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Geographies of renewable energy transition in the Caribbean: Reshaping the island energy metabolism

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ABSTRACT

Long dependent upon imported fossil fuels, the islands of the Caribbean have recently been targeted by initiatives meant to hasten a shift to more renewable forms of energy. In this paper, we provide an overview of this ongoing energy transition, focusing on the experiences of Jamaica and the Eastern Caribbean. To do so, we develop the concept of the 'island energy metabolism' as a way to conceptualize relationships between the biophysical properties of different energy sources and the distinctive territorial, infrastructural and geopolitical characteristics of islands. We trace the development of the prevailing fossil fuel-based metabolism in the Caribbean region, and highlight some of the resulting energy dilemmas faced by island territories in the region. We then turn our attention to the ongoing renewable energy transition, focusing on the opportunities and barriers posed by islands. We highlight the role of island imaginaries in attracting international interest, and point to the ways in which island geographies can hinder the transition. Drawing on examples gleaned from fieldwork in the Caribbean, we discuss the financial, logistical and infrastructural challenges posed by the region's fragmented sovereignty and island territoriality, and suggest how a metabolism lens can shed light on the trajectories of low-carbon transitions.

1. Introduction

According to a wide range of observers, the Caribbean region is on the cusp of a profound energy transformation. Long dependent upon costly imported petroleum, the islands of the region are plagued by high electricity prices and the detrimental economic impacts of petro-dependence. Recently, however, Caribbean islands have become targets for a proliferation of high-profile initiatives meant to hasten a shift toward renewable forms of energy by harnessing the region's available solar, wind and geothermal power. Influential actors within the region have insisted that the Caribbean "stands at a crossroads" [1,16], "finds itself at a turning point" [2,np], or is facing a "critical window" that will require "crucial choices" about the region's energy future [3]. Spurred by these pronouncements, the Caribbean basin has been blanketed in recent years by a multitude of development officials, consultants, financiers and renewable energy entrepreneurs seeking to guide (and in some cases profit from) the looming energy transition. Driven by the promise of billions of dollars of funding from a diverse array of sources, the Caribbean has become something of a laboratory for renewable energy strategies, policies and projects aimed at reshaping the region's legal and regulatory environments and re-engineering its energy landscapes and infrastructures.

For energy researchers, this emerging Caribbean energy transition is noteworthy in part because of the sheer scale of renewable energy activity taking place within the region. But, as we will argue in this paper, the dynamics of energy development and change in the Caribbean also highlight particularly well the ways in which energy transitions more generally are shaped by their spatial and material context, and the need therefore to develop interpretive frameworks that are able to account for geographical specificity. As such, we develop the idea of the 'island energy metabolism', a concept that draws from work in urban political ecology to denote "the interwoven knots of social and natural processes, material flows, and spatial structures" [4,703] binding together the geographies of energy production, circulation and consumption. In response to recent calls to better account for the role of context, space, and power in work on industrial ecology and socio-technical transitions [5,6,4], our use of metabolism is also informed by recent scholarship that examines how and why 'islandness' matters for thinking about the region and its energy transition [7,8]. Our overall aim is to offer some signposts toward understanding the current moment as a potential shift in the region's energy metabolism. To do so, we draw upon an ongoing research project focused around the variable trajectories of energy

