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Original research article

Embodied energy injustices: Unveiling and politicizing the transboundary harms of fossil fuel extractivism and fossil fuel supply chains

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ABSTRACT

We introduce the new concept of *embodied energy injustices* in order to encourage integrative, systemic, transboundary assessment of the global implications and responsibility of energy-policy decisions. Embodied energy injustices reframe considerations of energy justice to explicitly consider hidden and distant injustices (upstream or downstream) arising from the extraction, processing, transportation and disposal of energy resources. We assess the embodied energy injustices connected to the decision to decommission a coal-fired power plant in Salem, Massachusetts, US, and its replacement with a natural-gas-fired power station. *Cerrejón* open-pit coalmine in La Guajira, Colombia, powered the Salem plant for over a decade. Fracked gas from Pennsylvania now supplies fuel for the new power station. Comparing the extraction of these two very different fuels reveals multiple parallel injustices. But the regulatory environment fails to account for the different constituencies, jurisdictions and effects that fall outside the formal remit of existing impact assessments. We therefore call for mandatory transboundary impact assessments of large-scale energy-related projects, which explicitly integrate previously unrecognized social-environmental harms and injustices. Expanding energy law and policy discussions to incorporate embodied energy injustices can enhance sustainable energy governance and enable corporate accountability for the transboundary harms of fossil fuel extraction and use. Linking *chains of energy injustice*—by revealing their interconnected positions along fossil-fuel supply chains—may help generate and unite powerful trans-local solidarity movements, which politicize local struggles within wider national, regional and global energy politics.

1. Introduction

Energy decisions have transboundary impacts. Yet Environmental Assessments (EAs) and Environmental Impact Statements (EISs) of large-scale energy infrastructure, including distribution networks and pipelines, shipping terminals, and rail and trucking networks intended to transport fossil fuels to markets, rarely consider the direct and indirect greenhouse gas (GHG) emissions of such infrastructure linked with either upstream extraction or downstream consumption [1,2]. Moreover, the justice implications—especially for distant communities further up or down the energy supply chain (e.g. “sacrifice zones”; see [3])—are routinely overlooked or deliberately ignored [4]. The net effects of this analytical gap are incomplete considerations of climate impacts [2], and omissions of socio-environmental justice implications of energy decision-making [5].

Fossil-fuel extraction is associated with some of the worst human and ecological disasters in the world [6]. Growing global energy

demand has resulted in constantly expanding “commodity frontiers” [7], including new modes of expanding capital, fossil-fuel extraction, and associated toxic production and disposal [8]. Markets of the global south have become host to some of the biggest mining multinationals [9], while technological advances in hydrologic fracturing have recently further expanded the emerging frontiers of fossil fuel extraction. As a consequence, the last decade has seen a significant increase in socio-environmental conflicts involving communities around the world that oppose fossil-fuel-extractive activities [10–13].

Energy production has increasingly shifted across borders, particularly in the form of industrialization in low- and middle-income countries and deindustrialization in high-income countries. This transboundary shift has contributed to the increasing disconnect between places of energy consumption and those of energy production [1]. Consumers in importing countries suffer from “consumer blindness”: they are unaware of where the fuels they consume are coming from and

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under what conditions they were produced [14]. Energy extraction often entails the physical displacement of populations or the “slow violence” of landscape destruction, water contamination and livelihood disruption [8,15]. Complex energy governance issues thus emerge [16], particularly as local, state, national and international priorities are misaligned. As Haarstad [11] states: “outcomes and experiences for local communities affected by extraction may differ from *national* outcomes...because spaces for national government policy are always delimited by *international* constraints, such as export agreements, international market pricing and foreign investors” ([11]: 978).

Identifying, diagnosing and redressing the negative impacts of energy decisions and the unequal distribution of costs, risks and vulnerabilities across multiple levels of governance [17], supply chains [18], political jurisdictions and transnational boundaries [16,19] is a challenging task for consumers, researchers and decision-makers. Closer examination of the lifecycle impacts of energy production and consumption systems is necessary to draw attention to the global fossil-fuel-dominant energy regime’s multiple but largely hidden “sacrifice zones”¹ [20] and cross-scalar socio-environmental justice impacts [5]. A deeper understanding is needed of how injustices are embodied in energy production and consumption supply-chain systems. This understanding is critical, because considerations of such energy injustices can—or should—alter the balance of costs and benefits for proposed energy projects and infrastructure decisions, and alter decision-makers’ ability to justify the decision in light of that balance [2].

This paper examines how injustices are embodied in fossil fuel production and consumption systems by exploring fossil-fuel supply chains and their interconnected *chains of energy injustice*. By introducing the concept of *embodied energy injustices*, this paper reframes considerations of energy justice [21] to explicitly consider hidden and distant injustices (upstream or downstream) arising from the extraction, processing, transportation and disposal of energy resources. These interlinked chains of injustices are routinely overlooked or omitted from energy policy decision-making because they (a) typically fall outside the formal remit or jurisdiction of EAs or EISs, (b) occur in different geographical jurisdictions, or distant locales, disconnected from sites of combustion and consumption, (c) occur on different timescales, and (d) are often hidden or removed from centers of political power (see Fig. 1).

The term “embodied” was deliberately chosen for its existing resonance in energy policy. Our conceptualization builds off the parallel terms “embodied energy”—energy used in all phases of building construction [22]—and “embodied emissions,” which refers to the total amount of emissions from all upstream processes required to deliver a certain product or service [1,23–25]. Around one quarter of global GHG emissions are embodied in imported goods, thus escaping traditional climate regulations [23]. Embodiment has different meanings in different disciplines: in medical anthropology it focuses on how social influences impact the physical body; while in sociology and public health, embodied injustices describe how injustices take a physical toll on people who experience suffering. Our use of the term “embodied energy injustices” refers more broadly to the full spectrum of *transboundary* socio-environmental injustices linked to energy policy decision-making. Embodied energy injustices can be quantifiable, such as uneven environmental contamination, disproportionate environmental health impacts, and livelihood disruptions; or non-quantifiable, such as slow violence, forcible displacement, and human rights violations.

Given the focus on transboundary injustices, our conceptualization of embodied energy justice aligns with a cosmopolitan² view of energy

justice. Cosmopolitan justice posits that all human beings have equal moral worth, and their entitlements should not be determined by factors such as nationality or citizenship. This perspective views injustices not merely as a national problem but as a universal problem—we are all world citizens, deserving of energy justice [5]. Related to this, it is important to clarify how our conceptualization of embodied energy injustices relates to climate change impacts and principles of global intergenerational justice. We align with Caney’s (2005) argument that those who contribute to global climate change through high emissions are guilty of human rights violations. High emissions can lead to the erosion of “vital interests” of future generations and thus their ability to live in a relatively stable climate.

Just as the concept of ecologically unequal exchange [26] points to an asymmetric transfer of embodied resources between nations, the concept of embodied energy injustices draws attention to the transboundary nature of systems of energy production and consumption and their interlinked chains of injustices, which are rarely accounted for. Much as “conflict diamonds” [27], popularized in the media as “blood diamonds,” refers to the role diamonds are believed to have played in fuelling civil wars and conflicts in African countries such as Sierra Leone, embodied energy injustices³ can also be used to taint supply chains and challenge energy production and consumption laws, regulations and practices. By adopting an upstream focus on extraction and fossil fuels, and examining the power dynamics and political economy of energy production, embodied energy injustices redirect attention and responsibility to those decision-makers and other beneficiaries of energy development who typically slip under the radar of accountability for energy injustices [4,5,28]. As Princen et al. [28] argue, the power of the fossil-fuel complex is upstream, “where the rules of the game are written, capital is amassed, technological experiments are conducted, and wealth is accumulated” (p. 360).

To introduce and explore the application of embodied energy injustices, this paper reframes current energy justice frameworks and connects them to broader debates over scale and the global processes that generate socio-environmental injustices. First we examine the decommissioning of a Salem, Massachusetts, coal-fired power plant in northeastern US and its replacement with a natural-gas-fired power plant. Second, we examine existing injustices connected to Cerrejón—one of the world’s largest open-pit coalmines, in La Guajira, Colombia, and the primary supplier of coal to Salem for over a decade. Third, we examine existing injustices connected to hydraulic fracturing sites in northeastern and southwestern Pennsylvania in the US. These sites now supply natural gas to Massachusetts. Simultaneous assessment of interconnected sites allows for geographically distributed supply-chain analyses of how local energy decision-making in one region in the northeast US has multi-scalar socio-environmental justice implications for fossil-fuel extraction in La Guajira and Pennsylvania. We highlight how fossil fuel interests use corporate social responsibility (CSR) as a tactic to evade responsibility. We discuss the potential of politicizing corporate accountability for fossil-fuel-extraction impacts and injustices. To conclude, we expand on the challenges and opportunities for explicitly integrating consideration of embodied energy injustices into energy policy decision-making and governance.

2. Expanding and politicizing the energy-justice framework: connecting transboundary impacts and structural global inequities

The concept of embodied energy injustices builds on the energy

¹ Examples of sacrifice zones include oil-rich regions of Africa and Latin America such as Ogoni Land, Ecuadorian rainforests or the Appalachian coal fields in the US.

