

# **Business Models for Energy Entrepreneurship in Emerging Markets**

**School for Environment and Sustainability Master's Project**

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## Executive Summary

Access to electricity produces greater levels of economic value and increases the quality of life in emerging markets across the globe. Emerging economies have surpassed developed nations in clean energy investment and deployment<sup>1</sup>, but based on our review of the literature, there is a lack of high-level study on the factors that most affect the success of these businesses. The goal of this project is to identify these success factors, and use them to inform entrepreneurs' strategic decision-making as well as elucidate the environments in which these ventures have a higher probability of success. By better understanding what drives success in the renewable energy industry, both entrepreneurs and key stakeholders such as policy makers, investors, and interested non-governmental organizations (NGOs) can better prioritize their efforts and investments to drive increased levels of clean energy adoption.

This project focuses on clean energy business models in two emerging economies: India and Uganda. These countries have significant differences in levels of access to energy and development of their entrepreneurial landscapes, and therefore, provide a broad scope for analysis. This report presents an overview of existing empirical research on factors that hinder or increase success of business models, identifies potential gaps in this research, and presents analysis based on qualitative, in-country interviews conducted by our team. Based on a comparative analysis between the literature review and interview findings, the team drew conclusions about factors that would benefit from better coordination and investment from industry players. The team also identified aspects of the entrepreneurial experience in developing countries that are strong candidates for further academic research.

Throughout the project, entrepreneurs and industry experts (such as the stakeholders above) highlighted several of the key topics identified in existing research, including the challenge of attracting private investment, strategies for revenue collection given limited ability to pay among customers, the effect of domestic energy policy, and the industry's lack of institutional support, whether it be nonexistent or ineffective small business associations, trade associations, lobbying groups, etc. While it was reassuring to see entrepreneur and stakeholder interviews validate what had been uncovered in the literature review, the key value created by this project was largely the nuance the interviews provided regarding the structural issues that were inhibiting growth for the renewable and clean energy industries, and provide context around how some of these issues were overcome in India and Uganda. Our research questions aimed to understand how entrepreneurs can directly improve their prospects for success and where their efforts require coordination with other partners in the renewable energy value chain or key policymakers.

The interviews revealed a clear distinction between the factors that entrepreneurs and industry experts found to be most relevant and important to the success of clean energy entrepreneurs. Factors such as positioning/strategy, company structure, ability to collect revenue, and business model flexibility were by far more relevant for entrepreneurs than industry experts. This understanding of which factors are more directly in entrepreneurs' control can allow them to prioritize which factors to focus their attention and resources on. In contrast, industry experts regularly mentioned factors that were not top of mind for entrepreneurs in interviews such as domestic energy policy, customer financial resources, and distribution and utility infrastructure. Despite the relative dichotomy between entrepreneurs and industry experts, there was some overlap among what factors the two groups found to be the most important. These factors include

talent attraction and retention, accessibility of private investment, competitive landscape, consumer education and strategic partnerships. The overlapping factors indicate the significance of these challenges, and highlights the potential areas where strategic partnerships would be the most beneficial to foster a healthier entrepreneurial ecosystem.

Overall, the interviews raised new issues that were not discussed as in-depth in the literature. For example, the conclusion that there is a lack of product awareness and trust among most consumers, and that regulatory uncertainty of even the most well-intentioned policies can be extremely detrimental. In India, there were difficulties retaining employees. In Uganda, there appears to be a weak pipeline of educated, local talent. These issues demand comprehensive solutions that can only be realized by greater cooperation and coordination between entrepreneurs, industry experts, and policy makers. In sum, the hope is that this research will inform market players of key factors of entrepreneurial success and act as a catalyst for future research. In particular, what factors do entrepreneurs and industry experts see affecting success, where do they see greater opportunities for coordination, and how are the Indian and Ugandan experiences representative of other emerging markets?

## Introduction

Today, more than 20% of the global population lacks access to reliable electricity and nearly 40% are dependent on biomass fuels, such as charcoal or wood, for cooking.<sup>2</sup> Additionally, around half of the people in the world subsist on less than US\$2 per day.<sup>3</sup> Access to energy and a healthy market environment for small, locally-owned businesses are two major drivers of poverty reduction<sup>4</sup>. Significant progress has been made towards addressing these challenges, but there is still a long way to go and important consequences of increased global energy consumption must be considered moving forward<sup>5</sup>. One of the most critical consequences of this increased energy consumption is the increased emission of greenhouse gas emissions (GHG).

Energy consumption is responsible for 60% of global GHG emissions, making it the leading contributor to climate change.<sup>6</sup> With world energy consumption projected to increase by 28% in the coming decades, primarily due to growth in non-Organization for Economic Cooperation and Development (OECD) countries,<sup>7</sup> GHG emissions from increased energy production in emerging markets is of growing concern. Distributed renewable energy sources and clean technologies have the potential to curb growing GHG emissions in emerging markets by serving increased energy demand without the large-scale climate impacts of conventional, centralized fossil fuel energy generation. For countries trying to increase electricity access, the lower capital costs of small-scale, distributed renewable energy generation compared to larger, centralized energy infrastructure also make it an attractive option. This is particularly true in rural areas or areas of low population density, where it may be difficult to justify investment in transmission infrastructure connecting to centrally generated energy<sup>8</sup>. However, if emerging markets hope to increase electricity access via distributed renewable energy rather than centralized infrastructure, engaging the private sector may be a more efficient means to achieve this end.

Decentralized infrastructure opposes the traditional utility model, creating an opportunity for small businesses in emerging markets to implement and operate renewable energy technologies. Entrepreneurship is a growing source of income for people around the world, but entrepreneurs in emerging markets tend to face more barriers than startups in more developed countries. Helping small businesses achieve sustainability and scale has the potential for tremendous impact on global economic development, but there is a need for external support and coordination to enable this growth<sup>9</sup>. As these businesses scale, there are myriad of ways previously unserved populations can benefit from increased access to energy.

In addition to creating new business opportunities, decentralized energy can address challenges faced by populations that otherwise would not have access to the electrical grid. While there is widespread agreement about the importance of energy access, defining “access” is difficult. Determining if someone has energy access is not a simple yes or no question, rather energy access falls on a continuum or spectrum of access.<sup>10</sup> For instance, being connected to a grid that only provides power for two hours a day is different than continuous, reliable energy supply, despite both systems “technically” being connected to an electric grid. Consider a hotel owner who cannot rely on the grid for continuous electricity access. The hotelier would be unable to offer uninterrupted lighting, television, or refrigeration, despite technically being connected to the grid, and the business would suffer. Numerous factors must be considered when referring to energy access, including the reliability, cost, and predictability of access. To ensure accurate analysis, one needs to be aware of these different aspects when defining who does or does not have adequate

energy access. This complexity also has significant implications for the level of sophistication, and therefore cost, of possible solutions to help advance people along the energy access spectrum. For example, transitioning from no energy access to basic energy access (lighting, phone charging, etc.) requires significantly less sophistication than moving a person from basic energy access to advanced energy access (refrigeration, manufacturing, etc.) Leading efforts to transition people toward higher levels of energy access are numerous global NGOs and government organizations such as the United Nations. Aiding the efforts of these entities have been advancements in renewable energy technologies.

Recent innovations across the renewable energy sector, such as advancements in material science, manufacturing processes, and availability of microfinance, have led to lower prices, increased efficiency, and greater user familiarity of renewable energy products. In parallel, innovative financing techniques are allowing more people in developing countries to gain access to electricity.<sup>11,12</sup> Distributed renewable energy sources often provide more reliable power and offer more resilience in the face of a grid outage or natural disaster<sup>13</sup>. Solar photovoltaic (PV) has emerged as the dominant technology due to its ease of use and maintenance, supportive government policies, mobility, and scalability.<sup>14</sup> As a result of cheaper, more accessible solar power, numerous use cases are appearing in the agricultural, water, and industrial sectors.<sup>15</sup> This includes everything from solar-powered water pumps for irrigation and water purification to industrial solar products designed to offset or lower factory utility bills. Other renewables, such as wind and micro-hydro resources are viable options in certain areas that meet the specific physical requirements of each technology. Innovative uses for new forms of biomass/biogas are also being explored. Of note, since these technologies rely on feedstock supply chains, the business models selected for deployment often vary from those with solar PV technologies. For instance, feedstock business models may have more a complicated supply chain for feedstock and the equipment may require higher levels of operations and maintenance, affecting the cost structure of the project. This is in contrast to a solar PV project, which may have higher upfront costs but does not require feedstock and has more minimal operations and maintenance. Currently, renewable energy technologies are commercially viable and are increasingly reaching price parity with incumbent fossil fuel sources. It is often other parts of the value chain or business model that are limiting higher levels of utilization and growth. Access to finance and establishing and maintaining customer relationships are critical to successful ventures.<sup>16</sup>

### *India*

In the last few decades, India has been the focus of many venture capitalists and angel investors<sup>17</sup>. These investments have spurred the development of local enterprises, whose entrepreneurial owners are in the midst of navigating a constantly developing market shaped by policy implementation, rapidly changing cost structures, and sizeable market growth<sup>18</sup>. India presents an opportunity to consider businesses that have begun to experience success employing various business approaches for increasing energy access in contrast to businesses in less advanced markets, which have faced greater challenges. In this way, India is a unique example of a maturing market offering a diverse array of renewable energy solutions from entrepreneurs that seek to meet the currently unmet needs of customers. Overall, India presents an opportunity to study how various entrepreneurial business structures (such as direct-to-consumer solar systems, community cold-chain storage, digitized microfinance outfits, etc.) function and what kind of models succeed in one of the more mature developing markets.

## *Uganda*

Uganda, conversely, has experienced significantly lower levels of international investment and exhibits relatively lower levels of energy entrepreneurship than India. In the late 1990s and early 2000s, Uganda unbundled its generation, transmission, and distribution systems. This has led to significant private investments in energy projects throughout the country, but 80% of the population still remains in rural areas without reliable access to electricity. In recent years, solar home systems have been presented as a way to increase energy access while not placing the expensive, onerous duty to expand the nation's grid to every single village, a policy that was pursued with mixed effect in India. Decreasing manufacturing costs of solar cells have allowed smaller, off-grid systems to economically compete in the market, fueling a debate between on-grid and off-grid energy access. This segmentation represents two distinct market opportunities that both compete with and complement one another at the same time. Combined, however, entrepreneurial activity in both segments results in an overall increase in energy access. For example, if a country lacks the resources to extend its on-grid energy offerings, entrepreneurs can offer off-grid solutions to millions of people. On-grid opportunities exist for entrepreneurs who may seek to provide greater reliability than the existing grid. While certain entrepreneurs have had success in tapping into the Ugandan off-grid market, barriers such as access to finance and political red tape still hinder the ability of entrepreneurs to scale more quickly. Uganda represents an opportunity for our team to examine a developing country that is in a more nascent entrepreneurial environment.

Taken together, our research in both India and Uganda have implications related to energy access and improved financial and environmental conditions due to the influence of successful entrepreneurs. Considering the importance of energy access, the urgency to lower global carbon emissions, and the desire for economic development across emerging markets, this research seeks to investigate the intersection of all three of these topics through the lens of energy entrepreneurship in India and Uganda. Initially informed by existing literature, then by primary data collection through interviews, this team sought to better understand which factors bolster and which factors hinder the success of entrepreneurs who stand at this pivotal intersection. A success factor framework and interview methodology were developed to address the three key research questions for this project:

1. What factors do entrepreneurs perceive as having the greatest influence on success of their venture?
2. What factors do entrepreneurs perceive as having the greatest influence on successful interactions across the clean energy value chain?
3. What factors within the broader clean energy ecosystem do industry experts perceive as critical for entrepreneurial success?

Entrepreneurs must respond to each of these influences, and this paper seeks to uncover the nature of those responses.

## **Research Methodology**

In order to understand the factors that influence the success of renewable energy entrepreneurs in developing economies, the research team conducted an extensive literature review. Concepts of

entrepreneurship and renewable energy in developing markets have previously been researched independently, but the overlap between the two subjects leaves considerable room for further analysis. The existing literature was examined in detail in three distinct areas: economic, social, and policy related considerations (see Appendix 1).

Using the results of the literature review as a basis for further research, a framework of factors that could impact entrepreneurial success was created (Appendix 2).



The purpose of the framework was to cross-reference issues identified in research with those factors most salient to the interview participants and identify any unique gaps in the existing literature. The initial literature review identified 36 different factors split into four general categories: Business Operations; Financing; Policy, Regulation, & Governance; Country Demographics. Business Operations was then further split into internal and external factors, and Country Demographics was split into country and customer characteristics. These splits resulted from many characteristics within the four, overarching categories being interrelated, so dividing them into smaller components allowed for greater granularity of findings and comparisons. Once the initial factors of consideration were identified and organized, it was then possible to begin drafting an interview protocol (Appendix 3).

Two sets of interview questions were drafted, specific to the two sample groups: entrepreneurs and industry experts (appendices 4-A & 4-B). Entrepreneurs included business owners and operators; current CEOs; and other executive level employees of growing ventures. The second set of interview questions targeted a broader range of stakeholders that have industry knowledge, expertise, and a vested interest in the functioning of the entrepreneurs as well as the industry as a whole. The industry experts sample group included government entities, accelerators, private investors, academia, and larger established energy companies. Each question set covers the identified factors in way that is relevant to the perspective of the sample group.

Research participants were recruited using targeted invitations to a number of organizations throughout India and Uganda identified through university connections, industry news, and general online search engines. This invitation outlined what information was being asked, what the information was being used for within the context of the study, and why the particular organization was chosen. Ultimately, 22 companies or organizations agreed to participate in the study (Table 1).

*Table 1: Interview Sample Distribution by Country and Stakeholder Group*

<i>Sample Group</i>	<b>India</b>	<b>Uganda</b>
Entrepreneurs	11	3
Industry Experts	3	5



The companies run by entrepreneurs represent a variety of companies within the renewable energy and clean technology industries. Many of the companies focus on solar energy solutions, although wind power, biofuels, building efficiency, and cold storage are also represented. Company size and age varied, which provided a mix of perspectives from the entrepreneurs.

Industry experts make up a smaller sample size which includes established organizations in the renewable energy industry. These organizations tend to be in positions of higher power in the industry relative to the entrepreneurs, although that was not a criteria for their selection.

