The Paradoxes of Peruvian Infrastructure:
NGO Governance, Rural Energy Transitions, and Public-Private Partnerships

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Abstract

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What are the policies and procedures that have led to successful NGO delivery of solar energy in Peru, from both the perspective of the institution, as well as the rural *campesinos* it serves? And how can the Peruvian government replicate this solar energy program's success at national scale through a public-private partnership? At an institutional level, this research analyzes how NGO philosophies and on-the-ground practices facilitate the sustainable provision of solar energy in highland Peruvian communities. At a community level, it examines how rural residents engage with NGO solar energy provision and perceive, negotiate, and actively contest transitions to grid electrification in small Andean villages. On a policy level, this project explores the policy contact zone between public-private partnership frameworks and the ground-level challenges of rural solar energy infrastructure.

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Introduction

This dissertation project belongs to a growing third wave of anthropological engagement with energy, which is developing in a period of incredible environmental and political consequence—the era of climate change (Boyer 2014).[1] Even as climate change begins to negatively affect human well-being, energy access remains fundamental because it has a positive effect on people's productivity, income, and health and can improve gender equity, education and facilitate access to other infrastructure services (Pachauri and Brew-Hammond 2012). As a result of climatic changes that will fundamentally alter human livelihoods across the globe, governments must adapt their domestic energy policies to reflect this new reality (Strauss et al. 2013). The challenge for scholars is to understand how people can meaningfully engage with emerging technologies and how governments can manage energy resources, in order to improve standards of living without simply replicating the path taken by the expansion of the carbon economy (Gupta 2015). I demonstrate that ethnographic understanding of rural energy service can add value to areas considered the purview of technical fields. Gaining new disciplinary insights is imperative as threats of global energy demands and the attendant perils of climate change force scholars, governments, and private industry to accept that, especially in the context of developing countries, there are no easy policy or technological solutions. However, scholars have demonstrated that many of the threats to human well-being, and also environmental, economic, and political stability, are at their core, issues of power, institutional practice, culture, and values—all of which fall under the expertise of the social sciences (Boyer and Szeman 2014).

[1] Previous anthropological engagements with energy coincided with periods of vulnerability and transition in the dominant frameworks of power: first, with the rise of nuclear energy in the 1940s and second, with the oil shocks of 1973 and the end of the global North's imperial domination over carbon fuels (Boyer 2014).

Today, over a billion people on earth still do not have access to electricity (IEA 2017). In countries like Peru, non-governmental organizations (NGOs) are bridging this gap with renewable resource projects, yet not all NGO efforts are equally successful. Many initiatives have failed, leaving remote villages with "ghost grids" in which defunct energy equipment is abandoned even while energy access remains an essential need. Others, however, succeed and are able to catalyze innovation in public-private energy projects. What explains this variation? The empirical focus of my research centers around a project by the nonprofit, *Luz Solar Andina* (LSA),[2] which is the first NGO in Peru's history to be awarded an electricity concession area and also gain national authorization as a solar energy provider. Inspired by the success of LSA's small-scale solar energy project prioritizing community engagement, the Peruvian government has partnered with the private sector to electrify 150,000 homes via solar energy. This NGO's pioneering accomplishments, successful energy program, and influence on public-private partnerships for energy provision, have served as the impetus for this dissertation research.

My project is motivated by two broad questions: What are the policies and procedures that have led to LSA's successful delivery of solar energy, from both the perspective of the institution itself, as well as the rural *campesinos* it serves? And how can the government replicate this solar energy program's success at national scale through a public-private partnership? The analysis of LSA's *Casa Solar* program shows us that despite its ardent commitment to community development by its "engineers of communication," the sustainability of its energy service is not simply owed to its engagement with its rural customers (i.e. creating project buy-in and effectively communicating technical and payment rules), but through its simultaneous disciplining of residents (i.e. promptly cutting power and removing energy equipment for late payment or default);

[2] Unless otherwise noted, the names of all interviewees, towns, and programs names have been changed to pseudonyms; I have made these changes to protect the identities of my research participants.

it is in fact residents' fear of losing their solar energy service that motivates them to pay their monthly energy bills. Analysis reveals that, contradictorily, for all the emphasis that LSA places on cultural engagement and the organization's prioritization of the social development of its customers over its financial profit, its community development and disciplining together have effectively adhered to neoliberal logics—reorienting residents' away from dependence on state welfare and habituating them to paying monthly bills, setting the stage for their increased market involvement. Additionally, LSA's experiences complicate and add nuance to our understandings of development success. They show us that favorable development outcomes may in fact come at the cost of subjecting residents to neoliberal paradigms; and that paradoxically, this NGO-community collaboration may successfully produce energy while perpetuating the very same racial hierarchies which LSA's project is supposed to help its customers overcome.

The community ethnography component of this project brings into relief the contradictory circumstances that characterize the livelihoods of rural *campesinos* as their community transitions between LSA's solar energy service and the extension of the national electric grid. I argue that residents are paradoxically caught between access to solar energy and grid power; both of which are meant to serve as tools for their socioeconomic advancement, yet only re-inscribe their position at the bottom of Peru's social hierarchy. Solar home system (SHS) technology represents advancement, yet they are something residents can easily be stripped of if they fail to pay their bills. This represents both a material and symbolic loss of the rights that are expected as a citizen of a modern nation state. On the other side, residents do not accept the arrival of the electric grid blindly, fearing that frequent outages and poor service will further disrupt their already precarious existence.

At the public-private partnership level, this research makes visible the design flaws in the *proyecto masivo* contract that will hinder its ability to replicate LSA's success nationally. I argue that the Peruvian state does not fully grasp the interrelated importance of LSA's approach, which combines community trust building and communication, to create buy in and understanding, in tandem with disciplining customers through punctual energy service, to create a culture of payment and market-oriented citizens. I argue that the minimal technical and financial role outlined for the private company, Ergon, [3] has failed to fully account for the great logistical and social challenges inherent to solar energy provision in remote communities of the Peru; the vexing task of teaching isolated rural residents the technical and financial aspects of the program are left ill-defined in the *proyecto* contract. At the same time, it allocates the equally challenging bill collection duties to disinterested state distribution companies, who worry these added tasks will bring financial losses. Additionally, the *proyecto* contract obligates public and private entities to collaborate with one another (while reimbursed at low, state-mandated levels) regardless of the other's performance, which allows each sector to operate with indifference towards the other, ultimately, jeopardizing the viability and success of the *proyecto masivo*.

The chapters of this dissertation inform one another and address interrelated themes at the institutional, community, and policy level, which link them all together into one cohesive project. At an institutional level, this research analyzes how NGO philosophies and on-the-ground practices facilitate the sustainable provision of solar energy in highland Peruvian communities. At a community level, it examines how rural residents engage with NGO solar energy provision and perceive, negotiate, and actively contest transitions to grid electrification in small Andean villages.

[3] This is the company's real name, not a pseudonym.

On a policy level, this research explores the policy contact zone between public-private partnership frameworks and the ground-level challenges of rural solar energy infrastructure.

The chapters are organized to build on one another, which not only lend strength to the arguments made in each section, but also emphasize common themes addressed throughout. Additionally, the chapters are arranged to highlight narrative tensions and discord between the different institutional actors and community residents whose testimonies fill these pages. In the first chapter, entitled "We are Engineers of Communication": Solar Energy and Subject Formation in Rural Peru," I take a stance, not in defense of LSA's work, but rather one that is both critical of the organization while still supportive of its mission to implement solar energy to serve historically marginalized rural people. This chapter examines the operational ideologies and practices that have enabled its solar energy program, called *Casa Solar*, to adequately satisfy rural customers' expectations while ensuring that customers keep paying their recurring energy bills. It shows that much of LSA's success is owed to the organization's dedicated training of and engagement with its rural energy customers, which has engendered residents' sense of ownership over the program, far exceeding what government and private entities have been willing to do. LSA's thorough community training workshops have been driven by its dedicated personnel, so called "engineers of communication," who see their socially-oriented work managing resident's understanding and expectations of solar energy service, as just as important as technical operations carried out by traditional engineers.

Simultaneously, given the Peruvian state's uneven presence throughout the country, this chapter demonstrates that there is much disciplining and governance that takes place in the contact zones between NGOs and rural highland peoples (O'Donnell 1993; Lucero 2011). Borrowing from Foucault's ideas on "governmentality" (1991), I show how LSA works to acculturate rural

residents to making monthly payments, while also lessening what the organization sees as residents' dependence on state handouts, which ultimately, has served to make consumer-oriented subjects of the state. I argue that LSA accomplished this through creating mutual trust between the organization and its rural customers, while also disciplining them through prompt technical energy service, i.e. cutting power or removing energy equipment for falling behind on payments.

LSA's experiences suggest that perhaps we have to accept a more complex and messy definition of "development success," one that may come at the expense of challenging racialized hierarchies. Tthe organization's officials have conveyed a degree of disparaging remarks about highland people, while endeavoring to provide energy service so that these same residents can surpass the very stereotypes LSA officials have perpetuated in private dialogue with me. In spite of certain stereotypes expressed by LSA and its operations that essentially adhere to neoliberal logics, the organization's experiences help complicate our understanding of development success; this NGO-led solar program makes clear that if rural electrification is treated more as an ongoing "project and not a secure accomplishment" (Li 2007, 10), then they can in fact help foster a deeper sense of citizenship and inclusion among rural *campesinos* than the many state institutions.

The second chapter, entitled *"*Let the grid come but I'm not giving up my solar panel*"*: An Ethnography of Rural Energy Transitions in Cajamarca, Peru," explores how rural *campesinos* interact with and perceive LSA's solar energy program, as well as negotiate and push back against the impending transition to grid electrification in their isolated Andean village. This ethnography takes place in the community of Lahuaymarca, served by LSA's *Casa Solar* program in the highlands of Cajamarca. For community members, in one respect, solar energy service represents modernity and an increased level of citizenship. Yet, in another respect, the upcoming grid extension creates opportunities to be deceived into surrendering control of their land to the state

or private companies, as had happened with international mining interests in the region. For many citizens, connection to the electric grid is to share in modernity and progress. However, for residents of Lahuaymarca, this connection may bring with it new energy worries and uncertainties. For one family featured in this chapter, the grid's upcoming arrival proved to be most fortunate and paradoxical, as the grid extension plans call for poles and cables to run through the family's land in order to connect the main part of the community with electricity, while passing over this family's home entirely.

This ethnography answers a call made by Akhil Gupta (2015) that scholars address how people use and engage with the incomplete or intermittent presence of modern energy infrastructure. It shows how these residents do not greet the arrival of the national electric grid with open arms, but instead have deep worries about eventually forfeiting their solar home systems (SHS), in fear that grid electricity will prove faulty, dangerous, and more expensive than solar energy. I argue in this chapter that, as their village faces a transition from solar energy to grid power, these rural *campesinos* are caught up in various paradoxes of development. While both solar technology and grid power are meant to serve as technological tools to help rural *campesinos* overcome histories of social and economic exclusion, in the end, both serve to reinscribe their place at the bottom of Peru's racial and geographic hierarchy and their minimal claim to infrastructure rights.

This chapter also reveals a tension between institutional and community-level understandings of the causes underlining LSA's energy program success. While the first chapter shows how LSA officials attribute program success to its dedication to community development as "engineers of communication," working to foster residents' understanding and sense of ownership of the program, the community ethnography in the second chapter shows that the

program keeps working due to residents' constant fear of losing their solar energy if they fall behind on payment—which is what ultimately compels them to keep paying their monthly solar energy bills. Despite their overall contentment with their energy service, customers' SHS can be physically removed for late payment, which in effect, removes a symbolic form of their state citizenship and makes it contingent upon their ability to pay for it. Adding further complexity, residents' successful track record paying their bills has given rise to their feelings of empowerment, gained through their financial role in the "coproduction" (Ostrom 1996; Bebbington 2000) of solar energy service. So although grid service cannot be physically removed like a SHS, residents voice worries about being converted into passive recipients of electricity from the faulty national electric grid, whose technical capacity and customer service is known to be poor in rural areas.

Additionally, this section offers an example of how, in Peru, ideas of race formation are so intimately linked with geography. Even when rural highland communities do not identify as indigenous or speak Quechua, they are nonetheless racialized by outside groups. This racialization and inferiorization of rural *campesinos* is manifested through the extension of subpar grid infrastructure service into remote, highland regions of the country. This enables urban, outside groups to assume dominant status by associating themselves with being modern, urban, and more civilized, while perpetuating the notion that rural regions and people living there are more backward and less civilized (Weinstein 2105). While infrastructure is often described as something that is "by definition invisible," (Star 1999, 380) for residents of Lahuaymarca, their conceptions of impending electric grid infrastructure, which is known to be prone to power outages, in fact renders it highly visible, and a potentially disruptive force in their lives. This ethnography suggests that *campesinos'* experiences living in transitional spaces between solar energy provided by a

socially committed NGO and grid power provided by an aloof state energy company, are not passing phases but rather a more permanent condition of their racialized, rural existence.

The third chapter, entitled "The Most Ambitious Program in the World": The Challenges and Contradictions of Peru's *Proyecto Masivo de Energía Solar,* analyzes the first off-grid solar energy auction carried out by the Peruvian government and the subsequent public-private partnership (PPP) formed with the winner of the auction. Although much has been written about various facets of PPPs, such as the political, economic, financial, managerial, and renegotiation processes of these partnerships, this chapter seeks to fill a gap in the literature on public-private partnerships specifically for the provision of off-grid solar energy.

Because the design of PPP contracts can be incredibly complicated and carry long-term commitments from all members involved, they warrant in-depth analysis. Due to this complexity, PPP designers must foresee potential problems and also allocate risk properly in order to avoid contentious scenarios after the infrastructure has been installed and become operational (Yescombe 2013). At the same time, when put into practice, these contracts are frequently incomplete, since the institutions designing them cannot foresee all of the possible conflicts that may develop over the course of a contract (Hart 1995). Owing to their inherent incompleteness, PPP contracts are often prone to renegotiation early in the life of the contract (Sarmento and Renneboog 2016), which not only can be costly for all parties involved, but also run the risk of failing and being abandoned entirely (Delmon 2011). In Latin America, incidences of renegotiations have been high, with the majority of the financial losses suffered by government entities (Trebilock and Rosenstock 2015). The work in this chapter brings attention to the initial phases of PPP formation, highlighting the internal "invisible trouble" of infrastructural systems (Lampland and Star 2009), foregrounding the constitutive parts and inner workings embedded

within energy infrastructure contracts that are usually hidden away from the spotlight (Bowker 1994). The aim is to show how unseen, disjointed contract elements may disrupt the visions and estimations made by PPP design committees, which may ultimately lead to this project's failure to meet the expectations and needs of the historically neglected communities it is designed to serve.

LSA's *Casa Solar* program served as an inspiration for Peru's public-private partnership, commonly referred to as the *proyecto masivo,* which aims to electrify 150,000 rural homes nationwide with off-grid solar energy. Yet, this large-scale ambition features a program model that departs significantly from that employed by LSA. While LSA is responsible for the social, technical, and financial elements of energy service for the *Casa Solar* Program, in contrast, the *proyecto masivo* splits these responsibilities between the public and private entities of the partnership. The private company, Ergon, will carry out installation and maintenance of the solar home systems, while the various public distribution companies across the country will conduct invoicing and bill collection for the program. This chapter demonstrates how the state's poor understanding of the ground-level complexities of off-grid solar energy provision is reflected in the *proyecto masivo* design. It argues that the limited technical and financial role allocated for the private firm, Ergon, has not properly accounted for the logistical and social challenges of providing solar energy service in remote communities of the country. The social challenge is explaining solar home system function, as well as rules of payment and service, to rural communities that have never had access to electricity and have little to no experience making recurring payments for infrastructure services. The logistical challenge is reaching isolated homes across rough terrain, in order to provide solar home systems maintenance and repair, which is both labor intensive and time-consuming. In other words, the social demands of teaching residents how to use and care for their SHS, as well as the rules of payment, will directly affect how often SHS are abused and

customers' frequency of payment/delinquency/default, which in the end, directly affects the volume of Ergon's logistical workload. This chapter also argues that the *proyecto masivo* contract strains the country's energy public distribution companies with burdensome activities that these companies are unwilling to carry out and will ultimately cause them financial harm. Analysis of the *proyecto masivo* contract reveals how both the private and public companies are obligated to collaborate with one another, yet the duties allocated to each sector as well as the state-mandated remuneration levels tied to their responsibilities, ensure that each sector will operate with indifference towards the other.

Altogether, this chapter demonstrates that although this public-private partnership was designed to invite global competition, rural energy infrastructures remain "intensely local in the sense that, despite their global reach, they touch very specific communities in very specific contexts" (Lampland and Star 2009, 16), which necessitates that the mechanics of the partnerships embedded in these contracts reflect the logistical and social realities of the rural communities they are meant to serve.

Approached from distinct institutional, community, and policy vantage points, these chapters seek to understand the underlying philosophical and practical factors that contribute to NGO energy program success in rural Peru, and how the Peruvian government is attempting to emulate this solar program nationwide through a public-private partnership. Taken together, the interrelated lessons drawn from each chapter, serve as a formulation that helps explain rural energy program success at various scales in Peru—from small, regional NGO-led projects, to the most ambitious, public-private-led projects at the national level.

LSA's experiences suggest that under that feature dedicated "engineers of communication" working in combination with prompt, discipling technical service, small, NGO-led energy

programs can flourish and be sustained, not only in environments similar to highland Peru, but throughout rural areas across the developing world. LSA adds complexity to how we understand and define development success by showing that, in spite of the organization's neoliberal, civilizing tendencies and its discourses that have perpetuated certain racial tropes, the NGO has shown capable of sustaining its energy program for nearly a decade, and in doing so, inspired Peru's national government to attempt to recreate its success across the country through partnership with the private sector. What is more, research on LSA has provided a stark contrast with the Peruvian state's approach to rural electrification—which is often carried out more as a means to increase electrification statistics for political gain than to see improved quality of life of its most marginalized citizens. In contrast to many state-led efforts, LSA has demonstrated an unwavering commitment to facing down and addressing the many challenges habituating and compelling rural *campesinos* (even if through fear of SHS forfeiture), to make their recurring payments for energy service. Despite its problematic flaws, LSA has in fact played an undeniable role in strengthening rural *campesinos'* access to infrastructural citizenship rights and social inclusion, more so than Peru's national government.

Research Methods

For the purposes of this dissertation research, the selection of LSA and its *Casa Solar* program, serve as a sort of "most-likely" case, which are "are based on the assumption that some cases are more important than others for the purposes of testing a theory" (Levy 2008, 12). LSA is especially important to our understanding of off-grid energy provision in developing countries due to its achievements as Peru's first officially authorized NGO solar energy provider (meaning it has been awarded a concession area, is subject to government regulatory oversight, and operates

much like a traditional energy distribution company), its unique focus on the community development aspects of energy provision, and its successful operation since 2009. As such, evidence from this type of case "provides a great deal of leverage for increasing our confidence in the validity of [a] theory" (2008, 12). In other words, understanding the factors that contribute to LSA's ongoing success reveals the social and cultural conflicts that arise even under optimal technical conditions, offers insight into the relationship between program design and community intervention, and ultimately, casts light on the generalizability of LSA's institutional and operational experiences.

The data presented in these chapters were drawn from 14 months of field research in Peru, conducted in the Andean city of Cajamarca (and its surrounding countryside), as well as the capital city of Lima. The following chapters utilize data from interviews with and participant observation of personnel from the NGO, *Luz Solar Andina*, as well as other institutional officials operating in Cajamarca and Lima. All together I conducted over 50 extensive semi-structured, in-person interviews with actors representing wide ranging organizations working directly and indirectly on energy infrastructure and rural development in the country. Following "purposive/expert sampling" methods (Bernard 2002), interviewees were chosen based on their relevance to or expertise in the Peruvian energy and development sectors. Then, often times following the recommendations or suggestions of previous interview contacts, additional interviewees were sought out and contacted for interview, otherwise known as "snowball sampling" (2002). To make initial contact with interviewees, I relied on my academic affiliations at the Pontifical Catholic University of Peru (PUCP) through its Rural Sector Support Group (GRUPO), the Institute of Peruvian Studies (IEP), and also the Supervisory Agency for Investment in Mining and Energy (OSINERGMIN). These affiliations were established during my preliminary dissertation

fieldwork during the summer of 2015. Given the focus area of my dissertation, I primarily searched for actors with experience working directly with LSA, or on rural electrification and rural development efforts more broadly. Additionally, I searched for respondents who had been or were currently involved with the design and implementation of the *proyecto masivo*. Given the instability and resulting high rate of turnover at government agencies, I found there were ample potential interviewees who had worked on these themes and had close knowledge of LSA and the *proyecto masivo*. Depending on interviewees' availability and preference, our conversations usually took place in their office, a nearby coffeeshop, or restaurant. On only one occasion did an interviewee (a retiree) invite me to their home to hold the conversation. Interviewees included representatives from non-governmental organizations (NGOs), the Ministry of Energy and Mines (MEM), the Supervisory Agency for Investment in Energy and Mining (OSINERGMIN), various international financial institutions, both public and private energy companies, and domestic and foreign academic institutions. Additionally, data presented here were also attained through ethnographic work conducted in a rural community where LSA provides energy service, and also through participant observation of LSA technicians as they carried out program maintenance and operation, as well as other administrative tasks.

During the months I spent conducting research in Cajamarca, the manager of LSA, Carla Saenz, offered me a wealth of information about the organization. Many of the details about LSA's guiding philosophies and operational strategies, as well as the political drama and conflicts that affect LSA's efforts, were derived from conversations with her (and to a lesser extent, LSA's assistant manager, Irene Nogales). Having spent over 15 years living in Cajamarca, and through her work with LSA, Saenz had gained intimate exposure to and accrued in-depth knowledge of rural life in the region's highlands. Over the course of months, through formal interviews that took

place in her office, informal chats inside a bumpy 4x4 pickup truck on community visits, and loud conversations at a local *peña* amid the sound of guitar, *cajón* and singing of *coplas cajamarquinas*, Saenz spelled out LSA's multilayered philosophy of rural energy service. While these conversations provided unparalleled insights into the organization and the myriad challenges it faced in providing solar energy, these conversations also represent a methodological limitation of the research presented here. During the time I was doing research, LSA was not extending service into new communities with the same speed as it had in the first few years of its program. As such, it only held workshops and meetings for new communities every few months. Due simply to poor timing and difficulty of communication, when these workshops did take place, in small isolated villages in the region, I was unable to attend in person because I was carrying out research and living in a different, remote community.

My methods for much of this project consisted principally of participant observation and interviews in two sites: the community of Lahuaymarca and LSA itself. Over the course of four months I lived in this small highland community of approximately 35 families. The village is separated from the city of Cajamarca by a bumpy, two and a half hour drive in 4x4 truck. Perched on an imposing hillside nearly 12,000 feet above sea level, Lahuaymarca[4] overlooks an immense valley floor, dotted with dairy cows and crisscrossed with irrigation canals, stonewalls, and hundreds of narrow footpaths. The latter are well worn, and a testament to villagers' continued reliance on walking across the rugged landscape. During this time I arranged to live in a local resident's unoccupied adobe house and slowly became a familiar face in the community. My methods consisted of participant observation and interviews. By participant observation, I mean I engaged in everyday chores and shared routines that punctuated daily life, such as helping

[4] Lahuaymarca is considered a *caserío* or hamlet, which have between 151 and 1,000 inhabitants, houses that are partially dispersed or located along a main road/path, a multi-use communal house, and an operative school.

townspeople plow their fields by pick axe and by oxen team, eating heaping plates of potatoes, rice, and *quesillo* in small but warm, smoke-filled kitchens, and sharing cups of *cañazo* with the local men at dusk. I enjoyed pleasures such as playing lung-bursting games of soccer with school kids, and the connections to families that such events provided; in the process, I met almost all the town's residents. I also attended local meetings, including a *rondas campesinas*[5] meeting that sought to resolve a physical altercation between two local families. Besides this participant observation, my methods included 36 in-person interviews (with 40 people in total). The diversity of my interviewees allowed for a generous sample of residents, one from nearly every household in the village. Despite the male dominated nature of the Peruvian highlands, just over half of my interviewees were men, while the rest were women. To overcome challenges presented by local social customs, which would have frowned upon an unknown man alone in the house with another man's female partner, I almost always interviewed women while they were outside their homes taking care of livestock, washing clothes, or conducting other similar chores. There were roughly 35 households in the village during my time there, but that number fluctuated throughout the year due to seasonal work migration patterns or villagers taking up part time residency in Cajamarca or other nearby towns. Most residents of Lahuaymarca, (called Lahuaymarquinos) earn a living raising dairy cows. Their milk is then turned into *quesillo,* a very simple type of cheese, which they sell to nearby industrial cheese makers who then turn it into various kinds of finished cheese

[5] *Rondas campesinas*, literally "peasant rounds," are community nightwatches created to safeguard villages against theft of property, crops, and livestock. The *rondas* first sprung up in 1976 in Cajamarca, stepping in for ineffective local government which was seen as corrupt and unwilling to address the heightened insecurity and material poverty that pervaded the region's highlands. The atmosphere for the *rondas'* emergence was created in part by General Velasco's failed 1968 agrarian reform, which exacerbated already poor conditions in rural communities of the highlands. In addition, from the late 1970s into the early part of the 1990s, Peru (and much of Latin America) suffered its worst economic downturn and crisis, known as "the Lost Decade." In this context of state absence and economic adversity, *rondas* proliferated in the 1970s and into the 1980s, eventually playing a role protecting many of their communities against infiltration by the Maoist insurgent groups, *Sendero Luminoso* and Túpac Amaru Revolutionary Movement (MRTA) (Starn 1999).

products. However, Lahuaymarquinos do not make their entire living from dairy cows; they also raise other livestock, including guinea pigs, ducks, pigs, and chickens, as well as grow potatoes, fava beans, and other Andean tubers called *oca* and *olluco.* Although a family's income depends on the number of head of cattle they own and the size of their land to support growing grass for pasture, the average household income in Lahuaymarca is roughly 850 Soles ($250 USD) per month.[6]

I selected Lahuaymarca as my project site because it was recommended by LSA itself as a good place to study its energy service. LSA's manager, Carla Saenz, told me this was an ideal community to conduct my research because of 1) the town's location far enough from active mining sites to be free of related social conflicts; 2) its transactional history with LSA, which was "representative of all of LSA's communities": compliant customers, communication mishaps, cutting power to customers who do not pay and reconnecting power to residents once they do, and removal of SHS for residents who fail to pay for six month or more; and above all; 3) given the tense social atmosphere that mining has created throughout much of rural Cajamarca, the individual residents living there would be socially amenable to intrusion by an unknown *gringo*. That is to say, open and welcoming enough to consent to my sustained presence there and willing to cooperate with my academic inquiries.

Various interrelated factors likely contributed to why this community was viewed by LSA officials as socially amenable to my presence and an appropriate place to carry out research: 1) Lahuaymarca was one of LSA's pilot *Casa Solar* communities and has longstanding experience in successfully collaborating with the organization; and 2) the town's status as a pilot program has in a way ingratiated a number of its prominent residents with LSA and vice versa. After spending

[6] Marcos Tambo, personal communication, January 5, 2018

months in the community and getting to know its prominent residents quite well, I came to realize that when LSA personnel suggested Lahuaymarca, they understood that its principal, and very charismatic town residents would open their doors to me and aid my research by facilitating social relations between myself and other townspeople. It was also likely assumed by LSA that, given the organization's long-term and positive relationship with the residents of Lahuaymarca, that its residents would speak fondly of the organization and cast the community's interactions with LSA in a favorable light.

