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Abbreviations

ANARSE	Autorité Nationale de Régulation du Secteur de l'Énergie
BME	Bureau des Mines et de l'Énergie
CARICOM	Caribbean Community, Regional Integration
CRC	CARICOM Reparations Commission
CEAC	Coopérative Électrique de l'Arrondissement des Coteaux
CIAT	Comité Interministériel d'Aménagement du Territoire
CNC	Conseil National de Coopératives
CNGIS	Centre National de l'Information Géo-Spatiale
DMRE	Département des Mines et des Ressources Énergétiques
EDH	Électricité d'Haïti
IHSI	Institut Haïtien de Statistique et d'Informatique
IMF	International Monetary Fund
IPP	Independent power producer
MTPTC	Ministère des Travaux Publics, Transports et Communications
NRECA	National Rural Electric Cooperative Association
ODVA	Organisation de Développement de la Vallée de l'Artibonite
PREPSEL	Projet de Réduction des Pertes du Secteur Électrique
SIDS	Small island developing state

Energy Justice:
A Comparative Case Study of Decentralized Energy Planning Models in Rural Ayiti
by Sophonie Milande Joseph

Executive Summary

Changing political economies of urban infrastructure development and governance have informed the unbundling of services from government-provided public goods to private commodities (Graham, 2001). Current approaches to providing local electric service delivery are also institutionally fragmented in Ayiti (Haiti). Historically, this is partly due to centralized decision-making on essential market commodities' pricing (Dominique, 2005). Consequently, there is an ongoing but contested need for rural infrastructure expansion, as intentional decentralization planning policy, to counter the historic centralization of modernity and government power in Pòtoprens (Port-au-Prince) (Romeo & Smoke, 2015). In Ayiti, this has resulted in a trend towards fractured decentralization (Joseph, 2019). Institutional fragmentation serves as a delaying roadblock for implementing decentralization planning at regional and local levels (Alexander, 2005, pp. 214-215,218-219).

Decentralization planning is the devolution of strong central government responsibilities, functions or powers to a less concentrated area of subnational government units (Beard, Miraftab, & Silver, 2008; DIILG, 2008; Peterson, 1997; Smoke, Gómez, & Peterson, 2006). There are three main types of decentralization: the devolution of power to subnational government units; financial decentralization of government funds; and deconcentration of government offices from a primate city (Castor, 1997; Dorner, 1998). Decentralized planning for local service delivery is an objective established in the 1987 Haitian constitution, the first constitution after the end of the Duvalier dictatorial regimes. A primary critique of decentralization in Ayiti has been the focus on the deconcentration of government offices without the requisite fiscal or legal power to fully implement the steady provision of public goods (Élie, 2014). This one-handed approach, or fractured decentralization, delays equitable spatial-economic development and access to infrastructural services (Joseph, 2019).

The purpose of this study is to determine how different institutional arrangements affect energy justice and sovereignty. Several organizations are currently providing electricity to Haitian citizens, representing different organizational, technical, and geographic approaches to delivering energy services. I hypothesize that different institutional arrangements lead to differences in distributive, procedural, and recognition of energy services (Heffron, 2017; Jenkins, McCauley, Heffron, Stephan, & Rehner, 2016). Through a series of semi-structured interviews with representatives of three different models of electricity provision, this work seeks to uncover how just the energy provision is with respect to the people who use it; and how each system attempted to recover after natural disasters such as 2016's Hurricane Matthew and human disasters such as July 2018's country-wide protests.

On Friday, July 6, 2018, Brazil lost a quarter-finals game to Belgium at the FIFA World Cup game in Russia. In Ayiti, the government took the game as an opportunity to announce the International Monetary Fund (IMF) required an increase in previously government-subsidized fuel prices. July 2018's protests erupted that afternoon after the government, under pressure by international aid donors, increased fuel prices by about 40 percent. Journalist Jacqueline Charles, of the Miami Herald, noted increases include "38 percent on gas, 47 percent on diesel and 51 percent on kerosene, which is used largely by Haiti's poor to light up their homes." The economically regressive choice to raise kerosene at the highest percentage amount of all three affected fuel-types stands out as a planned decision

against the best interests of the poorest segments of Haitian society (Beckett, 2014; Roy, 2009; Watson, 2009). This policy choice by the World Bank, the IMF and Haitian leaders is unsustainable because it did not consider equity and environmental indicators over-pricing life-sustaining key resources (Adler, 2010; Campbell, 1996, p. 297; Sen, 1999).

Protesters were angry about multiple forms of social inequity, economic injustice and environmental degradation that make everyday living challenging and upward social mobility nearly impossible. The fuel price hike was viewed as a significant sign of disrespect for multiple historical and contemporary reasons. This is seen in the ownership list of major companies and family businesses circulated on Haitian social media. The named individuals and companies represent some of the wealthiest urban growth coalitions in the country. Urban growth coalitions comprise a mix of private and public sector actors who strategically collaborate to improve accumulation of private fortunes (Logan & Molotch, 2007).