Interviews were conducted in-country, outlined by the procedure detailed in Appendix 3, in August, 2018 (India) and October, 2018 (Uganda). After the Indian interviews, interview protocols and questions were adjusted to reflect interest and reoccurring themes of interviewees. While the adjustments were not extensive, some of the changes made included reordering of questions to better improve the logical flow of questions and avoid some confusion that had occurred in India due to the order in which the questions were asked. Additionally, a question regarding ‘cultures of innovation’ was reworded to improve clarity. The Ugandan interviews were then conducted using the updated interview questionnaires. Once the interviews were completed, research teams coded the interviews using notes and audio recordings (when available) to identify factors in the framework. The product that resulted from this coding was a list of the factors mentioned in the interviews and the number of times each factor was mentioned. These findings were then collated for further synthesis.

After the initial round of coding, it was determined that the original framework contained factors of limited relevance and factors that required redefinition. To address this, irrelevant factors were removed, existing factors were updated, and a couple of new factors were included (Appendix 4). The interviews were then coded a second time using the updated framework. To reduce biases, each interview was coded first by one team member who conducted the interview and one team member who did not attend the interview. In the re-coding process, the researcher noted factors they found in common with the first round of coding, as well as any discrepancies between the two rounds of coding. If a discrepancy occurred, both coders held a discussion around the factor in question and came to a mutual agreement on how to assign a code. The product that resulted from this process was a complete set of interviews coded by two researches in mutual agreement of the coding results. The coding results were once again summarized across interviews and collated across geographical region (India or Uganda) and a sample group type (Entrepreneur and Industry Expert). These coding results are used to identify trends in the research, trends which are discussed at length later in this report.

## **Research Questions**

The purpose of this study is to understand what internal and external factors determine which energy entrepreneurship models are successful in developing economies. Our research questions, cited below, reflect our aim to understand how entrepreneurs can directly improve their prospects for success and where their efforts require coordination with other partners in the renewable energy value chain or key policymakers.

1. What factors do entrepreneurs perceive as having the greatest influence on success of their venture?

2. What factors do entrepreneurs perceive as having the greatest influence on successful interactions across the clean energy value chain?
3. What factors do entrepreneurs perceive as having the greatest influence on success within the broader clean energy ecosystem?

Below, we explore each of these questions in depth.

## Results

Based on interview results, we compared which success factors were most prevalent for entrepreneurs and industry experts. We examined which critical success factors entrepreneurs have the most influence over; which require their interaction with other key industry stakeholders; and which are largely decided by stakeholders external to their company (Figure 1). Several themes from our literature review were reflected in our interviews, including the challenge of attracting private investment, strategies for collecting payment from customers, the effect of domestic energy policy, and the industry's lack of institutional support. Our research also uncovered key challenges that were largely absent in the existing literature, including a focus on hiring and retaining talent and the lack of awareness and consumer trust in renewable energy products. These are systemic challenges that require significant coordination across the renewable energy ecosystem within each market.

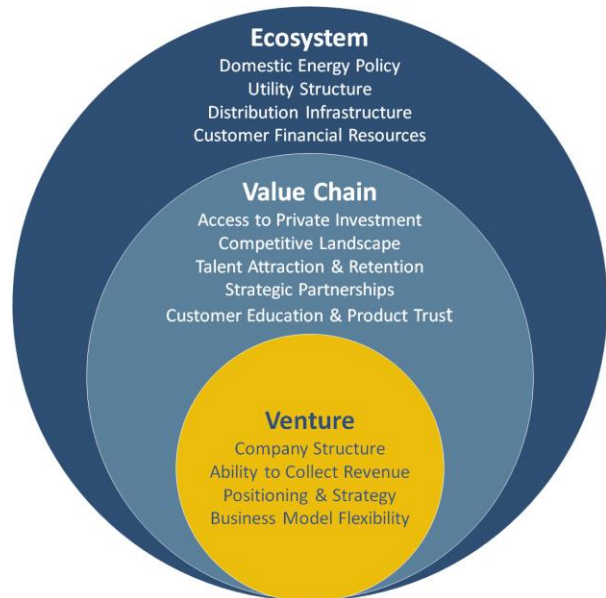


Figure 1: Venture-Value Chain-Ecosystem

While our findings are intended to be illustrative and not statistically representative or definitive, the content of our interviews, paired with our literature review, provide a nuanced perspective of the challenges facing entrepreneurs and raise critical questions for future research.

A driving purpose for this research was to gather insights into the top factors over which entrepreneurs have influence. Identifying these factors helps inform what entrepreneurs might prioritize in order to achieve success when operating their business. The content gathered from the literature review and research interviews help shape ideas around what entrepreneurs may be able to change to influence the success of their business. According to the entrepreneurs we interviewed, the most impactful factors for the success of their business include their positioning within the market, their company structure, the flexibility of their business model, and their ability to collect revenue. However, an entrepreneur's ability to operate in the marketplace is dependent on both factors they can influence and factors controlled by external stakeholders, such as policy.

When we investigated how entrepreneurs are interacting with stakeholders across the clean energy value chain, entrepreneurs focused not only on access to private investment, but also competition, talent attraction & retention, strategic partnerships, and consumer education. Most of these factors were frequently cited by both entrepreneurs and industry experts, suggesting that both groups recognize the importance of these relationships. Overall, these factors highlight the critical role coordination and collaboration play in creating an environment which supports entrepreneurs' growth.

Our analysis also uncovered important factors to both the entrepreneur and industry expert sample groups. While we place significant focus on insights gathered from entrepreneurs, we want to

ensure that the industry experts' priorities are also reflected in our analysis. Industry experts play a significant role in determining key factors including domestic energy policy, distribution infrastructure, utility structure, and financial resources available to renewable energy entrepreneurs. Entrepreneurs have a far smaller role in the creation and execution of these factors, thus it is crucial to incorporate the industry stakeholders' perspectives. During analysis, we uncovered that there is a key need for industry experts to incorporate entrepreneurs in their decision-making processes. Another key finding, relating to policy, is that clarity and improved implementation of policies by government actors is needed.

In a country-to-country comparison, our analysis revealed a few differences between India and Uganda, possibly correlating to the level of development of each entrepreneurial landscape. Entrepreneurs in India were more likely than those in Uganda to focus on talent attraction, accessibility of private investment, strategic partnerships, and company structure. On the other hand, entrepreneurs in Uganda were more likely to reference distribution infrastructure and domestic energy policy. This could demonstrate that Indian entrepreneurs are relatively more likely to prioritize internal factors, while Ugandan entrepreneurs are more likely to focus on the existing ecosystem. While talent attraction & retention and accessibility of private investment were still top factors among entrepreneurs in Uganda, those factors were particularly salient in India. This emphasis on strategic partnerships and private investment was also reflected among industry experts in India, who cited these factors more often than their counterparts in Uganda. In Uganda, industry experts are more likely than those in India to prioritize customers' financial resources.

The differences between stakeholder groups can be seen in Table 2 below. Each factor is broken down by the percent of total mentions it represents for each audience.

Table 2: Total Reference Count for Top 20 Factors

Success Factor	Entrepreneurs N=14	Industry Experts N=8	Total Count N=22
Accessibility of private investment*	6.11%	9.87%	7.41%
Positioning/Strategy*	8.55%	2.96%	6.61%
Domestic energy policy (net energy metering, feed-in tariffs, etc.)*	5.24%	8.55%	6.39%
Competitive landscape (# of competitors)*	4.89%	4.28%	4.68%
Consumer education & product trust to facilitate adoption of technology*	3.84%	6.25%	4.68%
Talent attraction/retention*	6.63%	0.66%	4.56%
Customer financial resources*	2.62%	6.91%	4.10%
Strategic partnerships*	3.66%	3.62%	3.65%
Grid structure	1.92%	6.58%	3.53%
Profitability/financial sustainability	4.19%	1.97%	3.42%
Future strategy/growth plans	4.36%	1.32%	3.31%
Company Structure*	4.01%	1.64%	3.19%
Ability to collect revenue*	3.14%	2.30%	2.85%
Domestic skilled labor supply (installation, electrician, etc.)	3.14%	1.64%	2.62%
Distribution infrastructure*	1.57%	4.28%	2.51%
Scalability	2.79%	1.97%	2.51%
Business Model Flexibility*	2.97%	0.99%	2.28%
Commitment to/culture of innovation	2.79%	0.99%	2.17%
Product Quality	1.92%	2.63%	2.17%
Utility Structure*	0.70%	4.28%	1.94%

\*Key factors for our Research Questions

Initially, we focused on the top 20 factors that were cited most often (seen above) in order to narrow down our total list of 40 factors. From there, we examined which factors were cited particularly among entrepreneurs, industry experts, or both audiences. This helped us understand each group's relative priorities and framed our learnings. Ultimately, we narrowed the list down 13 factors (asterisked and highlighted in grey) which we felt provided unique insight into the perspective of our respondents. These key factors are explored further in the three research questions included in the remainder of our Results section.

For each research question, we included a summary of the applicable learnings from our literature review, an in-depth analysis of what we learned from our research, and key implications for our understanding of this topic.

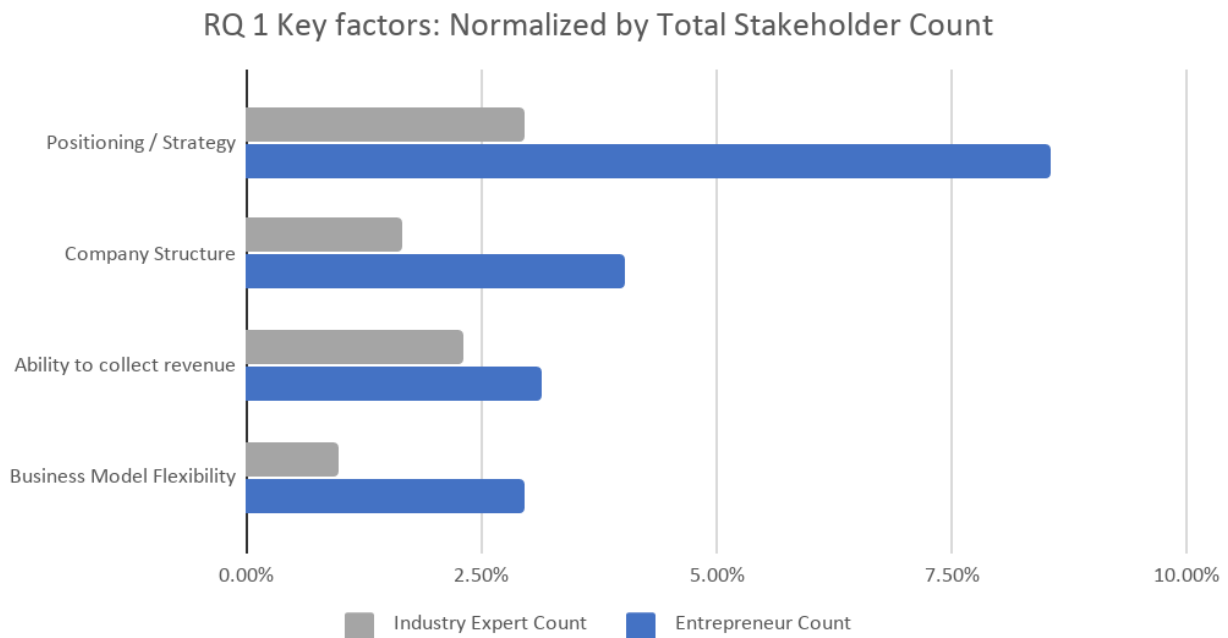
### **Research Question 1: What factors do entrepreneurs perceive as having the greatest influence on success of their venture?**

#### *Literature Review Context*

Our literature review revealed a multitude of factors that affect small businesses in emerging markets, categorized by economic, policy, and social considerations. One of the key factors uncovered in our literature review was entrepreneurs' ability to collect revenues from their customers and to maintain financial stability. Despite low margins, renewable energy systems tend to have high upfront costs<sup>19,20,21</sup> making them historically expensive for individual consumers. Enterprises in this space must meet two overlapping constraints of their target market - low incomes and seasonal cash flows. Renewable energy entrepreneurs are tackling these challenges in numerous ways. First, enterprises strive to make their offerings affordable through various payment structures and subsidized costs. One example of these decreasing upfront costs for customers is a recent trend of converting traditional business models, which involved the sale of assets, to business models adopting the idea of energy as a service. Additionally, given that cash flows in agricultural communities (regular target segment for these enterprises) are highly seasonal, renewable energy enterprises that help boost year-round productivity through the greater availability of electricity can ensure potential customers have smoother (and higher) levels of income, making regular payment more likely.<sup>22</sup> This theme of business model design to facilitate revenue collection was frequently mentioned by entrepreneurs and industry experts during our interviews as well. Additionally, our entrepreneur interviews revealed other factors beyond those explored in our literature review regarding the ways in which entrepreneurs positioned and structured their companies to succeed in a competitive marketplace.

#### *Research Findings*

While it is important to identify the top factors that entrepreneurs and industry experts recognize as essential to success, new businesses do not typically have the time or resources available to address every one of these factors. Instead, entrepreneurs in emerging markets need to be able to prioritize which factors to focus on. In order to do this, they first need to be able to understand which factors are within their control as business owners, and which factors they have only a peripheral influence over. Results from our interviews of both entrepreneurs and industry experts in India and Uganda start to bring these spheres of influence into focus. Within the sphere in entrepreneurs' direct proximity, several factors rose to the top that were important in stimulating growth, success, and longevity of businesses. The most frequent factors mentioned by both sample groups are displayed in Figure 2.



*Figure 2: Key Factors for RQ1 - What factors do entrepreneurs perceive as having the greatest influence on success of their venture? Factors selected based on prevalence and context.*

As we found in our literature review, one topic that was pervasive throughout the interviews was related to a company’s ability to collect revenue. While the financial health of their customers may not be within the purview of a small business, entrepreneurs can directly influence practices within their own business that increase the ease with which they collect revenue for their products and services. Two main strategies emerged from our conversations with both Indian and Ugandan companies that were aimed at improving the certainty with which they would be able to collect customer payments. First, several businesses, particularly in the solar sphere, developed different payment models, such as pay-as-you-go (PAYG) structures, and ensured the business would not be providing products without compensation. In a PAYG system, consumers pay in accordance with their usage until the system is paid off using remote monitoring technology to regulate activities and access. This payment structure breaks down barriers to access by lowering the upfront cost for consumers, but it is hands-on for businesses as it requires them to build monitoring capabilities and enforce contracts in the event of non-payment. Despite these challenges, PAYG has been gaining popularity in recent years as technological advancements and declining costs have made it more practical. With PAYG models, entrepreneurs can improve their ability to collect the appropriate amount of revenue for the services they provided because payment amounts are smaller and therefore more manageable to consumers and businesses have the capability to shut off access in the case of missed payments. For example, one India-based social enterprise that was interviewed installed an instrument within their products that allowed the company to shut the product off if payment had not been received, to act as a mechanism to enforce deadlines and increase their ability to collect revenue.