While there were clearly practical and social benefits to carrying out research in the community that LSA itself had recommended, in order to ensure residents' understood that I was not sent by LSA as a project evaluator and could speak freely about their energy service, I made a practice of emphatically identifying myself as a student researcher with no affiliation with LSA (nor any branch of the Peruvian government, and most especially, with no connection to mining companies). Nonetheless, residents with whom I spoke initially assumed that I was associated with LSA in some way because of my interest in LSA's solar energy service and related issues.

More importantly, and in spite of LSA's description, the ethnographic work that I conducted in this community was still shaped in many ways by social conflicts generated by mining activities in the region. While this community has not been directly affected by mining or social mobilizations related to it, this region of rural Cajamarca is located within the general sphere of influence of the mines. As a result, town residents have heard a great deal through broadcasts over their battery-operated portable radios (found ubiquitously in the rural Andean communities), stories told by friends and relatives, and trips to nearby population centers (*centros poblados*),[7] about the environmental and social conflicts that regional extraction has generated. Residents

[7] A *centro poblado rural* is a place of dwelling that is not the capital of the district and contains more than 100 homes, located in dispersed or grid settlement patterns.

reported hearing not of improvements in livelihoods in communities near extraction sites, but of abuses and environmental deterioration. In Lahuaymarca, all the residents with whom I spoke adamantly opposed the area's mining activities. These residents showed great fear of mining incursion into their communities and its consequences. Modern extractive technologies draw heavily on local water supplies and could possibly leave villagers without sufficient water to support their agricultural and pastoral livelihoods. Additionally, residents showed unease that mining activity could lead to degradation or dispossession of their land (Orihuela 2012; Arce 2014).

Given the potential threat that mining posed to these communities' lands and livelihood, most residents demonstrated a palpable apprehension and guarded skepticism towards strangers in the area.[8] The historical and contemporary processes that have led to highland suspicion of strangers were evident throughout my time in Lahuaymarca. Due to my appearance as an unknown, white person, this extended to me. Many interviewees suspected that my benign appearance belied some sinister intention of promoting mining company interests; that I was not the student I claimed to be, but a harbinger of environmental abuse and financial disruption that residents heard about through radio and word-of-mouth. Despite my efforts to alleviate locals' fear of me, after four months in the community, residents were still suspicious of my motives for being there. One resident named Marino, who grew to be a close friend, recounted how another resident

[8] A powerful example of the threat posed by mining intrusion is represented by the case of Máxima Acuña. She is a campesina landowner, who was accused by the multinational mining company, Yanacocha, in 2011 of employing violence to illegally occupy land it wanted in order to expand its mining activities. She had purchased the rural property called Tragadero Grande, located in the province of Celendín, Cajamarca in 1994. The mining company claimed that it had acquired the land from the community, but Acuña and her family asserted they had never given their permission of the sale. For years leading up to the lawsuit, Acuña and her relatives suffered intimidation, attacks, attempted evictions, as well as attacks on their land, pets, and livestock. Through her successful stand against Yanacocha's harassment she emerged as a prominent environmental leader, eventually wining the Goldman Prize for environmental defenders in 2016. In 2017, Peru's Supreme Court found her not guilty of illegal occupation of the land (Frontline Defenders 2017).

named Toribio, had confronted him after a local soccer match saying that he suspected I represented a mining company and had come to swindle the town. Toribio added that he believed I was a "wolf disguised as a little lamb" (*un lobo disfrazado de corderito*), insisting that a mining company would not send their "most noble" (*más noble*) employee, such as an older man dressed in a suit and tie. Instead, he suggested, that my down-to-earth appearance and cover as a student conducting research over the course of months was part of my strategy to dupe the people of Lahuaymarca in pursuit of mining expansion.

As mentioned above, I prefaced my conversations with residents by explaining my academic background and interests, in order to assuage their worries that I was working for a mining company. While I never felt restricted in the kinds of questions that I asked, on occasion, residents' responses betrayed their residual fears of mining company infiltration of their community under cover of LSA's solar energy program—they voiced worry about being dispossessed of their land; described how outsiders had reportedly run soil tests that killed off local wildlife; one woman forbade me from photographing her picturesque home at dusk for fear the documentation would later be used by mining companies to identify her home and strip her of her land; another elderly man that I interviewed, more worried about losing energy service, asked that I leave a detailed note in his possession (even though he admitted to being illiterate) as proof of our interaction so he would not run afoul of LSA. These fears of mining encroachment, environmental degradation, and disruption to energy service challenged the way I recorded data, as only two residents allowed me to audio record our interviews.[9] Because of this I relied heavily

[9] This type of reaction among highland community members is not uncommon as anthropologists have long been seen as potential CIA agents. Also, given Perú's contentious mining history, this antipathy and suspicion towards outsiders is understandable.

on taking hand written notes, which at times hampered the natural flow of interviews, though it greatly increased residents' sense of ease and openness during our conversations.

Conclusion

This dissertation addresses a scholarly void noted by Akhil Gupta (2105), showing how people's lives intersect with the partial or incomplete presence of modern infrastructure, while building off of Nikhil Anand's ideas of "hydraulic citizenship," (2017) by showing how *campesinos'* "electrical citizenship" is similarly not a single event that occurs over a linear political process, but sporadically over time, and most notably, can be undone. For rural Peruvians, like those urban residents of Mumbai studied by Anand, infrastructure services have not been provided simply owing to one's status as a citizen, nor have residents been entirely left out of infrastructural provision. However, in Mumbai, the water pipes and hydraulic pressure provide a place and process through which to evaluate and make demands upon and assess the validity of the state (Anand 2017). Yet, in many rural communities of Peru, state infrastructure is largely absent and energy services are provided by state proxies, such as LSA.

What is more, this research highlights the contradictory position that rural *campesinos'* occupy, caught between the not-fully-modern, but reliable SHS and frequently malfunctioning grid service, as both technologies are meant to serve as infrastructures to improve their well-being, yet both reinforce their inferior position among Peruvian society. This inferiority is manifested in the poor technical capacity of the national electric grid and the slow service that accompanies it, when it is extended into rural areas. This represents an infrastructure of mimicry that is "not quite" as good as the grid power that is found in urban areas, and a "representation of difference that itself is a process of disavowal" (Bhabha 1994, 86). This reduced quality of

infrastructure further strengthens the contrasts between urban and rural residents, serving as a material and symbolic reminder that rural Peruvians occupy inferior positions in society and are only perceived as "partial" citizens in the eyes of the state (86). This is important, because as scholars have pointed out (Anand 2017; Nye 1992; Larkin 2013; Howe et al. 2016), infrastructures have long been considered to represent the aspirations and trajectories of modernity—cultural and physical assemblages that help to differentiate advanced societies from those still in the process of developing (Anand 2017). This research shows that for these rural residents, energy provision in fact strengthens existing racial formations (Omi and Winant 1986), where *campesino*, serves as a sort of totalizing form of "othering" that re-inscribes racial hierarchies in Peru. What these racial formations and paradoxes of energy provision tell us, is that Peru's aspirations and trajectories of modernity, understood as social and economic inclusion, and full and equal claim to citizenship rights, are still a long way from being realized.

Another paradox that this work identifies is in the *proyecto masivo* design, which attempts to recreate LSA's small-scale success nationally, while employing a significantly different service model to that of LSA. From the very beginning of its creation, the proyecto masivo was designed and meant to be implemented under the unrealistic time constraints of Peru's political cycle, in order to shed positive light on the outgoing president. What resulted was a contract that leans heavily on technology (and not community development) to provide solutions to overcome longstanding energy access problems. The rushed, techno-financial nature of the contract largely casts aside the responsibilities for teaching rural communities how the technology or program works. Simultaneously, the undesired tasks of setting up remote bill collection centers throughout the most isolated parts of the country, was, despite their reticence, assigned to the public distribution companies. The low financial remuneration levels for certain logistical program

services were set by state regulators and not energy companies, and will financially harm Ergon and the public distributors; this only highlights the state's minimal grasp on the logistical obstacles presented by off-grid energy provision. What is more, the entire *proyecto masivo* contract is predicated on the assumption that both parties involved share equal motivation, as the financial reimbursement to Ergon and public distributors is isolated across sectors, which enables each sector to carry out their duties with indifference to how the other carries out their respective responsibilities in the partnership. Yet, while contractual mismatches may be remedied by adjusting financial incentivizes so the private and public sector to collaborate more effectively together, the *proyecto masivo* design flaws speak to broader historical issues of exclusion that have pervaded Peru for centuries; as the implementation of poorly designed and troubled infrastructure projects into Peru's rural areas mirror the inferior position and racialized stereotypes held by the communities these projects are meant to serve. However, ideally, the troublesome incoherencies identified here can function as a guidelines for other governments as they design and implement rural electrification projects in partnership with private actors. Overall, the lessons drawn from Peru's energy infrastructure endeavors carry with them implications for all developing countries that uphold the conviction that access to energy should not be a luxury afforded to a fortunate few, but a human right.

Chapter 1

"We are Engineers of Communication": Solar Energy and Subject Formation in Rural Peru

Introduction

As a corrective for contemporary reliance on technology and faith in free markets to address the global access to energy gap, this paper explores the institutional philosophies and on-the-ground practices that facilitate sustainable[10] renewable energy provision in developing countries. Based on an institutional ethnography of the nonprofit, *Luz Solar Andina* (hereafter LSA) in the Cajamarca region of Peru, this research examines the ideologies and practices driving LSA that help ensure that its solar energy program meets residents' expectations and that these residents continue to make their recurring payments for service. I argue that a key element to LSA's sustainable delivery of off-grid solar energy service is its deliberate and ongoing engagement with and training of rural energy users. This training fosters residents' acceptance and feeling of ownership of the energy program in ways that public and private sector energy providers have proven unable or unwilling.

What underlies LSA's program success is not simply its deployment of robust technology or its receipt of state subsidies, but the organization's dedication to community development and its role as self-described "engineers of communication."[11] This means that LSA personnel (not contracted third parties) carry out multiple, in-depth training workshops with community residents

[10] For the purpose of this paper, I use Zeriff's definition of "High Sustainability" for distributed rural electrification models: "Continued performance up to the expected lifetime of the technology is demonstrated or reasonably expected without major changes to the basic model" (Zeriff 2011, 31).
[11] This paper uses Zeriff's minimal definition of "success," indicating: "The installation meets the expectations of the parties involved in terms of cost and service" (Zeriff 2011, 11).

who sign up for its solar energy service. These time-consuming activities are conducted by LSA officials, who consider their communication responsibilities as equally important as those carried out by technical engineers, in order to manage residents' expectations of the uses and limitations of solar energy and to clearly convey the financial rules and regulations of service.

At the same time, the focus on LSA's engaged approach to community development reveals the disciplining and governance that occurs in the contact zones between NGOs and rural Andean populations (O'Donnell 1993; Lucero 2011). In the absence of uniform state presence throughout Peru's national territory, the seemingly benign social and technical procedures LSA uses to deliver energy service have also played a role in a kind of consumer-oriented subject formation. Drawing on Foucault's notions of "governmentality" (1991), this paper shows how LSA has labored to develop a culture of financial consumerism among the rural residents it serves while trying to break their perceived dependence on social welfare programs (*asistencialismo social*). LSA achieves this subject formation through interrelated processes of building trust and carrying out discipline. LSA conscientiously builds trust with residents over time through symbolic and practical social interactions and also disciplines them by promptly carrying out technical aspects of energy service, such as initial installation of energy equipment and cutting power/removal of equipment for delinquent payment. Following ideas laid out by Scott (1998), my research shows that LSA, like a state, "strive(s) to shape a people and landscape that will fit their technique of observation" (Scott 1998, 82). I demonstrate that LSA's "way of seeing" bears resemblance to a kind of "civilizing mission," as it has disciplined rural residents to operate as rational consumers. To be sure, here I do not seek to defend LSA, but rather to offer an analytical critique of its work, while maintaining solidarity with the organization's overarching goal of providing energy access to marginalized populations. The experiences of LSA are valuable

because they help problematize our understandings of development. They show us that what is often considered "development success" in fact comes at a cost—such as the perpetuation of racial tropes and maintenance of social hierarchies—as LSA officials have expressed pejorative views of rural peoples in some measure, while working to provide solar energy so rural residents can overcome the very tropes LSA workers have used in their discourse. The research presented here contributes to development studies more broadly in that it reveals how even the most innovative, socially focused development efforts may still be embedded in lager projects of disciplining and governance; simultaneously meeting their stated program goals, while preserving the same social deficiencies which its projects are meant to solve.

Peru's Electrification Landscape

Compared to regions such as sub-Saharan Africa and India, Latin America and the Caribbean have a comparatively high rate of electrification and a low number of total residents living without electricity. At the time this research was conducted, Peru's national electrification rate was 93%, while its rural electrification rate was 78% (PNER 2016), and it is estimated that roughly 2.5 million of the country's 32 million inhabitants do not have access to electricity (Gamio and Eisman 2016). What sets Peru apart from many countries in the abovementioned regions, is that the vast majority of Peru's un-electrified populations live in isolated rural areas of the Andes mountains and Amazon jungle, characterized by rugged topographies and dispersed settlement patterns. These factors, combined with the low energy demand from the poor rural residents living there, have made extending the national electric grid an immense challenge both financially and technically and made energy provision unprofitable, and thus an undesirable undertaking, for private and public utility companies (Strauss et al. 2013).

Beyond these physical and logistical challenges there are also a host of broad institutional and cultural factors that further impede electrification efforts. Among these are a lack of state presence in isolated rural communities, poor coordination among Peru's three levels of government (provincial, regional, and national), inadequacy of public investment infrastructure, limited capacity of regional governments, and insufficient coordination between national ministries. What is more, scholars, development officials, and renewable energy advocates alike have identified factors that create stumbling blocks for development interventions in rural Peru. These include low levels of educational attainment, which can make conveying technical concepts difficult, especially for institutions that frequently lack in depth understandings of indigenous languages or familiarity with cultural characteristics. Additional constraints include gender inequality and uneven access to education among men and women, as well as historically-rooted fear of and deception by outsiders (Gamio and Eisman 2016; Degregori 1990; Yezer 2008; Scarritt 2011).

AMP Program Model

The primary empirical focus of this paper is LSA and its off-grid solar energy program called *Casa Solar*, in the Andean region of Cajamarca. This project serves as a lens into the NGO philosophies and practices that can help overcome the pervasive legacy of poor infrastructure throughout much of indigenous and rural Latin America. LSA's energy program currently provides electricity via solar home systems (SHS) to nearly 4,000 households in rural areas surrounding the city of Cajamarca[12] that are not part of government grid extension plans. The roof-mounted solar home systems that LSA installs consist of (1) solar panel ranging in size from 60W to 85W, (1)

[12] By program design, all communities that AMP serves are located within a 3 hour drive from the city of Cajamarca.

100Ah battery, (1) 10A charge controller, (3) 5W LED lights; the installation also includes (1) electrical socket. Potential daily uses of the SHS include: (3) 5W LED lights for 8 hours, (1) radio for 6.5 hours, or (1) black and white TV for 3.5 hours; as well as cell phone charging.

In this fee-for-service model, residents make a fixed monthly payment to LSA representing 20% of the state-regulated solar tariff. This tariff level is based on natural region (coast, mountains, jungle, and Amazon) as well as the photovoltaic module size provided (50kW, 80kW, 160kW, and 320kW). The remaining 80% is covered by a national cross-subsidy called FOSE (Electrical Social Compensation Fund). Both the solar tariff and FOSE are calculated and regulated by the state's Supervisory Agency for Investment in Energy and Mining (OSINGERMIN). In the case of LSA's *Casa Solar*, this amounts to 10 Soles (PEN) ($3 USD) per month paid by residents and 40 Soles ($12.25 USD) covered by the FOSE subsidy. LSA is responsible for all aspects of service, including the installation, operation and maintenance of the SHS, as well as all billing transactions (Egido Aguliera 2014). The upfront (material) cost of the SHS is around $700; the solar panel has a useful life of roughly 20 years, the battery must be replaced on average every 5-7 years, and charge controller every 10 years. These costs, along with installation, operations and equipment maintenance are reflected in the monthly fees paid to LSA (Egido Aguilera 2014). Residents are required to pay their energy service bill monthly via their town's electrification committee or by paying in person at the LSA office in Cajamarca. If a resident fails to make their payment for two consecutive months then LSA technicians cut power to the SHS until the resident settles their debt. After six consecutive months of delinquent payment LSA technicians permanently remove the SHS from the resident's home. Although LSA would not share its internal documentation with me, the organization's manager confirmed that in the year preceding my research (2016), LSA carried out roughly 1,000 operations that included cutting power to SHS for late payment and

reconnecting power to SHS once the homeowner caught up their bills.[13] This does not necessarily mean LSA cut/reconnected power to a full quarter of its total number of households, as repeated activities may have been carried out with the same households that fell behind on payment at various times throughout the year. Nonetheless this does offer a window into the significant volume of operation and maintenance activities LSA undertakes within a year, especially given the relatively small-scale of its program.

"We're like father and son": LSA Policy Access and Institutional Support

LSA's unique institutional history and corporate connections warrant discussion, as these ties have helped shape the policy landscape in which it operates and provided financial assistance and administrative support, which have enabled the organization to thrive. LSA gained recognition by the Peruvian Agency for International Cooperation (APCI) as a Peruvian NGO in 2009, but was in fact established by a Spanish foundation, Fundación Luz Solar (FUNDALUZ) which itself was created to conduct corporate social responsibility projects on behalf of its parent company, the Spanish infrastructure and energy giant, InfraLuz Solar. As such, LSA has served as FUNDALUZ' vehicle to accomplish its mission to foster access to basic infrastructures, such as energy and water, in communities in developing countries where these services are unlikely to reach.

What makes LSA unique within the Peruvian context is how it has leveraged these institutional connections to coordinate with the Peruvian government to reshape the country's renewable energy policy landscape for its own benefit, which has enabled LSA to become the first NGO in Peru's history to gain full national authorization as a solar energy provider, be awarded

[13] Carla Saenz, personal communication, February 10, 2018.

an electricity concession area, and then qualify for the Electrical Social Compensation Fund subsidy (FOSE) in 2011.[14] This is a cross-subsidy (which does not phase out over time) where energy customers (generally located in poor rural areas) consuming less than 100 kWh of energy per month receive a discount on their monthly energy bill that is financed by those consumers (generally located in urban areas) using more than this amount of energy per month (Egido Aguilera 2014).

Another element that has aided LSA's institutional stability is FUNDALUZ' initial financial support of the organization during its first few years of operation, without which the latter's success would not have been possible.[15] At present, LSA continues to receive ongoing administrative support and technical advising from FUNDALUZ, but LSA's financial operations have been self-sustaining since 2014,[16] through customer payments and receipt of the FOSE subsidy.

"They work with communities a lot…It's not a business": Contrast Between AMP and Proyecto Masivo

Undoubtedly, the support that FUNDALUZ has lent LSA is not insignificant. Yet the literature shows us that renewable energy and other technology-transfer programs in developing countries have failed outright, been unable to achieve their stated goals, and experienced undesired outcomes, despite drawing on significant institutional and financial resources.[17] In the challenging

[14] Following in the footsteps of LSA's accomplishments, the private company Entelin (not a pseudonym), has also been recognized as an off-grid solar energy provider, qualified for the FOSE subsidy, been awarded a concession area, and began service in the region of San Martin in 2016.
[15] Carla Saenz, interviewed by the author, August 2015.
[16] Tomás Huilca, interviewed by author, July 2017.
[17] For critiques of past solar energy and technology-transfer initiatives in Peru and other developing countries, see: Fernández-Baldor et al. 2014; Van den Ekker 2008; Brass et al. 2012; Dodson et al. 2012; and Zerriffi 2011.

context of rural energy provision in developing countries, institutional capacity and financial backing are necessary but not sufficient factors for sustainability over time. As the former head of FUNDALUZ made clear, social engagement, such as building trust between LSA officials and community members, and developing residents' sense of ownership of the program, are key to getting rural residents to pay every month for their SHS; that an important factor for an energy company to thrive are the social aspects of service. Owing to this community-focused approach, not only has LSA's program come to be considered one of the most exemplary energy initiatives in the country, it has also served as an inspiration for Peru's beleaguered *proyecto masivo,*[18] a public-private partnership (PPP) aiming to electrify 150,000 rural homes nationwide via solar energy. Underlining the impact that LSA has had on Peru's broader energy and social landscape, an official from OSINERGMIN described how LSA has not only had success in pioneering alternative energy models, but also the implications for addressing social inclusion nationwide. He stated:

> Look, I'll tell you something very simply – thanks to [LSA], they've motivated us to do the 500,000 (solar) panels.[19] Because we saw that it was feasible, that yes, it worked...The problem is that here there are two Perus: a Peru that is emerging and very competitive and a Peru that has been forgotten.[20]

This official's statement is significant for two reasons: 1) It shows that LSA's successful program model played a direct role in inspiring the Ministry of Energy and Mines' (MEM) *proyecto masivo*; and 2) it carries great historical weight by alluding to Peruvian historian Jorge Basadre's notion of

[18] *Proyecto masivo* is the term commonly used to describe the off-grid solar electrification program that resulted from the "International auction for the supply of electricity with renewable energy resources in areas not connected to the grid", first announced in September, 2013. (*Subasta internacional para el suministro de electricidad con recursos energéticos renovables en áreas no conectadas a red*).

[19] The total electrification goals of the proyecto masivo have since been amended to 150,000, down from the initial objective of 500,000.

[20] Humberto Delgado, interviewed by the author, July 2015. Unless otherwise noted, all translations in this paper are my own.

Perú profundo, which has evolved to represent the "historical roots of Indianness as a component of Peru's sense of nationhood" (Mayer 1992, 192), and the gulf between the "official" Peru – which collectively make up the "two Perus" (Mayer 1992, 191-194). These cleavages separating the official juridical Peruvian state and its people have pervaded debates about nation-building since the country's independence.

Further highlighting the tension between LSA and state-led approaches to rural electrification, an official from MEM clearly privileged the technical and financial aspects of service, while voicing skepticism, bordering on dismissal of LSA and its socially-driven operational strategies:

> [LSA] work(s) with schemes that are more communal, from what I know. But you'd have to evaluate the sustainability of these experiences and the financial and technical viability. From what I know, they work with the communities a lot, which is fine; I believe that they depend a lot on the good will of the local leaders to help with fee collection and maintenance. It's not a business but rather it's collaborative social assistance and I don't know if this is sustainable over time, as leaders change and the new ones may or may not have the same willingness to help. We just don't know. So in this sense, I have doubts.[21]

The skepticism voiced by this official is representative of the MEM's techno-financial approach to rural electrification. It contrasted strongly with the tone struck by the OSINERMGIN official above, who instead praised LSA's accomplishments and highlighted the organization's innovation and overall influence on energy access and social inclusion in Peru more broadly. This divergence between the positive comments from the OSINERGMIN official and the more skeptical comments from the MEM official can be attributed to the different areas from within Peru's energy bureaucracy they were made. While MEM is a highly politicized institution tasked with advancing the president's administrative agenda, OSINERGMIN, on the other hand, is an independent, non-

[21] Alfredo Galeano, interviewed by the author, July 2015.

partisan state regulator. MEM's embrace of a more technical and financially-driven approach to rural electrification is largely influenced by the need to demonstrate progress during the five-year political period. A professor from the Pontifical Catholic University of Peru, who specializes in the engineering and application of appropriate technologies for rural development, offered a concise summary of why the MEM eschews the time-consuming community development aspects of rural electrification in favor of politically expedient, but hasty technical interventions, saying:

> Their mission is to electrify a number of families and they have to comply with numbers, statistics. They have to reach a certain number of electrified people for the statistics to go up. Whether people use [the electricity] afterwards or pay for it afterwards doesn't matter…It's has always been this way, at least this the state (government) that we have, this is the case.[22]

In contrast to MEM's presidentially appointed ministers, the top officials at OSINERGMIN are not presidential appointees, which has historically enabled OSINERMGIN to operate with much greater continuity amid political transitions than MEM. In addition, as part of an independent, non-partisan state regulatory agency, the various OSINERGMIN representatives that I interviewed were able to take more critical and dispassionate stances towards the many public, private, and NGO initiatives that they oversee. Absent the pressure that MEM felt to defend or advance a political agenda, OSINERGMIN interviewees showed more concern about how regulatory measures (such as tariffs and subsidies) affected program results, sustainability, and social inclusion, than politicized or dogmatic approaches to infrastructure provision in the country.

For the MEM official above, community development was not only a business liability, but nearly disqualified LSA as a business altogether. Yet, in contradiction to the assertion that LSA's work relies on "the good will of the local leaders" and that it is "not a business," LSA's program has involved training local community technicians, who officially register with National

[22] Horacio Magdalena, interviewed by author, November 2, 2016.

Superintendent of Tributary Administration (SUNAT) and receive payment and pay taxes as if they were formal employees of LSA. These local technicians carry out basic services (such as cutting and reconnecting power) which supports LSA technicians, who generally carry out these tasks as well as the more complicated tasks like SHS installation and removal. And it is known that LSA's program has in fact been successfully operating since its inception in 2009, and it is precisely the "work with the communities" and "collaborative social assistance" that the MEM official casts in a pejorative light, that undergirds LSA's success. So, if governments, private sector, and civil society are serious about using energy access to help bridge the socioeconomic gap between the 'competitive Peru' and the 'forgotten Peru', I argue that we must develop a more extensive understanding of rural energy service that extends beyond its financial and technical dimensions, overly focused on the technology to be applied and its price (Miller et al. 2015), to also encompass the social aspects of energy provision in rural areas.

"They thought… they'd have light 24 hours a day": SHS and the Need for Social Engagement

One main reason that community development is necessary for the sustainability of projects like *Casa Solar,* is that rural residents agree to pay for solar energy service that is in many ways inferior to the national electric grid. LSA is tasked with conveying to residents the basic concepts of solar energy, the financial commitments of energy service, as well as the uses and perhaps most importantly – managing residents' expectations of SHS performance. If residents do not have a firm grasp on SHS uses and limitations, they will feel disappointed and deceived by system energy output and eventually refuse to make their monthly payments or simply reject the project all together and request that LSA remove their SHS.[23] While grid power provides urban

[23] Eduardo Jiménez, interviewed by author, July 2017.
Carla Saenz, interviewed by the author, July 2017.

energy users with 24-hour access to energy, SHS represent only partial energy access, as they only provide rural residents with light and energy for roughly 5 hours a day and do not allow for the use of common AC-powered household appliances (Peru's national electric grid uses AC power). This is because the SHS models that LSA uses do not include DC to AC inverters (which can cost between $30 to $150 USD each). The exclusion of inverters makes SHS cheaper, lessens the demand on the battery, and increases the overall technical durability of the system. However, most household appliances, such as blenders and sewing machines, function with AC power, and the SHS that LSA utilizes are designed to mainly provide in-home lighting, cell phone charging, and use of a few, small DC-compatible devices. In short, these SHS do not provide enough energy for residents to utilize potentially income-generating tools and appliances and expand beyond bare necessity energy use. Essentially, because DC-powered tools and appliances are more expensive than their AC counterparts and less readily available, the deployment of DC powered SHS, instead of SHS with DC-AC inverters, prevents abuse (i.e. frequent battery discharge) which extends the overall life of the system and drastically reduces the maintenance and operation costs for LSA. Although access to reliable modern energy sources is widely accepted as a necessary condition to spur social and economic development in rural settings of developing countries, there are many debates on household solar energy's role in supporting these advances.[24] So although SHS are a financially viable, if not technically equivalent, alternative to grid extension, the technical constraints of SHS create sustainability challenges from a social standpoint. Returning to Zeriff's minimal definition of "success," LSA's energy provision must "meet the expectations of the parties involved in terms of cost and service" (Zeriff 2011, 11). In order to satisfy this definition, it is imperative that LSA adequately impart a range of technical, financial, and operational aspects

[24] For more on these debates see: Bambawale, et al. 2010; Mahama 2012; Jacobson 2007; Azimoh, et al. 2014; Martin and Susanto 2014; Kirubi, et al. 2009; Rahman and Ahmad 2013.

of the *Casa Solar* program so residents have realistic expectations about the technical performance of the SHS in relation to how much they are paying monthly for energy service. So what then are the philosophies and practices that LSA employs to make sure that – given the sub-optimal energy output of SHS – the *Casa Solar* program satisfies customers' expectations and compels these residents to keep making payments for service?