The choice to announce the hikes during the game may also be viewed as a form of disrespect to the population's intelligence about a policy change that would have drastic negative implications on their everyday cost of living. This underlying presumption implies the general public would not recognize the manipulation of indirectly announcing the tariff increases during an attention-diverting event: a World Cup game. Protesters made their presence felt in the Pòtoprens metropolitan region and regional nodes by bringing the country to a complete standstill in July 2018.

I was in Southern Haiti when news of the protests broke out. On July 8, I began the journey back to Pòtoprens. Sunday had been declared a day of truce so that people could have time to make provisions for two more days of general strikes. On the drive back from Southern Haiti to the capital region, I saw remnants of multiple blockades and got home safely. What strikes me about protesters of the tariff raises and the Petrocaraibe embezzlement scandal is that they align with a core objective of equitable distribution of public goods, such as energy service delivery, is a demand for justice. I cull planning and policy recommendations from the field research findings, to inform the development of future electricity planning for small island developing states (SIDs).

The report's findings indicate privatization of formerly state-goods, dependency on international aid and short-term, political maneuvers have undercut implementation of decentralization planning. As a result, the three models for energy provision are also affected by international aid limitations, privatization's demands for fiscal solvency, deconcentration of energy infrastructure beyond urbanized areas and delayed devolution of state powers to the local level.

Ayiti's trends in unbundling of utility services display the planning and policy implications of decentralization planning. Ongoing monitoring of energy justice indicators across different institutional arrangements provides lessons learned for practitioners and policymakers regarding best practices for improving access to electricity at the consumer level. In this manner, Haitian citizens may be spared the injustice of international aid and governing systems that seek to indirectly inform affected citizen stakeholders regarding pertinent energy policy decisions via a football game (Arnstein, 1969; Bullard, 1990; Moyo, 2009; Taylor, 2010; Young, 1990).

Energy Justice: A Comparative Case Study of Decentralized Energy Planning Models in Ayiti
by Sophonie Milande Joseph

1. Introduction

The purpose of this study is to determine how different institutional arrangements affect energy justice and sovereignty in Ayiti [Haiti]. Several organizations are currently providing electricity to Haitian citizens; representing different organizational, technical, and geographic approaches to delivering energy services. I hypothesize that different institutional arrangements lead to differences in distributive, procedural, and recognition of energy services — these key theoretical concepts in the emerging energy justice literature highlight three ways that inequality may occur during energy service provision (Jenkins et al., 2016). To evaluate this hypothesis, I collected data that describes the organizational properties of each institution through a semi-structured interview protocol administered to energy service provider representatives (Appendix B).

a.) Country Background

Ayiti is located in the Caribbean region, sharing the island of Hispaniola with the Dominican Republic. In Ayiti's republican governance system, the people and the state's social contract endows state powers at the national level. Thus, the central state must explicitly decree powers to subnational government units to undertake civic duties — for example, the provision of electric service delivery to local consumers.

The World Bank estimates a human population size of 10,981,229 people in 2017 (WB, 2018). In Figure 1, note the population distribution is within the capital and primate city: Pòtoprens (Port-au-Prince) and its metropolitan region (Bodson, Benoît, Duval, & Thérasmé, 2017; Manigat, 1997). Urban primacy is where population and economic activity within a given country are dominated by one or a few of the largest cities.

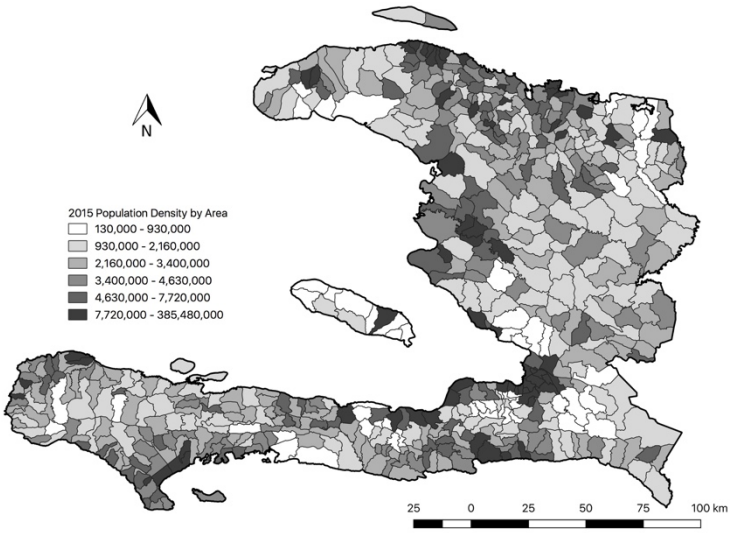

Figure 1: 2015 Population density normalized by geographic area at the seksyon-kominal level; data adapted on QGIS (2018) 3.2.3-Bonn by author; Source data from CNIGS & IHSI

b.) Roadmap to Energy Justice

I frame this study centering full decentralization as critical to facilitating increased energy justice. In the next section, I tell the story of decentralization planning in unbundling of utility services. Then I explain the case study methodology. Findings are presented at the end of this report where I also offer planning and policy implications for practitioners.