A second strategy employed by businesses was to adjust their customer base to a group from which they are better able to recover dues. Several companies noted that since they were operating in an

emerging market, significant portions of their originally targeted customers were unable to afford their product. By pivoting from a business-to-customer (B2C) model to a business-to-business (B2B) model, they found that their clients were more accountable for their payments. This also facilitated economies of scale because they could be selling products, for example solar energy power, to an entire hospital or business facility with one payment rather than to individual homes where they would have to spend time collecting dues from hundreds of households. There is a potential tradeoff with this strategy, however, as several entrepreneurs in India reported that the better established a customer company was, the more they would attempt to negotiate a lower price point, thus decreasing the entrepreneur's margin. However, the strategy to switch to a B2B model seems to reduce the risk of outstanding payments from customers for several entrepreneurs. Some entrepreneurs who made this pivot provided additional depth to the trade-offs involved. One entrepreneur noted that the sales cycles for the two business models were completely different, with business clients operating on a much longer sales cycle. This requires much more trust and relationship building than when selling individual home systems. Additionally, working capital and cash flow issues became more prominent because the entrepreneur's upfront outlays were higher and required financing to be successful.

One area where our interviews provided more nuance than what was found in the literature review was the strategic importance of business model flexibility. This is especially true in emerging markets where product saturation can become a significant issue after several smaller businesses flock to supply a certain product. For example, solar companies in both India and Uganda found that the pico solar market is becoming saturated, so they need to be innovative and adjust their business model to either find a new market with high demand or pivot to a new product. While the company in India that expressed this sentiment had already started expanding to other product offerings, it appeared the Ugandan company had not yet acted on this notion. The ability to be flexible is crucial to adjusting to changes in the market and can be a differentiator in staying ahead of competition.

Our interviews uncovered company structure as one of the primary factors that entrepreneurs focus on. Company structure relates to both the overall size and setup of the business operations, as well as the structure of the human capital employed at the business. Company structure was a factor commonly referenced by entrepreneurs when they were discussing the internal structure of employees at their businesses. In almost all of the interviews we conducted, the same sentiment was echoed that high quality and competency of employees is one of the crucial factors in running a successful company. One mechanism in which some businesses in India and Uganda tried to increase the quality and productivity of their employees was through their internal company structure. Businesses in both India and Uganda employed a relatively flat structure for employees, which differed vastly from the typical hierarchical structure of larger companies in the regions. Some companies believed hierarchical structures stifled innovation and the entrepreneurs found that a flat structure gave employees freedom not experienced at other companies, while incentivizing innovation. One co-founder even found that the culture of innovation became so pervasive that both his employees and himself had to limit the time they spent constantly trying to invent new improvements for their product in order to focus on actual deployment. Another benefit that companies found in having a flat structure was that it facilitated faster decision-making and iteration and thus improved efficiency while increasing innovation within the company. Furthermore, the managing director of an Indian solar firm shared that he creates a culture of openness and independence by running a flat structure that does not penalize for failed ideas.



A few common threads stood out when entrepreneurs discussed other ways to position themselves uniquely in the marketplace. First, in emerging markets where consumers may be less educated about clean energy technologies, the importance of positioning to focus on a particular product niche, service, and/or consumer segment where a business has a competitive edge was a common theme. Companies have found improved success of their products when they simply change their positioning. In Uganda, a solar company has done just that. In an interview, the company described its business, “We’re a solar company in our DNA, but now it’s about delivering services to meet needs – especially as appliance needs grow.” They have focused on various sectors in which utilizing different appliances drastically changes the way they operate and do business, such as automation or increasing employee efficiency. The company analyzes how different sectors, from agriculture to hotels, need energy to deliver various services and then enables them to do so through their solar solutions. For example, they offered solar for banking institutions that used to do everything by hand and now have transformed the efficiency of the workplace. Rather than promote a renewable energy source to the bank, the company positions itself as offering the ability to obtain a more efficient workplace.

The concept of product-service systems (PSS) has been the subject of recent research, which suggests that this strategic positioning move has the potential to improve the sustainability of energy business models.<sup>23</sup> The phrase “complementary disruption” has been used in reference to this industry trend of businesses providing services beyond just energy generation.<sup>24</sup> Ultimately, positioning as a company that improves other business’ services rather than energy provider is a key differentiator in the market and clearly outlines the value in a way that resonates with their customers.

For entrepreneurs, factors within their direct control, such as positioning, were the most frequently referenced factors from our framework (Figure 2). In contrast, the industry experts we interviewed did not place the same level of significance on these factors, and instead focused on accessibility of private financing, domestic energy policy, and customer financial resources. This could be largely attributed to the divergent motivations behind each group of stakeholders - entrepreneurs are primarily concerned with the factors internal to their business that impact the survival and success of their company while industry experts from investors to government entities are more focused on the external landscape of the ecosystem in which entrepreneurs operate.

### *Implications*

These factors provide a window into the challenges and decisions that entrepreneurs face in emerging markets. By highlighting factors that entrepreneurs can directly influence, it provides some insights into what small business owners could focus their efforts on to help ensure success of their company.

In an energy market not necessarily set up to support clean energy entrepreneurs, decision making could prove integral in determining how effectively a business responds to external factors. Having the ability to operate with flexibility, for example, can create resiliency for a business model that otherwise would have collapsed due to changes in the ecosystem. These changes could include shifts in policy such as subsidies or renewable generation targets, or the minimal availability of growth opportunities such as private investment. However, being a malleable business may only be beneficial if the levers a company is able to change line up appropriately with shifts in the market. One of the most significant challenges entrepreneurs face is being able to predict when

such shifts may occur. Being more integrated with stakeholders in the broader clean energy landscape could be one way in which they would have better foresight into impending shifts.

Overall, the factors that are internally most important to clean energy companies in emerging markets are largely impacted by the larger ecosystem in which they operate. The ability to collect revenue may not be as prominent for developed western startups, but it can be a crucial differentiating factor in emerging markets such as India and Uganda. However, achieving success within the factors that entrepreneurs are able to control can positively impact factors that are external to their company. While talent attraction and availability of skilled workers presents a problem in many emerging markets, startups can compete by having a unique employment structure that attracts employees and allows them to compete for the undersupplied talent.

It is also important to consider that factors within the sphere of influence closest to entrepreneurs tend to be less top-of-mind for industry experts. As demonstrated by the dichotomy of factors that industry experts and entrepreneurs found significant, industry experts are not focusing their resources on all the factors that entrepreneurs find crucial to success. As demonstrated in our research, factors such as the company's positioning/strategy, company structure, ability to collect revenue, and business model flexibility are all heavily emphasized by entrepreneurs but largely ignored by industry experts' analysis. In particular, positioning/strategy is the factor most frequently cited by entrepreneurs, while not even ranking in the top ten factors cited by industry experts. While the various strategies of each individual entrepreneur will be far too fragmented for industry experts to influence directly, it will be critical for them to consider given its outsized importance among entrepreneurs themselves. Ultimately, the ability to adapt and operate in the larger landscape of investors and politics requires a constant balance between the factors entrepreneurs can control, and those that they are peripherally tied to, as outlined below.

## **Research Question 2: What factors do entrepreneurs perceive as having the greatest influence on successful interactions across the clean energy value chain?**

### *Literature Review Context*

The existing literature suggests that organizations in the marketplace can have significant impacts on a small business in an emerging market, especially in the regulated energy industry.<sup>25</sup> In particular, access to private investment for entrepreneurs can prove especially challenging.<sup>26</sup> Companies seeking private financing must convince outside investors that they are a worthy investment. Until relatively recently, renewable energy technologies have been too expensive or unproven to successfully deploy and earn an acceptable return, and startups relying on government subsidies face significant bureaucracy and the subsequent uncertainty caused by the dynamic nature of politics.<sup>27</sup> These factors put additional pressure on the company's day-to-day operations and make future cash flows unpredictable, which increases the company's investment risk. Debt and equity represent a critical unmet need for these enterprises due to the high cost of standard domestic financing.<sup>28</sup>

This lack of access to reliable third-party capital places undue burden on local project developers and makes it difficult for startup companies to finance their operations.<sup>29</sup> Fundamentally, as long as outside investors view distributed renewable energy as a risky investment, there will be a mismatch between the perceived risks and rewards of investing in these startups. Part of this

mismatch is due to the fact that financial institutions do not understand the nuances of the markets due to lack of reliable data and technical expertise.<sup>30</sup>

The literature is clear that access to private financing is a challenge facing entrepreneurs in emerging markets, and this study’s findings further support this conclusion. Our study results shed additional detail onto this factor as well as others not explored in literature, especially around the nuanced and specific ways in which the market ecosystem impacts the entrepreneur's business model.

### Research Findings

Entrepreneurs interact with other stakeholders across the clean energy value chain in a variety of capacities and these interactions can have strong impacts on the success of energy businesses. The literature review primarily uncovered resources addressing access to private investment, but our interviews highlighted the role that other factors relating to relationships across the energy value chain, including competition, talent attraction and retention, strategic partnerships, and consumer education, can play in determining entrepreneurial success. Overall, these topics emphasized the critical role that coordination and collaboration play in shaping an environment which is supportive of entrepreneurs. As shown in Figure 3, most of these factors were frequent points of discussion for both entrepreneurs and industry experts, suggesting that the importance of these relationships is recognized by both groups.

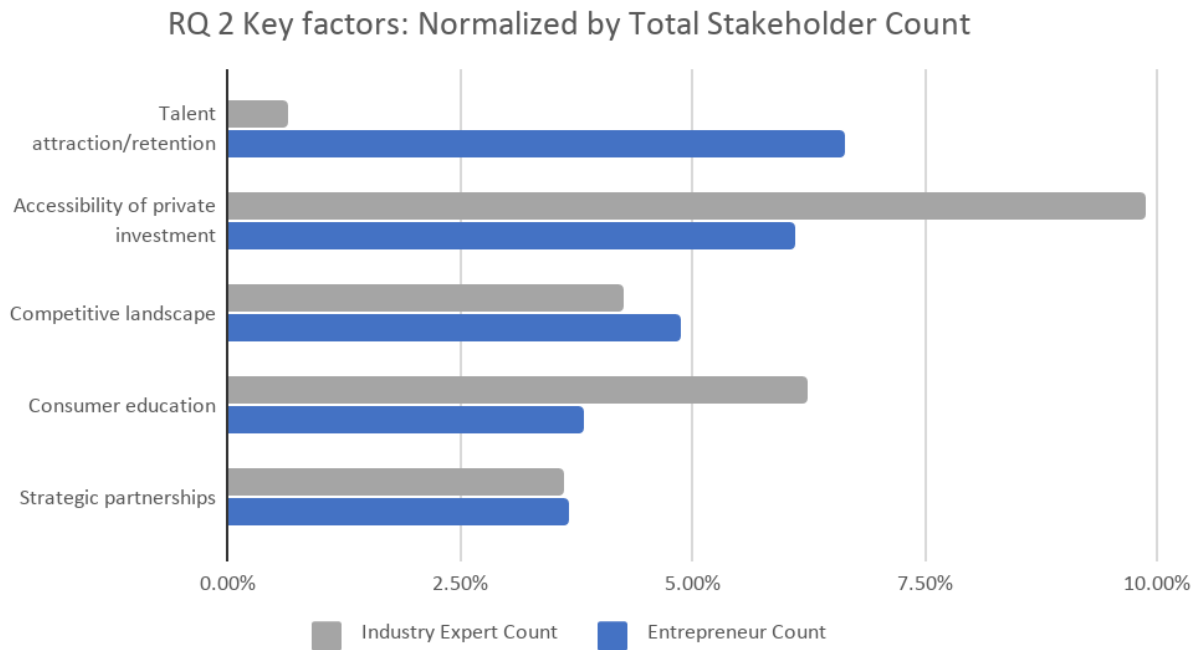


Figure 3: Key Factors for RQ2 - What factors do entrepreneurs perceive as having the greatest influence on successful interactions across the clean energy value chain? Factors selected based on prevalence and context.

Entrepreneurs and industry experts alike identified access to private investment and financing as a major factor in the success of energy startups in both India and Uganda. During the 22 interviews conducted, access to private investment was mentioned 66 times – more than any other factor.

According to one Uganda industry expert, the history of government subsidization that props up the country's energy sector has limited private investment from entering the market. This phenomenon was also seen in the expansion of rural microgrids in India.<sup>31</sup> While this is beginning to change as the market matures, the lack of investors has dampened the pace of development in the energy sector.

Additionally, many interviewees believe that the financial risk or in some cases simply the perception of risk associated with investing in or lending to small businesses in emerging markets is to blame for the lack of private investment and financing in India and Uganda. Risk aversion was a recurring theme among interviewees, including one who suggested the high perception of risk results in interest rates as high as 25%, compared to a normal business loan rate of 9%. An Indian venture we interviewed is working to increase access to loans by internalizing a facilitator role between entrepreneurs in the energy sector and banks. Despite their best efforts, companies with business-to-customer business models, have a harder time attracting funding due to perceived risks of collecting revenue from consumers. This is in comparison to enterprises employing a business-to-business model, where revenue collection is typically perceived as more secure.

Another deterrent for investors is the long payback periods associated with certain technologies. Although wind and solar start generating revenue immediately once operational, the development cycle is relatively long. This is an even greater hurdle for biofuel companies, as they must wait years for appropriate levels of feedstock to grow in order to produce fuel. Biofuel can be more profitable than other renewable technologies once the project starts producing fuel, yet investors in India have been hesitant to take on investments that do not generate more immediate returns.