"We are engineers of communication": AMP's Philosophical Approach to Energy Service

LSA is a small organization of only five employees: manager, assistant manager, head of administration and control, head technician, and assistant technician (unfulfilled at the time of research). To begin with, LSA views itself as a social entrepreneur, a business whose core value is to provide an ongoing social service, even though Peruvian state regulators by default treat LSA as they would a for-profit company. The leaders of LSA passionately profess their identity as "engineers of communication," on par with technical engineers, but charged with "creating a feeling" of trust with the communities that they serve. As "social communicators," LSA's goal is to involve residents in the project, instruct them so they understand crucial concepts, and ultimately, so that they feel a sense of ownership over the energy program. And this is a process that, more than anything, takes time. In spite of LSA's well-intentioned dedication to ongoing communication with residents and the delivery of prompt technical service, its simultaneous aim to develop a culture of payment among rural residents while breaking what it sees as residents' deeply rooted dependence on social welfare (*asistencialismo social*) from the government, fits firmly within a neoliberal paradigm.

Recalling the philosophical discord between LSA and MEM mentioned above, Saenz described how LSA's core focus of providing a social service is reflected in its sustained

commitment to program operations. As a result, MEM struggles to categorize LSA because it is a) a non-traditional development NGO, as its projects do not have a clearly defined start and end point, and b) a non-traditional business because it ostensibly prioritizes the social development of its customers over financial gain; yet all its social development efforts are ultimately linked to creating paying customers:

> I think that the image that MEM has of us is a private company and only a provider of solar panels. But the state doesn't seem to internalize or grasp the social aspect. They (MEM) don't understand this aspect, as much as we tell them, or they don't believe it, or they don't value it – [LSA] as a social entrepreneur. We insist on this every time we speak with someone (from MEM). We are technically an NGO…but our management model is not that of an NGO…our project model doesn't even fit in a project model box because if you look at what development is, it's that it has a beginning and end. This project – how long does it last? All our lives if it's necessary. Yes, they are projects in that they have objectives, confront challenges, offer solutions, but it's a project that lasts through time because as providers we have to offer a service, and we have to be present for this. And this is how we make the projects sustainable.[25]

Saenz' statement reveals how the sustained community development work that LSA carries out is constitutive of its organizational philosophies and that these philosophies are misunderstood and undervalued by MEM. Irene Nogales, LSA's assistant manager, who currently runs many of its training workshops with rural residents, expounds on these intangible aspects of community engagement, valorizing the emotional and communicative labor that their approach entails, offering it as a corrective for more technical-based interventions of energy delivery:

> It's that we are engineers of communication…what a communicator seeks is that they understand you, that they communicate with you, that they believe you and what you are telling them. You are working on the part that is not palpable, that you can't easily see, but when you have this sensibility you know when a community has understood…those of us that work in development, we're more meticulous, more detail-oriented with people…We don't try to deduce what they need, rather we ask them what they need, if they are in agreement or in disagreement. In

[25] Carla Saenz, interviewed by the author, August 2015.

> contrast, a (technical) engineer is more like: 'Do you want light? Here, have this. Do you want it or not? Ok. Register here. Sign this census. Write your name here.' So this work is more in the field, more about 'Do you believe me or do you not believe me?' [26]

Of all its institutional operations, the intangible community development involved in getting residents "to believe you" is what takes LSA the longest to carry out and are not program activities that can be neatly predicted and budgeted like other expenditures. Saenz insisted that organizations must truly value the human resources necessary to undertake the demands of rural community engagement. The socially focused work that LSA conducts goes beyond the conveyance of mere energy concepts and financial agreements, what LSA is working to establish through time consuming community outreach is trust. As Saenz told me:

> There has to be trust, like any human relationship…when communities trust you, they almost have an affection for you and won't let you down. So you have to work hard to develop this human relationship so that residents comply and come through for you. And that's why we have such low rates of delinquency.[27]

This institutional dedication to cultivating trust is imperative given Andean communities' long history of distrust of the Peruvian state and outside authorities. Extending back to the colonial period, indigenous and highland peoples have been racialized, systematically exploited, and treated as inferior beings (Klarén 2000; Postero 2006; Wolf 1982). In many highland regions of Peru, it is not uncommon that *campesinos* carry a deep historical shame related to having fallen

[26] Irene Nogales, interviewed by author, August 2017.

[27] According to its institutional memorandum for 2015, LSA's annual rate of delinquency of payment (*tasa de morosidad*) was 1.42%. This is defined as the percentage of users whose payments are no longer perceived as recoverable. A representative from Caxa Eléctrica, a public energy distribution company that operates in the regions of La Libertad, Ancash, and Cajamarca, confirmed that this rate of delinquency is incredibly low and considered an impressive accomplishment. He stated that that Cajamarca has the highest rate of payment among the three regions Caxa Eléctrica serves, but still has a delinquency rate between 2.5% and 3%. Ángel Ochoa, interviewed by author, May 2017.

victim to *engaño* (trickery or deceit) by local elites and landowners (Degregori 1990). Colonial legacies are woven into and still influence contemporary politics, social life, and land rights (Stern 1999). Centuries old patterns and phenomena thought to be dead and gone seem to reemerge and take on new life in Latin America. Steve Stern eloquently describes that, "Despite vast changes, the present seems not so much to replace the past as to super impose itself on it, only partly altering and displacing it" (1999, 135). Other scholars have identified that highland people's suspicion towards Peruvian authority figures expresses a certain truth about the country's social relations. Showing distrust is a way of attesting to the durable hierarchies of race and power that have relegated poor, dark-skinned, *campesinos* to the bottom of Peruvian society, and opened them up to new, more subtle types of subjugation (Yezer 2008). This atmosphere of distrust among Andean communities is also due to the long shadow cast by the armed internal conflict (officially 1980-95) between the Maoist insurgency group, *Sendero Luminoso,* and the Peruvian state. This generalized context of distrust of outsiders cannot be separated from this period of violence, in which indigenous highlanders were targets of both *Senderista* and state violence, for nearly ten years (García 2005). Even more recently, the region of Cajamarca has experienced fierce conflicts between the state, the private sector, and social movements over the rapid proliferation of mining activities during a roughly ten-year commodity boom (that has now wound down). These clashes pit local community members living close to the sites of extraction, against state forces and private companies, over the human, territorial, and environmental consequences of these activities (Bebbington 2009).

The discussion of LSA's community development must be understood against this backdrop of historical and contemporary trauma, which continues to underpin feelings of mistrust between Andean communities, the state, and other external actors. When speaking of social

relations, both Saenz and Nogales show a heightened awareness of how these historical trajectories still inform highland politics of the present, and that their strategies must account for the "perceived cultural and racial divide between the Andean highlands and the coast" and the harsh reality that many coastal politicians, as well as many *Limeños*, "consider the inhabitants of the Andean highlands to be racially and culturally inferior" (García 2005, 41). Saenz in particular, demonstrated a great sensitivity and respect towards Andean customs, which seemed like deliberate corrective for historical injustices perpetrated against highland *campesinos*, who are still among the most marginalized and politically disenfranchised peoples in Peruvian society (Otero 2003), saying:

> Although it seems simple, in Peru we don't all speak the same language. I'm not referring to Quechua or Aymara, I mean Spanish – we don't understand each other. It's not an issue of imposition, it's an issue of them feeling like you are entering and respecting them and their environment. You can't be perceived as aggressive…it maters how you talk to them, how you act or how you react in a situation, when in the same day they invite you to four plates of food, and you have to eat them all. These simple and little things can derail a project. It's not about electrification, this part is done quickly. It's about establishing a foundation…They have to trust you, they have to believe you.[28]

As outlined in various forms above, the organization's approach means building mutual trust with communities and convincing residents to "believe" in LSA. Stated more formally, LSA aims to establish a form of institutional trust, whereby a rural resident(s) believes that a person(s) or organization(s) can be depended on to meet stated objectives, has the competencies necessary to do so, and also shares similar values and desires as the resident themselves (Meltay 1999; Greenberg 2014). In order to achieve this institutional trust LSA must align its mission with residents' desires, by cultivating residents' "sense of ownership" over the program, while also

[28] Carla Saenz, interviewed by the author, August 2015.

ensuring that communities grasp the terms of energy service. Saenz spoke directly about the correlation between community understanding of the energy service being offered and payment for service, saying: "What happens if they don't pay me? It's probably because…they didn't understand from the outset, that they thought what the SHS was offering was different; that they'd have 24 hours of light a day."[29] Going further, Nogales makes clear that residents must both understand and feel a sense of ownership of the energy program to warrant cooperation and more crucially, financial reciprocation with LSA. Diáz also underlines one of the arguments of this paper – that given the immense challenges of rural energy provision, financial resources alone cannot purchase the stakeholder buy-in necessary for project sustainability.

> Everyone needs light, but we need for residents themselves to believe they need light, that they take it (the project) on as their own, and that they care for it (the SHS) as if it were their own. First, they have to believe, understand, assume and take control of the project; only then will they repay the support you're giving them. If not, the company with the most money in the world couldn't succeed. Working with communities is complicated.[30]

When I questioned Nogales more directly about how LSA makes residents begin to "feel ownership over the program," she responded that this is something that begins when she starts to explain the project to them. She perceives herself as a "social communicator" where she is able to see and recognize how residents are fed up with what they perceive as neglect by their local and state government, citing how they have grown tired of spending their limited resources on things like candles and then seeing their children get burned with open flames. For its part, LSA begins working with new communities without prior notification of local government officials, presenting itself as a social business (*empresa social*) that is not affiliated with the Peruvian government in any way. Nogales described that in the course of explaining the project that residents begin to

[29] Carla Saenz, interviewed by the author, June 2017.
[30] Irene Nogales, interviewed by author, August 2017.

adopt it as their own. But in order for them to understand, she has to "explain things at their level, explain using games, with simplistic dynamics."[31] To accomplish this, she uses easily relatable examples, such as a child that fell asleep next to a candle and got badly burned, and how in comparison, with a lightbulb this would not happen; at worse, if you fall asleep with the lightbulb on you only drain the system battery. Stories similar to this are used to relate to residents' personal experiences, eventually garnering an "Ah, this has happened to me! That's my story!" and from this point, residents decide they want a SHS and that this service would improve their lives. To be sure, Nogales' explanatory approach sounded paternalistic and seemed to advocate "dumbing down" the information she was tasked with conveying. Yet, given how foreign the idea of harnessing the sun for electricity is to most rural residents, I would argue that her overall instructive methods were intended to make concepts relatable.

The use of culturally appropriate concepts was intended to serve as a useful heuristic, demonstrating the degree to which LSA's "engineers of communication" were in touch with their rural customers' reality. However, from an analytical standpoint, many development efforts operate with two simple assumptions: that 'others' are underdeveloped and that 'we,' in contrast, are developed; and that 'we are in possession of the ideas or technology that will help 'others' become more advanced, like us (Hobart 1993, 2). For those development workers who have confronted the above proposition, it is likely that they either believe this or are reluctant to say so in such blunt terms (Uvin 1998). Nogales' recounted to me a script that she would use in community workshops as part of LSA's effort to alter rural residents' perceptions of poverty and dependence on state welfare, saying:

> No one here is poor, we're all the same. I work in the city, you also work, but in the field planting your potatoes; you harvest your potatoes, you sell them. You have

[31] Irene Nogales, interviewed by author, August 2017.

> your cows, I don't have cows. A cow—how much does one cost you? 2,500 Soles (roughly $750 USD)? I don't have a cow (that's worth) 2,500 Soles. So, who is poorer, you or me?

Nogales' approach was clearly intended to create a feeling of horizontality among LSA and the residents it serves, while also working to reshape residents' subjective conceptions of poverty and dependence. This statement revealed that, under the guise of "relevant examples," LSA has promoted false equivalencies that minimalize the importance of history and culture, and also ignore the conceptual distinction between those doing the developing and those being developed. However well intended, glossing over how historical racial and political legacies bear on rural residents' contemporary livelihoods does not make LSA's development efforts apolitical or its relationships with these customers more horizontal, it simply makes these historical legacies and their related processes harder to see (Uvin 1998).

Developing Culture & Breaking Dependency: LSA on a Civilizing Mission?

Adding another complex, contradictory layer to LSA's institutional philosophies, are its views on developing a culture of payment among the rural community members it serves and breaking what it perceives as residents' dependence on free state handouts. Here, a tension emerges between the way in which historically aware perspectives influence LSA's trust-building with rural *campesinos*, and the more civilizing tone LSA takes regarding its efforts to shape their attitudes and actions. Despite her demonstrated understanding and respect for highland society and its nuances, Carla Saenz helped sustain well-worn tropes about highland peoples, saying: "First off, you have to develop culture, culture of payment. They (rural residents) don't have (public infrastructure) services, so they aren't used to paying for anything. Also, they're still submissive.

It's in their nature to ask for things, 'because I'm poor.'"[32] Saenz commented on what she perceived to be a benign matter of fact, simply describing how LSA's energy service must match with rural social realities and practices. Nonetheless, comments such as these represent some of the worst historical tropes of Andean peoples, imposed on them by landowners and coastal elites for centuries. What is more, her interpretations of rural residents' submissive behavior and their pleas of poverty were oversimplified in order to meet with LSA's disciplining logics and operations. Instead, borrowing from Graham and Penny's (2014) ideas of "performing indigeneity," I would argue that often times residents were "performing poverty" through "contextually…embodied speech and action…anchored in past performances" that is "infused with expected outcome" (12). That is to say, rural peoples are aware of how others see them and "perform" in ways that they hope will garner an outcome that will serve their advantage, such as in this context, leniency in enforcing rules of SHS removal for late payment or an even lower monthly solar energy bill.

However, these performances of poverty can come at a cost, as Saenz' comments confirm, especially when rural peoples are not in control of the way they are represented to wider audiences (Graham and Penny 2014). Whatever the intent, Saenz' comments have the effect of reifying and perpetuating these tropes among international development circles. Her remarks are not only at odds with narratives around agricultural producers as crucial protagonists for Peruvian development (García 2013), but they also occupied a similar register as the accusations made about highland people's personal characteristics that Arthur Scarritt (2011) has observed. Accusations such as "'*campesinos* are not ambitious', or 'are very *conformista*', or 'do not put in the necessary work, and they lack knowledge and experience', or more simply they 'are accustomed to handouts

[32] Carla Saenz, interviewed by the author, August 2015.

and get lazier.'" Perhaps the most harmful trope in this context is the highlighting of failed development projects in a village, that a local elite arranged, but the rural residents proved unable to maintain (25). In a sense, Saenz presented a contradiction between the (private) discursive and (public) material aspects of LSA's operations. To some degree, Saenz has expressed a simplistic and detrimental view of rural peoples, while forwarding a benevolent agenda to help them overcome the very tropes she sustains in her professional discourse. Saenz' divulging of this particular view about poor rural *campesinos* reveals the power and continuity of these tropes and calls into question LSA's benevolent emphasis on community development. This shows us that the processes that have generated and sustained such tropes are an unclosed chapter in Latin American history and form a part of contemporary struggles and not a backdrop to them (Stern 1999).

Despite these philosophical and practical incongruities, as Saenz sees it, the main obstacle to creating a culture of payment is residents' widespread reliance on state welfare, something that in her view is psychological in nature. For her, it is not a problem with the *Casa Solar* project itself or residents' low purchasing power – it is about residents not having a habit of making payments. She asserts that in all the LSA communities where the state does not provide social services, residents are simply not accustomed to making reoccurring monthly payments. Historically, the Peruvian state has had an irregular and ineffective presence in many rural areas of the country. Today, throughout much of the Andean highlands, the results of nearly two centuries of effective social and economic marginalization, and all the associated trappings, are manifested in a lack of public investment, deficient infrastructure, and limited capacities of local government (Thorp and Paredes 2010). Saenz notes that often when state services are available, they take the form of

conditional cash transfer (CCT) programs like *Juntos,*[33] which Saenz views as paternalistic, free welfare handouts.

Related to this, Saenz insists that working with these communities also requires LSA to break residents' reasoning that, because they are poor, all social services should be offered to them for free. She added that if you give community members the opportunity to comment on the amount they have to pay for energy service, residents will always report that the amount is too high, but the low delinquency rate of payment for *Casa Solar* shows that residents can afford their payments. Additionally, despite rural residents' low earning power, LSA knows that the program can in fact save villagers money on their energy expenses, as an independent study conducted by the Inter-American Development Bank showed that the monthly tariff that users pay in the *Casa Solar* program is 33% less than their average household expenditures on batteries, candles, and kerosene (Egido Aguilera 2014). So, through its philosophies of reciprocity between development agency and project recipient, built on socially-focused communication, LSA takes on the responsibility of fomenting a culture of payment among rural populations and moving these residents away from a welfare-dependent mindset. Emphasizing the communicational role in achieving this, Irene Nogales sums up: "When not one resident…is going to do what you said on day one, it does not help you, because you are falling back into the same – to social welfare. You are giving something without expecting anything in return."[34] And the actions that LSA carries out

[33] Started in 2005, *Juntos* is a conditional cash transfer program (CCT) that brings together two primary objectives: 1) in the near term, lowering household poverty through cash transfer; and 2) in the long term, curtailing intergenerational transmission of poverty by increasing access to education (which includes boosting primary school attendance, lowering dropout rates, and lessening child labor) and bettering health services (by lowering infant and childhood malnourishment, lowering rates of infant and childhood mortality rates, as well as bringing down child, infant, prenatal, prenatal, and postnatal morbidity, while raising the number of medically-assisted births). To achieve these objectives, eligible households receive a cash transfer of 100 Soles (roughly $30 USD) per month and must comply with certain conditions that differ depending on the gender of the recipient and the age of their children (Perova and Vakis 2009).

[34] Irene Nogales, interviewed by author, August 2017.

on the ground to prevent residents from falling back into free welfare is what this paper turns to next.

"We sit on little stools like the rest of the people": AMP's Practical Approach to Energy Service

The program activities outlined in the following section demonstrate how LSA's institutional philosophies directly inform the practices that it carries out on the ground. I argue that LSA's sustained commitment to building trust through in-depth and repeated communication with the communities it serves is crucial to its success. LSA's coordination with local authorities, registering potential energy users, raising general awareness of its program, teaching residents the details of *Casa Solar*, and also delivering on promised timelines for SHS installation, lay effective groundwork for program sustainability. However, carrying out these measures alone does not guarantee favorable outcomes – it is the way in which these activities are carried out, the number of times they are repeated, and the impact that LSA's presence in the communities has on residents, that leads to program success.

The community development procedures (*procedimientos*) that LSA employs have been developed by Carla Saenz and Irene Nogales. LSA's self-described "engineers of communication" are the ones, not technical engineers, that carry out the majority of the in-person work with the communities. Saenz insisted that their role is to develop and maintain the efficient channels of communication with communities that are necessary for their program to work. Although other personnel may be able to achieve similar results, the social and cultural nuances of these rural communities demand more than reciting from the LSA field manual. Although their community engagement activities are guided by this

manual, which sets out meeting activities and objectives, the community meetings do not rigidly adhere to it, as LSA is conscious that there may be conflict between what is outlined in the manual, current factors on-the-ground, and residents' real-time comprehension of the lessons. Effectively leading these community meetings, Saenz described, is something that can only be learned through practice and repetition, reflecting on the efficacy of your own meeting facilitation, and absorbing external feedback. And as a socially and historically attuned communicator, Saenz makes a point to take a seat on the little handmade stools, found almost ubiquitously in rural Andes homes and community houses (*casas comunales*), bypassing the official tables and full-sized chairs used by teachers and authorities, and simply chat with the local residents before meetings and in other informal settings. And through these small symbolic acts of horizontality and deference, LSA begins the process of gaining the trust of the communities it serves.

"Nosotros empadronamos, no censamos": AMP and registering potential energy users

To initiate energy service, a local authority, which could be a district or regional mayor, leader of an area chapter of *rondas campesinas,*[35] or a village mayor (*agente municipal*) or deputy (*teniente gobernador*) who is seeking to benefit their community,

[35] *Rondas campesinas*, literally "peasant rounds," are community nightwatches created to safeguard villages against theft of property, crops, and livestock. The *rondas* first sprung up in 1976 in Cajamarca, stepping in for ineffective local government which was seen as corrupt and unwilling to address the heightened insecurity and material poverty that pervaded the region's highlands. The atmosphere for the *rondas'* emergence was created in part by General Velasco's failed 1968 agrarian reform, which exacerbated already poor conditions in rural communities of the highlands. In addition, from the late 1970s into the early part of the 1990s, Peru (and much of Latin America) suffered its worst economic downturn and crisis, known as "the Lost Decade." In this context of state absence and economic adversity, *rondas* proliferated in the 1970s and into the 1980s, eventually playing a role protecting many of their communities against infiltration by the Maoist insurgent groups, *Sendero Luminoso* and Túpac Amaru Revolutionary Movement (MRTA) (Starn 1999).

must visit AMP's office in Cajamarca in person to express interest on behalf of the community. The *Casa Solar* program always begins with starting a relationship with a local authority. The person does not have to hold an official position of authority but can simply be a respected member of the community. The important part is that LSA can establish effective communication with that person to begin the initial stages of program collaboration. LSA's community development efforts have 4 basic components: user registration (*empadronamiento*), awareness-raising (*sensibilización*), capacity building (*capacitaciones*), and installation. The first step is to register community residents interested in the *Casa Solar* program. To do this, LSA must first explain the general program parameters to the prospective community's authorities, who are then responsible for registering community residents interested in participating. This preliminary registration generally takes place at a community's monthly meeting, where the town mayor, deputy, or local authority figure responsible for initiating contact with LSA, explains the basic aspects of the program to the community. Those residents interested in being part of *Casa Solar* sign a form with their name and national identification number (DNI). Both Saenz and Nogales make clear that there is a not only a semantic, but material difference between registering users and conducting a community census. For LSA, registering users requires that a resident *be explained* what they are signing up for, not simply asked to write their names on a sheet of paper as a means of tallying townspeople to show support of a development project. LSA points out that private companies and state entities that they have dealt with of do not seem to grasp or care about the difference between the verbs *empadronar* (to register or sign up) and *censar* (to take a census), and often use the words interchangeably. But for LSA, *empadronar,* requires that they explain

to residents what they are being asked to endorse or be a part of. Although residents' understanding of the message being conveyed cannot be measured during the *empadronamiento*, the LSA workers aim to impart a certain level of understanding and gain approval on behalf of the person signing their name. In contrast, *censar* simply means writing someone's name down and does not involve their understanding or approval of a related issue. While the first registration list carried out by local authorities and is submitted to LSA to begin the process of project collaboration, members of LSA in fact carry out a second and final registration upon completing the awareness-raising meetings with each community. This is done to ensure that residents have a thorough understanding of what the program entails before deciding to sign up for or decline to be a part of *Casa Solar*.

LSA Community Presence and "how much people value that their lives have been take into consideration"

The presence of LSA officials and their repeated visits throughout the community engagement process, plays an important psychological role in establishing trust by providing residents visual affirmation that LSA is a credible and dedicated organization. LSA will make between five and ten visits to a community from the initial awareness-raising meeting through the final technical inspection of installed SHS. The number of visits that LSA makes is largely dependent on the number of visits required for community members to fully grasp the concepts of the awareness and capacity building meetings. Nogales again reiterated that although LSA has a well-outlined procedural manual, it is of utmost importance to their organization that residents understand what is being conveyed to them. She adds that her and Saenz have learned through extensive repetition and practice how to tell if the information they are communicating is being understood, as certain concepts should elicit certain types of reactions from residents. Nogales

contends that many communities comprehend very quickly, while others take much longer; you may be able to hold one meeting with a given village, but have to conduct the same workshop three times at another village in order for everyone to participate and understand.

However, often times LSA has to repeat workshops not due to residents' lack of comprehension but because the cultural practices and patterns of life in the rural Cajamarca highlands affects their ability to attend community meetings. Frequently because of the great distances separating rural residents' houses, community members simply do not receive word from their local leader that a meeting has been convoked on behalf of LSA. In other cases, absences can be directly attributed to the lack of state institutional presence, as residents have to travel to the nearest densely populated town (*centro poblado*) to carry out a bureaucratic task or seek medical attention. Other activities or circumstances that make it difficult for residents to show up for LSA workshops include attendance at local markets or festivals, increased labor demands during periods of planting and harvesting, working land belonging to a spouse or family member located outside the community, as well other seasonal or short-term labor migration activities. LSA demonstrates their deep understanding of these rural lifeways by scheduling their community interventions around market days, local festivities, and such. Moreover, LSA acknowledges and shows that they value the livelihood patterns outlined above by conducting the same workshop multiple times if necessary, so that all residents, despite the demands of their rural activities, have the opportunity to participate and fully understand the energy service they are signing up for.

During the same period that LSA begins meetings to bring awareness about *Casa Solar*, it also carries out geographic verifications of the town itself. LSA staff travel to a proposed community by 4x4 truck once or twice to verify the specific location of the community, the various routes that reach the town, whether or not they are accessible all year-round, and the time and

distance the town is located from Cajamarca. Between these site visits and the meetings to follow, residents will have an opportunity to see LSA staff in and around their community many times. What is more, throughout the course of community development, residents will not only see and meet LSA's technicians and management personnel, often they will also see and have a chance to meet personnel from FUNDALUZ and InfraLuz Solar visiting from Spain. When all levels of LSA employees and members of its parent companies, FUNDALUZ and InfraLuz Solar, are seen in villages and get to meet local residents, these optics play a valuable role in building community trust in LSA. For this reason, LSA is rigid in its belief that these community development activities must be taken seriously and never contracted out to third parties. Carla underlines the importance of residents seeing all ranks of LSA personnel and again shows her understanding of the cultural significance of sharing food, saying:

> Now there is the issue of hierarchy, and people realize that they need to meet me. So for them, when I arrive they kill guinea pigs (for us to eat). It's not just a technician that has arrived, it's more important for them. They see it as more important when I come, that the directors come, that they see us…so the people can meet the whole company.[36]

For isolated residents accustomed to neglect and absence by state entities, this visible institutional presence in their communities serves as a powerful demonstration of LSA's commitment to them and the project. LSA's repeated and sustained presence in rural villages, Saenz affirmed, is a way of showing rural people that their lives are valued.