2. Decentralization Planning: Trends in Unbundling of Utility Services

Changing political economies of urban infrastructure development and governance have influenced the unbundling of services from government-provided public goods to private commodities (Graham, 2001). In Ayiti, this one-handed approach, or fractured decentralization, furthermore delays equitable spatial-economic development and access to infrastructural services.

3. History of Energy Provision in Ayiti

In the 1950s, President Paul Magloire was in power when the Haitian government launched the Péligre Dam public works project in the Artibonite Valley sub-region of the country. The Péligre Dam and Lake was completed by 1956, during President Magloire's term..

In 1971, EdH was created with the purpose of managing the Péligre Dam's hydroelectric power generation. Unfortunately, the 1971 energy law lacked implementation components, which rendered the law and EdH partly inoperable without subsequent legislation.

On Aug. 20, 1989, EdH's enabling legislation passed. The new law delimited the institution's role as the monopoly controller of the Haitian energy sector. This decision was politically contested for the next decade. The passage of Haitian government modernization laws enabled a wave of privatization of formerly public goods, including energy assets. This opening of the Haitian energy market to private sector participation also influenced the passage of new laws for (de)regulating the emerging energy market.

, Since the passage of privatization laws, EdH became a competitor to the new independent power providers (IPPs). Thus, EdH could no longer serve as the government body overseeing electricity policy. The WB and the IDB provided funding for a new government unit. The World Bank financed Electricity Loss Reduction Project (PREPSEL). PREPSEL is a means by which the World Bank sought to invest in improving the Haitian energy sector. In 2011, MTPTC launched the Energy Cell using PREPSEL funds.

The development of energy policies and procedures has been a legalistic struggle. The change in EdH's status is coupled with incoherencies within energy laws. The lack of an explicit "loi organique" or enabling legislation for the Energy Cell served to delay action in the potentially lucrative energy industry (Fernandes, 2011; Watson, 2011; Yiftachel, 2009).

The lack of transparency in the assessment and production of the new energy laws overlapped with a multi-year period of turmoil due to delayed elections on the local and national level. On February 10, 2016, Michel Martelly's presidential administration came to an end when he submitted his resignation. These electoral and legal outcomes created initial

concern on the part of IPPs, affiliate businesses, etc. because of the new laws' potential ramifications on the viability of the energy market (Alphonse, 2016).

The intent of the laws is to create the Haitian Energy Regulatory Agency (ANARSE). This new body is responsible for regulating electrical energy production and distribution. Furthermore, this new body will be regulating the privatization of the Haitian energy market by regulating prices for EdH and the new independent power producers (IPPs). As of yet, it is unclear what, if any, public consultation was undertaken prior to the passage of these laws, and there remains the incoherency within and across Haitian energy legislation (Alphonse, 2016). This executive and legislative lack of transparency in public decision-making haves come at a significant cost. Most recently in July 2018, which triggered multi-day protests of fuel price increases while I was in the field.

Ongoing international aid provision is contingent upon the Haitian government's compliance with said foreign organization's economic policy measures (Ward, 2000, pp. 51-54). Recently, the Haitian government attempted to use the distraction caused by a FIFA World Cup soccer game as an opportunity to announce an International Monetary Fund (IMF) required increase in previously government-subsidized fuel prices. On Friday, July 6, 2018, Brazil lost a quarter-finals game to Belgium in the FIFA World Cup game in Russia.

> Ten minutes into the game, the news started rocketing around [Haitian] social media: an increase of 38 percent on gas, 47 percent on diesel and 51 percent on kerosene, which is used largely by Haiti's poor to light up their homes. Though many diehard Haitian fans of the struggling Brazilian World Cup team stuck with the game to the end, five minutes after it ended with Brazil's shocking loss, many took to the streets in anger, burning tires and blocking streets across the country (Charles, 2018, p. 2).

The economically regressive choice to raise kerosene at the highest percentage amount of all three fuel-types affected stands out as a planned decision against the best interests of the poorest segments of society (Watson, 2009). This policy choice by IMF, World Bank and Haitian leaders is unsustainable because the protests indicate the contested energy rate

decision did not sufficiently consider equity and environmental indicators over pricing key resources to sustaining life (Adler, 2010; Campbell, 1996; Sen, 1999).