There is also stiff competition in certain energy market segments in both countries, which poses additional challenges for the entrepreneurs interviewed. Especially in the small-scale, off-grid solar market in Uganda and the large-scale, on-grid market in India, there are hundreds of companies vying for market share. Quality is a major differentiator in both markets, but from the consumer perspective, it can be hard to distinguish between high and low-quality products. Often, small-scale energy generation is much less regulated, making it easier for low-quality products to slip through the cracks. According to a Uganda industry expert, the companies that fall in the middle in terms of price and quality tend to win out since high-quality equipment is too expensive to sell. An Indian solar company stated that service is a differentiator since companies in India frequently over promise and under deliver, but ultimately, India is a very price conscious market so even reliable service cannot always compete with the low-cost, low-quality competitors.

On the other hand, the mini grid market in Uganda only has a few larger companies since the market is more undeveloped. According to an international donor agency, the current focus is to connect suppliers, manufacturers, and distributors across the value chain to improve both operations and quality control in order to help the market develop. In India, an industry expert indicated that it is a great time to enter the renewable energy sector despite saturation in the large-scale solar segment since they see ample opportunity to address untapped demand in the residential solar, energy storage, and electric mobility sectors.

In addition to competing for customers, energy businesses much also compete for talent. Across enterprise types including solar, wind, and cold chain storage, the availability of skilled workers and retention of employees is a challenge to building a successful business. There is, however, some variation between Indian and Ugandan companies with regard to the cause of these labor

barriers. Based on interview analysis, India has more resources available to train skilled workers than Uganda, yet still struggles with attraction and retention of employees. While India has prestigious universities that train workers required for clean energy startups, such as engineers, many of the interviewed companies expressed frustration regarding the trend of workers leaving India to work in foreign countries. Oftentimes, other markets such as the Middle East offer higher salaries. In addition, there are incentivized programs offered in certain countries like Australia and neighboring regions for Indian talent to easily move and work abroad. As one green building company put it, “India’s biggest export is human resources.”

Another driver behind the lack of trained professionals available for employment is the existence of cultural norms that often discourage workers from joining a startup. Particularly in India, there is societal and cultural pressure from families to work for large, well-renowned companies rather than smaller unknown businesses. An India-based cold chain storage company shared that there is not necessarily a culture of accountability with new employees either. The company has faced several instances when it has hired new staff, only to have them not show up on their first day of work, with little fear of reputational or professional repercussion. Additionally, for both Indian and Ugandan companies there was a lack of loyalty to the company from employees. In several interviews, entrepreneurs mentioned that employees would leave to join other companies over extremely small differences in salary. Combined with the difficulty of finding experienced employees, several businesses have gone through periods of understaffing and been unable to expand at a rate that they otherwise may have been able to with full staffing.

In contrast to India, Ugandan companies face a scarcity of a skilled workforce a result of a lack of training opportunities. A Ugandan solar company found that hiring well-qualified professionals with work experience was not within its budget as a company. Even with the three engineers that it had been able to hire, there was a high turnover rate due to a “grass is always greener” syndrome in which the qualified staff members were faced with numerous other opportunities, leading to a 6-month turnover rate. Another solar company in Uganda has faced similar challenges. As a small, local company, it indicated that it is unable to compete for talent recruitment with larger companies. Some companies in India that have been around longer shared some similar stories regarding their workforces. A well-established Indian solar company explained that prior to 2010 there were only three large solar companies from which all startups and small businesses were recruiting. This company managed to attract three hires away from these larger companies at the time, but subsequently, faced poaching concerns of its own. Renewable energy developers in India often invest substantial resources to train their employees only to lose them to other companies once they have acquired advanced skills.

Many companies have turned to strategic partnerships to bolster their business in a variety of ways. First, partnerships can offer opportunities to cut costs through resource sharing. One Ugandan business indicated that they partner with other small companies to pool their manufacturing and increase their pricing leverage with manufacturers in order to achieve economies of scale in procurement. While this concept was not uncovered in our literature review, further research shows that pooled procurement is a strategy commonly used in the pharmaceutical sector to improve the buying power of public health systems around the world.<sup>32</sup> Additionally, the Ugandan company works with partner organizations with storefronts to sell their products to avoid the cost of brick-and-mortar operations.

Other companies have used partner organizations to build brand awareness when seeking an opportunity to increase customer adoption. One social enterprise worked with a well-known solar product company to co-brand products, which built trust in its products and increased brand recognition. Another company that employs a consultancy model used industry partners to build a reputation for the quality of its work by collaborating with another firm on early projects. In a similar vein, an Indian solar venture secured its primary investor through its partnership with a European company, which lowered the perception of risk in the eyes of the investor due to the stable reputation of its partner and the validation provided by being linked to a big-name company.

Partnerships can also be used as a mechanism for inorganic growth. For example, one well-established solar company in India has bought projects off of companies that do not have the working capital to complete them and then subcontracted the work back to them. They earn a margin on these projects simply for supplying the working capital for the job. This model is intended to help installers grow since they get to claim the project as their own and the arrangement is mutually beneficial since these are typically not projects the interviewed company would traditionally take on. While helping competition grow is atypical, the overall market is growing fast and companies aim to meet demand, so by doing this, the company developed a good relationship with installers while earning a small margin on the project. A byproduct of this partnership strategy is that balancing complementary capabilities between companies can allow both ventures to succeed.

Furthermore, some companies utilize partnerships to expand product or service offerings. This often takes the form of working with banks or micro-lending entities to provide a financing option for consumers. In Uganda, certain cellular service companies offer micro-financing for solar loans since access to solar energy allows customers to charge their phones. A previously mentioned Indian venture also works closely with banks to increase the availability of loans for solar project development. They have spent years developing a relationship with a large national bank, which has required substantial education of bank managers about solar energy, and they offer a viability study for all projects that seek financing through them. These measures have made it much easier for small solar developers to get loans, but the disbursement cycle is still very slow - an issue they hope to address as their partnership evolves. Aside from offering complementary lending options, partnerships can also help companies increase their social impact in other ways. An Indian social venture focused on expanding biofuels while also lifting rural farmers out of poverty uses their mission to form partnerships with nonprofits and social impact investors. These partnerships help rural farmers, key customers in the company's business model, afford the upfront costs of planting biofuel crops. Supporting the farmers with these initial costs of transitioning cropland allows them to earn a much higher yield with the goal of lifting themselves out of poverty. Partnering with these impact investors and NGOs essentially allows this company to engage the rural farmer population, increasing their income and standard of living, when they otherwise may not have been a viable option for another business model.

Partnerships are a well-studied business strategy, with research suggesting that alignment between both the business models and objectives of each participating firm as a primary driver of success.<sup>33</sup> Additionally, a study of startups in Switzerland suggests that “most startups know that they must cooperate with other companies from the very beginning of their existence, and that both sides have difficulties in performing a systematic search for possible partners.”<sup>34</sup>

Another salient issue for interviewees is the simple fact that the majority of off-grid consumers are unaware of renewable energy products and therefore do not seek them out. There are numerous reasons why this awareness gap exists, including a lack of channels for sharing information making it difficult to effectively market at scale. This restricts the implementation strategies and interventions that companies can use to build public awareness of renewable energy products. Additionally, in order to help build consumer education, an academic in Uganda stressed the importance of translating all relevant materials into the local language(s) for each community and providing live demonstrations for people to better understand the technology. A Ugandan non-profit also stressed the importance of translating highly technical product standards into everyday language to better accommodate the education levels in the country.

This lack of information also creates obstacles due to a tendency among consumers to be skeptical of new products once they are made aware of them. A Ugandan entity emphasized this challenge where consumers are initially distrustful of foreign-made products because they are uncertain of the quality. Given that the majority of renewable energy products are imported, this can be a critical barrier to getting buy-in from local consumers. The typical lack of information regarding renewable energy products can also make effective after-sales service for renewable energy products difficult to find. This unfortunately compounds negative perceptions of product quality, as consumers are unable to address fixable problems that can sometimes render an entire unit unusable.

Lastly, several organizations warned that even with adequate information it could be very difficult to get consumers to abandon previous habits and traditions. For example, a Ugandan agency cited a case in which they were unable to convince rural households to switch to clean, electric cookstoves because several people said the food “tasted different.” Even though the costs of the cookstoves were subsidized and individuals were fully informed of the health benefits to switching, households were simply unwilling to give up their cultural traditions and cooking heritage. A Ugandan industry expert stressed the importance of centralized, government-led communication campaign to help address this issue. For a related example in the healthcare sector, years ago, Uganda was able to launch a consumer education campaign to increase use of contraceptives during the height of the AIDS epidemic, which successfully changed attitudes towards contraception.

The factors examined for this research question sit at the intersection of industry experts and entrepreneurs, meaning they are influenced by both stakeholder groups. While our research shows that there is not consensus on the importance of these topics, we did learn that there is at least awareness on the part of both stakeholder groups of the problems that exist. The major deviation to this trend in our interviews relates to talent attraction and retention. Hiring is internal to a business and therefore not necessarily front of mind for industry experts. However, entrepreneurs spoke about talent attraction and retention much more broadly, focusing on the availability of trained workers and broader cultural and economic drivers that impact the decisions of jobseekers. This disconnect may explain why this factor was much more frequently discussed by entrepreneurs than industry experts.

### *Implications*

Our research into the interactions and connections between energy businesses and other value chain stakeholders indicates how crucial the ecosystem can be to the success of an individual

business. These ventures, especially when first starting out, cannot succeed in a bubble, so it is important for entrepreneurs to use their external relationships to their advantage. While lack of access to private investment was a chief concern among entrepreneurs (as we also saw in the literature review), our interviews highlighted how, rather than tackling this challenge head-on, entrepreneurs and energy sector stakeholders can work together on issues such as building a talent pipeline and educating the public in order to organically drive down category risk for investors. As entrepreneurs assess their position in the marketplace, capitalizing on external relationships can allow businesses to operate more efficiently by cutting costs or expand their offerings to consumers without additional internal capacity. Lastly, companies can even find strategic and mutually beneficial ways to engage with their competition, suggesting that there is merit to exploring strategic relationships with nearly any type of relevant stakeholder. That said, developing and maintaining external relationships requires time and effort, and some businesses may not have the capacity to do so. By weighing the potential benefits of a strategic relationship against the effort required to manage that relationship, enterprises can prioritize which types of interactions are worth pursuing.<sup>35</sup> Ultimately, our research further demonstrates how critical it is for entrepreneurs and industry experts to work together to address systemic barriers to growth for the renewable energy industry in their local markets.

### **Research Question 3: What factors within the broader clean energy ecosystem do industry experts perceive as critical for entrepreneurial success?**

#### *Literature Review Context*

Our literature review provided some critical context into how the utility structure in various emerging markets might affect the ecosystem for entrepreneurship. In particular, past research has shown how entrepreneurs' efforts might be threatened by grid expansion, tariffs, or heavily-subsidized government-backed competitors. For example, startups must consider how they can compete or coexist with state sponsored energy projects, which generally have the lowest costs due to economies of scale and heavy government subsidies.<sup>36</sup> In India, government policy and plans regarding grid-extension remain unclear. Given startup enterprises cannot directly compete with cheaper, subsidized grid power, this uncertainty leads to financial institutions becoming even more hesitant to finance renewable energy projects.<sup>37</sup> Some entrepreneurs attempt to create alternative value propositions by addressing other aspects of energy access such as reliability. For instance, if grid power is only available for a few hours during the day, entrepreneurs can provide backup services for when the grid does go down or extend the number of hours electricity is provided throughout the day. The economics of these alternative value propositions, however, are relatively new and untested, making lending institutions similarly hesitant to engage with these startups. Additionally, governments can levy high taxes or impose tariffs that negatively affect a startup. There can be a dichotomy between the most commercially profitable model and an optimal governmental policy model that provides a greater number of people with energy.<sup>38</sup> If a government's primary priority is to increase access to electrification using its own resources, it would require significant coordination for planning, implementation, operation and management.<sup>39</sup> However, grid extension into rural areas is enormously expensive due to high upfront costs, which is a challenge for limited state coffers.<sup>40</sup> If a government instead decides to let the marketplace tackle the challenge of rural electrification, its responsibility primarily becomes designing sound policies that will best incentivize private enterprises to assume the task. Unfortunately, this policy-making system can be challenging for startups to navigate.



Regulatory clarity from the government is critical for entrepreneurs to plan their future appropriately. Not only do uncertain energy policies make planning difficult for the entrepreneurs, but it can also deter foreign investment. In India, for example, periods during political elections can drastically alter the price structure of commodities such as electricity and agricultural pumps because officials are implementing heavy subsidies in order to secure votes.<sup>41</sup>

The literature demonstrates that entrepreneurs must work around policy barriers to compete in the market, and these findings both support these findings while also highlighting additional aspects to consider.

### Research Findings

Within the broader clean energy ecosystem, we examined factors that industry experts perceived to be critical to entrepreneurial success and cross-referenced that against how entrepreneurs thought about those same factors. Since industry experts are closer to the policy making apparatuses that affect the broader clean energy ecosystem, it seemed critical to highlight the factors on which industry experts were relatively more focused on. This includes domestic energy policy, distribution infrastructure, utility structure, and consumer financial resources (see Figure 4).

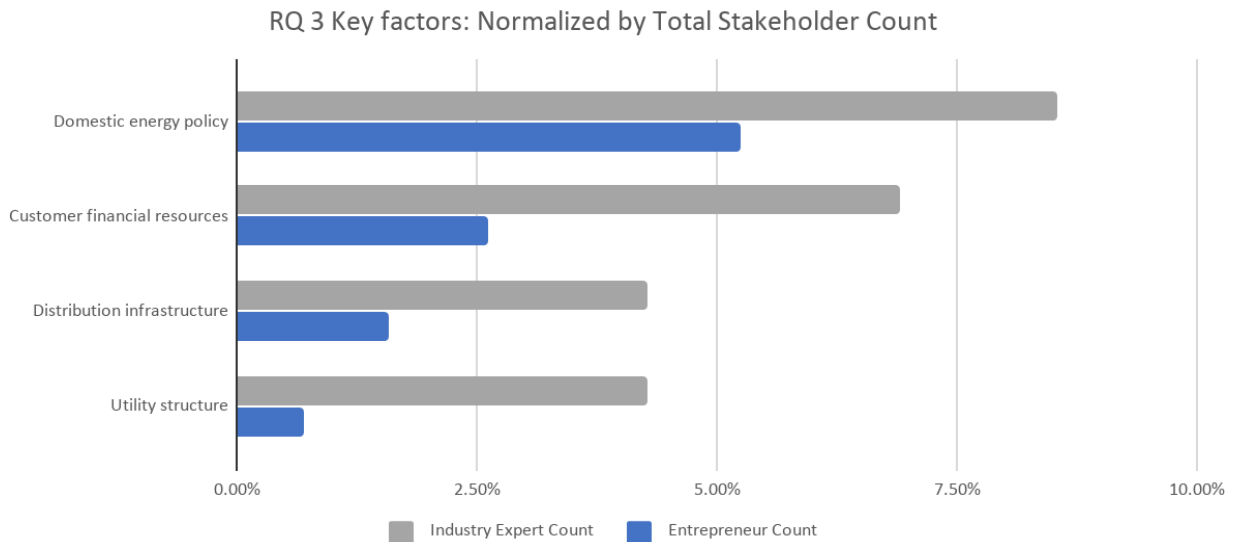


Figure 4: Key Factors for RQ3 - What factors do entrepreneurs perceive as having the greatest influence on success within the broader clean energy ecosystem? Factors selected based on prevalence and context.