Raising Awareness and Building Capacity Through Rural Metaphors

Building on these nascent foundations of trust, LSA begins its awareness talks with the community. These are held by both Saenz and Nogales and intended to explain and clarify the

[36] Carla Saenz, interviewed by author, June 1, 2017.

general outline of the *Casa Solar* program, as some residents may have registered (or refused to register) based on incorrect or partial information. After the LSA-led talks and residents have grasped the general concept of the program, and rules of payment, the town members elect an electrification committee (*comité de electrificación fotovoltaica* – CEF). The CEF is comprised of a president, treasurer, and secretary, one of which must be a woman, as per LSA's organizational commitment to gender equality. Its role is to facilitate communication between LSA and energy users about all facets of the program, make sure residents are properly using their SHS, collect monthly payments and submit them to the LSA office, as well as ensure the safety of the SHS against theft (Egido Aguilera 2014). The CEF's first task is to carry out a second registration of users now that residents have heard *Casa Solar* explained to them in person by LSA. This second registration represents a more accurate count of who is and is not interested in the program, since some residents may not have received word about the initial project sign up at all or authorities may have poorly conveyed the project profile to them. The awareness raising meeting ends with the CEF signing a declaration of formation (*acta de formación*), which is submitted to their local municipality. The municipality then emits an official recognition of the formation of the CEF. LSA has signed agreements with all the CEFs it works with as well as their corresponding municipalities.

The capacity building workshop(s) that LSA holds cover the financial benefits, as well as the legal and technical aspects of the *Casa Solar* program. If residents grasp the concepts quickly then the workshop can be conducted in one, three-hour session. As mentioned before, if Saenz and Nogales sense that residents do not understand the content after completing the first meeting, or in the case of poor meeting attendance, subsequent workshops will be scheduled. LSA's pedagogical instructions have been adapted to be relatable to rural residents and their daily lives. Nogales

highlighted that people must be able to recognize their experiences in the examples she offers and that rural residents' conceptual retention level is low, so she must work to actively engage them with pertinent examples or they will quickly become restless and bored in the meeting.

An important concept that Saenz and Nogales are tasked with explaining is the legal definition of 'right to use' (*cesión en uso*)[37] to residents. It is imperative that residents understand that the SHS is on loan and that they have to properly use and take care of it, or LSA has the right to remove it. As a regulated energy provider under Peruvian law, LSA provides residents with SHS on a 'right to use' basis. This means that a resident agrees to pay for the use of the SHS for an unspecified amount of time, during which LSA retains ownership of the SHS and is responsible for its operation and maintenance. LSA personnel uses relatable metaphors to introduce this complicated and legalistic concept. This right to use concept is not conveyed in technical terms but through locally relevant metaphors. Saenz uses what she calls the *sombrero* metaphor, which involves a demonstration where she acts out borrowing and misusing a *sombrero cajamarquino*. Wearing the *sombrero cajamarquino* is a way for its wearer to express their regional, social, economic, and rural identity; to both distinguish themselves from city dwellers and also reinforce social relationships with those of similar class and rural orientation (Ackerman 1991; Femenias 1991). These handmade straw hats are tall, white, broad brimmed sun hats, and worn by both men and women. They are often custom made to fit the exact diameter of the user's head and can cost hundreds of dollars. Due to these hats' high price tag, they convey that the person who wears it is a thriving and dignified *campesino cajamarquino*.

[37] The "Reglamento De La Ley N°28749 – Ley General De Electrificación Rural – Decreto Supremo N°025-2007-EM" outlines that SHS energy customers are required to pay for their energy use, similar to that of a grid-connected customer, while not owning the SHS themselves.

Saenz explains the sombrero metaphor in animated, vivid gestures, asking a male or female attendee to lend her their sombrero. She then takes it, and after trying it on and modeling it for the audience, she places it on the ground and pretends as if she is going to sit on it. Just before making contact with the hat and squishing it flat, the owner of the hat reacts, jumping up, exclaiming "I lent it to you for the sun, not to sit on!" and demands Saenz return the sombrero. But Saenz refuses, in feigned stubbornness, saying, "But I need it and don't want to give it back!" Once the resident starts playfully grabbing for the sombrero, Saenz gives the hat back, pointing out the error in her treatment of the sombrero, which highlights the first aspect of right to use – that what is lent out for an intended purpose, should not be mistreated by the borrower. And by using this basic but locally relevant symbol – the sombrero – LSA explains that the SHS is like the hat, it is on loan to residents from LSA and if a resident abuses the SHS, LSA has right to take the system back. Olivares adds that if you ask a resident who owns the SHS, they may mispronounce the name *LuzSolar Andina* or may call it "the company" (*la empresa*), but no one will say that they own the SHS – and "they will always remember that you almost sat on their hat." Building further on this lesson, Saenz makes clear that if residents do not yield the SHS, then that is called theft.

Once residents have grasped that the SHS is loaned to them and not their property, LSA begins teaching them about the SHS battery and electronic devices that can and cannot be used with the system. Steering clear of a technical explanation of voltage, Nogales uses examples from residents' everyday lives, drawing a parallel with potatoes and a barn. She explains that the SHS battery is like a potato barn, asking residents, "when you harvest potatoes, where do you store them?" To which they respond, "in the barn." This is the same with the solar panel, she describes, the solar panel is like you, harvesting potatoes and storing them in the potato barn, the difference is that the panel harvests the sun and then stores it in the battery. Building further off this metaphor,

she asks residents "where do you sell your potatoes?" to which the response is "at the market." She then describes how in the case of the battery, it "sells" its light to the lightbulbs. With these simplistic but practical examples, Nogales tries to reach the residents at their level so that they can assimilate these lessons into their own reality, "because if not," she told me "you won't get that 'click' moment with them." Similar to Nogales, Saenz, also uses agrarian metaphors to convey the uses and limits of the SHS battery and compatibility of electronic devices. To illustrate how SHS batteries are only compatible with DC devices, Saenz asks residents, "what happens if you feed your pig food for a chicken?" She then explains what residents already know, that the first few days the pig will survive but shortly after, it may get sick and eventually even die, because this is not the appropriate food for this animal. Saenz warns that the same rule applies for the SHS – if you give your electronic device food that's not meant for it, (i.e. plug a 220 volt AC electronic device into the 12 volt SHS DC plug in) the device will eventually die. For a few days this may be ok, but shortly after, Saenz assures, it will not only hurt the SHS battery but also your ruin your electronic device. Continuing this example, she describes that electronic devices are like livestock, in that each one need its own kind of food. But since farm animals often accept lots of different foods, this simplified explanation can have limitations. In the case that residents point this out, she will designate AC electricity from the national electric grid as 'food from the city' and DC power from the solar panels as 'food from the SHS,' and insist that residents can only use devices that take "food from the SHS."

To finish the workshop that helps residents understand services, LSA distributes certificates of completion to attendees. To earn this certificate, and more importantly to receive a SHS, one member of each family must attend and participate in at least one meeting. After certificates are handed out, each family signs a service agreement contract with LSA. Once

workshops are completed, Saenz makes clear how important it is that LSA keep its word on the final SHS installation date. As the reader will see in the following section, LSA's program success is supported by interrelated forms of trust and discipline; showing rural residents that LSA will both fulfill its promises to deliver energy and will also promptly cut power and remove SHS for delinquent payment. Through these coercive actions, LSA has been able to both compel residents to continue to pay for energy service and also conduct their actions and desires in service of creating modern subjects of the state.

Trust, Discipline, and Subject Formation

The Andean highlands are a challenging environment to provide rural energy service. LSA serves communities that are located up to a three-hour drive from the city of Cajamarca itself, reached via rugged dirt roads in a 4x4 truck. Because of the dispersed settlement patterns of these agro-pastoral communities, individual homes are often very isolated, located far from the main road, and must be accessed by winding, narrow footpaths. It is not uncommon for LSA's technicians to drive two hours to a community and have to hike for another 30 minutes, with a heavy replacement battery or other piece of equipment on their backs, up over an imposing hillside and down into deep valleys, in order to provide service for one single household. Given the great distance and effort required to cut power to a household to compel a resident to pay their bill, from a financial and logistics standpoint, it would be easier to simply not cut power, and instead just collect the FOSE subsidy, which covers 80% of a user's monthly tariff. Yet, LSA knows that if it does not follow through with its program rules of cutting power, non-payment "will go viral; one user doesn't pay, then another." Despite receiving the FOSE subsidy, Saenz notes that users'

payments are still a necessary part to their social sustainability and that making good on promises has a cohesive effect on the continual functioning of its program, saying:

> if people start to steal or not pay, then we could have problems with sustainability. Because of this…we have to come through on our promises. If you say I'll bring you light then you have to do it, just like if they don't pay, you have to go and cut their electricity. This relationship with the community is the basis for sustainability. When you start leaving this part aside, projects can fall apart.[38]

Rural *campesinos'* fear of being lied to and deceived by politicians and outsiders is an important and ongoing issue, as I heard stories about empty campaign promises by local politicians and lies told by community leaders; false offers of free solar energy service if elected or taking credit for securing already-planned LSA projects. In light of these recent and historical deceptions, Nogales understands the importance of keeping one's word, saying that: "There is nothing worse than telling them "yes…tomorrow you'll have [electricity]." But if you don't arrive tomorrow, then distrust begins…this is where you draw a distinction – that what I tell you, I do. If I tell you [the SHS] is going to arrive tomorrow, then tomorrow you'll have it."[39]

Over the course of 4 months, I lived off and on in the small highland community of Lahuaymarca which was among the first towns to be a part of the *Casa Solar* program. Between Lahuaymarca and its neighboring village, San Lázaro[40], I spoke with over 50 residents about their perceptions of LSA, their participation in the *Casa Solar* program, and LSA's performance in providing the technical aspect of energy service. Conversations with residents in these two communities confirmed that LSA has been effective in its social engagement and training of these residents from the outset, as nearly every resident with whom I spoke was very familiar with the financial obligations of the program and what happens if they are late on their monthly payment.

[38] Carla Saenz, interviewed by the author, August 2015.
[39] Irene Nogales, interviewed by author, August 2017.
[40] These town names are pseudonyms.

Residents' testimonies affirmed how LSA has proven dependable in carrying out energy service, most notably as it relates to the consequences of late and non-payment. That is to say, residents perceive LSA to be dependable in carrying out the aspects of energy service that most negatively affect their quality of life – temporarily cutting power to and/or permanently removing their SHS. Promptly cutting power and removing SHS makes clear that there are repercussions for violating program payment rules. Residents gain intimate exposure from what they see in person, hear from neighbors, and experience firsthand through deprivation of the energy to which they have grown accustomed. Irene Nogales described how residents have internalized LSA's disciplining actions, saying:

> Because when they already have light…they know perfectly well the 'rules of the game;'' that if they get behind (in payment) they'll end up without light…that if they do not pay in time, then the technician will come and cut power. They know that if they do not take care of the system, they are going to be left without light. Although it's unfortunate not to have the light, it's even worse to have it and then lose it; because they're already accustomed to it, they've felt it, they've touched it.[41]

"Go ahead and file a complaint, because it's your right": AMP and Subject Formation

Although LSA attempts to better rural livelihoods through what seem to be subtle and benevolent actions, its role as experts in improving the lives of others, represents a claim to power that warrants further exploration (Li 2007). The interactions between LSA and rural residents reveal how the organization has effectively acted as a "government" entity, while using trust and discipline to form consumer oriented, rights bearing rural citizens. What is more, these processes offer a valuable ethnographic window into how the contact zone between Foucault's notion of

[41] Irene Nogales, interviewed by author, August 2017.

"biopower," (1978; 2002) the management of life and population, and Boyer's notion of "energopower," (Boyer 2014, 309), the harnessing of electricity and fuel, shape modern expressions of institutional power and capitalism. Borrowing from Foucault's use of the term "government," characterized by the endeavor to shape human conduct by deliberate means, the evidence from respondents demonstrates that LSA has played a government-like role in educating rural populations to alter their habits and desires, and to create an environment so that individuals follow what they believe to be in their best interest, and act accordingly (Foucault 1991). As detailed above, LSA works to build trust with rural residents, foment their feeling of ownership over the project, build their capacities, and educate them about the *Casa Solar* program. Further reinforcing the notion that LSA shapes residents' desires so that they act in what they believe to be in their own self-interest, Díaz claims quite plainly, referring to rural energy users, that: "It's important…not to change their customs, but that they adopt for themselves what you (LSA) come to propose, without changing their culture, without changing their way of being."[42] As we have seen, the conduct of development agencies such as LSA do not resemble external imposition, but rather ordinary, common sense interactions between individuals and groups (Li 2007). This is because, as Tania Li points out, "some level of popular acquiescence is necessary for a development regime to retain a credible claim to be advancing popular well-being," and unlike a formal state government, without "access to the means of violence, they can operate only by educating the desires and reforming the practices of their target population" (2007, 16). Although LSA does not have the disciplining legitimacy of a state, it offers a public good that the Peruvian state has failed to provide, and still has the ability to coerce residents through the threat and act of removal of their SHS. LSA's coercive methods serve two simultaneous functions: 1) they compel

[42] Irene Nogales, interviewed by author, August 2017)

rural residents to make their monthly payments out of fear of losing their SHS, and in doing so 2) work to create capitalist, rights bearing citizens. By cultivating these capitalist relations in rural residents, LSA is helping to convey the characteristics of hard work, responsibility, and cautious, cost benefit analysis, which in liberal view, represent the ideal, independent subject of rights (Hindess 2001). Given that LSA's rate of payment delinquency is just over 1%, lower than the other traditional electricity distributors in the region, it is fair to say that LSA has effectively molded many of the residents it serves into responsible consumers that conform to payment schedules. These residents have come to trust that LSA will comply with its promises to cut power to their SHS, as a result, customers fear the consequences of late payment, when they previously had limited experience with similar monthly fee-for-service programs.

LSA has effectively accomplished this by playing a governance role in educating and shaping residents' desires and actions, using the removal of SHS as a disciplinary method to compel monthly payment for energy service, which has resulted in a more robust culture of payment among many of the community members it serves. In the process, LSA has also advanced a modernizing, subject forming agenda, an outcome that it has worked deliberately to achieve. These insights were revealed during "moments when the targets of expert schemes reveal, in word or deed, their own critical analysis of the problems that confront them" (Li 2007, 11). In one instance, Carla Saenz, directly connected the social basis of LSA's work to a larger civilizing mission. She laid bare that LSA's institutional objectives extend far beyond the provision of solar energy; that social engagement is used to develop a culture of payment and dissuade welfare dependency, and ultimately, that paying for energy service bestows the customer with citizenship rights. In her words:

Because we have a social focus, we are developing culture. So, we're teaching that

> you have an obligation to make payments. You've never had to pay for anything before, but now you have to pay. But more than just an obligation, we're teaching that this gives you a right to make claims (about poor energy service). So go ahead and file a complaint, because it's your right.[43]

To this end, LSA has also worked directly to coordinate workshops in rural communities, bringing together multiple towns' electrification committees and representatives from the energy regulators, OSINERGMIN, so residents can learn the process of submitting an official complaint to OSINERGMIN about poor electricity service or billing disputes, etc. Although, to date, Saenz maintains that no residents have filed official grievances with the regulatory agency, suggesting that many barriers may still exist to exercising rural consumers' rights.

Speaking directly on the connection between energy service and citizenship, Eduardo Jimenez, then head of LSA's parent foundation, FUNDALUZ, clearly articulated LSA's part in developing a sense of citizenship among its rural customers and the way in which LSA is stepping in to fill a social development void left by the Peruvian state, saying:

> I think it's a matter of citizenship… I (LSA) am not *giving* you anything, you *pay* and the one who pays, gets to make demands; it gives you rights, but also duties. This is an issue of citizenship, forming citizens; those people month after month without any services. This is something basic …we call it…energy education. It's a topic that, effectively, the state ignores, they don't consider it; however, it's key.[44]

This statement brings into relief how LSA's multilayered processes of 'energy education' in many ways positions the organization as an 'agent of modernizing development' (Escobar 1995), raising residents' awareness about their rights as both consumers and citizens while Peruvian state entities have largely been absent. LSA has educated residents that their ongoing financial compliance with

[43] Carla Saenz, interviewed by the author, June 2017.
[44] Eduardo Jiménez, interviewed by author, July 12, 2017.

Casa Solar not only entitles them to receive a quality of energy service set by Peruvian energy regulations,[45] but also the right and duty to file official grievances with state regulatory bodies if LSA fails to meet those standards.

Conclusion

On one level, LSA's experiences show us that in a context of adequate technical, administrative, and financial resources put in service of dedicated, socially engaged "engineers of communication," programs like *Casa Solar* can in fact succeed at a regional scale, not only in Peru, but in other rural settings throughout the developing world. As Peru's state government stands on the cusp of implementing a nationwide solar electrification program inspired by *Casa Solar*, the evidence in this research suggests that the government should take into account both the community development *and* disciplining aspect of energy provision, as LSA has so arduously done, otherwise this national solar energy effort may face serious threats to its sustainability.

Yet, on another level, LSA's experiences make a more valuable contribution to critical development and energy studies, by problematizing our understanding of development program success. This paper has shown that despite its civilizing tone and perpetuation of racial tropes, LSA has proven able to run a successful energy program over time, which has in turn, catalyzed the state government to try to replicate this success nationally. Given LSA's vocal dedication to community development and direct engagement with the rural residents it serves, it appears that LSA has failed to examine its own operations from the standpoint of an outside observer. As a result, the organization has not noticed how the practices employed by its "engineers of

[45] For example, the "Resolución De Consejo Directivo – Osinergmin N° 206-2010-OS/CD", requires that AMP reconnect energy service to a customer whose power has been cut, within seven days, starting the day after their bill has been paid.

communication" and its government-like disciplining, have largely served as a stand in for a neoliberal state. In the name of community engagement and developing a culture of payment, LSA has carried out infrastructure interventions that have helped foster more consumer-oriented identity among rural residents and ultimately, set the stage for their involvement in the market (Anand 2017). In spite of its vast rhetorical and material dedication to fostering residents' feeling of ownership over the program, the financial demands of getting rural customers to pay, have in fact, contoured LSA's actions to serve neoliberal market logics all along.

LSA's success has shown us that its painstaking attempts to reconfigure rural people's reliance on handouts and foster new habits of financial payments, constitute a political intervention that state institutions and private companies have largely been unwilling to undertake; as "infrastructure entangles liberal rule in lifeworlds that its administrators have long sought to transform and transcend" (Anand 2017, 6). LSA complicates the way we think about the sustainable delivery of off-grid energy to rural customers without prior experience paying for monthly infrastructure goods. The success of similar endeavors in the future may depend on an energy providers' willingness to approach energy service as LSA has—that is to say, as the "practice of politics," more like "a project and not a secure accomplishment" (Li 2007, 10). The Peruvian state has regarded rural energy provision as an intervention meant to raise electrification rates for political payoff rather than support socioeconomic advancement or address the social inclusion of its historically marginalized populations. In contrast, LSA has demonstrated that despite its problematic practices, unlike state entities, it has in fact been willing to confront the many unforeseen occurrences and makeshift processes that eventually lead to rural people's ongoing payment for energy service, and in doing so, has helped cultivate a deeper sense of citizenship and inclusion among its rural customers than has the Peruvian state.

Chapter 2

"Let the grid come but I'm not giving up my solar panel": An Ethnography of Rural Energy Transitions in Cajamarca, Peru

Introduction

In 2010, the nonprofit organization *Luz Solar Andina* started implementing a solar energy program in villages in the northern Andes of Peru. Communities in that area had been waiting on the state to extend the electric grid for years, with little result. Electricity meant domestic lighting superior to candles and kerosene and that children could study at night. Despite initial skepticism towards the project, over the years villagers have generally been satisfied with the solar program. However, the project has also generated expressions of local fears and possibilities, ones that reached far beyond the intentions of the NGO itself. This paper explores social aspects of rural solar energy and the forthcoming grid extension. On the one hand, local people saw the solar energy service and the symbolic aspects of modernity it offered them, as a new sign of citizenship. On the other, upcoming grid extension became, for some citizens, a new way of being duped into giving away control over their lives and lands to a larger state or foreign power, much as had been done in the region by foreign mining interests.[46] To be connected to the national electric grid is to be included in the nation, but for these residents, this inclusion has brought increased energy-related uncertainties. For one family who denied the state energy company permission to install

[46] Over the last two decades, mining-led growth has driven the political economy of development in Peru. During the 1990s, various mining companies founded in Canada, China, and Australia, entered the country. By 2011, 59% of Peru's total exports were derived from mining activities and 21% of the national territory formed part of a mining concession. As mining booms created great enclaves of wealth, they contrasted with the high levels of impoverishment in the areas these extractive activities took place, most notably the indigenous Andes. Peru's modern mining industries have come to be perceived as laden with labor abuses, land dispossession, and environmental mishaps (Orihuela 2012; Arce 2014b).

poles and cables on their land, the arrival of modernity via grid electricity could not have been more fortuitous or paradoxical—poles and transmission lines were slated to run directly through their land in route to the central part of their community, yet the state electrification plans bypassed them all together.

This paper explores how rural residents engage with solar energy provision and negotiate transitions to grid electrification in their small Andean community of Peru. I focus on a highland village called Lahuaymarca served by the nonprofit *Luz Solar Andina* (hereafter LSA) through its *Casa Solar* energy program in rural Cajamarca. This ethnographic project fills a gap in critical development studies, infrastructure studies, and the energy humanities literature by examining how people interact with the partial or incomplete presence of modern infrastructure (Gupta 2105). These bodies of literature have largely focused on the financial and policy mechanisms needed to support energy access, the analysis and selection of technologies for reaching unelectrified populations, as well as the sociocultural aspects of program design, implementation, and operation at the community level. While these areas of study have explored the processes involved in providing energy and sustaining energy service, they have not however, brought awareness to how rural and marginalized populations, who have only fragmented or intermittent access to modern energy service, engage with these infrastructures. In addition, this project expands on calls made by scholars such as Akhil Gupta (2015) and Dominic Boyer (2014) for social scientists to focus their analytical gaze on energy's role in the management and control of human populations. Relatedly, building on the work of Timothy Mitchell (2011), this work explores the linkages between sources of energy and social and political frameworks; following the properties of renewable energy infrastructures to observe how they modify and strengthen structures of power and inequalities in institutions and their operations. The findings presented here show that

processes of racial formation are so tied to region, that even communities of the Andes that do not seem to map onto Quechua or other indigenous labels are nonetheless racialized. Racialization is manifested through the extension of subpar infrastructure, which perpetuates urban/rural binaries by allowing outside, urban groups to "equate themselves with a particular region—assumed to be more modern, urban, and "progressive," while constructing other regions/populations as backward, stagnant, and semicivilized, thereby seeking to consolidate a dominant position for themselves within the boundaries of a single nation" (Weinstein 2015, 11).

More specifically, this paper contributes to our understanding of how rural people perceive, negotiate, and contest transitions from use of off-grid solar energy to grid electrification. These findings are not only applicable to the development context of Peru, as they help complicate our understanding of how marginalized groups confront energy transitions more broadly and also add to global conversations about this phenomenon. My research shows that residents do not greet the arrival of modern energy infrastructure with blind optimism, but instead express deep misgivings about the eventual surrender of their solar home system(s) (hereafter SHS) for fear that the grid electricity will prove less reliable, less safe, and more costly than solar energy. One resident's view expressed the worries of many in his town, saying: "where there's been electrification there have always been problems…suddenly, 'boom!' it starts to fail and you go…sometimes a month without light. By then you've become accustomed, it becomes something harmful because…with the (solar) panels…there is always light." This ethnographic work took place in a community on the verge of a transition between the *Casa Solar* off-grid solar energy program and traditional energy service through the extension of the national electric grid. I argue that residents' engagement with solar energy and the upcoming energy changeover reveals how they are caught in a development paradox. Both solar energy and grid electricity represent infrastructure

technology intended to help overcome social and economic disparities, yet both reinscribe rural residents' status as secondary citizens with little claim to infrastructure rights.

On one side, the *Casa Solar* program has been successful in compelling residents to pay for their ongoing energy service. LSA officials attribute this success to the organization's community development efforts, such as workshops and trainings, that have clearly explained the parameters of the program to residents and helped foster their sense of ownership of the program. However, my ethnographic research has revealed that it is residents' fear of LSA cutting the power, or removal of their SHS equipment if they fall behind in payment, that compels them to continually pay for program service. Interestingly, this financial compliance has simultaneously created feelings of empowerment within residents, who have come to perceive themselves as "coproducers" of energy service in collaboration with this socially-driven NGO. Still, the SHS represent a not-fully-modern technology, the kind provided to marginalized populations who have been forgotten by the state. Additionally, the SHS serve as a blunt reminder that rural residents' citizenship is contingent upon paying their energy bills. That is to say, symbolically, their citizenship and its accompanying infrastructure amenity can be revoked at any time. On the other side, while grid power cannot be physically removed like a SHS, it relegates residents to being passive recipients of energy service from a state energy distributor. By many accounts this energy distributor has shown to be reluctant to provide energy in isolated rural areas, and when it does, the technical capacity and customer service in these areas is known to be poor. For these rural dwellers, the impending access to this hallmark of modernity—grid electricity—in fact camouflages social inequalities, as grid capacity in the countryside is not comparable to or as reliable as the electrical capacity and energy service provided in urban areas.

LSA Program Model

LSA's off-grid solar energy program, *Casa Solar,*[47] serves communities in the Andean region of Cajamarca. Residents there make a monthly payment to LSA representing 20% of the established solar tariff, while the remaining 80% is covered by a national cross-subsidy called FOSE (Electrical Social Compensation Fund). This is a cross-subsidy where energy customers (generally located in poor rural areas) consuming less than 100 kWh of energy per month receive a discount that is financed by those consumers (generally located in urban areas) using more than this amount of energy per month. This amounts to 10 Soles (PEN) ($3 USD) per month paid by residents and 40 Soles ($12.25 USD) covered by the FOSE subsidy. LSA is responsible for all aspects of service, including the installation, operation and maintenance of the SHS, as well as all billing transactions (Egido Aguliera 2014). Residents are required to pay their energy service bill monthly via their town's electrification committee or by paying in person at the LSA office in Cajamarca. If a resident fails to make their payment for two consecutive months then LSA technicians cut power to the SHS until the resident settles their debt. After six consecutive months of delinquent payment LSA technicians permanently remove the SHS from the resident's home.