² Cosmopolitan justice is an ideal model of global justice based on several political principles, including globalism, universalism, participation and procedural fairness [95,100,104].

³ Embodied energy injustices can be differentiated from other efforts to identify the “hidden costs” of fossil fuels. Epstein et al. [98], for example, examined the full lifecycle cost of coal by monetizing its environmental externalities, while others have calculated the social costs of carbon [99] and methane [106].

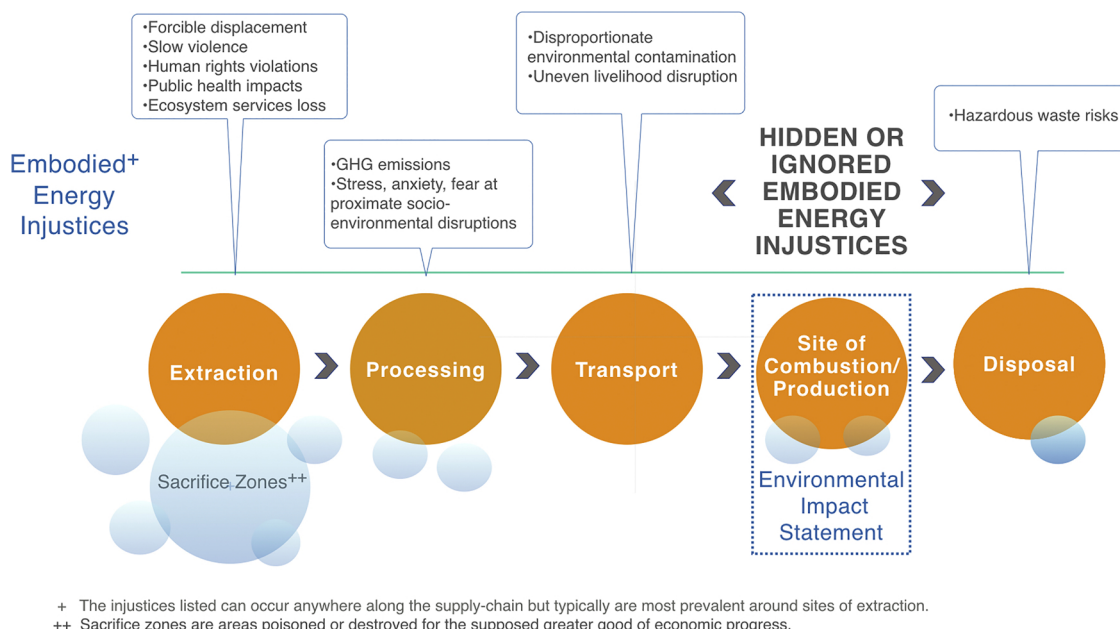


Fig. 1. Embodied energy injustices explicitly consider hidden and distant injustices (upstream or downstream) arising from the extraction, processing, transportation and disposal of energy resources.

justice framework, which is rooted in—but tends to oversimplify—decades of environmental justice research [29–32]. It also emerges from recent debates on how to integrate issues of climate justice, fairness and equity into large-scale shifts in the energy sector [33–35]. The environmental justice movement, with its origins in the Civil Rights movement, defends “people of color” and low-income communities against environmental harm and the disproportionate and unjust imposition of environmental hazards (e.g., the Love Canal tragedy) and fights for authentic participation in decision-making for affected and marginalized populations. Climate justice builds on the concerns of scholars and activists working in the fields of environmental racism and environmental justice. The combination of highly unequal GHG emissions and highly unequal vulnerability to climate change is at the heart of climate justice [36].

Climate justice, however, has often lacked the analytical focus and detailed spatial deconstruction of environmental justice [33,37]. As such, climate justice advocacy and action are needed at different scales, beyond international relations and the nation-state ideal. Aiming to fill this gap, energy justice seeks to embed principles of fairness and social equity into energy policy decisions and energy transitions [21,38]. Jenkins et al. [21] see energy justice as a way to evaluate (a) where injustices emerge, (b) which affected sections of society are ignored, and (c) what processes exist for their remediation in order to reveal and reduce such injustices. Energy justice assessments⁴ may therefore resonate more with energy policy decision-making and governance, due to its practical and specific focus on energy infrastructure and energy systems [39].

We note inconsistencies in the use of the term “justice” in the energy justice literature. The literature and movement associated with environmental justice focuses on how ethnic minorities and poor and marginalized people are *disproportionately* affected by environmental harm, are excluded from spaces of decision-making and information access, and have to fight for recognition and restoration of the biophysical world [40]. Energy justice literature often conflates environmental harms with “injustice” irrespective of the ethnicity or

socioeconomic status of impacted populations. For example, environmental harms imposed through energy extraction on impoverished, historically marginalized communities in Latin America, who are struggling against the state or against private companies that threaten their livelihoods, health, culture and autonomy —i.e., Joan Martinez-Alier [8] “environmentalism of the poor”— should be distinguished from the environmental harms of a power plant imposed on an affluent community in the global north. Our conceptualization of embodied energy injustices exposes the *disproportionate* distribution of environmental harms on vulnerable peoples situated along energy supply chains.

We define environmental harm as damage caused to persons, property or the environment. It can also include less quantifiable impacts such as distress, suffering, apprehension, anxiety and fear related to proximate socio-environmental disruptions [41]. These harms become an issue of justice when energy projects reinforce existing inequalities on particular individuals or groups. Environmental harms can also become an issue of justice when they violate the human right to a healthy environment.⁵

Integrating mechanisms for responsibility and redress for injustices is critical for the future development and significance of the energy justice concept in political practice and policy-making. A politicized and *realpolitik* understanding of energy injustice can foster processes and mechanisms for responsibility and accountability for decisions on energy infrastructure and their connected transboundary impacts. Explicitly investigating *injustices* (rather than justice) can more effectively facilitate change: As Simon [42] wrote, “injustice takes priority over justice.” Healy and Barry [4] proposed this reframing of energy justice, sustainability and democracy to energy injustice, unsustainability and a lack of democracy, arguing that energy transitions become “a more radical, systemic and politically oppositional project” (p. 452). Just as Barry [43] calls for analysis of “actually existing

⁴ David Schlosberg [40,105] work on theorizing environmental justice using tripartite categories of distribution, procedure and recognition is now part of a body of theory that is widely used in energy justice assessments [5,21].

⁵ The UN Committee on Economic, Social and Cultural Rights ([110]: 133) has described the right to a healthy environment as including “the requirement to ensure an adequate supply of safe and potable water and basic sanitation; and the prevention and reduction of the population’s exposure to harmful substances such as radiation and harmful chemicals or other detrimental environmental conditions that directly or indirectly impact upon human health.”

unsustainability” to take priority over analysis of sustainability, our conceptualization of embodied energy injustices draws attention to identifying “actually existing injustices” and remedying those injustices as a precondition for any aim to articulate and achieve a future conception of energy justice. Energy justice frameworks should not only evaluate the ethical desirability of certain policy measures, but also engage actors and publics to challenge existing injustices via disruptive actions in social, cultural, political and economic spheres.

Energy-related research often falls into the “local trap” of empirical richness and fails to make larger analytical connections to broader debates over scale [44] or global economic influences, especially neoliberalism [45,15]. Similarly, many scholars have written about the limits of locality-based struggles. As David Harvey points out:

the environmental movement “can either ignore the [capitalist] contradictions, remain within the confines of their own particularist militancies—fighting an incinerator here, a toxic waste dump there, a World Bank dam project somewhere else, and commercial logging in yet another place” or they can confront “the fundamental underlying process (and their associated power structures, social relations, institutional configurations, discourses and belief systems) that generate environmental and social injustices” ([46]: 400–401).

The challenge for energy justice research and practice is to identify and challenge the extralocal processes that shape energy injustices. The concept of embodied energy injustices requires justice advocates to move beyond local sites of struggle. It attempts to address this by expanding the energy justice framework, explicitly connecting it to global economic influences: integrating greater recognition of larger political-economic structures and geographies which shape current energy-policy landscapes.

For instance, over the last 30 years the global environmental regulatory systems have come under serious attack [47]. Institutional changes include both “rolling back” the regulatory state and “rolling out” neoliberal ideology and programs to “mask and contain” the destructive social and environmental impacts of extractivism [48]. Extractivism is usually embedded in a history of imperialism where natural resources are exported to first-world countries under unequal conditions of trade and profit. The neoliberal turn thus spurred an intensification of globalization, or the geographical expansion of capital from the global north to the global south, especially through opening up mineral exploitation to transnational firms and granting favorable conditions for private investors [9]. Neoliberal policies ultimately engendered a new phase of what David Harvey calls “accumulation by dispossession.”⁶

By diminishing regulations and devolving mechanisms of oversight to underfunded agencies, neoliberal policies spawn energy injustices (discussed in Section 6.1). Therefore, by *upstreaming* political attention to extractivism of the global south and sacrifice zones⁷ in the global north, embodied energy injustices connect the social and ecological impacts of extractive practices to distant energy policy decisions and consumption. This upstreaming also allows embodied energy injustices to serve as a lens to understand how globalization and the broader

⁶ Harvey (2003) argues that the predatory practices of capital accumulation based on predation, fraud and violence are a continuous characteristic of capitalism, and intensified during the onset of neoliberalism in the mid-1970s [71]. Unequal repartition of property rights has allowed capitalist “accumulation by dispossession,” which often entails expelling people from their land and degrading their environment. Military, diplomatic and financial support from states to corporations is key to its facilitation.