Our interviews with entrepreneurs and industry experts echoed several of the key themes discussed in our literature review, but with more nuance and subtext. We were able to probe entrepreneurs more deeply on how their country’s domestic energy policies help or hurt their businesses, what support they need, and how they overcome bureaucratic obstacles.

In the literature review, multiple ways bureaucracy could stifle entrepreneurs’ businesses emerged, including policies that actively impaired startups’ ability to do business as well as general regulatory uncertainty that could stymie entrepreneurs’ decision-making. While the sources in the literature review generally emphasized the former over the latter, our interviews tended to give

greater weight to the impact of uncertainty. While we still saw frustration with the typical complaints surrounding red tape and excessive regulation in both countries, on the whole entrepreneurs were much more likely to focus on how uncertainty undermined their ability to operate effectively. One entrepreneur in Uganda decried government regulation that was ambiguous, subjective, and led to unnecessary lost time and effort. Numerous entrepreneurs and industry experts stressed the need for clarity in regulations, subsidies, and financing to ensure the market operates smoothly. An entrepreneur in India specifically called out inconsistent policy and implementation across the country as the primary barrier to the solar market growing significantly in the country.

This reflects another critical aspect of domestic energy policy - the actual implementation and enforcement of those policies. Several entrepreneurs cited policies that were well-intended, but which had not been implemented properly and thus did not make a positive impact. For example, when India first enacted policies supporting wind energy the tax incentives, which were focused on accelerated depreciation, it only spurred the construction of wind farms without thought of how much power they would actually generate. This led to numerous farms being built in poorly located areas, setting the market back several years. One of the industry experts in Uganda also detailed how under-funded government agencies would not prioritize enforcement of different policies - making it easy for bad actors to disregard critical regulations without fear of reprisal. This lack of implementation and enforcement for supportive policies undermines the ability of local entrepreneurs to plan ahead and grow their businesses like expected.

One of the concerns we saw arise in our literature review was entrepreneurs' apprehension about whether grid expansion into previously off-grid communities would threaten their business model. However, in our interviews this concern was less salient than the broader issues of uncertainty already discussed. In particular, many entrepreneurs felt that several of the areas they served would be economically infeasible for the grid to reach at any point in the near future, while others focused on how even if the grid were to expand into communities they targeted, energy from the grid would still be so unreliable that there would continue to be a market for off-grid energy solutions. As we saw in our literature review,<sup>42</sup> just because a household may technically have "access" to the grid, entrepreneurs need to evaluate energy access along a continuum to determine whether their value proposition would meet unmet customer needs. This coexistence model with an expanding grid was more prevalent in India due to the stated government commitment to expand electrification as compared to Uganda where there is little centralized effort to aggressively expand the grid. In addition to grid infrastructure, entrepreneurs also had to think through their approach to low income customers.

One key area where entrepreneurs' and industry experts' objectives differed was the challenge of low income consumers. This divergence occurred in both India and Uganda. In our literature review, we saw that most renewable energy entrepreneurs are targeting communities with few financial resources and seasonal income cycles, with entrepreneurs developing numerous money collection techniques to help preserve their cash flows. While entrepreneurs are primarily concerned with how to achieve sales within those constraints, industry experts are focused on the broader challenge of easing those constraints all together and helping boost the overall income of these communities.

Tackling the actual challenge of affordability requires resources greater than those of any individual entrepreneur. One trend that industry experts highlighted in both countries was

increasing access to quick loans from local micro-finance institutions. One person even likened trying to buy a solar system without a loan to being like “trying to buy a house without a mortgage.” However, these are still largely unavailable to most consumers. Another approach industry experts highlighted was the use of subsidies. Several industry experts described a challenging paradox where new renewable energy products might actually save consumers money in the long-run, but consumers were reluctant to purchase them because the higher upfront costs loomed larger in their minds. While subsidies could help overcome this challenge, they require difficult decisions about who deserves these subsidizations and whether this would set the industry up for failure in the long-term if it became reliant on subsidies to survive.

According to industry experts interviewed, one fundamental challenge is that most households would only use off-grid renewable energy services for low-consumption tasks such as lighting or cell phone charging. This means there is not enough energy demanded to make it feasible for companies to charge based on energy consumption. Instead, industry experts recommended a greater focus on productive use applications for renewable energy technologies. The productive use of renewable energy is “agricultural, commercial and industrial activities, powered by renewable energy, which generate income.”<sup>43</sup> This would include industrial or commercial businesses who demand enough energy to make the entrepreneur’s business more viable. Industry experts pointed out that not only would productive use applications increase entrepreneurs’ revenues, but they are also more appealing to foreign investment and help to drive economic growth within the country. One entrepreneur in Uganda shared an example about their focus on rural hotels, where off-grid energy access allowed them to offer numerous new amenities, such as hot water, lighting, and fans, which lead to a jump in occupancy. However, the entrepreneur also noted that the higher upfront costs put them in a difficult cash flow position and highlighted the need for external financing focused on productive use applications. Overall, productive use represents a significant increase in energy demanded compared to typical household usage, making it a prime target for some renewable energy startups which charge based on the amount of energy consumed rather than a purchase price for the hardware. Productive use is also an appealing alternative for startups because it solves the consumer affordability dilemma. If the energy is being used productively to generate greater income for a business, entrepreneurs can be more confident that they will recoup their investment.

### *Implications*

One of the key implications from this analysis is the importance of clarity and proper implementation of policies among government decision-makers, as well as the importance of coordination between entrepreneurs and industry experts. As seen in our discussion with entrepreneurs and industry experts, even when local officials support policies that are helpful for entrepreneurs, the policies will not have any positive impact if they are not implemented well or enforced properly. When forming supportive policies, it is critical that there is coordination between various policy initiatives and that they complement one another under an overarching vision for energy access as opposed to one-off policy solutions for niche applications or small market segments, which can have unintended consequences for the broader clean energy sector. Additionally, while some entrepreneurs cited specific policies that negatively affected their businesses, entrepreneurs were more likely to focus on how simple uncertainty undermined their decision-making and made it more difficult to attract foreign investment. Addressing this

uncertainty is the primary challenge for policy makers who want to make it easier for renewable energy startups to grow.

Looking forward, one area where this may be relevant is the role of product quality regulation in these markets. While policy makers and entrepreneurs may be hesitant to push regulations that may hamper a growing industry, one concern noted was that a lack of quality standards enforcement could lead to distrust in renewable energy technologies. For example, if one company undercuts its competitors by selling cheap, poorly-made products and then those products fail, the consumers who purchased them will be less likely to purchase any clean energy products in the future. This is an area where clarity, coordination, and enforcement of regulation would be vital to demonstrate the value of renewable energy to consumers and spur greater adoption rates.

## **Conclusions and Implications**

In our analysis, we examined which critical success factors entrepreneurs have direct control over, which require their interaction with other key industry stakeholders, and which are largely decided by forces or entities outside their control. Several of the elements revealed by our literature review surfaced during our interviews as well. In particular, the entrepreneurs and industry experts we interviewed frequently emphasized the challenge of attracting private investment, strategies for collecting payment from customers, the effect of domestic energy policy, and the overall lack of institutional support for small businesses within the energy sector. It was encouraging to see our research reflect the learnings of the literature review and provide some additional perspective on these critical issues.

However, more salient for this project was exploring the nuances not captured by the literature review. In particular, our interviews emphasized the prevalence of market structure issues that can only be solved by extensive coordination between entrepreneurs and other industry stakeholders. Entrepreneurs were quick to highlight issues with their country's pipeline of educated local talent, the lack of product awareness and trust among most consumers, and challenges related to regulatory uncertainty. These are all problems that can only be addressed by wholesale reforms, including both partnerships between entrepreneurs and industry stakeholders and with policies that are well-designed, effectively implemented, and appropriately enforced. In the meantime, entrepreneurs must rely on increasingly flexible business models and innovative company structure in order to survive in an uncertain, rapidly changing industry.

The majority of scholarly research into entrepreneurial success has focused on the first and third of our research questions, or the places in the renewable energy value chain where entrepreneurs and industry experts occupy, respectively. While this research is beneficial, if there is a fundamental mismatch between what is perceived to be critical to entrepreneurial success among these two key stakeholder groups, the amount of coordination, collaboration, and information sharing among them will be sub-optimal. The primary insights from our qualitative, interview-based research is that the real growth opportunity seems to be the intersection of entrepreneurs and their ecosystem, as examined in our second research question. To address challenges with systemic issues, entrepreneurs can work to address the root causes by focusing on cooperation with policymakers and other industry experts.

Ultimately, we sought to better understand which factors enterprises should focus on and how they can leverage such factors to become successful. In order to apply these findings on a larger scale,

it is necessary to take an even deeper dive into a broad range of business types and structures across a to uncover what similarities exist across successful ventures. While the lines can get blurred, it is important for entrepreneurs to tease out the factors which are in their direct sphere of influence because these are the factors that they will likely have the least support on from external partners. While the clean energy entrepreneurial landscape is filled with a number of stakeholders ranging from political leaders to investors, it appears that they are focusing their resources elsewhere. As is often the case, without direct influence on how entrepreneurs choose to run their businesses, industry experts add value in other ways. This can take the shapes of acting as a middleman and connecting entrepreneurs to potential financiers, attracting outside capital to the emerging market's energy sector more broadly, advising government officials on policy initiatives, or conducting academic research that can help educate entrepreneurs in the market. If entrepreneurs are able to internalize and capitalize on the industry stakeholders' expertise, the entrepreneurs can better plug into the support network that is available. While this support network is important, entrepreneurs need to be able to make decisions that lead to a resilient business that does not rely exclusively on such support.

Collaboration between entrepreneurs and other stakeholders within the energy value chain is critical to the success of energy businesses and offers an opportunity for substantial improvement over the status quo. By tailoring institutional support directly to the needs of entrepreneurs or even co-creating solutions with entrepreneurs, there is potential for more effective relationships across the value chain that can ultimately spur the success of entrepreneurs and their energy ventures. Additionally, while many of these relationships across the energy value chain are focused on a single business and their needs, both entrepreneurs and industry experts have the opportunity to think bigger by striving to address systemic issues that hinder the growth of energy businesses more broadly.

As we consider the broad clean energy industry, it remains critical to understand how industry experts and policymakers shape the ecosystem that entrepreneurs operate within. While entrepreneurs will never have direct influence over a country's domestic energy policy or the ability to control macro-trends such as income levels of customers, there continues to be an opportunity for mutual cooperation and learning to drive industry growth. Ultimately, helping entrepreneurs be successful will meet industry experts' objective to grow the clean energy industry. By tackling systemic barriers to entrepreneur's success, such as lack of access to financing or low consumer income, industry experts and policy makers can be invaluable allies for entrepreneurs. However, how these policies are constructed and implemented carries far greater weight than their intent. Regulatory uncertainty and lax enforcement of supportive policies can be just as significant a challenge to entrepreneurs as the bureaucracy and oppressive regulations most often cited in our literature review.

## Next Steps

While our research provided great qualitative nuance to the critical issues explored in our literature review, it was intended to be a purely exploratory exercise to be used as a starting off point for deeper research. Potential questions for future research could include:

1. How do entrepreneurs define "success" for their ventures?

2. How do industry experts define “success” for the entrepreneurs they engage with? What would a healthy, developed market look like?
3. How do differing priorities between entrepreneurs and industry experts inform how they define “success?”
4. Which areas of opportunity for greater coordination between entrepreneurs and industry experts should be prioritized? Do the priorities differ by audience?
5. Are India and Uganda representative of other emerging markets? Why or why not?

This project reinforced key elements uncovered in the literature review while also providing greater nuance and depth into the interplay between entrepreneurs and the broader ecosystem. We hope our insights can be of practical use to both entrepreneurs and industry experts and that these important topics will be explored further in the future.

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- 38 Kagimu, V., & Ustun, T. S. (2016). *Novel Business Models and Policy Directions based on SE4ALL Global Framework for Minigrids*. IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies.
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<sup>40</sup> Ibid

<sup>41</sup> Jolly, S., Spodniak, P., & Raven, R. (2016). Institutional Entrepreneurship in transforming energy systems towards sustainability: Wind energy in Finland and India. *Energy Research & Social Science*, (17), 102-118.

<sup>42</sup> Bhatia, M., Angelou, N. (2016). Capturing the Multi-Dimensionality of Energy Access. World Bank Group.

<sup>43</sup> Lecoque, D., & Wiemann, M. (n.d.). *The Productive Use of Renewable Energy in Africa*(Rep.). Alliance for Rural Electrification. European Union Energy Initiative Partnership Dialogue Facility. [https://www.ruralelec.org/sites/default/files/productive\\_use\\_of\\_energy\\_final\\_web\\_0.pdf](https://www.ruralelec.org/sites/default/files/productive_use_of_energy_final_web_0.pdf)



## Appendix 1: Literature Review

*The literature review is a summary of the findings from primary research across our team. The review is split between three distinct considerations: economic, social, & policy.*

Our review of existing research has demonstrated that different emerging markets have unique economic, social, and political considerations that entrepreneurs must carefully navigate. Every market is different. Innovative solutions need to be tailored to the environment in which the entrepreneur operates. Some of the noted key socioeconomic factors include: currency stability; ability to attract technology capital; business support resources and skilled talent; fair, open and competitive markets; respect and enforcement of the rule of law.<sup>1</sup> Despite many of challenges faced by entrepreneurs being broadly similar across countries, there is no comprehensive analysis of which challenges are most critical to prioritize and what potential solutions can be applied to overcome them. The following literature review will highlight the key economic, social, and political considerations that many renewable energy entrepreneurs face in emerging economies, while discussing the ways our research can help to fill gaps in the existing body of knowledge.