The ongoing sustainability of the program is challenging for various reasons. Among the many challenges, rural residents must agree to pay for SHS, which offer considerably less energy output than the national electric grid. Lahuaymarca is located at just a 30-minute hike to the nearest town with electricity, and there are dozens of other towns connected to the electric grid along the two and a half hour drive to Cajamarca. Needless to say, Lahuaymarquinos have been exposed to

[47] This program provides electricity via solar home systems (SHS) to nearly 4,000 households in rural areas surrounding the city of Cajamarca that the national electric grid has been unable to reach. The roof-mounted solar home systems (SHS) that LSA installs consist of (1) solar panel ranging in size from 60W to 85W, (1) 100Ah battery, (1) 10A charge controller, (3) 5W LED lights; the installation also includes (1) electrical socket. Potential daily uses of the SHS include: (3) 5W LED lights for 8 hours, (1) radio for 6.5 hours, or (1) black and white TV for 3.5 hours; as well as cell phone charging.

the grid and understand, despite reports of nearby brownouts and black outs, that it should operate 24 hours a day. Through familiarity with the power grid residents know it has more electrical capacity than their SHS, which can generally only support lighting and small appliances (like a black and white TV) for roughly 5 hours a day and prohibit use of typical AC-powered domestic appliances. To address this, LSA holds various community meetings to teach residents about solar energy, the financial aspects of energy service, and manage community expectations of SHS performance. SHS models utilized by LSA do not feature DC to AC inverters. Without inverters the SHS are cheaper, it lowers demand on the battery, and improves useful life of the system. Unfortunately, domestic devices like blenders and sewing machines use AC power (as does the Peruvian electric grid), and the SHS used by LSA are only intended to support lighting, cell phone charging, and small DC-compatible devices like black and white TVs. That is to say, these SHS lack the capacity for residents to use income-generating tools, but instead, are intended for bare necessity energy uses.[48]

Rural Engagement with Solar Energy

During my research in Peru, I often heard government officials, NGO and private sector workers make a joke that betrayed the common pessimism towards development in the Andes. Rural people, it was often said, "they switch on the lightbulb to look for the candle." The underlying message is that highland peoples are too ignorant and stuck in their ways to properly utilize a technology that is in their best interest; they are obdurate and unmodern, culpable for project failures and their own lack of advancement. But this belief was not just one among

[48] Access to reliable modern energy sources is widely accepted as a necessary condition to spur social and economic development in rural settings of developing countries, yet there are many debates on household solar energy's role in supporting these advances. For more on these debates see: Bambawale et al. 2010; Mahama 2012; Jacobson 2007; Azimoh et al. 2014; Martin and Susanto 2014; Kirubi et al. 2009; Rahman and Ahmad 2013.

economic development experts; it was shared by much of the nation. The "Indian problem" as it was once called before Peru's agrarian reform of the 1970s – was that Peru might not advance because "indians" – or *campesinos* – were not interested in pursuing profit and thus were a stumbling block for Peruvian capitalism (Degregori 1978; De la Cadena 2000; García 2005).

Blaming development failure on race, geography, and ignorance conceals the social complexities and contradictions that must be addressed to in fact implement successful rural electrification projects in the Andes. In Lahuaymarca, LSA's *Casa Solar* program has been attentive to community-focused efforts cited in development literature as necessary for program success—LSA has involved local authorities in implementing the program, held various meetings to build residents' understanding of the project, tapped community members to carry out maintenance and repair of SHS, all of which has helped create a sense of community ownership of the program and contributed to its sustainability.[49] My ethnographic research shows that residents' feelings of ownership of the program have not been created through the abovementioned community development practices alone, but have also been shaped by playing on residents' poverty, marginalization, and deep fear of losing the material and citizenship benefits that SHS represent. This is because "electrification has provided the twentieth century with perhaps its most vivid symbol of modernization and development…electricity (like those other primary goods of modern life, education and health care) would link all of the country's citizens in…universal, national…modernity" (Ferguson 1999, 242). Rural residents can be seen embodying contradictory feelings of both empowerment, earned through their active contribution to program success, and

[49] For recent literature discussing the role of social and cultural engagement in renewable energy program sustainability, see: Fernández-Baldor, et al. 2014; Hancock 2015; Ikejemba et al. 2017; Urmee and Anisuzzaman 2016.

also constant distress about the possibility of being dispossessed of their SHS. *Campesinos'* ownership of SHS helps them counter the narratives of "contemporary highland peasants as outside the flow of modern history" (Starn 1991, 64), seen by urban residents and coastal elites as living "without water (i.e., faucets), light (i.e., that kind of light which can be turned on and off), without medical attention, without roads that link them to the rest of the world" (Vargas Llosa 1983, 36).

In much of rural Peru, citizenship is not a universal category to which all people enjoy equal access. Borrowing from concepts of citizenship laid out by Nikhil Anand (2017), I argue that for these rural residents, their (energy) citizenship is not earned through a linear political process that culminates in a single event (i.e. grid extension), but rather something that happens sporadically over varying timeframes, and most notably, that can be undone. The provision of solar energy infrastructure by an NGO highlights how citizenship rights are fluid and only attained through actions and exchanges carried out back and forth between the NGO (in absence of the state) and its customers (Anand 2017). That is to say, benefits of (energy) citizenship can be revoked and undone if a resident simply fails to pay their monthly energy bill. In this sense, citizenship becomes contingent upon one's ability to pay for it.

Community, Coercion, and Candles

Lahuaymarca was among the first communities where LSA implemented its *Casa Solar* program starting in 2010. The organization's community development efforts, including coordinating with local authorities to register potential energy customers, holding numerous meetings to raise general awareness of its program, and teaching residents the details of the *Casa Solar* project, helped lay effective groundwork for program sustainability. While residents' testimonies affirmed that these meetings helped them to understand the program, what truly

compelled villagers' compliance is the ongoing threat of LSA cutting power to their SHS or their removal, if they fall behind in payment. While hunched over in a small field adjacent to her house, harvesting *olluco* (a small Andean tuber) with her bare hands, a resident named Sara, told me that she cannot let two months slip by without paying her energy bill. Otherwise, she said, LSA comes and cuts the power to her SHS, and in addition to paying her debt, she would have to pay 12 Soles (roughly $3.50 USD), the fee to have power reconnected. Looking down at the dirt as she shook the tubers loose from the dirt clods in which they grow, her face blocked by the broad brim of her sombrero, she stated that she would go without eating if she has to in order to make her energy payments. Referencing the harvesting she was doing in that very moment, she went on to say that it is imperative that they sell their *olluco* so she can afford to pay her energy bill. Sara's stark commentary spoke to her family's financial precariousness and their commitment to maintaining energy service at all costs, despite personal sacrifice. She went on to make a simple statement, representative of townspeople's lack of alternatives and fear of taking backward steps after growing used to the SHS, saying that *Casa Solar* "is the only option, otherwise we have to go back to candles…There's just no other solution, candles don't last long at all. With candles you have to be searching for matches late at night." While her statements about skipping meals to afford her energy bill could be interpreted as perhaps a slight rhetorical embellishment, the underlying message about the importance of retaining her SHS, was evident.

Commentaries like Sara's were common in Lahuaymarca, a small town of about 35 households,[50] whose residents predominantly make a living raising dairy cows, whose milk they use to produce a rudimentary cheese called *quesillo*, that they sell to industrial lactose companies that process it into finished retail cheese products. Residents raise other small livestock too,

[50] This indicates the number of year round residents, as some families migrate seasonally for work.

including chickens, pigs, ducks, and guinea pigs, and also grow potatoes, fava beans, and other potato-like tubers like *oca* and *olluco*. While household income varies depending on the number of head of cattle and the amount of land owned to grow grass for pasture, the average monthly household income is roughly 850 Soles ($250 USD). Despite Lahuaymarca's location in one of the most fruitful dairy producing regions in the country and residents' ability to make a living largely from selling *quesillo*, Cajamarca has historically been and continues to be among the poorest departments in Peru (INEI 2012). This material poverty and the deficiency of infrastructure that rural residents experience is reflected in their sentiments about their current satisfaction with solar energy service and life before the arrival of *Casa Solar*. One resident named Amalia, said that she was content with her SHS, and went on to recount the drudgery of having to do her domestic work and raise her kids by candlelight and by the light of firewood. Pointing off to the hillside, zigzagged with foot trails, that drops down into the valley, she said that prior to *Casa Solar*, they could only illuminate the room beyond candlelight by "burning the heel of a shoe" that she found abandoned along the trails. This bleak description of resorting to the light given off by smoldering rubber illustrates the advancement that SHS represent for residents and why they feel fortunate to have overcome that energy-deprived lifestyle.

The *Casa Solar* program is one of the only infrastructure services residents are provided, and if they were deprived of it residents would have no recourse to other modern energy sources via private or public institutions. What is more, the benefits of this solar energy program have created a bottom threshold of acceptable levels of energy access for these residents and represents an infrastructure service on which they can rely amid an otherwise precarious rural existence. Another resident, Victoria, described how she felt "now accustomed (to the SHS). We've forgotten antiquated customs of the past." Not only does her statement capture the degree to which the solar

energy infrastructure has become normalized to her, but it begins to reveal how access to energy, or its absence, plays into Lahuaymarquinos' conceptions of modernity and development (a topic that will be addressed below). Over and over I heard commentaries from Lahuaymarquinos expressing their deep fear of having their solar panels taken away and being forced to return to a life of candles and kerosene; a lifestyle that has simply become unimaginable to them.

It was clear that the constant threat of cutting power and removal of energy equipment scared the residents, and they worried about losing the benefits of solar energy to which they have grown accustomed. This intimate coercion by the energy provider compelled the residents' continuing payment for energy service. Jorge, who lived in the house adjacent to mine, captured the sentiment of many town residents, saying that "at the beginning we didn't think that LSA would be so rigid at enforcing the rules," and since residents only had experience with candles and not SHS, they had a tough time adjusting to making payments. Residents' experiences of LSA's reliability was demonstrated back in the beginning of the *Casa Solar* program, and extended beyond just the physical threat of a LSA technician showing up to cut power. A town resident name Marcos echoed the general consensus of most all Lahuaymarquinos, when he told me how LSA has come through on more than just enforcing the consequences of late payment, because the organization had delivered on its first and most incredulous promise to the village—bringing solar energy. A promise which many residents were highly skeptical of in the early stages of collaboration. What is more, he described that LSA had also built trust and credibility with townspeople by delivering on the promise to lower residents' monthly energy bill from 15 to 10 Soles, once LSA had qualified for a state subsidy through a 2011 change in state energy policy.

Coproduction and Citizenship

While the disciplining actions carried out by LSA have led residents to live a with an ever-present worry of losing their SHS, curiously it has also led to residents to simultaneously view themselves as "coproducers" of energy service and constitutive components of the program's continuing success. Ostrom (1996) describes coproduction as "the process through which inputs from individuals that are not 'in' the same organization are transformed into goods and services." Conventionally, the group that generates the service of health, education and infrastructure has been the government, providing for "clients," in a passive way. Clients are acted upon, while coproduction means that citizens play a role in producing the public goods and services that they desire (Ostrom 1996, 1079). Relatedly, Bebbington (2000) claims that above all, people encounter development when attempting to make something they can call their own. In these instances, "modernizing development," like the implementation of solar energy programs, does not face resistance but is absorbed, remade into something that may serve the purposes of people's own design. According to Bebbington, almost everything that comes about in development comes through coproduction, as institutional and popular practices intersect and comingle with market, historical, and modernizing notions and practices (Bebbington 2000, 513-514). Advancing these ideas of coproduction in a more conceptual direction, my ethnographic work exposed how Lahuaymarquinos have internalized this energy program and have become empowered by their role in its ongoing functioning, to the extent that they claimed their financial compliance was vital for program success.

As such, residents do not conceive of themselves as passive recipients of energy service, but rather as vital operational components of *Casa Solar,* on par with the technical performance of the energy equipment and the maintenance and operation activities carried out by LSA technicians.

When asked their opinion on why the *Casa Solar* has continued to work all these years, many residents were plain-spoken about their responsibility in making the program function, saying things like: "It's because we make our payments punctually. What would happen if we didn't pay? LSA would take back their panels. It just wouldn't work if we don't pay." Other residents echoed the same feeling of pride in being responsible for the function of the energy service, rhetorically situating their payment compliance as an equal contributor to program operation, as the technical performance of the SHS and the prompt service LSA provides in addressing technical or financial problems.

The preceding paragraphs have outlined the contradictory nature of Lahuaymarquinos' experiences with *Casa Solar*, as they have expressed both a persistent fear of losing solar energy access and also undeniable feelings of pride and empowerment in coproducing it. For these residents, the SHS represent a more modern, advanced infrastructure than candles and kerosene, yet it is understood as an inferior technology to the grid; SHS are seen as providing energy and light better-than-before, but they still do not represent something as entirely modern or beneficial as the national electric grid. Despite only a 30-minute walk separating Lahuaymarca from the nearest population center (*centro poblado*) connected to the electric grid, SHS are still one of the only infrastructure goods to which these rural residents have access. And unlike grid power, where drop lines and meters are generally not dismantled and removed from a resident's house in the case of nonpayment, LSA has the right to dispossess a customer of their SHS once they fall behind on their bills. Thus, these villagers desperately cling to a technology they feel is useful and dependable but know is technically inferior to the grid. This situation highlights how these poor rural residents who depend upon the *Casa Solar* program have been presented with energy as an economic good, which dictates that their purchasing power, and not rights granted to them through

citizenship, are what determine their access to energy (Bjorkman 2015).

Scholars have demonstrated how social and cultural differences have served as the basis for withholding, as well as the granting of citizenship demands, as disenfranchised groups are often perceived and treated as inferior citizens by their respective governments (Anand 2017). Nowhere is this more evident than in Lahuaymarca, where the town's elementary school teacher, Ronaldo, resided in the school during the week, which was not part of *Casa Solar* and had no electricity. Like many teachers in Peru's small hamlets (*caseríos*), his placement there was not coordinated under the state's Ministry of Education, but rather arranged and paid for directly by the local municipality. Since the local municipality was said to operate on a minimal budget, Ronaldo was paid even less and given even fewer resources to work with than Ministry authorized teachers. His situation as a rural teacher living in a schoolhouse with no electricity, while surrounded by homes with solar energy, illustrates the difficulties and contradictions of state presence, infrastructure, and citizenship in Lahuaymarca. He told me that in his view, LSA, as an NGO, did things properly, "how they should be done." Unlike the absentee state, LSA had brought "solar panels where the other electricity (the grid) doesn't reach. Where other institutions don't go." He added that LSA has also been able to provide energy service much sooner than other state institutions. Ronaldo's energy-less living situation and his opinion of LSA filling an infrastructure void left by the state helps us understand both how residents of Lahuaymarca perceive the state, and the way in which residents are viewed and regarded as (un)worthy subjects by the state (Scott 1998; Corbridge et al. 2005).

Social Conflict and Grid Extension

I arrived in Lahuaymarca amid a period of overlapping energy transition. The rooftops were outfitted with SHS, while un-weathered utility poles stood newly erected and distribution lines were suspended high above the main road. Thin service wires drooped down from the tall cement utility poles to much smaller wooden posts and then reached the houses and connected to new energy meter boxes, embedded with fresh mortar into the sides of the homes' earthen walls. Despite the appearance that solar energy and grid electricity were both operative, only the SHS were functioning. The transmission hardware for grid extension had been installed only a few months prior to my arrival but energy service had yet to begin. As I would soon learn, the impending extension of the electrical grid had caused a social fissure within the community. This rift revealed the contradictions and conflicts generated by the implementation of modern infrastructure that fails to meet residents' expectations of advancement for all. The conflict centered around one family's refusal to grant permission to the electrical distribution company to install poles and distribution lines on their land, delaying project completion indefinitely. Various respondents from LSA and local residents with whom I spoke, broadly attributed this dispute to poor state planning; yet another example of how the state's lack of institutional capacity is manifested. Yet this simple explanation elides local social processes and residents' legitimate grievances into problems of deficient state planning. Scrutinizing beyond the state energy distributor's policies and procedures for acquiring project permission from landowners, uncovered complex community conflicts and showed how residents understand and position themselves (and their neighbors) in relation to ideas of modernity and development. Voices from around the community criticized one family's refusal to grant thoroughfare as ignorant and selfish. Yet in another light this family's withholding could also be conceived of as an "everyday form of

resistance" (Scott 1986) against the state that has failed them, at the expense of conflict within their own community. These narratives centered around grid extension disputes reveal how energy systems embody many aspects of the societies that assemble them; both a cause and effect of social developments (Hughes 1983). Simultaneously, seeing energy infrastructure through an up close, ethnographic lens allows scholars to appreciate how energy systems play a critical role in shaping communities' social landscapes and their imaginaries of modernity and development (Nye 1990). This stymied grid extension project serves as powerful and enduring metaphor for the state's mishandled rural interventions, the contradictions and shortcomings of modernity, and reified notions of rural underdevelopment.

Local Politics of "allowing passage"

When I arrived in Lahuaymarca the first families I met were those living in the houses surrounding my own. The same day I showed up I met Marino, a cousin of the owner of the house that I was staying in, who lived just uphill from me and would serve as a social intermediary between myself and the often guarded residents throughout the town. A few years younger than me, Marino spent his upbringing between Lauaymarca, the nearest population center (*centro poblado*) called Villanueva, as well as Cajamarca, and Lima. Compared to other residents in the village, he was well traveled and more educated, having completed high school in Lima. After getting to know him over the course of few weeks, I asked him to assist[51] me in navigating the town to meet residents and talk with them. He accompanied me to seek out houses hidden by false-peaks and winding topography, warned me of houses with aggressive dogs, and indicated in which pastures and plots of land to look for residents when their houses were empty. Most importantly,

[51] I financially compensated Marino for the days he spent working as my research assistant, as it kept him from his family's farming duties and care of their livestock.

he simply introduced me to people in a disarming way, explaining that I was a mere student hoping to chat with them, largely assuaging their fears that I may be a mining company representative. Given the recent mining conflicts in the region (see dissertation Introduction), residents had reason to be wary of the arrival of mining officials, whose presence could signal interest in land acquisition, which could lead to water resource depletion, soil degradation, or worse—the use of nefarious legal tactics to dispossess them of their land altogether.

One day he and I ventured out to meet residents that lived down a winding valley near the entrance into Lahuaymarca, who I had only seen passing by with their donkeys and horses loaded down in route to Friday market in Villanueva. That day I spoke with a woman named Fidela Sosa outside her home while a day laborer used a hand trawl to fling a mud/hay plaster mixture against the walls of a newly added room of her house. During the course of our interview she explained that she was interested in obtaining a SHS because she currently did not have any form of energy and her home was not slated to receive grid connection like the rest of Lahuaymarca. She described that her house was located in a valley of the community and that for some unknown reason the upcoming grid extension would apparently bypass her house. Seemingly emboldened by the presence of her female friend who had just sat down, she went on to vividly lament how the energy company had installed four electricity poles on her property without her permission while she and her husband were out of town. Unaware of the legal requirements for carrying out public works on private lands, I assumed her narratives to be honest and truthful, and listened in shock as Sosa recounted the property violation committed against her family's lands. Shortly after we concluded the interview, Marino and I began the steep climb back up to the main road towards the center of Lahuaymarca where we lived. As I tried to mentally process the interview while struggling for breath at altitude on our rugged ascent, I stammered to Marino that it seemed to me the Sosa family

had suffered a real injustice, with poles being installed on her land without her giving permission. He stopped and looked down at me, perfectly adjusted to a life at high altitude and breathing easily, he shook his head and said, "What she told you is very different from reality."

Marino agreed to stop by my house a few days later so I could interview him calmly, free from the physical duress of high altitude Andean hiking. As we sat around my small plastic coffee table illuminated by an overhead LED light (powered by the home's SHS), we shared the best rum I could find at the super market in Cajamarca just to keep warm. His narrative that followed upended Fidela's story of deceit by the energy contractor and painted a more complex picture of the local politics that configured and disrupted the orderly roll out of state infrastructure plans. Reportedly, the Sosas had in fact given signed permission for pole installation on their land. It was not until another neighbor had received a significant financial pay out for pole installation as compensation for being required to cut down a number of her commercial pine trees, that the Sosas withdraw their consent for posts on their land (See Appendix 1 for map of the property and path of grid extension). Unlike this neighbor, Marino described, the Sosas' poles had been installed in rocky terrain, not in areas that would cause them financial losses by forfeiting grazing pasture or land for timber. But since the Sosas had already given their signed permission, they needed a pretext for blocking passage of the electrical poles and cables. When the family realized that they would not be receiving electricity during this phase of grid extension, they claimed this as a pretext to deny passage and make demands of the energy company. Marino went on to describe that the family reportedly requested 5,000 Soles compensation per pole that had been installed (roughly $1,500 USD). He added that other townspeople had since gone to speak with the Sosa family but they could not be swayed. And since it is private land, there was little that other villagers or the energy company could do to change their minds. Marino feared that if the problem were not

resolved the community would be wired and ready but the grid electricity would never flow. This is what reportedly happened in a nearby town, where a family supposedly refused permission and the village languished for 13 years before finally receiving grid power.

In nearly all the previous interviews that I had conducted and in those I would conduct afterwards, residents mentioned an unnamed family that "doesn't want to allow passage" (*no quieren dar pase*) for grid extension. It was an obvious point of contention and resentment, yet no respondents seemed willing to specify which family or individuals were responsible for impeding electrification for the entire community. I finally asked Marino why, on such an important issue, were townspeople so reluctant to identify the people responsible. He described how there was a generalized sense of fear in the community; that speaking frankly the way he was to me, that others may over hear him and think he is being hateful or mean. Townspeople refrained from mentioning the Sosa family by name to avoid being caught pointing fingers. When residents made diffuse and ambiguous statements about an anonymous family that refused to allow poles on their property and blocked the electrification of the town, it opened up a space for them to not only offer their opinion of the family's actions, but more interestingly, to position themselves in relation to ideas of electrification, modernity, and progress. While I found it strange that residents refused to identify the culprit, as Marino later explained, interviewees were always sure to comment on the issue in order to make it clear to me as an outsider that it was not the whole community that was against allowing passage for grid extension, but rather a handful of obstinate and backward people. While being sure to avoid being seen or heard pointing fingers, residents were actively trying to create a distinction between themselves, as valuing electrification and the benefits it brings, and the unmodern and selfish family, willing to sacrifice the advancement and development that electrification brings, in order to take financial advantage of the situation. In a sense, these

residents were trying to appeal to me as an outsider and also align themselves with prevailing notions of development, while still adhering to rural codes of social conduct.

State Regulations and Land Titles

To be sure, most everyone with whom I spoke commented on the quarrel over grid extension, saying that blocking passage was an "absolutely awful" thing for the Sosas to do and that it was ignorant of them to block electrification simply because electrical connection to their house was to be bypassed. Yet, other residents also saw the state as complicit in this electrification drama and that the Sosa family was not entirely at fault. Residents complained that state roll out of electrification works are always heavily delayed and take a considerable amount of time because of poor state planning and execution, not just issues with landowners. They cited that in Villanueva, two years transpired between the installation of utility poles and cables and the actual electrification of the town. Some residents believed that the state's shoddy planning was demonstrated by its inability to complete when hindered by a dispute with just one single family. Others felt that the state had hired second-rate contractors to carry out the installation of transmission equipment and face-to-face interactions with landowners. To better understand how residents' perceptions of state electrification efforts met with the actual regulations guiding rural grid extension, I interviewed an official from Caxa Elécrica, the public energy distribution company responsible for rural electrification of Lahuaymarca. I had previously interviewed Ángel Ochoa, the head of the business division, during the summer of 2015 while conducting preliminary research in the region. After the security guard confirmed my appointment with the secretary on the other end of the receiver, I was allowed up to the second floor to Mr. Ochoa's office, past a waiting room packed full of *campesinos* sitting and standing in line to pay their energy bills or

speak to customer service. He greeted me heartily, visibly amenable to my presence there and my continued interest in talking about energy. What I learned from him during that encounter was that the residents of Lahuaymarca correctly perceived a discrepancy between the official regulations for obtaining permission to install transmission poles and cables, and what oftentimes happens on the ground. Although in the case of the Sosa family, who reportedly refused to allow passage after giving their written approval, their claim that contractors had installed poles without their permission was not without precedent. With a certain air of detachment and acceptance of the flaws in the system, Ochoa spoke knowledgably about procedural regulations that contractors are supposed to carry out and the shortcomings in their application. He admitted that it was possible that poles could have been installed on private land without permission, as contractors often gather signatures of approval as they are executing installations or when projects are nearing completion. Contractors often do not reach 100% of landowners, because one or both heads of household are often absent during installation, which inevitably leads to residents' complaints that they were not properly informed about or financially compensated for poles installed on their property.

Trying to grasp why the Sosa family was supposedly going to be left out of the approaching electrification, I inquired about the guidelines for homes to be included or excluded for grid extension. Ochoa stated that this house may simply be located too far from the center of the hamlet, since norms state that distributors must only provide electricity 25 meters beyond the last installed pole, it was likely the Sosa home was located far past this distance. However, Ochoa added that projects are generally planned 3-4 years before installation occurs, and are occasionally, but not always, designed and budgeted to expand up to 10% in case the community expands between the initial planning stage and installation date. Speaking specifically about the case of the Sosa family in Lahuauymarca, he told me that the contractor can in fact change the path of the posts if the

family refuses to allow passage. After describing the geography and reports from the Sosa family, Ochoa concluded that it was likely that their house was not considered for grid extension because of its unfortunate placement directly in between the origin of the grid extension and its terminal point, meaning that the poles were meant to pass through their property but not provide the house with electricity, as this would have required the home to have its own dedicated substation and transformer, increasing project costs considerably.

Upon returning to Lahuaymarca from Cajamarca to interview Ochoa, I happened upon the energy contractors as they were preparing to go and speak with the Sosas to resolve the impasse that had brought grid extension to a halt. Afraid that I might not catch them before they made their way down the steep valley, I dropped my backpacks and guitar inside my house and went stomping down to their double-cab 4X4 truck parked along the road overlooking the rugged gully. As I arrived at their tuck, half out of breath, I asked through a partially rolled-down window if they were the electrical contractors working on the town's grid extension project. The man who appeared to be the boss of the crew seated in the front passenger seat reluctantly answered yes, and I introduced myself. He seemed apprehensive about my description as a student conducting research on local energy projects and my interest in the ongoing social conflict hindering their work. But his opinion was critical in enabling me to triangulate between all the actors involved in this energy transition drama, so I pressed on. He informed me that contrary to what Marino had told me, the family was not asking for financial compensation for the poles that had been installed, but rather that their house and those of three other nearby relatives receive electrification. The contractor noted that the Sosa's house itself was too far away to initially be considered for connection, and the other three were clearly too far removed to also get power. He then confirmed that the family had signed their permission and it was not until learning of their omission from the

grid extension plans that they went back on their word. The contractor added that the Sosa family had threatened to use a chainsaw to cut down the poles. If this were to occur, then the authorities would look into area land titles to see who the Sosa's had acquired their land from and if they were in fact the lawful owners. Also, he claimed, if residents buy land from the Peruvian state, that land titles are often written and transferred with clauses in them requiring the new owners to permit public works on their property. And this is what the contractor said his company would likely pursue next.

This last admission by the contractor initially seemed nothing more than a typical legal procedure, but as I puzzled over it I realized how problematic this approach was, even if it was entirely lawful, given rural *campesino* and indigenous communities' history of distrust of the state and outside authority figures, especially in relation to land titles, land dispossession, and private mining interests (Bebbington 2009). The contractor was threatening to use legal leverage to undermine the Sosa's property rights, either by proving they were illegitimate landowners or too ignorant of the law to understand the clauses in their land deed. These potential actions should be viewed against the backdrop of recent protests and mobilizations in Cajamarca that stopped the massive gold and copper mining Conga project, (ran by Yanacocha, a joint venture between US-based Newmont and the Peruvian company, Buenaventura), which would likely have polluted and used up local water supplies and converted four natural lagoons into engineered reservoirs (Orihuela 2012). In a country where indigenous and *campesino* land rights have been ill defined since the post-colonial era, where the state retains rights to subsoil minerals, and where communities have been legally removed for the supposed benefit of the greater public (2012), this potential legal maneuvering by the energy company is troublesome to say the least. Scholars have observed how Peru's highland peoples often carry a deep sense of historical shame from having

been deceived by local elites (Degregori 1990), while pervasive legacies of racialization, exploitation, and treatment as inferior beings (Klarén 2000; Wolf 1982) have been reproduced since colonial times and continue to influence contemporary highland politics, social life, and struggles over land rights (Stern 1999). Although the contractor's tactic outlined above may be entirely lawful, if this avenue were pursued it would only stoke highland communities' historically-rooted fear of falling victim to *engaño* (trickery or deceit) by outside authorities.