In July 2018, protesters made their presence felt in the Pòtoprens metropolitan region and in regional nodes. In audiovisual and text communications circulating on Haitian social media networks, the fuel price hike is reflected as disrespectful of the impoverished. The choice to announce the hikes during the football game was also seen as a form of disrespect to the population's intellectual ability to recognize the drastic negative implications of the fuel price changes on an affected households' everyday cost of living.

I was in Southern Haiti when news of the general strike broke out. On Sunday, July 8, I began the journey back to Pòtoprens. Sunday had been declared a day of truce so that people would have time to make provisions for what would be followed by two more days of general strikes. During the drive, I saw remnants of multiple blockades and arrived home safely. The field experience leads me to focus on equitable distribution of public goods and thus opportunities for upward mobility (Bullard, 1990; Campbell, 1996, p. 298; Johnston, 2018; Taylor, 2010).

4. Theoretical underpinnings

Ayiti's fractured decentralization planning results from the political needs of national and subnational leaders, rather than reflecting a broader concern with the public good (Cantave, Fils-Aimé, & Brutus, 2000; Charles, 2018; Joseph, Klopp, Schumacher-Kocik, & Marcello, 2011Njoh, 2016 #64). Ayiti's non-urbanized areas are in varying states of fragmented, administrative deconcentration from the national state's influence centralized in the urban primate, Pòtoprens (Joseph, 2019). Legislative loopholes, or gray spaces, are strategic tools that facilitate ongoing corruption and co-opting of systems that delay implementation of decentralization (Yiftachel 2009).

Simultaneously, Haitian planning law also provides legal justification for the parallel pursuit of improved economic livelihoods, in this case through electrification, and social justice (law of April 5, 2017).[1] Energy justice metrics provide explicit measures for assessing just processes and equitable outcomes that parallel global trends in the creation and use of value-based, planning metrics (S. S. Fainstein, 2010; Griffin, Cohen, & Maddox, 2015; Heffron, 2015). Distributive, procedural, and recognition comprise key justice sub-types in the emerging energy justice literature stream. The justice indicators monitor the energy planning cycle and outcomes (Griffin et al., 2015). I use these three, energy justice building blocks, to frame the analysis of data findings.

Distributive justice (DJ) supports tracking social and spatial distribution of positive and negative externalities upon electricity consumers by operationalizing equity of outcomes [Appendix B: 8-12]. DJ's policy implications prioritize inclusionary, electricity distribution mechanisms.

Procedural justice (PJ) centers citizens' rights for meaningful, public participation in decision-making processes that affect their built environment's outcomes (Arnstein, 1969; Choguill, 1996). Moving beyond tokenized participation, PJ operationalizes energy service providers' institutional structure using three measures: organizational, technical and geographic characteristics [Appendix B: 1-7] (Heffron, 2017; Jenkins et al., 2016).

Recognition justice centers the struggle for redistributive justice by acknowledging inequalities originating in the slavery era's transnational mercantilism and its influence on population settlement patterns (Allen, 2017; Yarrington, 2015). Such spatial-historic analysis

[1] "Considérant qu'une approche régionale des politiques publiques en matière d'aménagement du territoire permettra un développement économique et social plus juste..." (loi du 5 Avril 2017, Le Moniteur, 172:54, pg. 7).

of infrastructure investments connects contemporary patterns in siting of energy infrastructure investment to extractive, institutional practices[2]

5. Case Study Methodology

I use the semi-structured interview protocol tool to collect data from energy service providers' representatives (see Appendix B). The tool is comprised of a series of 12 open-ended and dichotomous variable questions that are designed to measure the aligned theoretical concept. I conducted two in-person interviews with three people (Annex A). Two respondents shared their knowledge with me at their [X] offices in Pòtoprens (Interview X1, X2). A second interview with [X4], a subject matter expert and practitioner within the [X5] sector was undertaken in an open classroom at a local university.

Once the country-wide protests broke out, components of my originally proposed research plan, specifically a household survey, had to be canceled for safety reasons. Simultaneously, Ayiti's other privatized utility sector, the telephone network, became sporadically unreliable in Southern Ayiti. Consequently, the interview with EarthSpark representatives in Lezanglè, Ayiti was undertaken remotely by a colleague (X6).

6. Case Study Site & Energy Provider Descriptions

The Haitian energy sector switched from a state-controlled monopoly to a mixed-economy served by the state and independent power providers (IPPs). There are three case study sites: EdH, CEAC and EarthSpark. EdH is the former monopoly mentioned previously in Section 3 of this report. The 1) **EdH** case study zone comprises the areas in which EdH-derived electrical service delivery is currently present (Navigant, 2017). Figure 2 visualizes these administrative units at the komin or county-level. EdH manages the Peligre Dam's

[2] For example, population density requirements for micro-grid investments to be financially solvent, limits infrastructure investments to historic town centers. Anthropologist Suzanne Comhaire-Sylvain noted "the contrast between the Frenchified elite of the coastal towns and the illiterate peasantry in the interior" during her mid-20th century fieldwork of rural Ayiti (1955, p. 620).

hydroelectric plant and some smaller village-level dams. EdH serves about 250,000 household clients (Interview X). Although the nation's population is estimated at just under 11 million and steadily growing upward and urban since 1960, EdH is estimated to be serving 250,000 households (Bodson et al., 2017; WB, 2018).