### *Literature Review Methodology*

Entrepreneurship, and the business models that support it, is a well-researched subject. To better understand what makes a venture successful, studies have examined everything from the personal characteristics of entrepreneurs themselves to the broader market environment in which businesses operate. In 1987, Sandberg and Hofer identified industry structure, venture strategy, and the entrepreneur themselves as the main variables that impact a business, and found that the combination of these factors had a greater impact on entrepreneurial success than any one variable alone.<sup>2</sup> This framework has since been cited in over 300 other papers and has formed a basis for considering factors beyond the entrepreneurial skills of an entrepreneur. Similarly, a more recent literature review focused on factors affecting development of cleantech startups (without an emerging markets slant) concluded a similar framework based around individual, firm-specific, and external factors, such as policy.<sup>3</sup> Other studies have focused more specifically on the external factors, which are often broken down into economic, policy, and social categories. These categories have been identified as key to determining the performance of a business, suggesting that it is difficult for an entrepreneur to prevail amidst a weak enabling environment.<sup>4,5</sup>

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<sup>1</sup> Griffiths, M. D., & Kickul, J. (2008). The Socioeconomic Determinants of Innovation. *The International Journal of Entrepreneurship and Innovation*, 9(4), 231-240

<sup>2</sup> Sandberg, W., and Hofer, C. (1987). Improving new venture performance: The role of strategy, industry structure, and the entrepreneur. *Journal of Business Venturing*, 2(1), 5-28. [https://doi.org/10.1016/0883-9026\(87\)90016-4](https://doi.org/10.1016/0883-9026(87)90016-4).

<sup>3</sup> Bjornali, E. and Ellingsen, A. (2014). Factors Affecting the Development of Clean-tech Start-Ups: A Literature Review. *Renewable Energy*

<sup>4</sup> Tenenbaum, B., Greacen, C., Siyambalapitiya, T., Knuckles, J. (2014). From the bottom up: How small power producers and mini-grids can deliver electrification and renewable energy in Africa. *Directions in development: Energy and Mining*. Washington D.C.: World Bank Group.

<sup>5</sup> Gnyawali, D. R., & Fogel, D. S. (1994). Environments for Entrepreneurship Development: Key Dimensions and Research Implications. *Entrepreneurship Theory and Practice*, 18(4), 43-62. doi:10.1177/104225879401800403

As renewable energy has become more prevalent around the world, a significant body of literature specific to business models for off-grid or distributed energy generation has developed as well. In both developed and emerging markets, there are a few common themes, including the significant impact of policies, institutions, and governance practices on energy entrepreneurship.<sup>6</sup> This is not to say that policy is not an important consideration of entrepreneurs in general, but as energy is a more regulated industry than many, perhaps policy plays a larger role in this case.<sup>7</sup>

Studies of entrepreneurship in emerging markets is still fairly new and significantly less explored than the study of entrepreneurship in developed markets, despite the vast differences in context and business.<sup>8</sup> Due to the large scope of this research and the richness and complexity which it seeks to capture, this methodology will focus on a qualitative and case based approach, with a particular focus on gathering and reporting data in a way which aims to be helpful for future entrepreneurs seeking to build a business in energy in an emerging market. A precedent exists for exploratory, case-based studies in the context of examining business from a wide lens. In a study of socially oriented businesses in emerging markets, a case study approach examined existing literature and conducted interviews to develop a qualitative analysis of three successful social entrepreneurship ventures across three different emerging economies. This research focused primarily on commonalities among business organization decisions rather than focus on different regional external factors.<sup>9</sup> Other studies that focus on smaller market segments have approached the analysis of business with surveys and a more quantitative focus, such as the examination of the impacts of entrepreneurs in Bangladesh,<sup>10</sup> however a case based approach is commonly used when examining entrepreneurship in emerging markets more broadly, as demonstrated in research of strategic actions that social entrepreneurs take to serve the base of the pyramid.<sup>11</sup>

### *Economic Considerations*

Economically, two critical problems for any entrepreneur that largely determine the “success” of a startup renewable energy company in a developing market are its ability to access capital and to effectively structure and collect customer payments. Both of these factors are of central importance to entrepreneurial enterprises, whose operating cash flows are limited and tolerance for monetary risk is low. In developing countries, foreign capital is often scarce, particularly for renewable energy projects that are viewed as high-risk. Additionally, by the nature of developing markets, consumers tend to be low income with little to no credit history to more holistically evaluate risk. Given these constraints, both the unique elements of these environments and an enterprise’s ability to respond accordingly will significantly impact its success.

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<sup>6</sup> Wustenhagen, R. and Wuebker, R. (2011). Handbook of Research on Energy Entrepreneurship.

<sup>7</sup> Tenenbaum, B., Greacen, C., Siyambalapatiya, T., Knuckles, J. (2014). From the bottom up: How small power producers and mini-grids can deliver electrification and renewable energy in Africa. *Directions in development: Energy and Mining*. Washington D.C.: World Bank Group.

<sup>8</sup> Bruton, Garry D., David Ahlstrom, and Krzysztof Obloj. "Entrepreneurship in emerging economies: Where are we today and where should the research go in the future." *Entrepreneurship theory and practice* 32.1 (2008): 1-14.

<sup>9</sup> Mair, Johanna, and Oliver Schoen. "Successful social entrepreneurial business models in the context of developing economies: An explorative study." *International Journal of Emerging Markets* 2.1 (2007): 54-68.

<sup>10</sup> Chowdhury, Mohammed S. "Overcoming entrepreneurship development constraints: the case of Bangladesh." *Journal of Enterprising Communities: People and Places in the Global Economy* 1.3 (2007): 240-251.

<sup>11</sup> Goyal, Sandeep, Bruno S. Sergi, and Mahadeo P. Jaiswal. "Understanding the challenges and strategic actions of social entrepreneurship at base of the pyramid." *Management Decision* 54.2 (2016): 418-440.

Companies seeking private financing face the challenge of convincing outside investors that they are a worthy investment. Until relatively recently, renewable energy technologies have been too expensive or unproven to successfully deploy and earn an acceptable return. Alternatively, startups looking to bolster their balance sheets with government subsidies tend to face significant bureaucracy and the subsequent uncertainty it causes.<sup>12</sup> This uncertainty can manifest in two ways. In the short-term, enterprises that qualify for subsidy programs rarely actually benefit due to a lack of concrete timetables for subsidy disbursement. In the long-term, there is often a lack of clarity as to whether current subsidies will continue into the future. These factors put additional pressure on the company's day-to-day operations and makes future cash flows unpredictable. Debt represents a critical unmet need for these enterprises due to the high cost of standard domestic financing.<sup>13</sup> Enterprises face steep interest rates from local banking institutions due to the perceived risk in the renewables sector, the lack of adequate financial history for early stage enterprises, and the long payback periods common for renewable energy projects.

This lack of access to reliable third-party capital places undue burden on local project developers and makes it difficult for startup companies to finance their operations.<sup>14</sup> Fundamentally, as long as outside investors view distributed renewable energy as a risky investment, there will be a mismatch between the perceived risks and rewards of investing in these startups. Part of this mismatch is due to the fact that financial institutions do not understand the nuances of the markets, which include viability of renewable technologies, implications of different business models, and ways to assess future profitability of specific investments. There is also a lack of reliable business data that investors can evaluate.<sup>15</sup> Additionally, while government entities and NGOs may be willing to disburse subsidies based on environmental and social benefits for a renewable energy project, traditional financial institutions often do not share the same priorities.

Given that most of the targeted consumers for distributed renewable energy systems tend to be low-income and/or rural dwellers, it is crucial for startups to develop effective mechanisms to ensure their customers are able to pay for the energy services or goods. An example of a recent trend is the creation of mobile payment platforms given the high penetration of cell phone access in developing economies. Another example is employing local laborers whose payment structure is partially based on the amount of bills collected. This has proven useful in countries where lack of payment due to an inability to enforce contracts is commonplace.

Despite low margins, renewable energy systems tend to have high upfront costs<sup>16, 17, 18</sup> making them historically expensive for individual consumers. Enterprises in this space must meet two overlapping constraints of their target market - low incomes and seasonal cash flows. Renewable energy entrepreneurs are tackling these challenges in numerous ways. First, enterprises strive to make their offerings affordable through various payment structures and subsidized costs. A recent trend of converting traditional business models, which involved the sale of assets, to

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<sup>12</sup> Ibid

<sup>13</sup> Ibid

<sup>14</sup> Park, Jacob. (2016). *Global Entrepreneurship: Past, Present & Future. Advances in International Management*, Volume 29, 257-277

<sup>15</sup> The Business Case for Off-Grid Energy in India (Rep.). (2015). Retrieved May 10, 2018. The Climate Group & Goldman Sachs.

<sup>16</sup> Capital Cost Estimates for Utility Scale Electricity Generating Plants. (2016). Retrieved Feb 17, 2019. U.S. Energy Information Administration.

<sup>17</sup> Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2019. (2019). Retrieved Feb 17, 2019. U.S. Energy Information Administration.

<sup>18</sup> Jackson, Tom. (2015). "Africa's New Breed of Solar Energy Entrepreneurs". BBC News.

business models adopting the idea of energy as a service is a prime example of decreasing the upfront costs faced by consumers. Additionally, given that cash flows in agricultural communities (regular target segment for these enterprises) are highly seasonal, renewable energy enterprises that help boost year-round productivity through the greater availability of electricity can ensure potential customers have smoother (and higher) levels of income, making regular payment more likely. Companies are already utilizing a variety of financing schemes to ensure their offerings are more affordable.<sup>19</sup> The following are examples of innovative financing approaches:

- Individual loans: Consumers make a 10-25% down payment, while a third-party micro-finance institution or local bank provides a loan carrying a 5-20% interest rate for the remaining cost. This approach, however, faces challenges given the low penetration of these financial institutions and their relative unwillingness to lend to targeted consumer segments.
- Group loans: Loans are provided to an entire village or collective, who then share the costs and benefits of a renewable energy system among themselves. This approach can be challenging due to collective action problems, difficulty in obtaining loans, and the need for an organized, connected energy distribution network.
- Subsidies and grants: Consumers can also directly apply for government subsidies or donor grants to afford the technology, however due to the relative scarcity of these resources, they may be difficult to secure. Furthermore, they could create poor incentive schemes and reduce consumers' willingness to pay in the long-run as they come to expect subsidized prices.
- Installment plans: Under this construct, consumers pay fixed monthly installments until the costs of the energy systems are paid off. This not only places the onus on the startup to have additional working capital to cover the extended payback period, but also forces the business to incur high collection costs due to more intensive customer engagements.
- Pay-As-You-Go: Consumers pay in accordance with their usage until the system is paid off, with remote monitoring technology being used to regulate activities and access. This payment structure forces startups to build monitoring capabilities and enforce contracts in the event of non-payment, but has been gaining popularity in recent years as technological advancements and declining costs have made it more practical.

### *Social Considerations*

There are a myriad of social factors that startups must consider when undertaking and developing their business. Factors such as that absence of governmental support, inadequate local demand, the price of RETs, lack of institutional finance, limited skilled labor availability, underdeveloped infrastructure, and the power of incumbent players within the market all greatly affect the success of renewable energy ventures. As such, the culture within which the business operates is extremely important. In addition to the critical role played by a country's economic outlook and market development, startups have the best chance of being successful when operating in a

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<sup>19</sup> The Business Case for Off-Grid Energy in India (Rep.). (2015). Retrieved May 10, 2018. The Climate Group & Goldman Sachs.

culture that encourages and supports the idea of self-employment. Institutions that do not share this affinity for entrepreneur success will limit the ability of entrepreneurs to succeed.<sup>20</sup>

This concept of institutional support can come in the form of social, cultural, or political influences and help to structure the market, function as a rule maker, and ensure full market access. Institutional support comes primarily in the form of governmental regulation and policy. However, in many developing countries, such as the countries to be considered in this study, this high-level support is often absent or corrupt. In this event, the burden of ensuring a fair market falls to business groups, which can be problematic, especially when individual financial incentives do not align with fair trade. Thus, the market necessitates institutional support from social movement-like organizations, public-private organizations, religious organizations, etc. Countries that are able to manifest market support from such organizations ensure greater market access from marginalized populations and impoverished communities.<sup>21</sup>

Instilling institutional support from social organizations can be difficult and may often take a while to gain influence. In such events, entrepreneurs within developing nations that operate in a state of “bricolage”, or simply “making do” with what is available to them, find creative opportunities to circumvent institutional voids. The more entrepreneurs that penetrate the market, the more social movements have to grab root of and the quicker broader institutional support follows. As was previously mentioned, this institutional support is vital for opening full market access and removing barriers to entrepreneurs.

One example of this can be seen in how entrepreneurs are addressing the lack of purchasing power in locations where these ventures are operating. It is becoming increasingly evident that entrepreneurs are developing business models centered around grant applications and other donor fund sources; this funding is often based around a project-by-project approach and usually available through Non-Governmental Organizations & International Development Organizations.<sup>22</sup> Entrepreneurs are designing their business to receive this kind of philanthropic funding as a way to supplement the limited revenue opportunities. In this manner, the cost burden is partial passed from the consumer to the funding organizations. This allows more people to access the market and more flexibility in how the business can be run.

### *Policy Considerations*

Specific policies regulating the energy industry vary from country to country, but any renewable energy startup - no matter the location - will need to navigate their market’s specific regulations to succeed. The difficulty of navigating the political landscape can vary significantly, as entrepreneurs in some countries rely upon benefits received through the government, such as subsidies, while others must overcome challenges presented as a result of government policies or lack thereof. This review of policy literature details the effects that policies can have upon

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<sup>20</sup> Martinez, M. C., Fuensanta, M. J., & Rodriguez, I. M. (fall 2013). The Influence of Socioeconomic Factors on Entrepreneurship and Innovation. *Journal of Small Business Strategy; Peoria*, 23(2), 15-27. Retrieved May 14, 2018.