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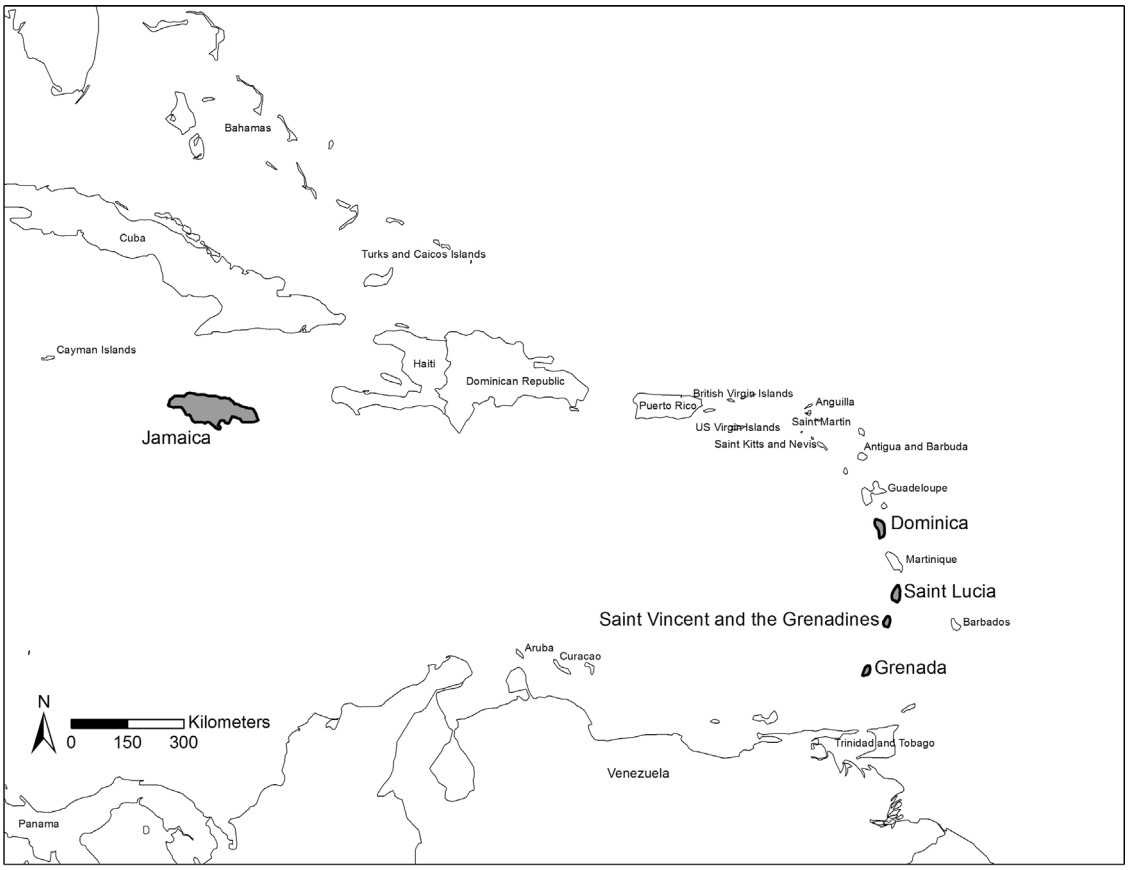

Fig. 1. Caribbean and Case Study Islands.

change taking place within the Caribbean island states of Dominica, Jamaica, Grenada, St. Lucia, and St. Vincent and the Grenadines (SVG) (see Fig. 1).

In what follows, we first lay out the theoretical framework, which combines recent geographical discussions of metabolism with scholarship from island studies to develop the concept of the island energy metabolism. After discussing our methods, we turn to describe the contemporary energy metabolism in our case countries, outlining some of the energy dilemmas that stem from the development of utilities during the colonial and post-colonial period, as well as the interactions between the biophysical properties of petroleum and the small island context. We then turn to ongoing efforts to shift the Caribbean energy metabolism. In this section we focus on the opportunities and barriers posed by islands. We highlight the role of islands in attracting interest from international organizations and developers, while at the same time pointing to the ways in which island geographies can serve to hinder the energy transition. Specifically, we show how the island context matters for our case study countries by pointing to their mix of territorial form, small market size, unique infrastructural challenges, and fragmented sovereignties. In the conclusion we summarize the utility of the island energy metabolism as an analytical framework and highlight its ability to analyze recent developments in the Caribbean energy transition.

2. Theoretical framework: the island energy metabolism

2.1. Metabolism and energy transitions

Metabolism is "the socially mediated process of environmental—including technological—transformation and trans-configuration, through which all manner of 'agents' are mobilized, attached, collectivized and networked" [9,113]. As a metaphorical device, metabolism has been used in a wide range of fields to conceptualize socio-natural processes, including industrial ecology, urban ecology, and in the form most prominent among geographers, Marxist urban political ecology [4]. In this context, metabolism has been used both to characterize objects of inquiry (e.g., a water system) and as an explanatory and theoretical device [10], and while its applications are diverse, metabolism approaches in geography share a number of commonalities. First, the notion of metabolism seeks to overcome the traditional binary between nature and society, bringing together political-economic relations, techno-social infrastructures, and ecological processes and materials into a single framework. Second, and in keeping with the Marxist roots of urban political ecology, the literature on metabolism stresses that socio-ecological processes are shaped by uneven power relations. In thinking about changes in a particular socio-natural metabolism, this means that "processes of metabolic change are never socially or ecologically neutral" [11,12]. And third, understandings of metabolism are frequently intertwined with the closely-related notion of circulation—of matter, waste, capital, and other substances. In this way, metabolism emphasizes movement, and calls attention to the dynamic and processual characteristics of technological and infrastructural regimes. It also highlights the fact that even obdurate infrastructures are subject to what Castán Broto and Bulkeley [12] refer to as "metabolic adjustment," that is, upgrades, maintenance, and even substantial change.

Scholars using a metabolism lens in Marxist urban political ecology have focused a great deal of attention on the infrastructures that distribute natural flows. Many early studies focused attention on water [13,14] and certain other forms of urban infrastructure [15]. More recent scholarship has drawn on the metabolism concept to interrogate the interactions of socio-natural energy flows [16,17,12,18–20]. As this work demonstrates, energy systems (and their transitions) highlight with particular clarity the dynamic interrelations between 'natural'