EdH's coverage area traverses geographically disparate regions of Ayiti: from Southern, Central, near North and the eastern border with the Dominican Republic. There is no overlap between EdH's service area and that of CEAC and EarthSpark.

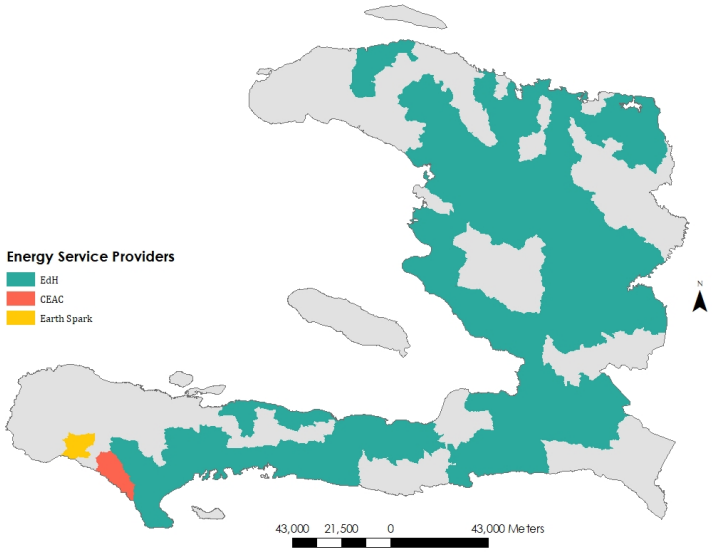

Figure 2: Case Study Areas; Adapted from Navigant. (2017, June 12-13, 2017). Electrifying Haiti With Intelligent Investment in Community Solar Minigrids. Paper presented at the Haiti Sustainable Energy Forum, Haiti.

Providers	Location	Service Area
EDH: centralized regional grids (15)	*Potoprens*	National
CEAC: cooperative enterprise micgrogrid model	*Koto Awondisman*	*Wòchabato*, *Koto* & *Pòtapiman*
EarthSpark: social entrepreneurship, decentralized microgrid	*Zanglè*	Southern Region

Table 1: Energy Service Providers by Region

CEAC and EarthSpark existed before the EdH monopoly was broken up through the passage of new energy laws (Interview X). The two cases represent different institutional models for decentralized energy microgrid implementation. The 2) Koto Awondisman Electricity Co-op (**CEAC**) case study area comprises three municipalities: Wòchabato, Koto

and Pòtapiman (Figure 2). This regional scale ostensibly provides sustainable energy service due to economies of scale needs for micro-grids to be financially viable. The Koto awondisman's population is an estimated 58,618 people (IHSI 2013).

CEAC represents a cooperative enterprise model of private sector rural electrification through a microgrid (Table 1). CEAC uses the cooperative enterprise model outlined in the Washington, D.C.-headquartered, National Rural Electric Cooperative Association's (NRECA) technical assistance guidelines (TAGs).

The town of Lezanglé is where 3) **EarthSpark** is currently providing energy service on its micro-grid infrastructure (Figure 2; Table 1). In contrast to CEAC's co-op model, EarthSpark is a non-profit entity that serves as an incubator of for-profit, clean energy businesses. EarthSpark has created two for-profit entities thus far: Enèji Pwòp, S.A. and SparkMeter, Inc. SparkMeter produces smart meters that remotely collects data on power usage at the household level. The infrastructure enables the provider to turn energy service provision on and off remotely for each household.

Both CEAC and EarthSpark's case study areas have lower population densities and a significant distance from the primate city, Pòtoprens (Figure 2). In comparison, Zangle's 2009 (27,182) and 2013 (29,891) population is growing, but only slowly. Urbanized areas, i.e. places with dense population, is preferential in order to increase the likelihood of recovering costs through client fees. Consequently, the micro-grid business model results in an institutional design that repeats historical spatial-economic preference for the historic downtown core's residents to obtain physical infrastructural investments (Schnitzer et al., 2014, p. 63; Yarrington, 2015).