<sup>21</sup> Mair, J., & Marti, I. (2009). Entrepreneurship in and around institutional voids: A case study from Bangladesh. *Journal of Business Venturing*, 24(5), 419-435. doi:10.1016/j.jbusvent.2008.04.006

<sup>22</sup> Gabriel, C., Kirkwood, J., Walton, S., & Rose, E. L. (2016). How do developing country constraints affect renewable energy entrepreneurs? *Energy for Sustainable Development*, 35, 52-66. doi:10.1016/j.esd.2016.09.006

entrepreneurs and small businesses, but also demonstrates that there is not widespread consensus as to which types of policies are the most influential in driving entrepreneurial growth.

Prior to determining the best policy options, they must be broken down into distinct categories. This way in which various regulations are characterized is also contested among some scholars. When exploring governments' entrepreneurship strategy in Latin American nations, Gonzalez and Spencer broke down policies into three buckets: those related to financial assistance, entrepreneurial training, or those dealing with the societal perception of entrepreneurship.<sup>23</sup> Ultimately the most successful entrepreneurial ecosystems existed in nations that were able to combine elements from all three types of policies into their government structure. Another common characterization of policies is in relation to the mechanism by which they encourage entrepreneurship - either through technology push or market pull.<sup>24</sup> 'Technology push' policies are designed with the goal to increase amount of technology supply, while 'market pull' policies try to increase demand for products so entrepreneurs are more incentivized to step in and create a supply. There is no consensus as to which type of policy yields better results, as there is a long history of mixed results based on factors including technology type and market structure.

In addition to traditional subsidies and tax credits, or 'market pull', that can make an innovative venture more financially viable, models of low cost micro finance facilitated by government funds have been demonstrated to spur growth of micro enterprises.<sup>25</sup> At times it is not the taxes and tariffs themselves that can benefit startups, but the policy structure that addresses how new technologies will be incorporated into the current system. This was evident when India imposed the National Tariff Policy to acknowledge how mini-grid technologies would be integrated into the existing grid tariff structure.<sup>26</sup> Essentially, governments can act to normalize new technologies that are surrounded by uncertainty or apprehension.

Despite the evidence for policies factoring into entrepreneurial success, there are several cases in which regulations can impede, or even stop, new businesses from progressing. Government projects can threaten private startups profits in a few ways. One would be undercutting their prices. For example, startups must consider how they can compete or coexist with state sponsored energy projects, which generally boast the lowest costs thanks to their heavy subsidies.<sup>27</sup> In India government policy and plans around grid-extension is still unclear and it is unclear where the government will actually extend the grid. Given startup enterprises cannot directly compete with cheaper, subsidized grid power, this uncertainty leads to financial institutions becoming even more hesitant to finance renewable energy projects.<sup>28</sup> While this trend may be more acute in India than it might be in some African countries where grid extension is further off, it is nonetheless a factor in any off-grid market.

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<sup>23</sup> Spencer, J. W., & Gonzalez, C. (2001). Can Government Policies Promote Entrepreneurship? Evidence from Costa Rica, Uruguay and Chile. Center for Latin American Issues.

<sup>24</sup> Mary Jean Bürer, Rolf Wüstenhagen. (2009). Which renewable energy policy is a venture capitalist's best friend? Empirical evidence from a survey of international cleantech investors. *Energy Policy*, (37)12:4997-5006.

<sup>25</sup> Jahanshahi, A. A., Nawaser, K., Khaksar, S. M., & Kamalain, A. R. (2011). The Relationship Between Government Policy and the Growth of Entrepreneurship in the Micro, Small & Medium Enterprises of India. *Journal of Technology Management & Innovation*, 6(1).

<sup>26</sup> Dalberg. (2017, May). Improving Access to Electricity Through Decentralised Renewable Energy. Dalberg Global Development Advisors.

<sup>27</sup> Comello et. al. (2016). *Enabling Mini-grid Development in Rural India*. Stanford Graduate School of Business, Working Paper No. 3382.

<sup>28</sup> The Business Case for Off-Grid Energy in India (Rep.). (2015). Retrieved May 10, 2018. The Climate Group & Goldman Sachs.

Additionally, governments can levy high taxes or impose tariffs that negatively affect a startup. There can be a dichotomy between the most commercially profitable model and an optimal governmental policy model that provides a greater number of people with electrification.<sup>29</sup> When evaluating the “success” of various startups, it will be critical to determine whether their first priority is the business’ impact or its finances. This will not only provide insight into which strategies are successful, but also how we want to define “success” to begin with. Ultimately we predict that there will have to be a balance struck between the two goals, as profitability is vital to keeping the business afloat to carry out its mission, however it is unclear where this balance lies.

A key obstacle for startups is the clarity and certainty needed to plan for the future. Given the volatile governing structures in many emerging economies, the ever-evolving nature of relevant policies requires startups to be flexible to adapt successfully. As mentioned previously, these shifting policies create uncertainty which acts as a deterrent for foreign investment. In India, for example, periods during political elections can drastically alter the price structure commodities such as electricity and agricultural pumps because officials are implementing heavy subsidies in order to secure votes.<sup>30</sup>

Additionally, bureaucratic red tape can significantly delay or even prevent entrepreneurs from creating or expanding a business, or prevent investors from investing. For example, the U.S. Department of State found that bureaucratic overreach and poor business climate had on disincentivizing foreign investment in Gabon.<sup>31</sup> This misalignment of policy overreaches boundaries and affects innovation and the ability of entrepreneurs to succeed.<sup>32</sup> Oftentimes policy creation occurs at levels far removed from the entrepreneurs that they are meant to impact. In these instances, entrepreneurs are often constrained by the design of the regulation in question. Several potential business owners in Cuba experienced this misalignment, when the Cuban government introduced policies intended to encourage entrepreneurship in sectors that were not desired by entrepreneurs in the country.<sup>33</sup> While less literature exists on it, there is also an interesting relationship between stakeholders trying to influence the very institutional contexts, or policies, that they are also constrained by. At times the existence of opportunity and flexibility to influence those policies can be key in determining entrepreneurial success.<sup>34</sup> During in-country research, we will make a point to try and gauge the receptiveness of government entities to be influenced by trends occurring among the populations they govern.

### *Limitations*

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<sup>29</sup> Kagimu, V., & Ustun, T. S. (2016). *Novel Business Models and Policy Directions based on SE4ALL Global Framework for Minigrids*. IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies.

<sup>30</sup> Jolly, S., Spodniak, P., & Raven, R. (2016). Institutional Entrepreneurship in transforming energy systems towards sustainability: Wind energy in Finland and India. *Energy Research & Social Science*, (17), 102-118.

<sup>31</sup> U.S. Department of State. (2015). Gabon Investment Climate Statement.

<sup>32</sup> Edoho, F. M. (2015). Entrepreneurship and socioeconomic development. *African Journal of Economic and Management Studies*, 6(2), 127-147.

<sup>33</sup> Orozco, M., & Hansing, K. (n.d.). Remittance Recipients and the Present and Future of Entrepreneurship in Cuba. In *A Contemporary Cuba Reader* (pp. 183-197).

<sup>34</sup> Jolly, S., Spodniak, P., & Raven, R. (2016). Institutional Entrepreneurship in transforming energy systems towards sustainability: Wind energy in Finland and India. *Energy Research & Social Science*, (17), 102-118.

In the process of building out this literature review, many of the sources we used for our literature review generally emphasized historical data and secondary sources, rather than primary interviews or data collection.<sup>35</sup> This paper is instead built on primary research - with key learnings and insights stemming from that research. Additionally, while these referenced material have extremely rich information about a particular country, it is not always applicable to other markets. Given that these insights are not necessarily transferable to other countries, one of the objectives of this research is to develop insights that can be broadly applied across other locations and contexts. Some of these sources also focused on startups in more industrialized nations, particularly in the European Union, which differ greatly from those emerging markets.<sup>36</sup>

Another limitation faced is access to information. While many relevant sources of information have been analyzed, collection of primary information in developing countries is limited. This leads to a dearth of reliable data and statistics for analysis. Limited access to this existing information makes accurately predicting the development of socio-economic factors in these countries difficult. For example, the context within which a startup is created will often determine whether entrepreneurs plan for their companies to be “necessity-driven” or “opportunity-based”. Based on this context, similar stimuli could provoke radically different responses from entrepreneurs - putting more emphasis in our analysis on hard-to-measure factors such as market development and economic hardships.<sup>38</sup> Lastly, each country has unique public policy implications, and these will likely not be shared between countries.<sup>39</sup> Given this, it will be critical to explore methods for effectively interacting with policy that can be broadly used by entrepreneurs in various countries.

## Conclusion

This research has outlined existing considerations that significantly impact the success of startup businesses in the renewable energy space. In particular the literature review has focused on how unique economic, social, and policy considerations can affect startups. These three categories that have been established by the reviewed literature form the framework of this research, as detailed in the Methodology section. While each country is different, there are broad findings that can be applied across different markets. How entrepreneurs respond to these stimuli will be critically important as they attempt to build their business. However, while many challenges facing entrepreneurs may be broadly similar across countries, this review has shown there is limited analysis in emerging markets of which challenges are most critical to prioritize, and the potential solutions that can be applied. By focusing on the primary category delineations that have emerged from this literature - including social, political, and economic - this research

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<sup>35</sup> Jahanshahi, A. A., Nawaser, K., Khaksar, S. M., & Kamalain, A. R. (2011). *The Relationship Between Government Policy and the Growth of Entrepreneurship in the Micro, Small & Medium Enterprises of India*. *Journal of Technology Management & Innovation*, 6(1)

<sup>36</sup> Griffiths, M. D., & Kickul, J. (2008). The Socioeconomic Determinants of Innovation. *The International Journal of Entrepreneurship and Innovation*, 9(4), 231-240

<sup>37</sup> Martinez, M. C., Fuensanta, M. J., & Rodriguez, I. M. (fall 2013). The Influence of Socioeconomic Factors on Entrepreneurship and Innovation. *Journal of Small Business Strategy; Peoria*, 23(2), 15-27. Retrieved May 14, 2018.

<sup>38</sup> Kautonen, T., & Palmroos, J. (2009). The impact of a necessity-based start-up on subsequent entrepreneurial satisfaction. *International Entrepreneurship and Management Journal*, 6(3), 285-300

<sup>39</sup> Edoho, F. M. (2015). Entrepreneurship and socioeconomic development. *African Journal of Economic and Management Studies*, 6(2), 127-147.



explores the path to success for renewable energy entrepreneurs in emerging markets.

## Appendix 2: Analytical Framework

The analytical framework outlines success factors identified in primary literature influence that influence the ability of an entrepreneur's business to succeed in a developing economy. The framework is into four general categories and then subdivided into internal and external groupings for each category.

Code	Success Factor	Information Value / Context
<b>I. Business Operations</b>		
<i>A. Internal</i>		
I.A.1	Growth to-date (revenue/sales growth, # of customers, rate of new customer acquisition, customer retention, etc)	Past growth is a strong indicator of continued business success. Wiklunch, et al 2013 include metrics such as employment growth, sales growth, sales growth compared to competitors, and value growth compared to competitors to measure growth
I.A.2	Future strategy/growth plans	Future strategy will allow us to understand if a business expects to continue its current growth trajectory, increase their growth rate, or perhaps slow down/level off if they aren't intending to achieve scale.
I.A.3	Product quality	Lack of regulation surrounding product quality leads to an excess of cheaply produced, low-quality products flooding the marketplace. When these products invariably break down or do not work properly, consumers lose trust in the product category and are unlikely to repurchase other products - even if the quality is superior.
I.A.4	Scalability	It's important to consider any operational constraints that limit the scalability of a business model. Depending on the goals of the entrepreneur, limits to scale may or may not be a metric that affects 'success'.
I.A.5	Reason for founding company	"This is valuable because the motivation behind why a company's founders began the start-up often influences their future growth plans. For example, if the company was started out of necessity (feed family) rather than an opportunity for entrepreneurship/making an impact then the company may only grow to a size sufficient to fill the purpose of meeting the needs of feeding a family. If the company is started because of opportunity, then the start-up phase may be viewed as the first step of many.  Walker and Brown, 2004 argue that "'Pull' motivation is associated

			with the individual having a reasonably strong positive internal desire to start a business venture. The opposite motivation is 'push', which is associated with a possible equally strong desire, but based on external negative reasons."
	I.A.6	Commitment to/culture of innovation	<p>"Based on Shumpeter's famed book, Capitalism, Socialism, and Democracy 1942, which has informed many subsequent economic works, we have defined this factor to include both innovation of products, services, production methods, distribution, and marketing as well as innovation of business models.</p> <p>Zott and Amit, 2010 focus on the innovation of business models as a key indicator of firm performance. Wilkund 2013, et al describe this factor as 'entrepreneurial orientation' which they break down into innovativeness, proactiveness, and risk taking; entrepreneurial orientation was found to be the primary indicator of business success in their study.</p> <p>However, in emerging markets, it is critical that innovations be appropriate for the context. Zeschky, et al 2014 and other sources use the term ""frugal innovation"" to describe this specific type of innovation that succeeds in emerging markets due to its cost advantage in resource-constrained settings compared to existing solutions, even at the expense of functionality sometimes."</p>
	I.A.7	Consumer education to facilitate adoption of technology	Emerging markets may have customers that are not familiar with renewable energy technologies. The businesses ability to make customers comfortable with the new technologies, thus facilitating adoption, could be a key to their success.
	I.A.8	Ability to collect revenue	"SMEs in emerging markets do not have high investment capital and hence are restricted in the ways they can accept payments from customers (most accept 'cash-only' payments)." This limited ability to collect revenue can have negative effects on a company's cash flow and in turn, negative impacts on its overall success.
	I.A.9	Existence of multiple/diverse revenue streams	Diversification is generally considered to be a smart move for businesses because diverse revenue streams mitigate risk as compared to relying solely on a single revenue stream. However, diversification can come with its own risks, including over-extending a resource-constrained company. Therefore, diversification is only an asset if done well and not at the expense of other factors that fuel business success.
	I.A.10	Profitability/financial sustainability	<p>"Profitability and likelihood of future profits are both key metrics used by businesses and investors alike when evaluating the probability of success of a business. Newer businesses have higher failure rates and achieving profitability is an indicator of future business longevity.</p> <p>Gorgievski, et al 2011 said: ""In line with previous literature reviews (for example, Adams and Sykes 2003; Julien 1998; Paige and</p>