It would be easy to paint the Sosa family's refusal to allow passage through their land as a selfish act that adversely affects the people of Lauaymarca. While their stubbornness has surely impeded the smooth extension of the grid to their town and won them no friends, I would argue that it may be more helpful to see their refusal as a "weapon of the weak" (Scott 1985); a space of resistance where their "passive non-compliance" or "feigned ignorance" could be used to seek reparations from the state which has provided minimal material benefits in support of their rural livelihoods. This may be one of the few opportunities this family has to make specific citizenship demands of a state that has historically neglected them; to obtain modern energy infrastructure that would otherwise, paradoxically, arrive and still pass them by. The residents' discussions of this conflict suggested that their conceptions of development were largely bound up in electricity's role in providing lighting for reading and education. Lahuaymarquinos looked to the impending grid extension for development and progress, but at the same time, they held the state energy distributor's poor planning responsible for the delay in extending the grid and at fault for its inability to resolve the social conflict with the Sosa family. While residents made it clear that they saw the grid as a form of progress and look forward to the much assailed energy company resolving the conflict, contradictorily, they must rely on the same poorly functioning state apparatus to deliver grid energy service. Perhaps most troubling of all these developments is the state energy

distributor's use of the law to invalidate objections from landowners, which reifies the idea that rural residents are inferior citizens, whose rights can be undermined when it benefits the state and the "public good."

Contradictions of Rural Energy Transitions

On one of my last days in Lahuaymarca I sat on the porch belonging to my neighbor and town matriarch, doña Zeneida, taking notes on recent interviews and waiting for the rain to stop. A local resident named Rodrigo appeared looking for doña Zeneida's husband, don Bernardo, who had just left. Not finding him, Rodrigo sat down, offered me a sip of a plastic soda bottle filled with homemade cane liquor called *cañazo*. As we drank, I peppered him with questions about the upcoming grid extension and his thoughts about this nearing transition from solar to grid. He told me he wanted to keep his SHS instead of letting LSA remove it once the grid arrived (as the company confirmed to me it would do). Like many other residents he was concerned about the prospect of being forced to forfeit his SHS, which was widely seen as much more reliable than the grid electricity in these rural parts. Lahuaymarquinos plainly felt that the grid could offer more electrical capacity than SHS, but knew the grid was susceptible to power outages caused by foul weather, and that the energy distributor, Caxa Eléctrica, was slow to remedy rural power outages. Like much of Lahuaymarca, Rodrigo's clear desire to keep his SHS spoke to the degree to which residents have grown accustomed to the benefits these solar energy systems provide and their apprehension towards electricity from the grid. Residents found themselves in a contradiction—they preferred the SHS, which they saw as more reliable and nearly unfailing, compared to an unpredictable grid and the poor service offered by the state, which they soon would have to accept. The energy transition soon to take place in Lahuaymarca outwardly appears to represent linear

progress from partial access to energy and lighting via SHS, to a fully modern infrastructure, via the national electric grid. Instead, I suggest that grid electricity in rural areas of Lahuaymarca represents an infrastructure of mimicry that is "not quite" as good as the grid power provided in nearby urban areas, and a "representation of difference that itself is a process of disavowal" (Bhabha 1994, 86). The lesser quality of rural infrastructure reinforces the differences between urban and rural dwellers; it reminds us of *campesinos'* "partial" and "incomplete" presence in the eyes of the state and reifies their position as inferior citizens of Peru (86).

"The solar panels don't fail you"

Residents asserted that with access to grid power they would acquire electro-domestic tools like TVs, blenders, and use electricity to support activities like carpentry and sewing. Grid power and SHS were commonly understood as belonging to two distinct categories: saying things like "the grid has more benefits; for carpentry, or whatever use. The (solar) panels are just for lighting" (*Cableado tiene más beneficios; para carpintería, para cualquier uso. Los paneles son para luz, no más*). But residents' frequent and most revealing comment comparing the SHS with the grid succinctly captured their predicament, "the grid is stronger, but the (solar) panels don't fail you" (*La luz tiene más potencia, pero los paneles no te fallan*).

In the same way that residents expressed their firm reliance on the consistent technical performance of the SHS, they also placed a great value on the fixed monthly cost of SHS service. Residents demonstrated palpable uncertainty and worry about the financial disruption that this transition to grid power represented. Amid their humble existence, residents will soon be responsible for paying for and installing interior electrical equipment in their own houses, including wires, plug-ins, switches, and light bulbs. This is because Peruvian law only requires the

public distribution company to install electricity equipment up to the meter, located on the exterior of the house, while the interior equipment is the responsibility of the homeowner. In contrast, the SHS are installed by trained technicians and include all necessary interior equipment, even the light bulbs. Along with grid extension imposing a new expense and responsibility on residents in order for them to have grid electricity, residents were also worried about how much this new energy service will cost them. Although, like many rural areas, their energy meters will likely operate on a prepay system,[52] residents showed widespread concern about this unknown cost. Thus, while the "grid has more benefits" in residents' view, it correspondingly means the more electricity they use, the more they must spend. Residents live a precarious existence and derive a sense of financial security from knowing that they can use their SHS as much as the system would allow for a set price that never fluctuates. Despite the advancements that the grid offers, it opens residents up to an increased sense of economic vulnerability around energy that had largely been resolved by the SHS.

"I'm not giving up my solar panel"

Residents poignantly discussed the technical and financial worries generated by the thought of moving from the *Casa Solar's* SHS and state-provided grid power. Yet much of what residents said also expressed the unpredictability about what grid electricity would mean for them. This ambivalence between the two technologies, a sort of straddling of two imperfect realities, was best captured by a resident named Marcos, who was in fact a recipient of one of 10 demonstration panels that were installed in individual homes in various communities during the pilot phase of

[52] In poor rural areas where access is difficult and customers' energy consumption is low, companies often use a pre-pay system. Instead of reading a user's energy meter every month and distributing a bill to each household, the users purchase a pre-paid card from a local, authorized agent. The cards have a code on them that the user than manually enters into their energy meter or via cell phone network, depending on the technology used by the company.

Casa Solar in 2009. Showing how much the SHS had become an integral part of his life in Lahuaymarca, he told me defiantly: "Let the grid come but I'm not giving up my (solar) panel." He then softened his stance slightly, admitting that he is yet to live with the grid and would be willing to give it a chance, but was uneasy at the prospect of grid's reported power outages. Finally, suggesting a small compromise, he said that he did not want to hand over his solar panels for at least a year until he could thoroughly try out the grid and confirm whether its performance warranted giving up his SHS. Given the frequent power outages and the negligent reputation that Caxa Eléctrica had in the area, there was little wonder why he and others were unwilling to give up their SHS in exchange for a supposedly superior grid,[53] that reports heard over the radio had long contradicted.

Despite their relative isolation, Lahuaymarquinos were well informed about goings-on in surrounding towns through attendance at nearby markets and festivals, word of mouth, and for the most part, through the radio. The radio served a principal role in informing residents about local affairs and especially, shaping their opinions and understanding of the grid electricity service in the area. Largely through radio reports residents had come to understand that the grid was unstable and suffered frequent outages, that Caxa Elécrica was slow to respond to service disruptions in rural areas, and that the grid brought with it safety concerns for their children and livestock. One morning a resident named Victor showed up at my house, knocking on the window while I was still asleep, as he heard from his daughter that I was looking to talk to him the day before. I yelled to him, inviting him in and scrambled out of bed. We started talking while I made us coffee and

[53] An official from LSA stated that they will begin removing SHS from Lahuaymarca once the grid arrives. However, the removal of SHS will take place over an undetermined amount of time for two reasons: 1) the logistical constraints of removing SHS from Lahuaymarca and the other nearby communities that receive power as part of the same grid expansion; and 2) the challenge of warehousing and performing a technical review of all of these SHS before installing them in new communities. Carla Saenz, interviewed by author, July 12, 2017.

poured two bowls of cereal for us. It was rare that a resident would seek me out the way he did, as most residents treated me with slight apprehension or polite aloofness. He spoke to me with a tone of conviction and certainty that many others did not. Speaking on the topic of the transition to the grid, he conveyed that he had heard of many communities in the surrounding areas experience power outages and that these people make calls to Caxa Elécrica for days to have their electricity reestablished but get no response. From what he had heard, Caxa Elécrica's service was much poorer in the rural areas than in and Cajamarca and bigger towns. He added that contacting Caxa Elécrica itself can be challenging task, since communication from the countryside to the city is difficult, and further exacerbates the effects of a power outage. His comments were representative of many that residents had made to me over my time there—that service in their isolated villages was subpar and their demands for service went unheeded by state energy distributor, Caxa Elécrica.

For residents that spend much of their time outdoors, dedicated to agricultural activities and raising livestock, they were keenly aware and commented that the grid was frequently affected by natural causes like fallen trees, heavy rains, and thunder and lightning storms. Much like Victor's description above, other residents were fearful about nature's ability to disable a finicky grid and disapproval about the time it reportedly took for service to be returned to normal. Residents' accounts of the duration of power outage varied from two to three days, to 15 days, to a month. But their comments on the erratic grid were always coupled with contrasting statements describing the stability of the SHS. Beyond issues of dependability, residents also perceived the grid as a very real safety threat compared to the innocuously safe SHS. Again, they recounted stories about neighboring villages and family members whose houses experienced fires or had burned down entirely due to faulty electrical issues related to the gird. Both male and female

residents also expressed concern that their children and livestock may be harmed by running into or playing on the electrical poles.

Touching on a specific concern that leads to a much broader theme of this paper, Victor voiced his worry that there may be "manipulation of the wires," (*manipulación de los cableados*) resulting in the theft of electricity once the grid arrives. While theft of electricity in developing countries is not uncommon, it brings into question whether the electric grid can not only support extension into rural areas such as Lahuaymarca, but also provide comparable electrical capacity as supplied to urban customers. Comments from the manager of LSA, Carla Saenz, cast doubt on the grid's capacity to satisfactorily supply energy to former *Casa Solar* customers. She spoke of the considerable voltage drop that occurs when installing thousands of kilometers of wires to reach remote rural households. And since grid electrification projects always exclude some households, as this paper has shown, energy theft is inevitable and further increases voltage drop. This has resulted in residents located near the outer edges of the grid complaining that their household electricity has barely enough voltage to power a lightbulb, that reportedly illuminate so poorly they are no brighter than a candle. Saenz described how at another *Casa Solar* community near Lahuaymarca, where grid electricity service had begun just 10 days prior, residents were already lamenting their dissatisfaction with the performance of grid energy. Saenz reported that these residents, much like those of Lahuaymarca, did not want to give up their SHS and told LSA officials "I'll keep paying (for SHS)" despite having grid electricity. Reflecting a certain frustration with the contradictions and constraints of this rural reality, she said "you can't have a panel if you already have the grid."

This brief narrative from LSA helps substantiate what Lahuaymarquinos have long been aware of—that the grid infrastructure implemented in Cajamarca's countryside is inferior to that

provided in more urban areas. This provision of a public good that is the same but demonstrably unequal, works to reinforce rural residents' view that the state is incapable of effectively providing public goods in remote areas, and that as rural *campesinos* they are viewed by the state as inferior citizens whose socioeconomic development needs do not merit the state's most robust infrastructure services. The above narratives show that the changeover from SHS to grid infrastructure is not a linear progression. Rather it is characterized by uncertainties and contradictions, as the arrival of modern infrastructure will bring back many of the safety, financial, and energy insecurities that residents thought they had moved beyond and left firmly in the past.

Conclusion

The ethnographic work presented here has explored the transitional spaces between partial and full infrastructure provision. It has revealed the ways in which these energy technologies bind residents in a development contradiction and deepen preexisting inequalities among Peruvian citizens. These sites of infrastructural transitions are deeply informative about the social conditions during the time in which they occur (Howe et al. 2017), as the testimonies in this paper answer the question that infrastructure continually poses about who benefits from its presence and who is marginalized by its absence (Anand 2017). In Lahuaymarca, state-led grid extension efforts have a poor reputation, earned through years of power outages reported on the radio, and more recently, through social conflicts with a local family. The extension of faulty infrastructure into rural areas not only reflects the inferior position and racialized stereotypes held by the communities the grid is meant to serve, but is also one of the "constitutive elements of historically structured spatial inequalities" (Weinstein 2015, 2). Infrastructure is often considered "by definition invisible, part of the background for other kinds of work" (Star 1999, 380). Yet, Lahuaymarquinos' conceptions

of future grid infrastructure contradicts this. They see it as something highly faulty and thus, visible, not a tool to carry out other kinds of work, but rather a source of disruption of their daily lives. The state-led efforts to extend energy provision in Lahuaymarca threaten the town's solar energy arrangements, which have generated local empowerment and become socially and culturally embedded, ever reliable and representative of an established level of citizenship. If energy infrastructure is a symbol of the "good life," an amenity that facilitates advancement and equality, then the state-led grid extension may represent a troubling paradox for Lahuaymarquinos. Residents' narratives suggest that their anxieties and fears are not simply transitional, but a more enduring condition of their existence, a place of negotiation between their past and an unfulfilled future (Gupta 2013). For them, energy provision strengthens existing racial formations (Omi and Winant 1986), where *campesino*, functions as a sort of totalizing and generic language of "othering" that reinforces racial hierarchies in Peru. As one resident described, they must give up a certain past for an unknown future, one that is necessarily reliant on an unreliable state, "It's no longer unordinary, we are already accustomed to the reality of the government…it always happens…they come, they offer you [a project], and it can be up and running and in the middle it stops."

Chapter 3

"The Most Ambitious Program in the World": The Challenges and Contradictions of Peru's *Proyecto Masivo de Energía Solar*

Introduction

Throughout much of Latin America, public auctions[54] have become the most common mechanism used to build countries' renewable energy infrastructure (OSINERGMIN 2016). However, auctions generally have tradeoffs between issues such as low prices, pace of delivery of service, and social and economic impact. As a result, a country's priorities towards a range of issues including energy technology preference, socioeconomic development, and policy benefits can be seen in the design of their energy auction (IRENA 2017). This paper examines Peru's first off-grid solar energy auction and the resulting public-private partnership (hereafter PPP) that the government has formed with the auction winner. While research on public-private partnerships for infrastructure provision in developing countries has explored many areas, including economic considerations, project finance and management, as well as the more social and political concerns regarding design and renegotiation,[55] there has been little academic work focused specifically on PPPs for the delivery of off-grid solar energy. PPP contracts merit further study because they are incredibly complex to design and involve long-term operational commitments from all parties involved. As such, the public entities responsible for PPP design must be able to both foresee risky scenarios and properly allocate program risks in order to avoid conflicts once the infrastructure is

[54] This type of auction is defined by the public announcement or offer of a renewable energy project of a determined size where competition among energy companies is the driving force and the company that submits the lowest bid wins the auction (IRENA 2015).
[55] For more on these topics, see: Boardman and Vining 2010; Hellowell and Vecchi 2012; Wettenhall 2010; and Guasch 2004.

installed and service is underway (Yescombe 2013). Relatedly, PPP contracts, in practice, are often incomplete largely because the public institutions designing them have not been able to account for the many contingencies that arise during the course of a given contract (Hart 1995). Due to the incomplete nature of PPP contracts, they have been shown to be susceptible to renegotiation, especially during the early period of the contract (Sarmento and Renneboog 2016) which results in significant loss of time and money for both public and private sectors, or worse, projects that fail and are abandoned completely (Delmon 2011). Incidences of renegotiations of PPP contracts in Latin America have shown to be particularly high and have tended to favor the private operator, indicating serious financial losses on part of the government sector (Trebilock and Rosenstock 2015).

There is significant extant literature on the "the front end of PPPs," such as how projects develop, their goals, and related financing, as well as literature devoted to the processes and outcomes of PPP contract renegotiations years after service has begun.[56] While the research presented here also addresses the formation of PPPs "on the front end," its aim is to orient the reader to the internal "invisible trouble" of infrastructural systems, by exposing the design of contracts that "are argued through in hardworking committees that rarely see the light of history…manifested in written documents that are rarely perused by any but their most immediate users" (Lampland and Star 2009, 22, 13-14). I do this in order to show how unforeseen discord can unsettle the well-intentioned calculations of PPP designers, while failing to meet the expectations of the communities infrastructure projects are meant to benefit. More broadly, this paper contributes to conversations about infrastructural systems, by revealing the internal elements that are most often hidden from sight and that tend to only become visible or be discussed when

[56] For more on these aspects of PPPs, see: Hodge et al. 2010; Yesecombe 2013; and Sarmento and Renneboog 2016.

infrastructures seem at risk of failing (2009), in order to remedy long histories of neglect and deficient infrastructure service in rural regions in Peru.

Luz Solar Andina (hereafter LSA) operates a rural solar energy program in the Andean region of Cajamarca, called *Casa Solar*, considered by energy industry and development experts to be among the most exemplary energy initiatives in the country. This NGO's small-scale project prioritizing community engagement has inspired Peru's beleaguered *proyecto masivo*, a public-private partnership aiming to electrify 150,000 rural homes nationwide via off-grid solar energy. Yet, problematically, the *proyecto masivo* attempts to replicate LSA's success nationally while utilizing a program model that is fundamentally different from that of LSA. While LSA alone carries out all the social, technical, and financial components of *Casa Solar*, in contrast, the *proyecto masivo* divides these responsibilities between public and private entities. Ergon Peru (hereafter Ergon), the private energy company involved in the *proyecto masivo*, is responsible for installation of the solar home systems (hereafter SHS) and all technical service related to them. The different public energy distribution companies throughout the country are responsible for carrying out all customer invoicing and bill collection aspects of the program.

This paper explores how the state's lack of understanding of the many ground-level challenges of off-grid solar energy provision are manifested in the design of the *proyecto masivo*. The arguments made in the following pages regarding the logistical obstacles and social nuances of energy service and operation have been informed by participant observation of LSA as it carried out operation and maintenance of its *Casa Solar* energy program, as well as four months of ethnographic work carried out in a highland community of Cajamarca, served by this same solar energy program. I argue that the narrow technical and financial role outlined for the private company Ergon has overlooked the interrelated logistical and social challenges of providing

ongoing solar energy service in isolated rural communities. The social challenge for Ergon will be explaining SHS function and payment rules to residents who have never before had access to electricity. The logistical challenge is that the company must engage in costly and laborious trips to reach isolated homes located across vast, rugged terrain to conduct SHS maintenance and service. That is to say, the social component, the company's ability to teach residents the uses and limits of SHS, as well as payment rules, will affect the rate of SHS misuse and also residents' rate of payment/delinquency/default for energy service, ultimately influencing Ergon's logistical operations. The ethnographic findings presented in chapter two of this dissertation project support the idea that energy users' "sense of ownership" of the program increased their commitment to making their recurring payments for solar energy service. Relatedly, the rural *campesinos* that I interviewed described how this sense of ownership led them to feel that their financial cooperation with the program, by consistently paying their bills on time, was a crucial component to *Casa Solar's* success, equally as important as the performance of their solar home systems (SHS) and the technical service provided by LSA itself.

In this chapter I argue that the energy service model designated by the *proyecto masivo* burdens public distribution companies with new responsibilities that they are reluctant to engage in and will cause them financial deficits. Successful PPP contract design necessitates that program risk be adequately allocated between the public and private sectors, allowing the public sector to fulfill its needs while giving the private sector flexibility to innovate. Instead, what is often seen, is limited communication or collaboration between sectors, with each taking an adversarial position toward the other (Domingues and Zlatkovic 2015). In the case of the *masivo*, the program's success hinges upon these private and public actors' ability to carry out energy service in coordination with one another. Rather than adversarial relations, this auction design simply

allows Ergon and public actors to operate independently and with indifference towards how the other performs their partnership responsibilities.

Background and Current Status of Proyecto Masivo

In 2013, Peru's Ministry of Energy and Mines (hereafter MEM) announced its first public international auction for off-grid solar energy which was awarded to Ergon in 2014 with the goal of providing solar home systems[57] (hereafter SHS) to 150,000 rural households in the north, central, and south regions of the country where the national electric grid has not reached (OSINERGMIN 2016). The solar energy program that resulted from this auction award, often called the *proyecto masivo,*[58] requires that Ergon design, procure, install, and provide operation and maintenance of these SHS for a period of 15 years.[59] This business model also involves the participation of public energy distribution companies. The public distributors will carry out the customer invoicing and billing for the energy service that the private operator, Ergon, provides. Essentially, Ergon will install solar energy at the individual household level, as well as provide maintenance and operation for these SHS, as if it were a contractor working for the local public distribution company (Orosco 2014).

[57] According to the technical specification of the auction, Ergon must equip households with pole-mounted, (12V/DC) solar home systems, which consist of (1) solar panel no smaller than 85W, (1) sealed battery no smaller than 90Ah, (1) charge controller no smaller than 10A, (3) LED lights not to exceed 10W, (1) light switch, and (1) electrical socket. Rough estimates of daily uses of SHS of these specifications include: (3) 10W LED lights for 8 hours, (1) radio for 6.5 hours, or (1) black and white TV for 3.5 hours; as well as cell phone charging.

[58] *Proyecto masivo* is the term commonly used to describe the off-grid solar electrification program that resulted from the "International auction for the supply of electricity with renewable energy resources in areas not connected to the grid", first announced in September, 2013. (*Subasta internacional para el suministro de electricidad con recursos energéticos renovables en áreas no conectadas a red*).

[59] This is known as a BOOT model whereby the contractor builds, owns, operates, and then transfers the infrastructure equipment back to the state upon contract fulfillment (Delmon 2011).

In this business model 80% of customers' monthly solar energy costs are covered by a national cross-subsidy called FOSE (Electrical Social Compensation Fund). [60] Customers make a fixed monthly payment representing nearly 20% of the established solar tariff, while the difference is covered by another subsidy called FISE (Fund for Energy Social Inclusion).[61] This PPP business model has been intentionally designed to isolate the private company, Ergon, from the financial risks involved in billing rural energy customers. Thus, Ergon receives its monthly FOSE subsidy payment regardless of whether the end-user pays their bill for the corresponding month (Orosco 2014). The FOSE subsidy will cover 80% of the total annual financial remuneration amount Ergon submitted for its energy auction bid; this subsidy will also compensate the public electricity distribution companies for their activities involved in issuing invoices and collecting payments.

Although the *proyecto masivo* was awarded to Ergon in late 2014, it has since fallen far behind schedule. According to the auction agreement, 150,000 SHS were supposed to have been installed by late 2016 (OSINERGMIN 2014). These setbacks have been caused by the design flaws in the original auction framework. The auction's stipulated timeline reportedly gave Ergon insufficient time to carry out a nationwide census and registration of the potential 150,000[62] rural energy customers. Additionally, the technical requirements for SHS design were reportedly vague and led to conflicts between MEM and Ergon regarding the use of certain system components. These complications resulted in a drawn-out arbitration process in which Ergon was eventually vindicated on both issues. This judgment allowed Ergon more time to carry out the necessary

[60] FOSE is a cross-subsidy where energy customers (generally located in poor rural areas) consuming less than 100 kWh of energy per month receive a discount that is financed by those consumers (gene rally located in urban areas) using more than this amount of energy per month (OSINERGMIN 2017a).
[61] FISE is subsidy intended to benefit the most vulnerable sectors of Peruvian society that is supported by taxes on the sale and transportation of various forms liquid hydrocarbons (FISE 2017).
[62] The framework for the *proyecto masivo* was initially designed to reach 500,000 off-grid rural customers, with a minimum benchmark of 150,000 customers, before continuing to the full 500,000. However, after the two arbitrations and implementation delay, the contract between Ergon and MEM has been revised downward to 150,000 total customers.

census work without incurring a penalty for violating project timelines and it also allowed Ergon to use a piece of technical equipment that served the same function as the component MEM insisted on. At the time this research was completed in late 2017, only 2,000 SHS had been installed in each of Peru's north, central, and south regions, totaling 6,000 SHS installed nationwide. Much like the rushed timeframe given for census and registration, it was said that installing these few thousand SHS was "a kind of political goal. The idea was to start with a symbolic amount…and that the President (Humala) could inaugurate the project, they were called the 'two thousand for the (inauguration) photo'".[63] So, while these SHS have been "inaugurated," to bring positive attention to then-president Humala's out-going administration, they have not undergone technical inspection and been officially recognized by the Ministry of Energy and Mines. As such, the 6,000 households with installed SHS have not been required to pay for monthly solar energy service since their installation in early 2017.

It is well known among those working in the energy industry and other related sectors in Peru, that the *proyecto masivo* has been beset with complications and is well behind the expected project timeline. While the *proyecto* has garnered praise from some energy industry officials, it has also been critiqued by experts and officials across nearly every sector linked to energy and development. Some of the general points of contention bear mentioning, as they help illustrate the critical landscape surrounding the *proyecto masivo* more broadly. Most prominently, the *proyecto* has received criticism for what experts believe were the political and economic motives for its creation. Many respondents that I interviewed[64] asserted that the *masivo* was born of former

[63] Octavio Díaz, interviewed by author, October 17, 2016.
[64] Octavio Díaz, interviewed by author, October 17, 2016.
Santiago Salgado, interviewed by author, July 27, 2017.
María Álvarez, interviewed by author, December 7, 2016.
Gerardo Porres, interviewed by author, October 30, 2016.
Carla Saenz, interviewed by author, August 18, 2015.
Eduardo Jiménez, interviewed by author, July 10, 2015.

President Ollanta Humala's desire to complete the project by the end of his political term in mid 2016. It was reportedly[65] rushed forward by bureaucrats at the Ministry of Energy and Mines as a politically expedient and innovative business initiative, rather than on the merits of its technical design. Critics of the origins of *proyecto* were quick to point out the stark mismatch between the presidential political cycle (2011-2016) and program implementation of this magnitude. The political and business incentives of accelerating this project to completion by the end of Humala's term simply did not match with the protracted technical exigencies of carrying out the *masivo*. For example, officials experienced in planning rural electrification programs claimed that locating and registering half a million potential energy customers across isolated rural areas of the country would alone take one to two years to carry out. The timeline established in the *proyecto masivo* framework allowed Ergon just four and half months.

Moreover, the MEM has been critiqued for designing the *proyecto masivo* auction without coordinating with other state ministries, nor consulting with domestic universities. It has been observed that coordination between various ministries and agencies, as well as political leadership from multiple sectors rather than a single champion of an initiative, is required to create a healthy climate for PPPs to emerge (Delmon 2011). Relatedly, many countries have established PPP units dedicated specifically to helping "ensure that the necessary capacity to create, support, and evaluate multiple PPP agreements exists" (OECD 2010, 11). In contrast, suggesting a very fragmented approach to development initiatives in Peru, many interviewees[66] bemoaned the

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Horacio Magdelena, interviewed by author, November 2, 2016.

[65] María Álvarez, interviewed by author, December 7, 2016.
Gerardo Porres, interviewed by author, October 30, 2016.