⁷ Relatedly, Naomi Klein argues that “Extractivism is [...] directly connected with the notion of sacrifice zones—places that, to their extractors, somehow don’t count and therefore can be poisoned, drained, or otherwise destroyed, for the supposed greater good of economic progress” (2015: 169). Concentration of injustices along fossil fuel supply chains, in particular violence and state policing, is often centered at sites of extraction.

dynamics of global capitalism have fostered widespread injustices through fossil fuel extraction.

3. Research design: multi-site ethnography

3.1. Data collection and analysis

This research employs a comparative case study of existing injustices in two fossil-fuel extraction regions interconnected by the decision to decommission a coal-fired power plant in Salem, Massachusetts. This comparative approach connects the neglected voices of locals and localities affected by extraction with decisions of the communities relying on fossil-fuel combustion and use. Data collection methods were adapted for each of the locations to enhance effectiveness by integrating a locally appropriate approach.

3.1.1. Salem Harbor power plant, Massachusetts

Semi-structured interviews (n = 21), informal interviews (n = 13) and document analyses were conducted by the first author between April 2017 and March 2018. A purposive sampling technique was employed to identify interviewees who were directly involved in, or impacted by, the decommissioning of the Salem coal plant and the decision to replace it with the Salem Footprint Power LLC (hereafter Footprint) natural gas power plant. Purposive sampling was facilitated by field observation, snowball sampling, and the lead authors’ intimate local knowledge of the study area. Interviews were carried out with energy-industry professionals, local and state government officials and politicians, municipal administrations, environmental justice groups, planners, environmental lawyers, academic researchers and local residents. Where participants gave permission to be recorded, responses were transcribed and shorthand notes were also taken. To verify intercoder reliability, two researchers coded transcripts independently.

3.1.2. Cerrejón coal mine, La Guajira

Data collection took place in June 2017, when the lead author traveled as part of a Witness for Peace (WFP) delegation⁸ to the Cerrejón mining zone in the department of La Guajira. WFP organized, facilitated and provided live translation for interviews and community forums with Indigenous Wayúu, Afro-Colombian and campesino communities. Eleven forums were conducted with community members ranging from 4 to 50 people. These forums followed a similar protocol, providing a place for people to report injustices related to the mine. Leaders from each community spoke first. Informal interviews and discussions were held with community leaders and the WFP delegation. An additional forum was conducted with Cerrejón’s mining union, Sintracarbón, and grassroots social justice organization Congreso de los Pueblos (People’s Congress). WFP also organized for representatives of the 11 community forums to meet with Cerrejón’s Social Standards and International Engagement Division at Cerrejón’s headquarters (see Fig. 2). This oral-hearing-structured meeting lasted 2 hours. Fourteen Cerrejón representatives were present. WFP members provided testimonies of existing injustices. Semi-structured interviews and informal conversations were held with mining officials. Responses were transcribed, and through inductive coding, forum transcriptions were thematically analyzed. The same intercoder reliability as the Salem analysis was used.

3.1.3. Bradford, Susquehanna and Washington Counties, Pennsylvania

To examine energy-related injustices in Pennsylvania, the third author gathered data from three counties: Bradford, Susquehanna and

⁸ Witness for Peace (WFP) is an NGO whose mission is to support peace, justice and sustainable economies in the Americas by changing US policies and corporate practices that contribute to poverty and oppression in Latin America and the Caribbean.



Fig. 2. Witness for Peace, Wayúu, Afro-Colombian and campesinos representatives at oral hearing in Cerrejón headquarters, July 2017 (photo: Noel Healy).

Washington. Data collection used multiple qualitative and ethnographic methods, including extensive fieldwork and multiple farm stays or visits, 42 in-depth interviews with operators of small and medium farms that also had active wellpads or pipelines, and archival research on regulatory responses to unconventional natural-gas extraction in Pennsylvania. The three counties were selected by creating ARC-GIS overlays of unconventional natural-gas wells and farmland, focusing on three counties with the most overlaps. From this, farms were identified for interview and visit requests that fit study criteria: hosting operational wells or related infrastructure such as pipelines; and classified as small or medium operations. Extensive field notes were taken and typed after each day, archival analyses were coded, and verbatim transcriptions of interviews were coded by three separate coders and tested for intercoder reliability.

4. Case-study backgrounds

4.1. Salem Harbor power plant background

Decommissioning of the Salem Harbor coal-fired power plant began in February 2012, when the Conservation Law Foundation (CLF), a Massachusetts environmental law organization, and HealthLink, a nonprofit public-health advocacy organization, secured an order from the US District Court in Massachusetts to shut down the 60-year-old, 720-megawatt (MW) plant by 2014. The settlement, which followed a

20-year campaign by a coalition of activists, stipulated that coal could never again be used as fuel for generating electricity at the site. Anticipating the closure, political leaders, environmental organizations and community groups wrangled over future visions for the site (see Appendix A).

Concerned with the potential loss of tax revenues, city and state politicians created alliances in late 2009 with Footprint, an energy company that proposed to replace the coal plant with a 674 MW natural-gas-fired power station. By June 2012, Footprint had bought the plant and then filed for expedited approval with the Federal Energy Regulatory Commission (FERC). Throughout this time, tension emerged in and between communities and among environmental groups. Opposition to the power plant had, at its core, environmental health, projected climate impacts, and resistance to continued fossil-fuel dependence. Yet CLF settled with the developer in 2014 and the plans for the power plant advanced [49]. Interviewees reveal how fossil-fuel and utility interests were deeply ingrained in the energy planning and regulatory system. Dismayed by the CLF settlement, grassroots community activists and 350MA-Better Future Project continued their opposition (see Fig. 3). The gas-fired power plant began supplying electricity to New England in June 2018. The Salem case shows how energy decisions have implications not only for the local region and communities affected by the plant, but also for other communities implicated in coal production and natural-gas extraction.



Fig. 3. Anti-gas-plant protest in front of the former Salem Coal Plant [113].



Fig. 4. A Roche man is arrested (February 2016) trying to protect his community from eviction. He was “taken to prison via a Cerrejón truck” (personal correspondence 14) (photo: Rafael Ríos).

4.2. Cerrejón coal mine background

The Cerrejón mine began operating in the 1970s as a joint venture between state-owned Carboacol and Exxon. In 2000, in line with Colombia’s neoliberal restructuring, the mine was fully privatized, and the state sold its 50% stake in Cerrejón to three multinational corporations: BHP Billiton (UK/Australia), Glencore Xstrata (Switzerland) and Anglo American (UK/South Africa). Colombia is the world’s fourth-largest coal exporter: 90% of its coal is exported [50]. At around 69,000 ha, Cerrejón is one of the world’s largest open-pit coalmines. For over a decade, Cerrejón supplied coal to the Salem power plant, and to another Massachusetts coal plant at Brayton Point. Around 60% of hard coal from Cerrejón is exported to Europe, especially Germany, Denmark, the Netherlands, the UK, France, Spain, Portugal, Turkey and Ireland; China is another key market (interview 22).

The mine has a legacy of environmental justice problems. Approximately 270,000 indigenous Wayúu live in La Guajira, 44% of the department’s population. The mine has displaced thousands of Wayúu, Afro-Colombian and campesinos populations in the region. Official displacement follows a Colombian legal procedure called “expropriation,” whereby the government approves or participates in the removal of populations in zones designated for natural-resource extraction or megaprojects (see Fig. 4). Colombia’s extractivist model coexists with the state’s commitment to the 1991 Constitution, which grants the right of prior consultation to indigenous people. Colombia ratified the International Labour Organisation’s (ILO) Convention 169 on indigenous peoples’ rights.⁹ Law 70, passed in 1993, officially recognizes Afro-Colombians as a distinct ethnicity, and endows ethnicity with land rights, providing a legal foundation in the Constitution for defense of their territorial rights. However, as Chomsky [51] warns, despite laws that look progressive on paper, the rights of indigenous and Afro-Colombian communities continue to be subordinated to the “rights” of multinationals to make a profit.

4.3. Pennsylvania unconventional natural-gas production background

Although it is difficult to trace natural gas to a specific supply site, the natural gas being used at the new Salem power plant is highly likely to originate in Pennsylvania, a top natural-gas producer in the US (interviews 1, 2, 16–20). Pennsylvania sits atop the Marcellus shale formation, which holds the most voluminous store of natural gas in the nation. The region became one of the nation’s first booming sites of

⁹ The ILO Convention 169 acknowledges tribal people’s land-ownership rights, and sets a series of minimum UN Standards on consultation and consent.

unconventional-fossil-fuel production, and as a result it has experienced enormous socio-environmental impacts, such as water contamination and increase of birth defects [52,53,54].

