor on geography, hence it remains important to build a thematic identification with energy geographies as a field within conferences and associations explicitly focussed on geographic scholarship.

Coda: On powershifts and empowerment

Unification and elaboration of energy inquiries and interventions from energy geographers necessitates no less than (*inter alia*) a wholesale engendering of inclusive spaces both outside academia and within. It is particularly crucial to encourage and provide inclusive, equitable spaces for actors and institutions historically and presently excluded and Othered by politics and practices of energy and geographical knowledge production. Opening up and transforming energy geographies requires privileged actors to rethink their positions and power within academia, government and industry to create and cede opportunities for marginalized groups and frontline communities. Representation is an essential component for elevating and centering the subdiscipline. The politics of citation are yet another dimension of equity in scholarship; let us reference and amplify the work of underrepresented energy geographers and cease the obsequious validation of stratospheric-citation-rate-obsessed academics. Grounding efforts and interactions in an ethos of care and repair, powershifts and empowerment must become core components and defining characteristics of the ascendant field. Moving outward from the

periphery and into the center should emerge from empowering relationships across diverse spaces and places for global North and global South energy geographers and institutions.

Consider this article not a diagnostic review nor a prognostic blueprint. Confronting the manifold and coalescing crises afflicting our more-than-human planetary systems will require an energetic rewiring of social, political, cultural, economic and ecological circuitry. Indeed, energy geographers are well positioned to design and implement reparative interventions at specific places and across diverse scales with processes coordinated by local leadership, knowledge, expertise and aspirations. Simultaneously and occasionally contrarily, energy geographers must also strive to elaborate broadly-defined policy-relevant metrics, heuristics and best practices to transcend scale and space in order to hasten transitions and mitigate enduring socioenvironmental degradation. Confronting climate coloniality requires alternative energy geographies (Sultana, 2024). As this critical time for decarbonization evolves and unleashes uneven environmental hazards (Ptak et al. 2024) and cascading failures within and across diverse geographies, geographers are positioned to expand the reach and impact of salient, timely and critical spatially centered and place-based energy scholarship (Hoicka et al. 2025). We all bear responsibility to animate empowered, just and equitable futures. Consequently, there has never been more urgency to amplify energy geographies scholarship and work to reposition the subdiscipline from its marginal position, inwards to the center.

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