[66] María Álvarez, interviewed by author, December 7, 2016.
Carla Saenz, interviewed by author, August 18, 2015.
Horacio Magdelena, interviewed by author, November 2, 2016.
Gerardo Porres, interviewed by author, October 30, 2016.
Humberto Moreno, interviewed by author, January 31, 2017.
Esteban Ramos, interviewed by author, December 7, 2016.

complete lack of coordination with other ministries, such as the Ministry of Education and Ministry of Health, even though schools and medical posts will be provided SHS as part of *proyecto masivo*. Professors from both engineering universities and technical institutes remarked that no one in their field had been consulted, despite their expertise and abilities to have provided input on the technical specifications of the public auction. Relatedly, MEM personnel were broadly perceived by many officials that I interviewed as unfamiliar with cutting edge renewable energy technology, and that the technical requirements outlined in the auction framework were too ambiguous and incorporated out of date SHS technology.

"The auction contract is not well done": Conflicting Views on the Proyecto Masivo Design

While I sat comfortably in an air-conditioned conference room in a Lima office of Peru's Supervisory Agency for Investment in Energy and Mining (hereafter OSINERGMIN), a tariff specialist named Daniel Montenegro, explained the various energy tariff categories and subsidy mechanisms that were being projected onto the presentation screen, with enthusiasm and convincing detail. The solar tariffs that rural customers were to be charged and the subsidies that were to be applied to support private sector involvement in the *proyecto masivo*, all seemed to add up and make logical sense, especially given his clear understanding of the subject and impassioned descriptions. However, when I pressed him about how these subsidies would actually be deployed on the ground by companies providing energy service, such as maintenance and operation responsibilities, and how the social aspects of the program would be conducted, especially customer billing, he revealed his honest and optimistic criticism of the *proyecto masivo*. Acknowledging the conflicting opinions that I had heard from other industry experts regarding its

faulty design, he said: "…right now you see that there are…problems with the investor, the auction contract is not well done…Maybe if there is another [auction] all these problems will be avoided. Like every project, when it's the first time, it hurts, and the second time it will be easier; and I think this is the first time in the world this type of investment contract is being carried out at all cost and that's what this is."[67] Despite Montenegro's confidence in the underlying subsidy mechanisms, this brief statement recognizes not only how the *proyecto* has become ensnared with arbitrations and project delays, but of graver consequence, that controversies surround the service model of the auction.

This section explores the logics behind the state's decision to separate energy service responsibilities between the private and public sector in providing off-grid solar energy in Peru. Examining this specific issue serves as a window into how the Peruvian state views its own role, as well as that of the market, in providing infrastructure as a means to overcome the historic social and economic exclusion of its rural populations. To begin to understand how the *masivo* design reflects the state's underappreciation of the social component of rural solar energy provision, it is helpful to first see how the registering of potential energy users (*empadronamiento*) was carried out. The auction contract, relying on the private sector's supposed logistical expertise, stipulated that the bid winner, Ergon, would carry out the massive undertaking of identifying and registering 150,000 rural residents for the *proyecto*. For NGO leaders like those from LSA, whose program success the *proyecto masivo* aims to replicate, registering potential energy customers means that their workers explain to residents what they are being asked to sign up for, not merely ask them to put their name on paper to demonstrate community support of a development initiative. Moreover, in the eyes of the socially-focused LSA, registering users requires not only conveyance of project

[67] Daniel Montenegro, interviewed by author, November 22, 2016.

parameters, but also that the person who signs their name has a degree of understanding and approves of what is being proposed to them.[68]

Octavio Díaz, a former MEM official and one of the main architects of the *masivo* auction itself, explained how the *proyecto* model had reportedly planned for awareness raising efforts to be carried out with the communities prior to the registration of potential users. These explanatory workshops were supposed to be coordinated by the state with logistical support of the public electricity distribution companies. However, the project awareness activities never happened and Ergon carried out user registration without these prior activities having been conducted. Given the immensity of the registration task and the short time frame given for its completion, it is safe to assume that these 150,000 residents have signed up for energy service through the *proyecto masivo* with little to no understanding of what the program actually entails. The state's failure to comply with its supposed commitments at the outset of the *masivo* is reflective of how social elements of energy service, like explaining the technical and financial workings of the program to customers, are regarded in the auction design. As we will see throughout this paper, the *masivo* auction treats the private company and public distributors as entirely separate actors. There seems to be little recognition that social aspects, like rural residents' understanding of SHS operation, will affect the financial aspects of the program, such as the rate of bill payment or delinquency. Similarly, the *proyecto* design does not acknowledge a connection between how residents' comprehension of the SHS operation and financial rules of the program, may influence operation and maintenance activities, such as cutting/reconnecting power to SHS or repair SHS from misuse and abuse. Instead, as I discuss below, the *masivo* auction's division of program responsibilities treats these

[68] Irene Nogales, interviewed by author, August 2017.
Carla Saenz, interviewed by the author, July 2017.

social issues as challenges that can be addressed in passing by Ergon, or handed over to an ill-equipped and unwilling state apparatus.

Helping to shed light on the Peruvian state's justification for separating program responsibilities between private and public entities, Octavio Díaz offered a narrative that revealed how the auction design was driven predominantly by economic motives, that on one hand, intended to allow the private company to do "what the private company knows how to do," and on the other, delegated the social component of energy service, the billing and collection, to the state's public energy distributors, saying that "solving this social dimension corresponds to the state." When asked directly about why the auction was designed in this manner, Díaz responded:

> There is an economic logic behind this. The private (company) is good at generating profit,…knows how to manage procurement issues, engineering…logistics, contracting, outsourcing. This is their strength…If you ask a private (company) to be efficient in handling social issues, it takes them away from their focus.

He seemed confident about the private sector's ability to comply with the auction's technical, logistical, and administrative requirements, as this was their area of expertise. Simultaneously, he was fully aware of the immense social challenges related to habituating rural residents to making monthly bill payments, which had been intentionally allocated to the public sector. From what he expressed, the top priority of the auction was clearly to allow the private company to operate within its area of purported competencies, while relegating the state (or other sectors) to fumbling their way in addressing the vexing social element of rural energy service, saying:

> It seems sort of irresponsible, because taking away [the social part] from the private (company) does not mean that the problem disappears, the problem continues, it is a social problem...The state can handle it in a more trial and error way, with social instruments like subsidies, research…the think tanks, or the
> NGOs, are more specialized in social issues.

Díaz readily acknowledged the difficulty in providing infrastructure in poor, rural communities of Peru and the immensity of confronting the social parts of energy service, like getting rural customers to pay, saying:

> The (bill) collection for example, was a subject that was very difficult to demand of a private (company), because it was like, 'hey, you do not know the (rural) reality, the issue of (rural residents') ability to pay.' What we proposed in the auction, could not be demanded from a private (company) at scale…you could ask a private (company) but it would be a project in itself to solve the social problem.[69]

These remarks by Octavio Díaz articulated the state's techno-economic vision of the *proyecto masivo*; one that relied heavily on private firms' supposed business and technology strengths, at the same time depended on the state's (or an outsourced NGO's) ability to "trial and error" its way through its program responsibilities. However, as Daniel Montenegro from OSINERGMIN said at the opening of this section, the design of the *proyecto* was characterized by novice missteps. As a result, during the opening phases of the *masivo* auction the energy service model outlined in the bid contract did not involve the public sector, instead, it tasked the private company that won the bid with carrying out both SHS installation and maintenance, as well as bill collection responsibilities. Commenting on this, Ulises López, a representative from Norte Renovables,[70] a private firm that submitted a losing bid for this project, had seen various iterations of the auction contract. He described in blunt terms the effect of this earlier auction design, saying that: "the investors got scared; the risk of billing and (payment) collection was off-putting to many investors."[71] A former officer from the International Finance Corporation (IFC), named Natalia González, whose company had shown interest in financing Ergon's involvement in the *proyecto*

[69] Unless otherwise noted, the preceding quotes are from Octavio Díaz, interviewed by author, October 17, 2016.
[70] This is the company's real name, not a pseudonym.
[71] Ulises López, interviewed by author, November 10, 2016.

before ultimately declining to do so, echoed the sentiment that having all aspects of the service model under control of one company posed too much financial risk for a private company. Ultimately, González claimed, the risks that private companies and financial institutions perceived, led the MEM take the duty of billing and payment collection away from the private company and assign it to the public distribution companies.[72] These reports from energy industry and financial experts familiar with the *proyecto* suggest that MEM originally planned for the private bid winner to take on all elements of the energy service. It was not until these outside actors' showed aversion to the initial energy service model that MEM altered the final auction contract. In an abstract sense, capital seemed to boycott the auction until the terms of investment evolved to shield them from risk. As a means to incentivize private firm involvement, MEM drastically limited the private sector's role (and thus, financial liability) in the *masivo*, while correspondingly expanding that of the public sector.

Industry experts such as Ulises Lopez, described to me how public energy distributors already had a logistics and infrastructure presence established throughout much of the Peruvian countryside. And since MEM's original auction contract was found unpalatable to private firms, MEM then reassessed the involvement of the public distributors, suddenly seeing them as the most appropriate entity to carry out the commercial (billing and collection) activities of the *proyecto*. For López, an official from a solar energy firm, the way that MEM had tilted certain *proyecto* responsibilities towards to the public energy distributors, was not in itself a problem. In recognition of the increased logistic complexity of the *masivo*, López described that if public distributors are to be involved, MEM will have to "give them economic resources, so they can hire more people, take on longer, more complex routes, because they (off-grid communities) are less accessible." He

[72] Natalia González, interviewed by author, January 25, 2017.

also pointed towards the contentions around public distributor participation—that these kinds of projects are inherently difficult to administer and that the reimbursement that public distributors receive for their new responsibilities related to the *proyecto* may well prove insufficient, saying that this represents:

> one of the critical points of the development of the project in the next few years, because they (off-grid solar programs) are difficult to manage. As for the ministry…who has to coordinate this, they are requiring [public distributors] do a job from which they have little to gain, and I do not know how well compensated they will be…by the state, and that is a problem.[73]

The above comments by López begin to gesture to the main arguments of this paper—that the *masivo* design reflects the state's unfamiliarity with the difficulties of rural energy provision, and as such, burdens the public distributors with duties they are reluctant to engage in.

Relatedly, Spanish professor and engineer, Cristian Jiménez, who collaborates with Peru's National University of Engineering (UNI) on solar research, described a principal tension in the design of the *proyecto masivo* auction alluded to in the above paragraphs. It isolates the private company from financial risk, while straddling the public company with obligations likely to incur debt, which ultimately perpetuates a simplistic binary understanding of private and public capabilities in providing infrastructure. He said of the *proyecto masivo* energy service model, which divides responsibilities between Ergon and public distributors:

> this a mixed model—what generates profit is left to the private company, but what generates damage and deficit, is left to the public company. So this way, we will always be complaining about the public company, if the difficult part of this project, that has less benefits and sends you looking for the customers to pay you, when you know that they (rural customers) are also poor and have no resources; then we think that it is the public company that does not fulfill its mission.[74]

[73] Ulises López, interviewed by author, November 10, 2016.
[74] Cristian Jiménez, interviewed by author, November 30, 2016.

What is more, critics of the *masivo* design have also highlighted that the way that private and public responsibilities have been allocated, will likely generate discord in the partnership; that the entities involved cannot simply operate independently, but must work well together for the whole *proyecto* to function cohesively. Santiago Salgado, a former official from MEM who worked on rural electrification programs funded by the World Bank, called out one of the principal designers of the *proyecto masivo* for designing an auction model that lacks coherence between the private and public roles, stating "if the public (distribution company) part doesn't work, what the hell does the private (company) do? There everything gets screwed. [Octavio Díaz] does not understand this—it's a public-private *partnership*, the state and the private (company) are partners…the two parts need each other."[75]

The above commentary begins to bring into focus why the *proyecto masivo* auction was designed to divide program activities between public and private actors and the resulting contentions surrounding this service model. We know that the auction initially placed all aspects of energy service in private hands and only upon frightening investors with billing and collection duties did the MEM alter the auction contract. The final auction framework greatly isolates the private company from financial risk by limiting its responsibilities, while placing the billing activities under public control. Despite their experience with grid energy service in rural areas, given the immense social and logistic challenges involved with off-grid solar energy, the public companies will need considerably increased human resources and financial compensation to fulfill their added responsibilities, an issue that remains undefined and in question. This is all to say that this partnership appears to be disjointed, having elected to privilege a private company's so-called expertise in the narrow ambit of technology installation and maintenance, while offloading the

[75] Santiago Salgado, interviewed by author, July 27, 2017.

undesirable and challenging program elements onto the public distribution companies. This next section delves further into the ground-level challenges that the private company Ergon will face in carrying out its obligations of the *proyecto masivo*.

"The solution would be provided by the market": Ergon and Rural Solar Energy Provision

Riding along with the technicians from *Luz Solar Andina*, the NGO whose program largely inspired the *proyecto masivo*, I had the chance to experience the grueling work[76] that is off-grid solar energy service. After a two and a half hour drive out of Cajamarca, mainly on bumpy, unpaved dirt roads, we arrived at a small school, where we parked and got out of the 4x4 truck. From there, locals told us, we could follow a trail to reach the house of an energy customer whose faulty SHS battery the technicians were scheduled to replace. During the 30-minute hike, the technicians, the driver, and I alternated carrying the 80 pound battery on our backs, down a narrow foot path that ascended and descended with the rugged Andean terrain, snaking our way around and down into a deep valley. Even though both the driver (who was not required to assist the technicians) and I helped transport the battery, it was still a physically exhausting endeavor. As we approached the house, we called out for the owner but she was nowhere to be found. After yelling for her for a few minutes, she appeared and hurriedly made her way down from over the hillside. We then warily snuck past the family's dog, who barked aggressively, guarding its newborn puppies, only relenting when its owner shushed it. The homeowner then led the technicians inside and they switched out the faulty battery for the new one. Once again facing the

[76] Various energy officials that I interviewed recognized the arduous nature of providing off-grid energy service in isolated rural communities, describing it as "ant-like work" (*trabajo de hormiga*). However, their use of the term in this context harkens back to Peruvian scholars such as MarioVargas Llosa, who has described Peru's indigenous communities as "ant-like societies" (1990, 51) and views "contemporary highland peasants as outside the flow of modern history" (Starn 1991:64).

burden of carrying the old battery to the truck on our shoulders and backs, this time up valley, we kindly inquired if the homeowner might lend us a donkey to carry the battery. She agreed and quickly made her way up the hill surrounding her house and brought down a donkey that had been grazing, hidden out of sight by trees and shrubs. After loading the battery on the donkey's back and securing it with ropes, the homeowner accompanied us as we made the 45-minute hike back up to where we had parked the truck. This small maintenance operation involving a 4x4 truck, diesel fuel, a driver, two technicians, replacement equipment, and a borrowed donkey, took nearly two hours to complete and is representative of the daily challenges of maintaining and operating SHS in rural Peru. While some maintenance operations are simpler because a customer's home may be located close to the main road or not require replacement of heavy equipment, other trips are even harder than the one outlined here. In the case that residents are not home when technicians reach their house, the same arduous trip, similar to what is described above, must be carried out again on another day. The following section explores how the *proyecto masivo* design simultaneously reflects the Peruvian state's lack of understanding of off-grid solar energy provision, such as those described above, and its trust in market forces to solve technical and logistic challenges associated with the *proyecto*. Despite the auction contract that attempts to shield private firms from risk, the *masivo's* service model will nonetheless generate conflicts for Ergon in carrying out its operation and maintenance duties.

The *proyecto masivo* auction was designed, not with the nuances of rural energy service in mind, but as a technical and financial initiative to attract private investors. Studies on energy auctions have shown that setting very rigid or very lax requirements for auction participation by investors can create trade-offs (IRENA 2016). Setting a high bar for applicants can minimize the number of bidders, which can harm competition and possibly lead to more elevated prices. In the

opposite case, setting a low bar for requirements may lead to applicants who may be less qualified and eventually lead to project delays (2016). The *masivo* has shown to be an example of the latter. An official from the state energy regulator, OSINERGMIN, and president of committee that designed the *proyecto* auction contract, Manuel Rodríguez, described how the contract outlined low technical requirements and allowed the market to define the appropriate technological characteristics to be deployed in the *proyecto*, saying that the "Ministry (of Energy and Mines)…defined a very traditional technology, in terms of batteries requirements, and then (the contract) evolved, so that the (technical) solution would be provided by the market." This statement not only lends strength to the criticism, noted earlier in this paper, that MEM is unfamiliar with cutting edge solar energy technology (or is indifferent to it at best), but also that it allowed market actors to largely dictate the specific technical details of the batteries, the most expensive and crucial component to SHS performance and sustainability. Rodríguez went on to elaborate about the effect of setting high requirements on auction contracts and how he approaches risks and guarantees. He said: "From the experience that I have, as soon as you put up more barriers, you end up with few bidders. It's as simple as that. I prefer to pass the risk on to whoever is going to assume [the *proyecto*] and I put in…guarantees for those who submit bids." This means that the state set low barriers for bidders, allowing them, for example, to present bids utilizing SHS technology of their choice, taking the risk that their chosen technology will perform robustly over the course of the 15-year contract commitment. Meanwhile, the state offered the bid winner a guaranteed subsidy (FOSE) for each of the 150,000 households that receive solar energy, regardless if the homeowner pays their monthly bill.

Yet, as we will see, Rodríguez' statements indicate that on one hand, the generally lax requirements of the *masivo* auction were intended to attract many bidders, and on the other, there

was an expectation that this approach would also garner bids from serious energy companies. He said:

> We were looking for people who had the experience of having done this. Not anyone can get involved in this business. So if for example, they already had done [projects] in India, they know how to deal with communities, know how to deal with rural areas. In…Peru, what we...do not want is a company that comes to gain experience in this, they should already come with experience.[77]

Instead of a veteran of off-grid energy provision the *proyecto masivo* was ultimately awarded to Ergon Peru, a subsidiary of the Italian-based holding company Tozzi Green—a company with no prior experience working in Peru, nor any prior experience carrying out rural, off-grid solar energy programs.[78] Tozzi Green formed Ergon expressly for the purpose of submitting a bid for Peru's *proyecto masivo* auction;[79] however, Tozzi Green began focusing on renewable energy in the 1990s, and since then has conducted *grid-tied* renewable energy projects in Italy, Madagascar, and South Africa. It bears mentioning at this point that the former MEM official and one of the two main architects of the *masivo* auction contract, Octavio Díaz, began working for Ergon after it won the auction as its head representative in Peru. While it is not the purpose of this paper to question the motives or the ethics of this career move, this helps us understand how the MEM views off-grid energy provision, as reflected in the *masivo* auction drafted by Díaz, and how Ergon sees these same challenges, are in many respects, one and the same.

[77] Unless otherwise noted the preceding quotes are from Manuel Rodríguez, interviewed by author, December 12, 2016.
[78] Octavio Díaz, interviewed by author, October 17, 2016.
[79] Ergon is what is referred to as a "special purpose vehicle" (SPV) which is created as a "legal entity that only operates and owns one specific project/concession during the contract period" (Sarmento and Rennenboog 2016, 102).

Energy industry experts across the NGO, public, and private sectors have all voiced criticisms that Ergon, a subsidiary of a company with no experience in this type of solar program, headed by a former MEM bureaucrat, does not have a true grasp on the challenging realities of off-grid solar energy service in rural Peru. Carla Saenz, the manager of LSA, noted that Ergon's financial interests in the *proyecto* have likely exceeded its actual understanding and capability to carry out the job. In one particular interview, repeating what I had heard from others, I asked her if perhaps Ergon had been intentionally misled into submitting a bid, she replied: "We didn't think it was a scam but rather over enthusiasm…seeing all the money involved on paper; without experience in this kind of project and all the difficulties that arise and the true costs…involved."[80] Doubts about Ergon's comprehension of the exhausting on-the-ground work that household solar energy service entails, also came from the private sector. Ulíses Lopez, of Norte Renovables, illustrated a rural solar energy scenario outlining the challenges of the *proyecto* that Ergon seems unaware of, saying:

> To do an installation in a user's house, for example, you may have transported a battery that weighs 30 or 40 kilos on a mule…a panel weighing 15 kilos more, and you arrive after a walk of several hours, and [the homeowner] isn't there, because he is visiting his family…or he has a second home a few kilometers away and he has gone there for two months. And then you're stressed; when you went [there] two months ago this person said yes, but when you go there…you have no way of notifying [homeowners] beforehand. There are a ton of things that we could analyze— risks, logistical complications—which make this project a unattractive, both for their size and for all these logistical difficulties, for large companies.[81]

Comments such as these demonstrated that López' understanding of energy service in isolated communities of the Peruvian highlands is not without nuance. What makes this statement all the more interesting is that his company, which has in fact participated in the installation and operation

[80] Carla Saenz, interviewed by the author, August 18, 2015.
[81] Ulises López, interviewed by author, November 10, 2016.

of SHS in rural Peru, lost the *masivo* auction to Ergon. What is more, Ergon's bid was half the amount of Norte Renovables'. Which means that Ergon has bet that it can profitably procure, install, operate, and maintain 150,000 SHS across Peru, for half the annual cost that was proposed by Norte Renovables, despite Ergon's complete lack of prior experience with off-grid solar provision in rural settings. Alternately, Ergon's low bid may in fact prove to be an example of what is known as the "winner's curse," a situation where the auction winner ends up making negative profits. This can result from the company's perception of an extremely competitive auction environment, leading to the submission of an overly aggressive bid proposal (IRENA 2016). While speculating on Ergon's business strategies is outside the scope of this chapter, the company's drastically low bid, in combination with its inexperience with off-grid solar provision, suggest that the company may have misjudged its competitive environment, be using less costly SHS components, believes it can operate with very slim profit margins, or simply does not fully grasp the challenging nature of its role in the *proyecto's* service model.

"Hey, Ergon, cut their power": Fees for Cutting and Reconnecting SHS Power

Another element that gives cause for concern is Díaz's simplistic view regarding Ergon's role in providing maintenance and operation of SHS. He paid no attention to the difficulty of sending technicians to cut power of a single SHS of a homeowner that has fallen behind in payment. Even more troublingly, his "indifference" towards whether or not a customer pays, revealed that he sees Ergon as an independent, technical actor, with no recognition of its partnership with the public sector, nor the public distributors' efforts at bill collection. He said:

> Ergon, what it does is installs the (solar home) system, it makes sure that the system is operational, whether the user pays or doesn't pay, Ergon is indifferent. Complying with its obligation, Ergon has to keep [the SHS] operative. If at any time the (public energy) distributor says "Hey, Ergon, cut their power," at that

> moment Ergon cuts off power, but the amount charged to cut power is not included in the operation, it is a separate charge.[82]

Perhaps the greatest consequence of Ergon's underestimation of rural energy service is related to how the *masivo* has been designed to financially compensate Ergon for its activities related to cutting power, reconnecting power, and removing SHS from households. This important detail is touched upon only briefly in the auction contract, which states: "The Investor has the right to the corresponding remuneration for the disconnection and reconnection of the Autonomous RER [Renewable Energy Resource] Installations. The charge for disconnection or reconnection will be set by OSINERGMIN" (OSINERGMIN 2014, 60). While Ergon was allowed to set its annual required remuneration amount through its bid proposal for the *proyecto masivo*, the state's energy regulator, OSINERGMIN, establishes the fixed amounts that Ergon will be allowed to charge rural energy customers for certain required energy services. These include how much Ergon can charge customers for cutting power and reconnecting power to their SHS (usually only billed upon reconnection), as well as reimbursement fees for having to reinstall SHS in another community if the national electric grid expands into Ergon's zones of operation. A former MEM official with close knowledge of the *proyecto masivo* contract highlighted the problem of some prices being set by the bidder and others by state regulators, saying: "The big defect that I see in the auction…in which all of [the private companies] competed, is that it doesn't take into consideration the cutting (power) and reconnection… as you know, it's paid at the price set by OSINERGMIN."[83] To emphasize

[82] Octavio Díaz, interviewed by author, October 17, 2016.
[83] Santiago Salagado, interviewed by author, July 27, 2017.

the dramatic financial and logistic implications of cutting/reconnecting SHS power for Ergon, he went on to reference the experiences of LSA, saying:

> [LSA] is important, because…this year it's made an average of 1,000 cuts (to SHS power) and reconnections…we are talking about 25% of its (total number of) customers. That it is no small thing. I think that Ergon believes it's going to make a few (cuts to power)…but imagine if it has to cut and reconnect 20,000, 30,000 (customers)? It will not be an insignificant (financial) amount, because, [Ergon] thought it was going to have a very small number of incidences…So, the big problem of the auction…model, is that it combines seemingly firm revenue streams (from the FOSE subsidy of 150,000 customers), but unfortunately [Ergon has to] keep carrying out operations that are [financially] regulated by [OSINERGMIN], but as a private (company) will not necessarily accept them.[84]

Cutting and reconnecting SHS power is an arduous, two-step intervention. It involves sending a technician to first cut power to a SHS whose owner has fallen behind on payment, then once the customer pays their outstanding debt, sending a technician back to the same household to reconnect power to the SHS. Regardless of the difficulty of this multipart task, LSA for example, can only charge a customer the OSINERGMIN-regulated fee of 12 Soles (roughly $3.75). Given this low remuneration amount, the detailed accounts of the physical logistics of rural energy service offered above, and the potentially high number of cuts and reconnections that Ergon may have to carry out, the same MEM official went on to say: "I bet you that there will be problems when [Ergon] begins to operate, because [Ergon] will begin to complain, to fight because they do not like the [remuneration] values, and it's going to happen."[85] This issue of cutting power for late payment and reconnection once a customer becomes caught up on their bills, shows not only a weakness of the *proyecto* auction, but also the degree to which Ergon does not understand the true costs involved in maintaining 150,000 SHS in operation. This is a weakness because the *masivo*

[84] Santiago Salagado, interviewed by author, July 27, 2017.
[85] Santiago Salagado, interviewed by author, July 27, 2017.

auction required bidders to submit proposals without them knowing the exact remuneration levels for cutting and reconnecting power to SHS, an activity that, based on LSA's experience, will likely take up a considerable portion of their time and resources. As for Ergon, it appears that they have an underappreciation for the financial and human resources necessary in cutting/reconnecting power, and most importantly, little acknowledgment of how the corollary role of the public sector will greatly affect its customers' rate of payment and default, which in turn, will affect the number of cuts and reconnections it will be required to carry out. This discord between the potential operational commitments of solar energy service and state-mandated levels of remuneration for these activities, is illustrative of the sort of contract design flaws that can eventually lead to contract renegotiation. While it is not the aim of this chapter to thoroughly explore all the causes of and remedies for potential contact renegotiation of the *proyecto masivo*, it is worth placing these conflicts in context, since "contractual renegotiation has typically been seen as undesirable and reflecting the inefficiencies of contracts since it imposes high transaction and social costs and may induce opportunistic behaviour of both private and public parties" (Domingues and Zlatkovic 2015, 206). More broadly, when renegotiations occur they contribute to the general perception that private sector involvement in infrastructure services leads to poor outcomes. This perception can cause the general public to lose support of private infrastructure provision and, given governments' budget restrictions and growing reluctance to provide public services, can ultimately lead to fewer viable alternative forms of infrastructure provision (Sarmento and Renneboog 2016).