The collaborating partners for funding and/or implementing the CEAC project include the United Nations Environmental Program (UNEP), the Government of Norway, the United States Agency for International Development (USAID), the Inter-American Development

Bank (IADB), NRECA International and the Solar Electric Light Fund (SELF). However, since 2013,

7. Results: How are different institutional arrangements affecting energy justice in rural Ayiti?

a.) Electricity Provision by EarthSpark, CEAC, and EDH

Organization and Public Participation

Each of the institutions reviewed had varied organizational structures and different methods for public engagement. The EarthSpark microgrid is owned privately with the aim to operate a for-profit business. The EarthSpark team is knowledgeable and comprised of experienced employees working to develop and maintain the microgrid (Interview X). They have a memorandum of understanding with the local komin. There are three levels of engagement with the community: an energy committee, community meetings and grid ambassadors. The energy committee is composed of selected members of the community. The purpose of the committee is to discuss any pressing items relating to the microgrid system. The greater community meeting is open to all members of the community. Inevitably, the voices in the energy committee and greater community meeting do not always align. Lastly, the grid ambassadors are the face of EarthSpark in their respective areas. They typically work at a store in town and act as the point of communication between individual customers and the microgrid.

The CEAC cooperative is designed to include the community in the development and operation of the microgrid. The responsibility for such communication lies with the board, which consists of three members of the community who each serve three-year terms (Interview). The board members are paid only a token remuneration and are responsible for overseeing all aspects of the microgrid development and operations. Due to the technical and economic difficulties of the microgrid development, official communication channels were not a priority and thus never developed. There are, however, periodic informal exchanges through places of public gathering, such as schools and churches. For practical needs, if a

customer needs to report a failure, they can contact a representative located in each commune or call the commercial director or general manager. Due to the small number of clients, the interviewee states this direct mode of interaction is feasible; however, there would be more difficulty with higher client numbers.

EDH does not have explicitly delineated policies for including the community in the planning of new energy-related, infrastructure (Interview). Communications appear to primarily be top-down using mediums such as newspapers, televisions, and radio. Customers can call to report failure or outages, but they are not guaranteed a response (Interview).

Technical Systems

The physical structure used by each institution to provide electricity varied in size, the type of generators used, and the aims for a level of service.

	Generators	*System Capacity*	*Households Served*	*Operating Hours*	*Reliability*
EDH	Diesel Generators [ex,int]	244MW [ex]	250,000 [int,ex]	Unpublished availability hours [int,ex]	Rolling black outs [int,ex]
CEAC	Solar Panels + Batteries [int,ex]	130 kW PV and 200 kW Diesel [ex]	1400 pre, 1100 post [int]	12 hours a day pre, 4 hours a day post [int]	90% [int]
EarthSpark	Solar Panels, batteries, diesel back up [int,ex]	93 kW of PV, 400 kWh of battery capacity [ex]	451 pre, 344 post [int]	24 hours a day [int]	100% outside of planned maintenance [int]

Table 2: Overview of technical provision from EDH, CEAC, and EarthSpark, Source: (Interviews, NREL 2015, Stuebi & Hatch 2018)[3]

EarthSpark has designed their system to provide electricity with 24-hour availability with 100% reliability outside of planning maintenance which is the highest level of service of the three institutions reviewed. EarthSpark can provide this level of service through sustained funding and from a technical design that has gone through several iterations (Archambault, 2014; Stuebi & Hatch, 2018). The system is designed with a capacity margin of 2, meaning

[3] int = interview; ex = excerpt from document analysis

the system can provide two times the peak electricity demand currently connected to the system. With such a large capacity margin, the system could connect many more households before needing to upgrade their systems. The EarthSpark interviewee also indicated that the system is designed to be modular, allowing for easy capacity expansions over future time horizons. EarthSpark, and the communities they serve have yet to fully recover from hurricane Matthew as only 76% of their customers have returned.

CEAC through their hybrid PV and diesel system provide electricity for 4 hours a day with extended hours on the weekend [int]. The aim is to ensure 90% reliability to their customers. Before hurricane Matthew, the microgrid was able to provide electricity for 12 hours of the day and like EarthSpark they have only been able to recover 78% of their customers. Getting the system back operating is taking time as crucial equipment, such as distribution lines, transformers, and poles, are all imported. In this way, the system is exposed to the global supply chain. However, the CEAC system, as it stands, is oversized with the ability to incorporate up to 1,700 to 2,200 customers.

The grids operated by EDH primarily use generators that run on fossil fuels. The level of service from EDH is low with unknown availability hours between 5 and 15 hours a day (NREL, 2015; Stuebi & Hatch, 2018) and characteristic rolling blackouts. For the 10 grids operated by EDH, the total installed capacity is 244 MW with an estimated peak demand of up to 500 MW, indicating that only half of the demand in these regions are being satisfied. In addition, the transmission and distribution losses have been estimated at 66% the majority of which are due to a theft and an inability to collect payment (NREL, 2015). The budget for EDH is provided by the state but the interviewee states that there is no funding available for the expansion of the grid concerning capacity and locations.

Business Models for Sustained Operation

Common to all the institutions is the inability to recover costs, as none have yet to settle on a sustainable business model.