This portion of our analysis focuses on three Pennsylvania counties where natural gas extraction has boomed. Bradford and Susquehanna counties sit in northeastern Pennsylvania, in the scenic, lush, agricultural Endless Mountains region, where rapid and widespread extraction of natural gas began around 2006, using mainly unconventional methods, including hydraulic fracturing. Washington County, in southwestern Pennsylvania, has hosted more recent development. Farmers generally own their mineral rights here, and corporations often must enter into surface and mineral leases to access the natural-gas assets beneath their productive farmland. Farmers act as gatekeepers for industrial development, though with different degrees of control. While some farmers have reasonable power and wealth through their land and mineral assets, they also experience multiple forms of environmental injustice and risk. As such, embodied energy injustices drives the conservation beyond Salem to the upstream injustices in Pennsylvania.

5. Salem power plant: embodied energy injustices

5.1. Embodied energy injustices emerge in the public discourse in Salem

The debate over the power plant decommissioning raised questions about the appropriate role of local officials in shaping energy decisions whose impacts go far beyond local political boundaries. The issue of embodied injustices linked to Colombian coal featured somewhat in the public debate over the closing of the coal power plant. The embodied energy injustices of relying on fracked natural gas were less prominent in public discourse in Salem.

5.1.1. Embodied energy injustices linked to Colombia

Trans-local solidarities emerged between Salem and La Guajira. High levels of violence against unionists in Colombia, including the killing of three union leaders at Drummond mine in 2001, helped mobilize labor unions in the US, Canada and Europe to join international solidarity groups. In April 2012, Aviva Chomsky—a Salem resident, professor and activist—learned that the Salem power plant was importing coal from the Cerrejón mine in Colombia, then owned by Exxon. As a result, Chomsky founded the North Shore Colombian Solidarity Committee (NSCSC) and organized for Wayúu leader Remedios Fajardo and Indigenous rights lawyer Armando Pérez Araújo to come to Salem.¹⁰

Residents of Salem, who were also consumers of Colombian coal, were thus offered a rare opportunity to hear first-hand the story of injustices inflicted by US corporations operating abroad [55]. The Wayúu leader told Salem’s mayor, its city council, and others: “Salem’s [coal] has its origins in violence ... [others] had to shed their blood ... for this coal to arrive in Salem [and other parts of the world]” (Council meeting notes). Soon after, Salem City Council passed a resolution¹¹ calling on the mining companies to carry out “peaceful and just negotiations that guarantee residents in the mining area basic human rights”

¹⁰ In May 2012, PowerPoint, a US-based NGO, also sponsored two representatives of local communities affected by the mine to testify at an Exxon shareholders meeting in Texas.

¹¹ The resolution concluded: “As a community hosting a coal power generated facility, we condemn violations of human rights by all actors involved in Colombia’s conflict, including guerrilla groups, military, paramilitary, police, multinational corporations, and foreign agents, including U.S. defense contractors; we express our solidarity with all Colombians working for nonviolent, just, political solutions to the conflict in Colombia; and we encourage the establishment of an ongoing relationship with organizations in the Guajira working peacefully for the human and democratic rights of the Wayúu indigenous people (Yanama) and the villagers of Tabaco (Comité Pro-Reubicación de Tabaco)” [55].

[55]. In subsequent years the NSCSC brought many Colombian Wayúu leaders and mining union representatives to Salem and initiated the Witness For Peace delegations to communities impacted by Cerrejón. In 2006, the newly elected Salem mayor, Kim Driscoll, issued a proclamation honoring Colombian leader and activist Jose Julio Perez. Members of the Colombian solidarity group and other environmental justice advocates met with Dominion (then owner of the Salem power plant) to ask the multinational to respect the human rights of their workers and indigenous communities. Salem City Council then passed a resolution reiterating the city's support for the displaced villagers of Tabaco, and forwarded it to the Colombian government and the mining companies accused of human rights violations in La Guajira. The same mayor who signed the proclamation honoring Colombian activists, however, refused to acknowledge the embodied injustices of the proposed gas plant. Several interviewees argued that Footprint's political coalitions (e.g., the mayor and Massachusetts state representative) were happy to play up the embodied energy injustices of coal in order to make a stronger case for its replacement with a "cleaner fossil fuel" (Salem interviews 1–3).

5.1.2. Denying embodied energy injustices from fracking

Given the controversial socio-environmental impacts associated with fracking, Footprint was careful to distance itself: "Footprint Power will not pursue development opportunities that depend on the continuation of fracking" [56]. Instead it claimed that gas would stem from "a conventional source in the Canadian Maritimes" (Salem interviews 1–6). Opponents of the gas power plant saw this as smoke-and-mirror tactics, and many accused the company of "deception and greenwashing" (Salem interview 19), questioning the transparency of its public statements: "Footprint Power's position on fracking is simple: if it cannot be demonstrated to be safe to the environment and effective in reducing greenhouse gas emissions—or if it cannot be made safe and effective through appropriate regulation—it should not be pursued" [56]. Footprint's stance on fracking in 2018 is less steadfast: "relatively little of our gas comes from fracking. ... But we do not rely on this fact in presenting the environmental story of our facility because this could change [in the future]" (email correspondence); "fracking can be done in a safe way through strengthening the kind of regulatory systems under which fracking is happening" (Salem interview 19). The Massachusetts Environmental Policy Act (MEPA) was amended in 2009¹² to require the consideration of GHG emissions and climate change impacts in its Environmental Impact Assessment (EIA) statute [57]. Several climate action groups, however, outlined the complete failure to take upstream emissions into account (e.g. methane leakages). Concerns about embodied emissions were raised by intervenor CLF as part of the Salem EIS process.

5.1.3. Embodied injustices of high energy consumption

Gas-plant opposition groups also criticized the fact that regulatory assessments from ISO New-England—an "independent" regional transmission organizer¹³—are based on meeting increased, rather than reduced, consumption projections. A broader critique of the global north's consumption and interlinked structural global injustices was raised by Cerrejón's labor union Sintracarbón. It cited the ecological debt that is owed by the rich to the poor for the historical and ongoing plundering of resources in third-world countries. Union leaders, two of

¹² Amended by Massachusetts Global Warming Solutions Act 2008, which requires the state to reduce its greenhouse gas emissions to 20% below 1990 levels in 2020, and to 80% below by 2050. The state also published a *Draft MEPA Climate Change Adaptation and Resilience Policy* in 2014, which calls for a "climate impact assessment" to "evaluate how a project may be impacted by climate change related events and how the project itself may contribute to, or reduce, climate change impacts" ([96]: 5).

¹³ Interviewees challenged its independence due to its "pro-fossil-fuel bias" and "links to fossil fuel lobbyists" (interviews 1–3).

whom had visited the Salem coal plant, offered an anti-imperialist critique of "US hyper-consumption" and the "American standard of living": "The US represents 5% of the world's population—yet they consume 25% of the world's energy" (Colombia interview 17). First-world consumer rights, they argued, take precedence over third-world injustices, as toxic production and disposal are shifted south. Union leaders also pointed to the impact of global decarbonization efforts on labor. Given the sheer size of Cerrejón, the decommissioning of the Salem coal plant had minuscule impact on labor needs. One representative, however, linked the loss of 300 jobs at Cerrejón to decarbonization commitments at the 2018 G7 summit, in particular the German government's commitment to phase out coal. Germany is one of Cerrejón's biggest customers. This highlights the often-overlooked interlinked transboundary responsibilities of a just transition between first-world consumers and vulnerable, fossil-fuel-rich third-world countries

5.2. La Guajira: existing energy injustices

Coal mining in La Guajira has produced severe injustices. Table 1 summarizes an array of injustices reported by interviewees in communities impacted by Cerrejón's mining operations. Our findings suggest that inhabitants in the region have become victims, rather than beneficiaries, of resource extraction. Communities continue to be forcibly displaced by physical force, coercion and intimidation, by the slow violence of the contamination of farmland and drinking water, and by forced malnutrition through loss of traditional lands. Access to clean water is a critical issue in the drought-stricken province. Cerrejón uses around 17 million liters of water a day, while the average person has access to 0.7 liters a day Fig. 5.

In 2001, the Afro-Colombian town of Tabaco was bulldozed and the residents forcibly removed by state security forces to allow the mine to expand. A Supreme Court order called for the community to be resettled. At the time of writing (September 2018), Tabaco residents have yet to be resettled. Cerrejón has forcibly displaced at least 15 Wayúu, Afro-Colombian and campesino communities from the mining zone. Forcible displacement also occurs around Cerrejón's private port¹⁴ and along its heavily militarized railway, which now divides the department (see Fig. 6).

The complicity of the state in these injustices is reflected in its aggressive response to protests, criminalizing dissent and sending riot police to break up demonstrations and detain leaders. Many community leaders who resist mine expansion plans or are in negotiations with Cerrejón have received death threats, while other Wayúu leaders have been forced to abscond (interviews 1, 7–9).

5.3. Pennsylvania: existing energy injustices

Unconventional natural-gas extraction has produced severe socio-environmental harms, risks and injustices for communities (see Table 2). There is growing evidence that living close to these sites may cause various public health complications at multiple scales [58], cause negative health outcomes such as increased risk of birth defects and certain cancers [59], reduce property values [60], and adversely impact livelihoods and daily quality of life [61].

Farmers were uncertain about long-term impacts on their land, its productivity, and the health and safety of their livestock and even their families (see Fig. 7). They often ambivalently accepted these risks because they needed income from signing bonuses, lease monies and royalties. Yet the unpredictability of environmental risks, particularly from water quality, added stress to their daily lives. Procedural inequities manifest as: lack of access to information about the impacts of

¹⁴ For instance, in 2004 nearly 600 people were forcibly displaced from a Wayúu community neighboring Cerrejón's port [64].