"Exclusively on the technical side": Technology, Community Engagement, and Subsidies

True to the intention of the *masivo* auction design, Ergon's representative, Octavio Díaz, demonstrated a heavy reliance on technology performance and receipt of the FOSE subsidy to

shield Ergon from financial risks of the *proyecto.* Additionally, the company is further protected from risky program activities, which have instead been allocated to the public sector. Confident in its limited technical role and buttressed by the FOSE subsidy, Díaz seemed incapable of connecting the dots between how the customers' grasp on SHS function may drastically influence Ergon's ability to carry out its own responsibilities and ultimately, affect its bottom line, saying:

> In the case of ERGON, the…responsibility is very focused on the technical part, in fact, I would say exclusively on the technical side. So, to the extent that [Ergon] has sufficient trust in the (performance of the) equipment it's installing… in the sense that you are installing equipment that you trust and will not generate (problems)…Based on that you can say with confidence, "I don't care how far [away customers] are," because if [regulations] give me 5 days, 6 days to get there, I know that when I go, it will not be a problem that I have to replace the panel, or replace the battery, because those cases will be the minority. Most (problems) will be…generated by misuse by the [customer], and a problem of misuse, is no longer the fault of the equipment, you understand? In that sense, the remuneration it is not affected…you have [FOSE subsidy] guaranteed.[86]

This narrow view of rural energy provision expressed by Díaz is reflective of the *masivo* auction itself, which offers only vague guidelines about the private company's responsibilities for explaining energy service to customers. Out of the 108-page contract, only the following two paragraphs dictate how the private company ("Investor") must engage with rural residents ("Users") about energy service and bill collection by local public distribution companies ("Distributor"). The contract stipulates:

> The Investor taking into consideration the profile of the User and the characteristics of the zone of influence (such as, for example, language, customs, among others), will have the necessary training information material to be handed over to the Users, for the use, maintenance and preservation of the Autonomous RER [renewable energy resource] Installations, as well as the operation of the technical service and the function of the Distributor.

[86] Octavio Díaz, interviewed by author, July 24, 2017.

> The Investor will give training and information to the Users regarding the installations, will give them the installation certificates, the instructions for use, and the handbook of maintenance and will update the users' information during the Time Term of Enforcement (OSINERGMIN 2014, 57).

These ill-defined stipulations not only underscore how the Peruvian state sees the *masivo* through a purely technical and financial lens, but also how various components of the program are treated as if they were unrelated and have no effect on one another. There seemed to be no recognition by Díaz that if community residents do not fully understand the uses and limits of the SHS and the corresponding financial obligations of the program, a vast number of technical issues may arise for Ergon. As mentioned above, the registration of the 150,000 customers was completed without proper information given to these potential energy users. What is more, Ergon treats this social component of service in cavalier fashion, more as preparation for a one-time technical intervention and perfunctory training, than a series of ongoing activities on which the success of the *proyecto* largely depends.

Díaz described the community engagement process that Ergon will conduct, which, shockingly, entirely bypasses direct engagement with community members, primarily emphasizing coordination with local authorities so that these authorities successfully relay the message to townspeople to be in their homes during the scheduled SHS installation date. He said:

> Once registered…in the list of potential users, Ergon carries out an…awareness-raising effort weeks before the installation. This work is done by our installation contractor… in coordination with our community relations area. The activity consists in coordinating with the authorities and local representatives to make them aware of the program and the installation process that will take place. This work is very important operationally for the installation process, because this depends on ensuring the maximum presence of people in their homes for the dates of installation itself.[87]

[87] Octavio Díaz, personal communication, July 10, 2017.

Equally as troubling were Díaz' comments about how Ergon will conduct training to energy customers about *proyecto masivo* energy service. Again, contracted installers will be tasked with explaining to household individuals all technical and financial aspects of the program at the time of installation.

> Additionally…during the installation process in the home, Ergon's installation contractor is responsible for training the user in the use of the system, and providing all the necessary information to the user so that they can…call the corresponding distribution company's call center.[88]

The importance of social aspects of energy service, such as in-depth training workshops to familiarize new customers with program details, have not only been stressed by development officials in Peru and identified in the literature more broadly (Fernández-Baldor et al. 2014; Hancock 2015; Ikejemba et al. 2017; Urmee and Anisuzzaman 2016), but they have also been emphasized by rural energy customers themselves. My ethnographic fieldwork in a small village served by LSA's *Casa Solar* program in the highlands surrounding Cajamarca, called Lahuaymarca, confirmed that residents placed great value on the informational meetings that LSA held in their community prior to the start of solar energy provision. Residents' testimonies, gathered over the course of four months while living in the village, described how LSA's repeated community workshops provided them opportunities to understand both the technical and financial details of *Casa Solar* and gain an overall sense of ownership over the program. Residents of Lahuaymarca were clear that, if given a choice, multiple informational meetings facilitated by energy company representatives with the whole community in attendance, would be preferable to one (or even more) meetings run by local community authorities. Their reasons behind this preference begins to reveal why the *masivo* auction contract's loose community engagement

[88] Octavio Díaz, personal communication, July 10, 2017.

guidelines and Ergon's minimalist approach to conveying program information to residents, may well prove problematic as the *proyecto* takes effect in the future.

Ergon's reliance on contracted installers to first explain the *proyecto* guidelines to local authorities and then task these authorities with spreading word of the program to individual community members is a troublesome approach. This is because rural Peruvian communities, counter to how they are often viewed by outsiders, are not monolithic and more characterized by complex social tensions, rather than social harmony. *Lahuaymarquinos* were plain spoken about their occasional distrust of their own local authorities and their preference to hear about development projects directly from the institution or officials offering them. Additionally, a former village mayor (*agente municipal*) from Lahuaymarca, named Lorenzo Escobar, drew attention to the fact that community leaders are not necessarily the most trusted members of the community. Despite their position of authority, community leaders are often not the most knowledgeable members of their village or even the most educated, as Escobar admitted that he himself was illiterate. Additionally, due to the patterns of rural highland life, whereby many residents travel to larger population centers for medical attention, leave for seasonal work elsewhere or to work land belonging to family members, attend nearby markets and festivals, or simply live in an isolated location in the village, it makes it unlikely that authorities will be able to successfully notify every single household in a given community. As a result, Ergon's dependence on authorities to notify residents to be in their homes on scheduled installation dates, rather than Ergon notifying residents over the course of multiple in-person community workshops, as LSA does, will likely create significant installation challenges for Ergon.

What is more, residents of Lahuaymarca were adamant that, unlike Ergon's approach that entrusts contracted installers to teach homeowners all aspects of the program at the time of

installation, they would better understand new solar energy concepts and financial rules if they were offered multiple, community-wide meetings by the energy company. They claimed that holding multiple meetings would serve various purposes. They would provide residents who were out of town or did not receive notification of previous meetings the chance to attend, they would help residents with low levels of educational attainment to better assimilate foreign solar energy concepts and the program's financial rules and, given the male-dominated culture of the Andean highlands, they would also increase women's chances to learn in-person about the program, instead of through their male partners or sons.

Explaining the technical and financial parameters of the *proyecto* to rural residents is crucial for program success. This is because the national electric grid offers urban residents electricity 24 hours a day, in contrast, the SHS (like those used in the *masivo*) generally only provide rural residents with light and energy for about 5-7 hours a day and only allow the use of DC tools and appliances (Peru's national electric grid uses AC power). Speaking to the crucial importance of community workshops and communicating this information with rural residents, the manager of LSA, Carla Saenz, emphasized countless times throughout our interviews, that if residents fail to truly grasp the uses and limitations of SHS, they will feel disappointed and let down by the SHS energy output and eventually stop making their payments or simply reject the project outright and ask Ergon to remove their SHS.

These community and NGO voices stand in stark contrast with Ergon's stated plans to carry out household trainings as superficially and quickly as possible. Díaz did not show concern for how Ergon's cursory explanations given by contracted installers may lead to residents' poor understanding of SHS performance or misunderstanding of payment rules. Nor did he seem to grasp how residents' misapprehension could lead to misuse of the SHS or cause delinquent

payment, all of which would increase Ergon's maintenance and operation workload. Instead, given Ergon's limited technical role and guaranteed subsidies, Díaz shrugged off worry about the how social elements may affect its operation, saying:

> In our case, there is a guaranteed remuneration…if a user tells us they no longer want (their SHS), the ministry continues paying us. When a user gives up their SHS…we continue to get paid, but we're obligated to take that SHS to another place. It's as if I was being paid for making a SHS available, which is not the same as being paid depending on whether the client wants or does not want the SHS…the project was designed to isolate the 'risk of quantity,' the risk of quantity is isolated in the contract of ERGON, because you have a minimum amount (of SHS customers).[89]

That is to say, the *masivo* has been intentionally designed so that Ergon's base number of 150,000 customers and the corresponding FOSE subsidy is guaranteed. So unlike LSA, who loses the FOSE subsidy for a customer who gives up their SHS or stops paying, in a similar situation, Ergon retains its monthly FOSE subsidy payment, as long as it relocates the SHS to another user. Further highlighting Ergon's restricted, technical role, the state's technology-driven understanding of rural energy provision, and the preference it has given to private actors in the *masivo*, Daniel Montenegro, of OSINERGMIN, said:

> The function of the investor is to simply install and charge, practically, those are the conditions that were in the contract, but [Ergon] is not charging, who charges is the (public energy) distributor… I think it is a sweet deal for the investor, because they are only installing, nothing else.[90]

Despite the overtly technically and financially-minded approach outlined by Ergon, Díaz, still expressed some recognition of the social demands of this project. Seeming to pay lip service to the social concerns surrounding the *proyecto's* service model, he went so far as to recognize them as a general stumbling block that needs to be addressed as part of the *proyecto*. More

[89] Octavio Díaz, interviewed by author, July 24, 2017.
[90] Daniel Montenegro, interviewed by author, November 22, 2016.

importantly, for him, this was an issue that should be confronted by the state, and not by the private sector. He said:

> You realize the social problem, or rather the problem of community development, has both components, a technical component and social component. The issue is that you have to cover both. So, it is bad that it's…seen only as a technical solution, because in the end it is not a solution, it is a good business for a private (company) but it is not the solution.[91]

Addressing criticisms voiced by actors in the NGO sector and advocates of renewable energy in Peru, Díaz finally admitted that the design of the *masivo* essentially punted the billing responsibilities of energy service off to the public distributors and remains a largely ill-defined endeavor, stating bluntly: "So…when [LSA] tells you that this social component is not (in the auction contract), it's true, it's not within the auction, but (it's) within the project, only that it's on the side of the state."[92] That is to say, at the time of the auction award, the process by which distributors were to expand their rural bill collection efforts for the *masivo* was yet to be specifically outlined by the MEM. Again, bringing into sharp relief the effects of the auction design, which has allowed Ergon to view itself as an independent actor whose profits are essentially guaranteed, and not part of a cohesive public-private partnership, Díaz said straightforwardly: "I know…the people of [LSA] said this will not work. If in reality this does not work out well, this dispute will generate problems, but it will not generate problems for the private [company]."[93] On another occasion, he distanced Ergon even from the state's flawed social development efforts, striking an even more critical tone, saying that: "Social awareness, regarding…bill collection and (energy) service is a very critical issue. The social sustainability…does not fall on Ergon but on the state apparatus. The state…is not diligent, does

[91] Octavio Díaz, interviewed by author, October 17, 2016.
[92] Octavio Díaz, interviewed by author, July 24, 2017.
[93] Octavio Díaz, interviewed by author, October 17, 2016.

not do its studies, it does not do its work in relation to [social issues], so there may be problems."[94] And towards the various potential problems that *masivo* may generate for the public distribution companies is what this chapter turns to next.

"The solution for this was left out of the auction": Public Distributors' Role in the Proyecto Masivo

Just outside Cajamarca's historic main plaza, I sat in a plush leather chair in a brightly lit office across from Ángel Ochoa, the director of the public energy distributor, Caxa Eléctrica. This was our third encounter, having interviewed him twice before, yet, his enthusiasm and willingness to talk with me about the policies and practices of energy provision in rural Peru had not waned. On this occasion, what struck me more than his continued openness and eagerness to engage in these discussions, was how woefully unaware he was of the public distributors' role in the impending *proyecto masivo*. This ignorance was not born of laziness or ineptitude, but because MEM was yet to deliver mandates to public distributors regarding their bill collection activities in the *masivo*, despite two years having passed since the award of the auction. In absence of concrete plans for the distributors' role in the program, he offered sketches of how he expected the distributors would fulfill their responsibilities, based on their current operations. Ochoa made it clear he would rather have seen Ergon assume all responsibilities of the *proyecto*. Yet, consistent with his good-humored demeanor, he expressed optimism that distributors such as Caxa Eléctrica will figure out a way to successfully carry out their soon-to-be imposed duties. Although, he lamented that Caxa Eléctrica was even required to be a part of the initiative because, as he said quite plainly, "it's going to generate problems for us." This section shows how the role of the

[94] Octavio Díaz, interviewed by author, July 24, 2017.

public distributors has not been explicitly spelled out in the *masivo* design and demonstrates that public distributors are apprehensive that these new activities will bring financial and logistic challenges, as well as increased debt upon their operations. These interviews also suggest that the auction was in some ways, based on the false premise that both the private *and* the public distributors would have equal motivation to fulfill their energy service duties in the *masivo*.

Speaking with both current and former officials from Peru's MEM, it was clear that the *masivo* auction had left the details of the public energy distributors' roles in the program largely undefined, and that the state was still lagging behind in determining how they would carry out the duties stipulated in the auction. A MEM official named Héctor Alarcón, who works on productive uses of energy programs in conjunction with a World Bank funded rural electrification initiative, offered a frank assessment of the state's preparedness to tackle the *proyecto*, stating: "If you ask me if the electricity distribution companies are prepared for the task they're being given, I would categorically say no, absolutely not. They could be prepared in the future, if a period of transition is given and they handle it well. They may be (ready), but it's… a tricky task right now." [95]

It is little wonder then, that this MEM official offered such a critical assessment of the state distributors' current capabilities to address the *masivo* duties. Because how these vexing social activities are to be carried out—interfacing with isolated rural communities regarding bill collection, whose residents often have little experience with making recurring monthly payments—was never explicitly outlined in the *masivo* auction. In fact, they were intentionally left vague in the auction contract, with the expectation that the state would find an adequate solution to these socially burdensome responsibilities sometime down the road. Octavio Díaz, was plain-spoken in his description of how its design offered technical, but not social solutions, while

[95] Héctor Alarcón, interviewed by author, January 31st, 2017.

unloading these unresolved problems on an unresponsive state apparatus. He described how the social part:

> is not defined…the solution for this was left out of the auction. It is not that the auction gives the solution for the whole thing. Actually the auction and Ergon offer only a partial solution. Because the problem…the technical problem has been solved, not the social problem. The social problem has been postponed…the idea is that it gets solved along the way…the state has to see, that the problem is what we are seeing now— that the state is a little slow at this. There is a big challenge here.[96]

Perhaps most disconcerting, were comments made by Roberto Miyagi, a MEM official overseeing the implementation of the *proyecto masivo*. At the time of the interview the *masivo* was still mired in arbitration and Ergon had not installed a single SHS, even though the contracted date for installation of all 150,000 SHS had passed 6 months beforehand. Yet, the MEM was still months away from reaching an agreement with public distributors on issues related to bill collection, saying:

> Surely in 2, 3 months we're going to have it clarified. For example, this issue of billing is on the table being discussed, some ideas are being exchanged. The idea, like we've said at the roundtables, is that this project has to have a way forward… to be both profitable for [public distributors] and that it can be financed with the FOSE (subsidy) resources.[97]

In addition to the state distributors' general lack of preparedness and the unresolved details regarding their duties in the *proyecto*, there was an undeniable sense that these new billing activities in Peru's most remote areas, where public distributors do not have established bill collection infrastructure, will surely create challenges for them. Ángel Ochoa, of Caxa Eléctrica, shared his thoughts on the *proyecto masivo* from the standpoint of a public distributor, saying:

[96] Octavio Díaz, interviewed by author, October 17, 2016.
[97] Roberto Miyagi, interviewed by author, November 21, 2016.

> it's going to generate problems for us because it means increasing our…process of collecting [rural residents'] bills…I don't know how [many SHS] there will be in the area of Cajamarca… Because we don't have collection centers in all areas…Even for the residents this can sometimes create a problem—How to get there? Where to go to pay? In certain areas we have collection centers, but not everywhere. I imagine that those parts that do not already have conventional (grid) electrification, we would have to implement some kind of collection center, that will generate costs.[98]

His comments not only made it clear that public distributors will obviously incur new operational costs involved in setting up and operating new bill collection centers, but they also alluded to social elements of rural energy service, whose importance Ergon has seemed reluctant to recognize. His mention of the new logistical demands placed on residents and their potential confusion about where and who to pay for their energy service, speaks to his comprehension of the minute social challenges that have been overlooked both by the *masivo* auction design and Ergon's casual approach to community engagement. Addressing the dreaded social aspect of energy service that the public distributors must confront, he said: "People in the area…they'll have to participate. A [public] worker going there? No. It has to be (someone) from there, because the area is very dispersed, it's very expansive…there are places where it isn't accessible, there are no roads, there are trails, suddenly [trucks] can't get through."[99] He added a general description of the requirements of residents' collaboration with Caxa Eléctrica's rural bill collection, saying:

> Someone from the area will be hired, but with certain requirements, including a guarantee, because it's money, right? Since they're not business people or anything…Generally, they're asked (to provide) a mortgage title, to avoid collecting the money and disappearing; that's happened. Hahaha. Generally, you look for someone who has a business in the area…so that bill collection doesn't mean an additional expense for them… apart from their business they can set up a payment window for these bills.[100]

[98] Ángel Ochoa, interviewed by author, April 4, 2017.
[99] Ángel Ochoa, interviewed by author, April 4, 2017.
[100] Ángel Ochoa, interviewed by author, April 4, 2017.

While he spoke in a positive tone about the increase in public distributors' workload, his description of these rural community collaborations belied his general optimism. As it was precisely these undertakings, dealing with "the idiosyncrasies of the people," as Ochoa called it, which posed a challenge for public distribution companies, that the *masivo* auction dealt to the state and Ergon planned to avoid.

"The public company really has no motivation": Remuneration and the Auction's False Premise

This final section brings into focus how the *masivo* contract mandates that public distribution companies be reimbursed at rates set not by the companies themselves, but at levels established by OSINERMGIN. While state officials claimed these remuneration levels are well-calculated and sufficient, doubt remains as to whether or not this will hold true in practice. Ultimately, the potentially low level of compensation for public distributors suggests that much of the *proyecto masivo* auction was predicated on a false premise. This was the premise that OSINERGMIN-mandated reimbursement would serve as sufficient motivation for public distributors to execute their new partnership role as purposefully as Ergon. As described above, OSINERGMIN's Daniel Montenegro, walked me through tables and statistics, confidently assuring me that state regulator's calculations pertaining to *proyecto masivo* subsidies and remuneration were thorough and indisputable, saying:

> Here is the cost of billing for each province, then we do a weighted analysis to try to get the total cost in each region, north, central, and south. Here is the cost of billing, how much it will cost, how much you should pay to each (distribution) company…everything is supported by…analysis, which…says that the distribution company must be paid for extra activities it performs...Everything is well detailed here.[101]

[101] Daniel Montenegro, interviewed by author, November 22, 2016.

Alluding to public distributors' likely discontent with OSINERGMIN's calculations, Díaz assessed that: "We, Ergon, have a guarantee that we will get paid what we asked for in the auction, but the distributor will not, the distributor has a guarantee that they will get paid what OSINERGMIN says."[102] He went on to rebut Montenegro's assertion, calling into question whether OSINERGMIN's numbers would support the public distribution companies' activities in practice. Not only did Díaz claim that the reimbursement rates are insufficient, but alluded to how the MEM will likely override norms protecting distribution companies, using political sway to compel public distributors into assuming tasks that will put them in the red, saying:

> The problem that…happens a lot in Peru—it's one thing that's written on paper and another what happens in real life. On paper, the public (distribution) company is protected, in the sense that it can reject an assignment. 'Look…you are giving me a commission but…according to what you tell me, my accounts don't add up. So, I reject the order.' But in this case, the [Ministry of Energy and Mines] has exercised its power that it has with public companies and said 'You accept the orders even if your accounts don't add up,'…without respecting the economic balance of these duties, and…has left the responsibility to define how much to pay, to OSINERGMIN. Currently, OSINERGMIN…defines how much the distributor is paid…So…there is a serious problem because the (public distribution) companies…complain that [OSINERGMIN is] recognizing them at such a low rate for an activity that actually has a higher cost. That problem right now is not solved. But happily, this problem does not affect Ergon.[103]

As outlined above, one of the principal controversies surrounding the operation of the *proyecto* is the public distribution companies' dissatisfaction with reimbursement for their program involvement. The issue of insufficient compensation levels is revealing in various ways. In one respect, it shows how the *masivo* auction was built on the false premise that public distributors would carry out their program functions with similar efficacy and motivation as the

[102] Octavio Díaz, interviewed by author, July 24, 2017.
[103] Octavio Díaz, interviewed by author, July 24, 2017.

private sector. In another respect, it again highlights the program's isolated and fragmented design, which has created an operational dynamic where public and private actors have little incentive (or even need) to operate in cohesion with one another. Santiago Salgado, a former MEM official, offered critical insight into the contradictions of the auction's premise, saying:

> The big problem…the error of our PPP, is that…the public company really has no motivation in doing…rural electrification projects…there is no interest by the distribution companies, in intervening in the rural electricity sector, be it through the extension of (grid) networks or even of photovoltaic. There is no interest, because…it costs so much and it's believed that the distributors have reached their limit and they are not going to do more. But nevertheless the [PPP] mobilizes them, and the [PPP] is supported by the public (distribution companies)…they are not given a small role…the [public distributors] are being asked…to distribute invoices and do bill charging…The model contradicts its premise in that the public (distributors) are not interested in doing the rural electrification activities…given that these OSINERGMIN (remuneration price) signals are not enough…everyone has the hope it will turn out, but there will be problems.

He also alluded to what Díaz mentioned previously, about the public distribution companies relenting to pressure from MEM to carry out responsibilities in the *proyecto*. His comments also supported the notion that many of the auction details regarding how public distributors would be compensated, were ill defined or misleading. He said:

> the big problem there that is not solved, because in the end the public will accept it, always the public ends up accepting everything, it is that when the agreement with the ministry was signed, it was believed, and therefore the public (distributors) accepted…that they would be recognized based on their incurred costs. And this is not the case, they are recognized by the costs that OSINERGMIN regulates…So, but the public (distributors)…assume…these additional activities that are not part of their routine business activities, but additional one that the state is giving them to perform.

Perhaps most consequential of all his criticisms were his observations, which lend strength to the argument made throughout this paper, that the *masivo* design lacks articulation between involved actors. Salgado said:

> The public (distributors) they have no interest in doing [bill collection], if they distribute (bills) and [customers] don't pay, they don't not pay. They'll present their numbers to OSINERGMIN and ask to be paid; 'It's is not my problem,'…I believe that under these conditions [public distributors] will not have any interest in carrying out effective (bill) collection, but they are things that will come out little by little.[104]

The indifference that he foresees expressed by public distributors mirrors the same lack of concern voiced by Ergon. This is because the design of the *masivo* allows both Ergon and public distributors to disregard the collective mechanisms that will sustain the *proyecto's* operation, with each actor compelled only to conduct their contractual responsibilities; Ergon incentivized to make a profit, the public sector constrained to minimize deficit.

Conclusion

Drawing on the testimonies of officials from across Peruvian energy and development sectors, as well as participant observation of rural energy programs, this paper has helped shed light on the challenges and contradictions of the Peru' *proyecto masivo* auction design. From its inception, the *proyecto* was meant to adhere to an unrealistic political cycle timeline, which necessarily precluded a better auction contract. What resulted was a contract that relies heavily on a private company to deploy a robust technology to solve longstanding energy access deficiencies in rural areas. This technological and market-based approach saw the omission of explicit guidelines designating responsibility for raising community awareness of SHS function or program details. At the same time, public distribution companies were delegated the unwanted task of establishing new billing operations in some of the most remote corners of the country. The state-regulated remuneration levels for program activities, that will adversely affect both Ergon and

[104] Unless otherwise noted, the preceding quotes are from Santiago Salagado, interviewed by author, July 27, 2017.

public companies, draws further attention to the state's trivialized view of the logistical challenges inherent to off-grid energy service. And it has been shown that the *masivo* auction has been propped up under a faulty proposition, as remuneration mechanisms are isolated across sectors, allowing Ergon and public distributors to operate with indifference to how the other fulfills their duties in this "partnership."

This paper demonstrates that there is in fact much to be learned from Peru's approach to off-grid solar energy provision and public-private partnerships, even for those who may not have any specific interest in the country. While much PPP-focused literature has offered analyses of risk allocation between the public and private partners in broad financial and operational terms, this paper presents an in-depth analysis of the mechanics at play in the contact zone between contract design and on-the-ground solar energy service, which can serve as a roadmap for other governments as they design and implement rural electrification projects in partnership with private actors.

Although the *proyecto masivo* is yet to officially commence, the arguments forwarded in this paper aimed to orient the reader to the internal "invisible trouble" of infrastructural systems (Lampland and Star 2009), to highlight the uncertainty and potential volatility in the way that the actors and relational mechanisms in the *proyecto masivo* cohere with one another. In regards to the future design of public auctions and PPPs, Peru's MEM would do well to envision them as more than narrow tools of "depoliticization" (Willems and van Dooren 2016), and rather, as dynamic infrastructure services embedded in larger political and historical currents. To begin to accomplish this, a robust and transparent dialogue is needed between Peruvian ministries so that public auctions incorporate cross-institutional input that is attendant to the social and geographical realities of the country's remotest populations located even beyond the reach of the *proyecto*

masivo. Going further, the Peruvian government should form a PPP-dedicated department that plans, coordinates, oversees PPPs over their entire lifecycle, which will help ensure their long-term viability and success (Sarmento and Renneboog 2016). What is more, upon evaluating submitted bids, this PPP department would do well to differentiate between feasible and non-feasible bids, instead of simply choosing the lowest price (Trebilock and Rosenstock 2015), as was the case in the *masivo.* This will necessitate that PPP design and implementation periods span multiple political cycles and will require improved state institutional capacity and flexibility. Under these conditions, the *proyecto masivo* and other PPPs may be able get beyond ribbon cutting and inauguration photos, to responsively administer cohesive collaborations between public and private actors in order to address longstanding legacies of exclusion and infrastructural deficiency in Peru's most remote communities.

Abbreviations

APCI – Peruvian Agency for International Cooperation (*Agencia Peruana de Cooperación Internacional*)
CCT – Conditional Cash Transfer program
CEF – Photovoltaic Electrification Committee (*Comité de Electrificación Fotovoltaica*)
DGER – General Directorate of Rural Electrification (*Dirección General de Electrificación Rural*)
FISE – Fund for Energy Social Inclusion (*Fondo de Inclusión Social Eléctrica*)
FOSE – Electrical Social Compensation Fund (*Fondo de Compensación Social Eléctrica*)
FUNDALUZ – Fundación Luz Solar
IFC – International Finance Corporation
LSA – LuzSolar Andina
MEM – Ministry of Energy and Mines (*Ministerios de Energía y Minas*)
NGO – Non-governmental Organization
OSINERGMIN – Supervisory Agency for Investment in Energy and Mining (*Organismo Supervisor de la Inversión en Energía y Minería*)
PPP – Public-Private Partnership
SHS – Solar Home System
UNI – National University of Engineering (Perú)

Appendix 1

Aerial photo of Lahuaymarca and author diagrams. (Google Maps 2018. URL withheld for anonymity).

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