EDH has well documented financial issues. The government pays two-thirds of the system's running costs with payments for service only covering a small fraction of costs. It is estimated, however, that if revenue were able to be recovered that the system could run at a profit (Belt, Allien, Mackinnon, & Kashi, 2017). While technically introducing metering technology is possible, recent attempts to do so have failed due to what has been termed as a lack of will from the organizations in power.

In contrast, EarthSpark was initially funded through external grant funding with the intent to develop a sustainable business model through public and private partnerships. EarthSpark has made several strides in attempting to develop a model of electricity provision that can be profitable. They have developed a methodology to evaluate and rank various communities throughout rural Haiti to assess their suitability, based on several metrics including population density and ability to pay (Archambault, 2014; Interview). They have also developed new low-cost metering technologies, incorporated pay-as-you-go payment methods, and developed ties with the community to mitigate theft all in attempts to bring costs down (Archambault, 2014; Interview). They have significantly oversized their system enabling them to have a controlled ramp up to more customers while maintaining the same level of service. However, they are still yet to recover costs. To rebuild after Hurricane Matthew, EarthSpark was required to return to investors for subsequent funding (Stuebi & Hatch, 2018).

The CEAC cooperative was built with initial funding from the Norwegian government, USAID, and other non-governmental organizations (NGO's) and with volunteer contributions in-kind from the National Rural Electrical Cooperative Association (Stuebi et

al. 2018; Interview). The initial business model aimed at the microgrid to be self-sufficient in 4 years. However, several aspects hindered this progress. The business model assumed a rate of demand increase higher than what occurred, the cost to obtain diesel increased substantially from initial projections, and Hurricane Matthew destroyed the microgrid requiring additional financing and slowing the growth of the system. Currently the price of electricity is subsidized to a value of 25 c/kwh but according to the interviewee may need to increase to the full cost of 45 c/kwh (Interview). This would be a substantial increase for their customers and could render the whole project infeasible.

Environmental and Sustainability Policies and Practices

In CEAC, environmental policies are adhered to in order to maintain membership in the Conseil National de Cooperatives. EDH has a department of environmental affairs to manage environmental issues of siting. EarthSpark has environmental practices which mainly consists of social and environmental impact assessments used to mitigate risk. EDH has stated sustainability policies but it is unclear what has been done in practice. CEAC does not have any explicitly stated sustainability policies.

b.) Implications for Energy Justice

Procedural Justice

Procedural justice seeks to determine how decision-makers have sought to meaningfully engage with the community and power relations. Arnstein (1969) outlined eight levels of public participation: manipulation, therapy, informing, consultation, placation, partnership, delegated power and citizen control.

EarthSpark exhibits a level of public participation that is categorized as placation. This level is defined by engaging the community in dialogue through surveys, neighborhood meetings and public hearings. While the community is consulted and able to provide advice, EarthSpark retains final decision-making power.

CEAC is a cooperative. There is a layer of technical experts that mediate communications between the CEAC citizen representatives and external funding bodies (Interview). I categorize CEAC as also being a case of the placation form of public participation.

I have not been able to identify EDH's systematic process for continuous public participation. There has been project-by-project inclusion of community members through informational campaigns in the past (Interview X). Respondents noted such public engagement activities will occur again in the future. As such, I categorize EDH as being in the non-participation levels of Arnstein's ladder of public participation.

The differences in the level of citizen participation directly translate into meeting the electrification for economic development needs of people through socially just planning processes and outcomes (S. Fainstein, 2011). July 2018's events mark the start of an energy justice story that demonstrates how corruption related to the Petrocaraibe funds' embezzlement and the lack of transparency in fuel price decision-making negatively impact recent strides in the country's branding as a place of socio-economic stability that is open for business to investors and tourists alike (Seraphin, 2016). Instead, the lack of inclusion of social justice issues in previous energy-related decision-making launched the ongoing "Ayiti Nou Vle A / The Ayiti We Want," social media-led uprising against corruption within Ayiti's state and international aid sectors. Sustainable development requires simultaneous pursuit of equity, economic and environmental goals (Campbell, 1996); otherwise, electrification for economic development will not be sufficient to spark Ayiti's viable inclusion in a globalized economy (Goldsmith, 1997).

Distributive Justice

Distributive justice seeks to highlight the equity of differences in benefits and negative effects. With respect to the benefits afforded by electricity service, there is a clear

division in the allocation of energy services to the rural customers served by EarthSpark and CEAC's micro-grids and the urban customers served by EDH. The microgrid systems through their targeted approach were each able to provide a high level of service relative to EDH and incorporate various levels of public participation. Using urban and rural as collective classes to compare differences in service outcomes, demonstrates urban citizens have access to more electricity provision, albeit sparse and intermittent, than their rural counterparts. EarthSpark will only expand a microgrid system to komins that show the possibility for favorable returns. For the cooperative model, komins could petition to develop a cooperative microgrid but are still beholden to outside funding organizations to obtain capital and technical know-how. Overall, densely populated areas are viewed as a priority for electrification by EDH while EarthSpark targets specific urbanized areas of rural regions due to the minimum densities required for micro-grids to be financially solvent within privatized funding models.