Table 1
Energy Injustices in La Guajira Communities Affected by Cerrejón Coal Mine.^a

Distributonal injustices: Unequal distribution of benefits and burdens	
Human Health	<p>Cause</p> <p>Widespread pollution and coal dust</p> <p>Mining transportation accidents</p> <p>Forced displacement</p> <p>Daily explosions & vibrations</p> <p>Failed expected benefits of mining</p> <p>Mining operations & diverted rivers</p> <p>Effect</p> <p>Increased mortality & morbidity. DNA damage in miners [115]</p> <p>Death and injuries of mine workers/community</p> <p>Collective community trauma</p> <p>Fear, anxiety, disruption of dreams (sacred in Wayúu culture)</p> <p>Depression & anxiety</p> <p>High levels of air particulates and dust</p> <p>Contaminated streams & loss of traditional water sources</p> <p>Destruction of local habitat & biodiversity</p> <p>Fear, anxiety, & disrupted sleep</p> <p>La Guajira transformed to food-insecure region. Reduced population.</p> <p>Increased hospitalization costs due to health impacts</p> <p>Displaced subsistence labor. Cerrejón will close in 2035.</p> <p>Restricted right to free movement. Reduced access to vital facilities</p> <p>Destruction/loss of access to sacred sites & ancestral grounds</p> <p>Destruction of social and cultural fabric of communities</p> <p>Loss of traditional land management techniques & knowledge</p>
Environment	<p>Cause</p> <p>Polluted fishing & hunting grounds</p> <p>Widespread pollution & coal dust</p> <p>Propagated boom & bust cycle</p> <p>Privatized & militarized territory</p> <p>Traditional migration routes cut off</p> <p>Forcible displacement</p> <p>Displaced to urban locations</p>
Economic	<p>Cause</p> <p>Widespread pollution & coal dust</p> <p>Propagated boom & bust cycle</p> <p>Privatized & militarized territory</p> <p>Traditional migration routes cut off</p> <p>Forcible displacement</p> <p>Displaced to urban locations</p>
Cultural	<p>Cause</p> <p>Widespread pollution & coal dust</p> <p>Propagated boom & bust cycle</p> <p>Privatized & militarized territory</p> <p>Traditional migration routes cut off</p> <p>Forcible displacement</p> <p>Displaced to urban locations</p>
Procedural injustices: Inequitable procedures	<p>Cause</p> <p>Cerrejón uses financial capital & legal expertise to suppress information. Citizens lack access to legal counsel.</p> <p>Colombian State is supportive of Cerrejón via diminished & under-utilized regulatory capacity.</p> <p>Structural violence (physical and political) is used to silence local critical voices.</p> <p>Citizens are forced to sign leases without transparent information to acceptable terms & risks, etc.</p> <p>Cerrejón “negotiates” with individuals rather than collectively as required by 1991 Colombian constitution.</p> <p>Cerrejón employs “landmen” or “fixers” to blackmail, bully and coerce individuals into signing agreements.</p> <p>Leases are entered into privately, leading to inaccessible information about terms across communities.</p> <p>Effect</p> <p>Denial of cultural ethnicity of Afro-Colombians: use of ethnic categories and definitions to deny rights.</p> <p>Wayúu are largely not employed by Cerrejón. Skilled workers are hired from elsewhere.</p> <p>Denial of rights of non-landowners (e.g. peasants). Forced subsistence communities into urban areas.</p> <p>Lack of representation in Department government. Protests against coal are criminalized by the State.</p>
Access to information	
Neutrality	
Voice	
Transparency and accountability	
Due process	
Ethics	
Representation of all concerned	
Recognition injustices: Reinforcing existing inequalities of vulnerable groups	
Misrecognition	
Economic distribution	
Socio-cultural recognition	
Political representation	

^a Data compiled through interviews and open forums.



Fig. 5. A Wayú woman and her child in La Guajira (photo: Nicolo Filippo Rosso). La Guajira is now Colombia's second-poorest province, with 53.3% of inhabitants living in poverty in 2015, while almost 28% of its children are malnourished [114].

development are initiated and supported at national and global scales, their impacts are felt locally. Indigenous communities and peasant farmers in La Guajira bear the brunt of multinational capital and the negative socio-environmental impacts of globalized mining operations. BHP Billiton, Glencore Xstrata and Anglo American—and in turn pension and share funds—have seen their capital grow through mining operations at Cerrejón. Similarly, Footprint's financiers at US-based Highstar Capital IV and Japan-based Toyota Tsusho, along with natural-gas-drilling multinationals Exxon, Chesapeake Energy and others, reap the benefits of Pennsylvania's sacrifice zones. The socio-environmental devastation in these zones is often shielded by the absence of effective regulatory frameworks, and it is normalized by an economic logic that allows some places to be destroyed in the name of progress, profit, and national and regional economic interests. Cerrejón, for example, justifies its continued expansion with slogans such as “*Minería responsable, aliada del desarrollo en Colombia*” (“Responsible Mining, an ally of development in Colombia”). Similarly, in Pennsylvania energy independence is invoked as justification for the expansion of natural gas.

Diminished federal regulation of unconventional natural gas extraction, particularly related to US statutes like the Clean Water Act and

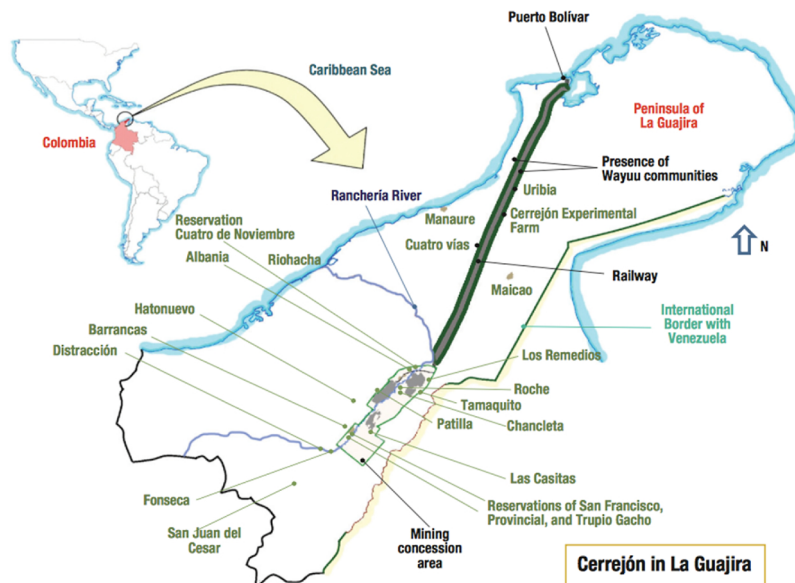


Fig. 6. Map of Cerrejón mine in La Guajira (Cerrejón Minería Responsable, 2011). Just 5 of the 15 communities in the mining concession area have been partially resettled (interviews 2–7).

natural gas development; lack of transparency around lease-signing and production processes; corporate bullying around lease-signing; and other complications of diminished, deregulated energy systems. Residents reported significant barriers to understanding the reality of potential exposure to chemicals and toxins. Anti-fracking advocates argued that fracking in the region violated the human right to a healthy environment.

6. Discussion

The new concept of embodied energy injustices can be used to identify and challenge the global economic influences that shape energy injustices. It can help identify deficits in energy law, policy and CSR, and enable transboundary solidarity movements. In the conclusion (Section 7) we offer recommendations for incorporating embodied energy injustices into energy governance.

6.1. Embodied energy injustices: global structural inequities

Although large-scale coal mining and industrial natural-gas

Safe Drinking Water Act, has increased risks and energy injustices. Leaving regulation to individual states has led to complex negotiations, resulting in multiple accusations of inadequate enforcement of even minimal regulations. For instance, the 2005 Energy Policy Act exempted operators using underground hydraulic fracturing technologies and directional drilling for natural gas from seven of fifteen federal environmental regulations, including the Safe Drinking Water Act and the Clean Water Act¹⁵ [61]. This allows the industry to rapidly increase its pace and scale of development, as individual states must decide how best to regulate the boom in onshore gas production. Peltier [62] reports that because fracking is regulated at state level for all 30+ fracking states, there is no accurate and centralized database that reports water damage from hydraulic fracturing, above-ground spills, waste pond or drilling mishaps and failures. The NGO Public Herald discovered 2309 previously unreported fracking complaints in Pennsylvania through mismanaged record-keeping and reporting by the Department of Environmental Protection (DEP) (ibid). Meanwhile the

¹⁵ This regulatory exemption was nicknamed the “Halliburton loophole,” as it was introduced by former Halliburton CEO Dick Cheney.