Recognition Justice

Recognition attempts to determine which communities are mis-represented and ignored by energy service providers by asking survey questions to understand the make-up of each energy provider's customer base, the participatory committees and governance bodies. Due to the fuel riots, which canceled the household survey, the study was not able to obtain household-level data about the communities served by each energy service provider.

8. Conclusions and implications of the study

The purpose of this study is to determine how different institutional arrangements affect energy justice and sovereignty in Ayiti. The findings indicate privatization of formerly state-goods, dependency on international aid and short-term, political maneuvers have undercut implementation of decentralization planning. As a result, the three models for energy provision are also affected by international aid limitations, privatization's demands for

fiscal solvency, deconcentration of energy infrastructure beyond urbanized areas and delayed devolution of state powers to the local level.

There are positives and negatives in my findings on the launch and implementation of the two decentralized IPPs in the Southern Haiti region. CEAC and EarthSpark are providing partially clean-energy in sites that previously did not have access to or reliable access to energy. Furthermore, CEAC and EarthSpark are experimental models that are creating experiential knowledge that may inform future energy infrastructure expansion in other communities.

The negatives regarding the two decentralized IPPs in the Southern Haiti region that also provide lessons learned for planning professionals working to expand utility infrastructure within marginalized communities. Given the push for privatized utilities, business models for sustained operation demand changes in business and technical plans. There is a need for business plans that explicitly incorporate known uncertainties due to damage from natural disasters. For example, the CEAC business plan's forecasts did not incorporate financial needs in case of a natural disaster such as Hurricane Matthew in October 2016. Technical plans need to include modular build up to be able to operate under changing conditions.

The organization's size has positive and negative impacts on energy justice outcomes for individual consumers. The struggle may appear to be binary: how do you balance the business need for economies of scale and the need for organizations equipped to meet the communications needs of the community? The black and white approach is a set up for failure. A holistic approach acknowledges that without social stability, economic development is not sustainable.

The planning and policy implications of decentralization planning displayed in Ayiti's trends in unbundling of utility services. Ongoing monitoring of energy justice indicators

across different institutional arrangements provides lessons learned for practitioners and policymakers regarding best practices for improving access to electricity. In this manner, Haitian citizens may be spared the injustice of an international aid and governing system that seeks to indirectly inform affected citizen stakeholders regarding pertinent energy policy decisions via a football game.

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Annex A – List of Interviews

Interviews undertaken by phone (February 2018)

Interviewee 1	Representative from CEAC
Interviewee 2	Representative from Civil Society Organization 1

Interviews undertaken in Ayiti (July 2018)

Interviewee 3	Representative 1 from MTPTC
Interviewee 4	Representative 2 from MTPTC
Interviewee 5	Representative from [X] University & [X]

Appendix B: Semi-Structured Interview Tool: Energy Service Provider Institutions

Concept	Measures	Interview Questions
Institutional Arrangement (Independent Variable)	Organizational Approaches (System Design Intent)	1. How many households do you serve?
	Financing	2. How is your institutions energy system financed?
		3. What is the capital expenditure cycle for new infrastructure provision?
	Technical Approaches	4. Do power plants provide electricity to the system?
		4a. If so, what types of power plants provide electricity to the system?
		5. Does your institution intend to meet all peak demands for energy service by design?
		5a. If yes, how much additional capacity do you make available to meet electricity demands? i.e. what is your capacity margin?
		5b. What level of reliability do you aim to maintain? e.g. do you aim to meet demand 99% of the time?
		5c. If no, what level of reliability do you aim to maintain?
		5d. If no, does your institution have specific hours for which household clients are provided power?
		5e. If no, How does your institution manage when there is excess demand for energy service?
	Geographic Approaches (Environmental Policies)	6. Do you have policies in place for environmental protection?
		6a. If yes, what are those policies?
		6b. If yes, what is the rationale behind having those policies?
		7. Do you have sustainability policies?
		7a. If yes, what are those policies?
		7b. What is the rationale behind having those policies?
Distributive Mechanisms of Inclusion (Independent Variable)	Systems Planning	8. What types of policies do you have in place to ensure public participation in the system planning? e.g. in determining where to site new infrastructure
		9. What types of policies do you have in place to ensure public participation in the system operation? E.g. determining operating hours
		10. How are system failures or broken items reported back from the customers?
		11. How do you provide information to your customers about an update(s) to the electricity system?
	Meter Usage Data	12. Discuss with energy service provider process for obtaining direct meter usage data

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