Table 2
Energy Injustices in Pennsylvania Communities Affected by Fracking.^a

Distributional injustices: Unequal distribution of benefits and burdens	
Human Health Environment	<p>Cause</p> <ul style="list-style-type: none"> Unconventional gas production (UGP) Uncertainty about environmental risks UGP Spills & improper disposal early in boom Hydraulic fracturing fluid spills Increased truck traffic Hydraulic fracturing process Expanding UGP Unstable commodity/natural-gas markets <p>Effect</p> <ul style="list-style-type: none"> Linked negative human health outcomes Quality of life & stress impacts risks Polluted air from methane leaks & venting Contaminated surface & ground water Contaminated farmland and livestock harm Increased accidents on rural roadways Sleep disruption Replacing dairy/high-intensity farming Disruption of other rural livelihoods Community-level volatility & economic instability Population booms/ natural resource dependence Nationalized/socialized costs of industry operations Lost crop and livestock production Loss of rural livelihoods, bartering systems, etc. Propagated community tensions and divided views Differentiated impacts to farmers
Economic	<p>Cause</p> <ul style="list-style-type: none"> Little severance tax on industry Followed agricultural land Widespread development shifts Expanded UGP <p>Effect</p> <ul style="list-style-type: none"> Gas developers hold huge financial capital, seismic & satellite imaging, legal expertise. Citizens lacked transparent information on signing leases, acceptable terms & risks, etc.: legal counsel necessary. Industry negotiates with individuals rather than collectively, typically via landmen—corporate bullying tactics. Leases are entered into privately, leading to inaccessible information about terms across communities. State support of industry. Diminished & unused regulatory capacity (via PA Dept. of Environmental Quality). Pace and scale of production along with little transparency left few seats at the table for affected communities. Alternative and sustainable livelihoods are minimized or ignored in discussion of economic “boom”. Profits are privatized and risks nationalized/socialized. Denial of rights of non-landowners (renters & farmers leasing land) to reject UGP. Local workers are often not hired; gas workers are imported from other state production sites. Collective trauma of rural communities.
Cultural	<p>Cause</p> <ul style="list-style-type: none"> Unstable commodity/natural-gas markets Little severance tax on industry Followed agricultural land Widespread development shifts Expanded UGP <p>Effect</p> <ul style="list-style-type: none"> Gas developers hold huge financial capital, seismic & satellite imaging, legal expertise. Citizens lacked transparent information on signing leases, acceptable terms & risks, etc.: legal counsel necessary. Industry negotiates with individuals rather than collectively, typically via landmen—corporate bullying tactics. Leases are entered into privately, leading to inaccessible information about terms across communities. State support of industry. Diminished & unused regulatory capacity (via PA Dept. of Environmental Quality). Pace and scale of production along with little transparency left few seats at the table for affected communities. Alternative and sustainable livelihoods are minimized or ignored in discussion of economic “boom”. Profits are privatized and risks nationalized/socialized. Denial of rights of non-landowners (renters & farmers leasing land) to reject UGP. Local workers are often not hired; gas workers are imported from other state production sites. Collective trauma of rural communities.
Procedural injustices: Inequitable procedures	
<i>Access to information</i>	
<i>Voice</i>	
<i>Transparency and accountability</i>	
<i>Due process/governance</i>	
<i>Representation of all concerned</i>	
Recognition injustices: Reinforcing existing inequalities of vulnerable groups	
<i>Misrecognition</i>	
<i>Economic distribution</i>	
<i>Local participation in industry</i>	
<i>Rural inequality</i>	

^a Data compiled through interviews & observation.



Fig. 7. Resident of Dimock, Pennsylvania, holding tap water contaminated by fracking (photo: Katie Colaneri/ StateImpact Pennsylvania).

privatization of mining in Colombia has also given corporations power to self-regulate safety measures and management of water and other resources in their concessions. Mining governance in Colombia has favored mining companies for decades, as rules and regulations are ineffectively implemented and compliance is poorly monitored [63]. Lawsuits brought against Cerrejón on environmental and public health grounds have failed due to a lack of baseline evidence and reliable public data controlled independently of mining companies [64]. However, Colombian municipalities and civil organizations still rely on litigation—specifically the Constitutional Court—to try to expose gaps in the sector’s sustainable governance and to challenge new mining projects. In 2016, the Colombian Constitutional Court found the state had violated the “fundamental right to water” in Afro-Colombian resettlements. The Colombian Human Rights Ombudsman also found that resettlements are insufficient in quality and quantity [65].

6.2. Embodied energy injustices: expanding energy law and policy

The Salem case, in which a coal plant was replaced with a natural-gas plant, reveals two major flaws in energy decision-making in the US. First, the Massachusetts Energy Facilities Siting Board did not consider the cumulative climate change impacts of the new natural-gas power plant. No efforts were made to assess its lifecycle emissions, including incremental impacts or reasonable foreseeable climate impacts. Instead, the EIS was used as a tool to modify project design features, for example elevating facilities 16 feet to “climate-proof” the plant from projected sea-level rise. But the upstream and downstream emissions of the new gas plant were not included; if they had been, the argument of natural gas as a “bridge fuel” would have failed. A study by Alvarez et al. [66] found that natural gas will likely warm the earth as much as coal in the short term. When coal plants are replaced with gas-fired plants, there is no net climate benefit for at least two decades. This is consistent with other studies, which show how methane and other GHGs are leaked throughout the lifecycle of natural gas [67]. The spike in natural-gas exploration made possible by fracking also thwarts decarbonization of the global energy system [68].

Second, the upstream embodied energy injustices arising from the extraction, processing and transportation of the natural gas were not considered in the formal siting process. Because energy projects have an impact at different geographic scales, different populations will be affected by the costs and benefits of energy-system transitions. The regulatory environment fails to account for the different constituencies, jurisdictions and effects that fall outside the formal remit of existing impact assessments. What is more, the technocratic nature and standard cost–benefit analysis approach of many EAs and EIS processes means a narrow focus on biophysical impacts and an inherent blindness to social, cultural and justice-related impacts, even when impacts fall



Fig. 8. Interviewees often pointed to Cerrejón’s “Oxfam-like” website, which “presents a world directly opposite to the lived experiences of marginalized communities” (interviews 14, 15) (retrieved from www.cerrejon.com on Nov 1st 2017).

squarely within decision-makers’ jurisdiction [69].

Ironically, the states of New York and Massachusetts—the two territories through which the fracked natural gas travels to Salem from Pennsylvania—have imposed bans on fracking. These bans signal recognition of the socio-environmental harms of fracking and also speak to the devolving nature of regulatory oversight, since the ban is not national but open to state consideration. This selectivity highlights how some states, such as Pennsylvania, are more amenable to sacrificing their citizens for the extractive economy, while others, such as Massachusetts and New York, are willing to benefit from it but will not expose their citizens to the same harms.

6.3. Embodied energy injustices: reclaiming corporate social responsibility

This study of interlinked sites of extraction and consumption illustrates the arduous challenge of seeking corporate accountability and liability for fossil-fuel extraction impacts. Transnational corporations often hide behind “limited-liability status” and claims of corporate social responsibility (CSR) to evade responsibilities to their shareholders and the wider community [70]. Governments often claim that multinational corporations must abide by international human rights law, and it is the responsibility of host states to enforce this [71]. When governments or conglomerates invest in transnational extraction projects, they claim they do not have the legal authority to prosecute corporations for transgressions made beyond their border. Transnational corporations, in turn, claim they cannot intervene in ways that compromise national sovereignty, and often profess ignorance or limited control over injustices carried out by subsidiaries [13]. Thus, states blame private companies to absolve themselves of their responsibility for financing social services and infrastructural projects.

This phenomenon is clearly evident in the present study. CSR strategies are used to perpetuate and expand fossil-fuel extraction by providing short-term compensation and achieving a minimum level of community cooperation (e.g., negotiating with individuals rather than communities) to maximize operational productivity and profitability [72]. Both Footprint in Salem and the Marcellus Shale natural-gas-extraction multinationals in Pennsylvania relied on greenwashing and CSR to justify their operations.

Cerrejón’s use of CSR to deflect attention from academic and political critiques of extractivist, imperial and enclave economies is particularly striking [73]. After Cerrejón was privatized, new ownership moved swiftly to rebrand itself as “Cerrejón Minería responsable” (responsible mining; see Fig. 8), launching a system of charitable foundations¹⁶ to complement an in-house CSR division. Cerrejón frequently touts its compliance with the Extractive Industries Transparency

¹⁶ USAID provides the Cerrejón Foundation with millions of US dollars in funding despite its role as a CSR front for projects linked to a history of displacement and violence [64].

Initiative¹⁷ (EITI) and the standards for resettlement of the International Finance Corporation (IFC) of the World Bank and the UN Global Compact Initiative in order to improve its “social license to operate” in the eyes of shareholders, governments, the Colombian state, publics and international observers.

Moreover, extractivism and its various connected supply chains are shrouded in secrecy, typically couched in terms of national security and commercial confidentiality, making the disclosure of operations almost impossible to verify. The lack of transparency over the sourcing of Salem’s gas supply and the chemical composition of fracking fluids is indicative of these broader trends of secrecy with fossil-fuel supply chains. European utility companies fail to disclose from which Colombian mines they buy their coal. The Centre for Research on Multinational Corporations revealed a “chronic and acute lack of transparency in the coal supply chain, effectively shielding coal-importing power companies from association with the adverse social and environmental conditions at the mines supplying them with fuel” ([74]: 1). Thus, when extraction costs are outsourced to regions distant from where the benefits are enjoyed, the lack of transparency in energy supply chains and the veil of CSR are employed to avoid any responsibility for the damage caused by the industry.

6.4. Embodied energy injustices: enabling transboundary solidarity movements

Fossil-fuel extraction and consumption in these geographically distant regions are linked by transboundary socio-environmental injustices and conflicts. Conceptualizing embodied energy injustices can help connected communities around the world to jointly articulate their positions and create new coalitions and alliances between different local struggles across geographic scales. As such, the concept of embodied energy injustices invites transnational resistance groups to make “spatially stretched relations of power contestable and localizable” ([75]: 407). Communities can thus resist energy projects by relocating place-based energy struggles that are not confined by the neat boundaries of nation states.

During the early 2000s, fracking was supported by many big-green organizations, such as Environmental Defense Fund and the Nature Conservancy, while the anti-fracking movement was still emerging. Robust transboundary solidarities between Pennsylvania and Salem did not therefore materialize when the plant was being planned. In Pennsylvania, a supportive state government and a relative lack of coherent resistance helped Marcellus shale gas development. Pockets of anti-fracking resistance emerged, but strong state support combined with predicted economic benefits restricted its ultimate influence. The climate movement, however, has since grown, and more transboundary solidarities and alliances have emerged between fracking extraction communities and sites of combustion. In May 2018, for example, the environmental justice organization Clean Water Action and the climate justice organization Mothers Out Front brought two community leaders from the Marcellus Shale region of Pennsylvania to speak to anti-fossil-fuel activists opposing the continued expansion of gas pipelines and infrastructure in Boston and across Massachusetts, particularly the North Weymouth compressor station and the Northeast Energy Direct pipeline.

The North Shore Colombian Solidarity Committee (NSCSC) has now organized over ten Witness For Peace delegations to La Guajira, published a book on Cerrejón’s human rights abuses [76] and lobbied US and Colombian embassies to protect human rights in La Guajira. Scholar-activists also brought indigenous representatives and coal miners from Colombia on multiple occasions between 1992 and 2018 (see Fig. 9). By introducing the embodied energy injustices of Colombian



Fig. 9. Tamaquitos Wayú leader Jairo Fuentes Epiayu speaking to Professor Aviva Chomsky in front of the Salem Harbor coal plant in 2011 (photo: Don McConnell).

coal, the NSCSC pushed local campaigns, politicians and decision-makers to look beyond reducing local environmental harm to more structural issues of global inequality and transnational impacts of energy policies [77]. Paradoxically, during the Salem power plant debate, political supporters of Footprint co-opted the embodied injustices of coal to make way for the introduction of natural gas. This was largely successful, as the embodied energy injustices of fracking during this period were suppressed, as outlined above.

Scholar-activists from the NSCSC continue to coordinate actions with other coal-consuming communities in Massachusetts and Nova Scotia, and with solidarity groups in London (e.g., London Mining Network), Australia and Switzerland, where the three companies that bought Cerrejón have their headquarters. The solidarity groups have organized protests at these three companies’ shareholder meetings. Indigenous Wayú representatives, for example, spoke at the BHP Billiton AGM in London. Raising the issues of socio-environmental injustices at company shareholder meetings shows how oppositional politics can “jump scale” by rearticulating injustices at larger scales [78]. It also shows how solidarity groups can target an adversary on its own terms, often by bypassing the state in seeking corporate accountability.

Ultimately, the Colombian case study reveals how transnational corporations operate in the global south is almost the same as in the Colonial era. Nowadays, however, survivors of the violence inherent to capitalist expansion have more opportunities to initiate transnational oppositional politics. Indigenous people like the Wayú reconfigure place-based political identities to advance narratives of resistance to the violence of transnational corporations. Embodied energy injustice thus offers a useful framework for exploring how to politicize the impacts of transnational fossil-fuel extraction.

7. Conclusion

This exploration of the new concept of embodied energy injustices reframes energy justice to explicitly consider hidden and distant injustices (upstream or downstream) arising from the extraction, processing, transportation and disposal of energy resources. The concept provides a valuable lens to connect transboundary energy justice issues with decisions on energy infrastructure. This study shows how place-specific political structures and power relations shape energy decisions whose impacts go far beyond local political boundaries. Energy production, consumption and policy-making decisions in one place can cause hidden but harmful, multi-dimensional, socio-environmental injustices in others. Expanding the conceptualization of energy justice to include transboundary responsibility and impact invites new approaches to corporate accountability in the fossil-fuel industry. It shifts attention upstream to the extraction of fossil fuels, placing a new focus on traditionally overlooked elements of the fossil-

¹⁷ In 2014, Colombia joined the EITI, which sets a global standard for good governance of oil, gas and mineral resources.

fuel supply chain (e.g., sacrifice zones) and on the state and non-state actors that organize, invest in and benefit from the extraction, processing and distribution of fossil fuels [28]. Beyond the empirical scope of this study, which focused on sites of extraction, further injustices occur in between the “poles” of energy extraction and consumption [79] throughout the processing, transportation and distribution of fossil fuels.

By making visible the full spectrum of injustices in fossil-fuel supply chains, conceptualizations of embodied energy injustices help situate chains of energy injustices and place-based energy struggles within wider national and regional energy politics. As Chantal Mouffe argued, the basic tenets of radical politics involve “the definition of an adversary” ([80]: 13) and bringing those responsible for injustices to the fore. Thus, “making them visible so that they can enter the terrain of contestation” ([81]: 33–4; see also [75]) is central to how embodied energy injustices can foster political agency in tackling energy injustices. Connecting local energy struggles with distant transboundary social impacts creates opportunities for new solidarity movements. Disruptive political action across different jurisdictions can expose and weaken the fossil-fuel industry’s narratives that claim commitment to socially responsible activity. The concept of embodied energy injustices can be used to counter corporate greenwashing designed to redirect public attention away from contentious debates about extraction injustices and the fairness of rent distribution, and to perpetuate the slow violence of polluted waterways, degraded lands and social unrest long after extraction ceases.

While the energy justice framework has strengths at the local level, embodied energy injustices provide a framework to situate and understand these place-based injustices as part of an unjust global order. Gordon and Webber [71] and Chomsky [73] observe that transnational mining companies’ activities must be analyzed in the broader dynamics of global capitalism, in particular the relations between countries of the global north and global south. The shift in fossil-fuel production and extraction to countries with no or lax emissions controls has led to a costly increase of emissions (i.e., emissions leakage) and an associated rise in embodied energy injustices. The incentives and interests generated by the de-/re-regulation, devolution and privatization of natural resources (accumulation by dispossession) have thus undermined the protection of human rights, leaving many socio-environmental impacts unmitigated, unrecognized and unacknowledged. In this context, attention to the transboundary complexities of energy decisions is central to understanding and minimizing embodied energy injustices.

Conceptualizations of embodied energy injustices can help address regulatory gaps in energy governance by expanding the scope of energy decisions and processes. First, the idea of embodied energy injustices encourages decision-makers to consider the lifecycle emissions of fossil fuels and the indirect and cumulative effect of GHG emissions. System-wide perspective and analysis also reveal deep inequality within and between nations and between generations, which are often ignored or dismissed [5]. Multiple recent rulings have revealed that climate impacts are not being properly analyzed in approval of natural-gas projects (*Zero Zone v. Dept. of Energy*, 2016) (*Sierra Club et al. v. FERC*, 2017). Revesz et al. [82] argue that from a legal perspective, domestic laws such as the Clean Air Act and National Environmental Policy Act (NEPA) require or give discretion to agencies to consider global climate costs [83]. Instruments such as the federal social cost of carbon protocol and the values used by the federal government to calculate the social costs of methane and nitrous oxide provide useful tools for such assessments.

The Salem case also reveals how regulatory assessments from ISO-New England are based on meeting increased, rather than reduced, consumption projections. Baseline scenario for regulatory assessments should not correspond with “business as usual” trajectories for energy use and emissions but rather trajectories that are consistent with state and national GHG targets. Exploring embodied energy injustices exposes this kind of major disconnect in energy and environmental goals

and policies.

An embodied energy injustices lens also reveals that the regulatory environment should allow for decision-makers to incorporate the full range of injustices connected to individual energy-policy decisions. The challenge, of course, is to hold decision-makers accountable for upstream embodied injustices, particularly when they fall within the oversight of another agency, jurisdiction, state or country. We call for mandatory transboundary impact assessments of large-scale energy-related projects, which explicitly integrate previously unrecognized social-environmental impacts and injustices. Gathering and analysis of such lifecycle impacts should occur at the design stage of projects. Central to this is the adoption of new vocabulary and legal frameworks that could prescribe regulatory bodies (for example, the Massachusetts Energy Facilities Siting Board or FERC, which regulates the interstate transmission of natural gas, oil and electricity) to expand their authority and purview in relation to transboundary climate and embodied injustice impacts. A permitting process that includes testimonies from extraction communities—even if the communities are outside the state or country of the permitting process—may encourage more recognition of embodied injustices. Such an approach would align with the UN Espoo Convention (re: Environmental Impact Assessments in a Transboundary Context), which requires participating state parties to offer non-residents the same right to participate in the EIA procedure as their own resident nationals.

There is much cynicism already about the overall effectiveness of EIAs. Knox [84] argues that EIA systems virtually never halt projects due to their potential contribution to climate change, thus illustrating a process that focuses on reducing environmental harm rather than mitigating climate impact. More broadly, new approaches to uphold justice that are outside the government are desperately needed, given that corporations are conducting extraction under laws that legalize the extraction and are operating under permits issued to them by government [85]. For instance, the Permanent Peoples’ Tribunal Session on Human Rights, Fracking and Climate Change argued that “existing environmental legal frameworks, in fact, cannot stop human-caused environmental and climate harm because they were simply not designed to do” ([85]: 15). With rising awareness of the urgent need to avert fossil-fuel lock-in, civil disobedience over fossil fuels is surging. For instance, in March 2018 a West Roxbury judge in Boston ruled that 13 defendants’ civil disobedience actions of blocking construction of the West Roxbury Lateral Gas Pipeline were necessary to prevent a greater harm. Defendants were found not responsible for any infraction, based on climate necessity. Disruptive political actions, civil disobedience and direct action will likely be critical to holding agencies and governments accountable for upstream emissions and injustices, particularly when those impacts fall within the oversight of another agency, jurisdiction, state or country.

The lens of embodied energy injustices can also address the accountability deficit in fossil-fuel supply chains. This study connects the politics of extraction to the politics of everyday energy consumers. As such, expanding energy justice across transboundary scales and across multiple interconnected supply chains requires a spatial focus on energy demand as well as supply. With the emerging energy democracy movement in the US and the accelerating transition toward more renewable-based energy systems, demand for local non-fossil-fuel energy is growing [86,87]. But the lack of transparency in energy supply makes it difficult for consumers and stakeholders to know where their electricity comes from and to hold companies accountable for their actions. The dominance of a small number of transnational fossil-fuel corporations limits the possibility of any choice that could generate significant change. As such, individuals and communities are generally disenfranchised and shielded from the embodied injustices of their energy supply chain.

The UN Guiding Principles on Business and Human Rights do include grounds for recognizing embodied energy injustices: “Businesses have a responsibility for human rights impacts that are directly linked

to their operations, products or services by their business relationships, even if they have not contributed to those impacts” ([88]: 14). Thus, energy corporations have a responsibility to seek, prevent and mitigate adverse human rights impacts from fossil-fuel suppliers. In response to government failure to hold corporations accountable, environmental justice organizations are actively seeking corporate accountability and liability for fossil-fuel extraction impacts.

Individual consumers can play a role in mitigating energy injustices through multiple mechanisms: advocating for replacing fossil fuels with renewables; forming international alliances and solidarity actions with communities impacted by fossil-fuel extraction and infrastructure; reducing energy consumption, particularly in the global north; and engaging in disruptive political actions to reclaim decision-making power from vested interests of fossil fuel companies (e.g., divesting from fossil fuels) [89]. Giving greater voice to extractivist resistance, and encouraging deeper consideration of the justice implications of extractivism, strengthens valuable counter-narratives to conventional energy policy and analysis.

Greater transparency of energy-company operations is key to addressing energy injustices. Mandating public disclosure of the origins of fuel (differentiated by country, extraction site or mine) could allow consumers to hold companies accountable for transboundary impacts that are otherwise ignored. Additional lifecycle analyses are needed to assess the impacts of fracking, including the extraction of sand for proppants and the manufacture and storage of hazardous chemicals [90]. Examples of law reporting requirements that address lifecycle perspectives include the California Transparency in the Supply Chains Act, which gives consumers information about companies’ efforts to prevent and root out human trafficking and slavery in their product supply chains (see [91]). The act does not, however, mandate action other than reporting. Related to this, the issue of carbon embodied in trade is slowly gaining recognition. Consumption-based emissions accounting can inform policymaking that aims to close the carbon loop-hole. For example, the Buy Clean Act in California (AB 262) requires state agencies to consider the embodied emissions in steel, glass and other building materials when contracting for state-funded infrastructure projects. Other countries (e.g., UK, France, Sweden, Denmark) provide *voluntary*, government-initiated reporting on embodied emissions [23]. Better understanding of both embodied emissions and embodied energy injustices is critical to informing future just discussions on global decarbonization.

Another potential mechanism for operationalizing embodied energy injustices is a legal requirement in energy-policy decisions to compare the full lifecycle impacts of fuels and energy technologies in current use with those of proposed alternatives. Although the empirical details presented here focus on the comparative injustices of coal and natural gas, embodied energy injustices can also be applied to renewable energy [92], transportation innovations and other policies designed to alter energy systems. Future policy actions could also explore creative solutions that blend deterrence-based environmental enforcement with principles of restorative justice.¹⁸ Rustad et al. [93] observe that joining these distinct jurisprudential traditions can deter polluters while repairing past wrongs through remedial projects. For instance, embodied energy injustices and restorative justice principles could be included in extraction companies’ balance sheets as a requirement, should mining concessions or drilling licenses continue. After all, the granting of licenses to extract is a gift from the public to a private interest, so there should be full public involvement in the decision and also public benefit from such concessions. Granting new fossil fuel extraction licenses, however, directly opposes the Paris Agreement and the urgent actions

¹⁸ Restorative justice is a process for resolving crime (or injustices) by focusing on redressing harm done to victims, holding offenders accountable, engaging communities in conflict resolution and reducing future harm through crime prevention [97].

required to limit dangerous climate change.¹⁹

Awareness is growing among climate and energy justice advocates that fossil-fuel extraction and combustion must end. The “keep it in the ground” movement tries to tackle head-on the need to drastically change energy policy priorities and assumptions. In response to the Trump administration’s “energy dominance” doctrine [94], the energy democracy movement is rapidly growing, connecting energy policy with social justice more effectively than ever [86,87]. Linking disparate sites of energy injustice can connect marginalized communities, residents and labor movements with climate activists and concerned consumers into powerful trans-local solidarity movements. Restructuring the scale of oppositional politics and linking local and transnational sites of contestation opens new possibilities for more just socio-energy transitions. The challenge is how upstream and downstream oppositional politics can withstand the pressures of government-supported extraction operations, and to have true power over relevant decisions within a reasonable timeframe. Expanding energy policy discussions to include consideration of embodied energy injustices is one of many approaches and tools required to radically shift mainstream energy politics and practice toward a more just energy future.

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Appendix A. Salem Harbor power plant

Decommissioning of the Salem Harbor coal-fired power plant began in February 2012, when the Conservation Law Foundation (CLF), a Massachusetts environmental law organization, and HealthLink, a Marblehead-based (bordering Salem) nonprofit public-health advocacy organization, secured an order from the US District Court in Massachusetts to shut down the 60-year-old, 720-megawatt (MW) Salem plant by 2014. The court’s order was based on a settlement with then-owner Dominion to avoid CLF’s 2010 lawsuit, which alleged Dominion had violated the Clean Air Act more than 300 times in five years.²⁰ The settlement, which followed a 20-year campaign by a coalition of activists,²¹ stipulated that neither Dominion nor any successor could ever again use coal as fuel for generating electricity at the site.

Anticipating the coal plant closure, political leaders, environmental

¹⁹ McGlade and Ekins [101] calculate that 33% of oil, 50% of gas, and over 80% of current coal reserves must be left in the ground by 2050 for a 50% chance of capping planetary warming at 2°C.

²⁰ Levy et al. [109] found that pollution from the Salem plant was linked to approximately 53 premature deaths, 570 emergency room visits, 14,400 asthma attacks and 99,000 daily episodes of upper respiratory illnesses. The impacts on those within 30 miles were 2–5 times greater than those living at a distance [108].

²¹ The roots of the movement to shut down the Salem plant can be traced back to the late-1990s “Filthy Five” campaign, which targeted five aging Massachusetts coal- and oil-fired power plants that were built before the 1977 re-authorization of the federal Clean Air Act and thus were granted exemption, or grandfathered, from its emissions standards.

organizations and community groups wrangled over future visions for the site. Some residents from nearby Marblehead funded a study by The Brattle Group [112]. This study called for the shutdown and reuse of Salem Harbor Station as a mixed-used commercial development site. City and state politicians, however, concerned with the potential loss of tax revenues, created alliances in late 2009 with Footprint, an energy company that proposed to replace the coal plant with a 674 MW natural-gas-fired power station. By June 2012, Footprint had bought the plant and then filed for expedited approval with the Federal Energy Regulatory Commission (FERC). Throughout this time, tension emerged within and between communities and among environmental groups. Salem Alliance For the Environment (SAFE) shifted from opposing to supporting Footprint's plans in 2012.²² Opponents redoubled their efforts, led by a new organization called Grassroots Against Another Salem Power Plant (GAASPP) (Fig. 3). Environmental health, projected climate impacts, and resistance to continued fossil-fuel dependence formed the core of GAASPP's opposition.

CLF settled with Footprint in 2014 [111]. The CLF called the settlement with Footprint “groundbreaking” because it was the first-ever set of binding conditions for a natural gas plant that established decreasing annual emissions limits and a retirement date of no later than 2050. Dismayed and shocked by the CLF settlement, the grassroots community activists have continued their opposition to the Footprint plant, which began supplying electricity to New England in June 2018.

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²² Reasons for SAFE shift to supporting Footprint explained here: <https://salesafe.org/campaigns/salem-harbor-station/safe-statement-regarding-future-power-generation-in-salem/>.

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