			Littrell 2002), we found that growth and profitability are the two criteria most often used as performance measures in the entrepreneurship and small business literature."
	I.A.11	After-sales service	Given the lack of population density for many communities lacking access to a central grid, providing after-sales service has become an integral part of distributors' value proposition. This helps entrepreneurs build stable long-term sources of revenue, while providing users the peace of mind that any product issues can be duly serviced.
	I.A.12	Strength of relationships with investors	VC is an emerging asset class in the entrepreneurial sector in India and the high-risk/high-reward nature of VC investment in start-ups requires trust and partnership between investors and investees to manage those risks and achieve success.
	I.A.13	Entrepreneurial experience	Research shows that more experienced entrepreneurs have higher success rates launching new ventures
	I.A.14	Talent attraction/retention	The ability to attract and retain talented employees is a mark of good management, while the inability to do so indicates potential issues either with the business model itself or management, or a larger institutional gap in the ecosystem.
	I.A.15	Domestic skilled labor supply (installation, electrician, etc.)	A limited supply of domestic skilled labor will limit the ability for a business to scale and perhaps even keep up with its day-to-day operations
	I.A.16	Positioning / Strategy	Entrepreneurs focus on developing a unique positioning strategy for their business. This could include a focus on a particular niche of product, service, or consumer that the entrepreneur feels is best delivered by them.
	I.A.17	Company Structure	Entrepreneurs decisions can be constrained by the company's structure, include it's debt liabilities, customer payment structure, sales cycle, or level of outsourcing.
	I.A.18	Business Model Flexibility	Numerous entrepreneurs explain that the fast face of the industry renders most business plans obsolete within 6-12 months. In order to remain competitive, startups must constantly adjust their value proposition to ensure they're able to meet consumers' changing demands.
<b>B. External</b>			
	I.B.1	Cost of rival goods (products, electricity, alternative fuels, etc)	Directly influences the cost at which the venture will be able to compete. Important to consider as it pertains to the affordability of the product by customers within the market it operates.

	I.B.2	Cost of inputs/raw materials	Directly influences the cost at which the venture will be able to compete. Important to consider as it pertains to the affordability of the product by customers within the market it operates.
	I.B.3	Strategic partnerships	Entrepreneurs often seek out partnerships with other companies along the value to establish mutually beneficial relationships. This could include partnering with other companies who provide complementary services, or similar companies to increase their combined bargaining power.
	I.B.4	Competitive landscape (# of competitors)	Both the number of competitors/incumbents and the power of those competitors/incumbents impact the ability of a firm to succeed. Filling a niche market is more desirable than competing for market share in a saturated market.
	I.B.5	Level of corruption (bribes, favors, "greasing the skids")	Corruption could discourage potential entrepreneurs from starting a business or reduce investment from entrepreneurs already in business because of increased risk, either real or perceived. Studies have shown that corruption has a stronger impact on necessity-based entrepreneurship than on opportunity-based entrepreneurship.
<b>II. Financing</b>			
	II.1	Accessibility of government financing	Access to capital is one of the single most important drivers of business success. If a business struggles to gain access to the capital needed to launch and scale its operations, it will struggle to achieve success.
	II.2	Accessibility of private investment	Access to capital is one of the single most important drivers of business success. If a business struggles to gain access to the capital needed to launch and scale its operations, it will struggle to achieve success.
	II.3	Accessibility of philanthropic funds/grants	Access to capital is one of the single most important drivers of business success. If a business struggles to gain access to the capital needed to launch and scale its operations, it will struggle to achieve success.
	II.4	Accessibility of working capital	The availability of working capital on hand is critical for entrepreneurs to fund the day-to-day operations of their businesses and provide liquidity to their finances.
<b>III. Policy, Regulation, and Governance</b>			
	III.1	Financial incentives (taxes, subsidies, etc)	Financial incentives provided through government policies can create a market demand for new energy technologies, or create a landscape in which it is more financially viable to increase supply of new energy tech through new start-ups.
	III.2	Utility structure	Influences competing costs, as well as how customers are accustomed to purchasing energy.

	III.3	Domestic energy policy (net energy metering, feed-in tariffs, etc)	Feed-in tariffs effectively increasing the share of renewables have been proven to lower risk for investors interested in funding such technologies.
	III.4	Political Landscape	The political landscape introduces a degree of uncertainty and unfamiliarity for the entrepreneurs. Political turmoil often negatively influences the ability for a venture to succeed.
<b>IV. Country Demographics</b>			
<i>A. Country Characteristics</i>			
	IV.A.1	Grid structure	Important to consider how the product will tie into the grid, if it needs to. This will be important to reach customers and spur scalability.
	IV.A.2	Distribution infrastructure	How the venture plans to transmit energy to customers is important. It may tap into the grid, or operate on a smaller, more isolated scale. Each requires a unique business model.
	IV.A.3	Productive use	In order to maximize the gains of increased efficiency, many entrepreneurs and industry experts advocate for an increased focus on heavy energy users. Productive usage (ex. manufacturing) provides an opportunity for the sellers to tap a much higher level of energy demanded while users can realize efficiency gains at a much greater scale than home users.
	IV.A.4	Percent of country off-grid	Off-grid populations are a unique market that offers a lot of opportunity, but also poses difficulty pertaining to existing infrastructure and scalable nature of the business. Strategy should align with infrastructure considerations and target market. A country with a considerable population off-grid, yet currently experiencing accelerated grid expansion is desirable.
	IV.A.5	Presence of institutional support	Institutional support comes in the form of social, cultural, and political influences. It drives market transactions and set “rules” in which ventures operate. This institutional support should come, first and foremost, from the government in the form of market regulation and policy. In the absence of such, business groups self-regulation is important. Where business interest doesn’t align, social organizations need to take the lead. Voids originate from interplay between existing power structures, legacy institutions, and institutional practices. Voids raise the cost of transactions and limit access to markets.
<i>B. Customer Characteristics</i>			
	IV.B.1	Customer financial resources	The financial resources of the customer greatly influence the price point from which the venture can operate.
	IV.B.2	Prevalence of	Primarily relates to the cost of the available product. Grid

		clandestine grid connections	connections that fit the technological development of the community and technology from within which they function, reduce explicit and variable cost. At the same time, the technology becomes prepared for wider scale implementation, the grid development will have to be considered.
	IV.B.3	Secondary benefits	Some benefits of renewable energy are not directly captured by entrepreneurs. This includes could include improved education outcomes through additional lighting or improved health outcomes from switching from charcoal stoves to clean cookstoves.
	IV.B.4	Consumer creditworthiness	In addition to firms struggling to attract investment, many target consumers for off-grid renewable energy lack a proven credit history that could qualify them for personal loans that could increase their ability to afford renewable energy products / services.

## Appendix 3: WDI Project Team Interview Protocol

*The interview protocol outlines the methodology used to conduct interviews between the two identified stakeholder groups.*

### *Objectives*

The goal of our research was to understand how energy entrepreneurs in emerging markets can navigate key social, political, and economic considerations in order to succeed. We hoped to use our research to identify which challenges are most critical to prioritize and which solutions or strategies are most effective. Taken together, we hope to illuminate a path to higher rates of success for renewable energy entrepreneurs in emerging markets.

### *Methodology*

Our research focused on energy entrepreneurship in two developing countries – India & Uganda. These countries were selected to ensure we have a suitably differentiated sample mix across the landscape of the developing world.

We conducted qualitative interviews with a variety of key stakeholders in each country. Each interview lasted ~60-75 minutes. When possible, interviews were conducted face-to-face during on-site visits. If in-person interviews are not possible, the team utilized online tools (ex. Skype) to conduct the interviews. Interviewers followed the natural flow of the conversation and did not necessarily follow the explicit order of the interview questionnaires. This allowed interviewees to spend time on the issues more pertinent to their operations. If particular questions had not been reached in the natural flow of conversation, they were explicitly asked at the end of the interview.

In each country, our team aimed for a mix of respondents from the following audiences:

<b>Audience</b>	<b>Definition</b>	<b>Objective</b>
Energy Startups	Current energy entrepreneurs. Can include founders or high-level employees of startup companies. Include a mix of industries (solar, biomass, etc.), sizes, and ownership structure. To avoid survivorship bias, including failed energy ventures if possible.	Understand the experience of current entrepreneurs. What challenges do they face? What solutions do they find most effective?
Industry Experts	NGOs, non-profits, numerous types of investors, and other business support organizations	Understand the country-specific context within which energy entrepreneurs operate.



## Appendix 4-A: Interview Overview for Energy Entrepreneurs

*Below is a draft of the questionnaire our team utilized. Various elements of the questionnaire were emphasized / de-emphasized based on the relevant audience. Additionally, we conducted mock interviews prior to travel to optimize the questionnaire. Detailed notes were taken and at least two researchers were present during all interviews. If given the consent of the interviewee, interviews were recorded for note taking and analysis purposes. Any findings or desired publications directly attributable to an individual will require their express permission before release.*

### 1. Introduction and Open-Ended Responses

Thank you for taking the time to speak with us today. This interview should last ~75 minutes, but our goal is to have this be more of a conversation than a question-and-answer session. The goal of our research is to understand how energy entrepreneurs in developing countries are most successful, so it is important for us is to get your honest feedback. There are no right or wrong answers/opinions and if you do not feel comfortable answering a question, we will move to the next one. We intend to anonymize all the information gathered during our analysis. If it's ok with you we'd like to record the conversation so we can refer back to it, however if you aren't comfortable with this we can rely on note-taking. We'll start with a few general questions.

To start out the conversation: **Can you first tell us the story about how you came to create this company?**

1. How would you describe what your company does? What value do you provide to your customers?
2. What inspired you to start this company?
3. Did you have experience as an entrepreneur before starting this company?
  - a. [IF RELEVANT] What was it? What did you learn from that experience that informed your approach to this company?

**OR:** How has your background contributed to your decision to starting this company?

4. How has the company grown since you started it?
5. What are the most significant challenges the company has faced and how did you overcome them?

**OR:** Can you talk about a significant challenge you've faced with this company?

**Follow-up:** How did you overcome it?

6. How do you hope the company will grow in the next five years?

- a. [IF NOT MENTIONED ORGANICALLY] How will you achieve this desired growth? What challenges to scaling do you foresee?

## 2. Internal Success Probes

Great, thank you. There are a few things that I'd like to get your perspective on. First, I'd like to ask you a bit more about your team:

- 7. What is the labor market in \_\_\_\_\_ like?

**OR:** Can you talk about how you hire employees for your company here in \_\_\_\_\_ ?

- a. Are you easily able to hire talented individuals?
  - b. How do you retain your best employees?
- 8. Can you give an example of a time when your company had to make a difficult decision? What did you decide to do and how did you come to that decision?
    - a. [IF USING DATA IS NOT MENTIONED ORGANICALLY] What kind of data did you use to make this decision?
  - 9. Who are your key partners? Can you give us an example of a key partnership? How has it been useful in your development as a company?
    - a. [IF INVESTORS ARE MENTIONED] How does your team build relationships with investors? What are those relationships like?

Thank you. Now I'd like to ask you about your customers:

- 10. What customer segments do you target? Why do you target these audiences? What kind of market research did you conduct, and how?
  - a. What financial resources do these customers have?
  - b. [IF RELEVANT] How do you facilitate the adoption of your technology among this audience?
- 11. What kind of financial margins are typical in this industry?
  - a. [IF RELEVANT] Does your company have multiple revenue streams? Do you have plans to develop any new revenue streams?
- 12. How do you collect revenue from your customers?
  - a. Do you have any challenges with revenue collection? [PROBE - clandestine grid connections]

### 3. External Success Probes

Great. There are a few things we've heard regarding different market forces and how they impact businesses that I'd like to ask you about.

13. Who are your competitors? What about your company differentiates it from your competitors? How do you provide more value for your customers than your competitors do?
  14. How does the cost of your goods / services compare to rival goods? [PROBE - products, electricity, alternative fuels]
    - a. How much are your prices impacted by the prices of raw materials vs operational issues like shipping / distribution?
  15. How does the grid infrastructure in your market impact your business? Do you interact with utilities?
  16. How easy or difficult is it for your company to get financing? Why? How does this affect how your business operates?
- OR:** What common methods have you seen with your or your competitors to obtain financing?
- a. Government financing?
  - b. Private investment?
  - c. Philanthropic grants?
17. What government policies most impact your company? [PROBE - Taxes / subsidies]
    - a. [IF NOT MENTIONED ORGANICALLY] Is corruption a challenge in the markets in which you operate? If so, how?

#### **4. Closing + Advice**

Thank you. And now we just have a few final wrap-up questions before we finish.

18. What do you know now that you most wish you'd known when you started your company?
19. What are you most worried about moving forward?
20. [IF INNOVATION NOT MENTIONED ORGANICALLY EARLIER] One thing we've heard other organizations talk about is "innovation". What does "innovation" mean to you and your company?
  - a. [PROBE] How do you foster and maintain a culture of innovation?
21. Who else should we talk to during our research?
22. Is there anything that we haven't talked about today that you think is important?

#### *Wrap-up*

Thank you again for your support of our project. Your answers will provide invaluable insight into the topic of successful renewable energy entrepreneurship. We plan to conclude our project by April 2019. If you would like a copy of the final product or have any further questions or comments regarding this study at any time, we can be reached at the following email address: [WDIMastersProject@umich.edu](mailto:WDIMastersProject@umich.edu).

## **Appendix 4-B: Interview Overview for Industry Experts**

*Below is a draft of the questionnaire our team utilized. Various elements of the questionnaire were emphasized / de-emphasized based on the relevant audience. Additionally, we conducted mock interviews prior to travel to optimize the questionnaire. Detailed notes were taken and at least two researchers were present during all interviews. If given the consent of the interviewee, interviews were recorded for note taking and analysis purposes. Any findings or desired publications directly attributable to an individual will require their express permission before release.*

### **1. Introduction and Open-Ended Responses**

Thank you for taking the time to speak with us today. This interview should last ~60 minutes, but our goal is to have this be more of a conversation than a question-and-answer session. The goal of our research is to understand how energy entrepreneurs in developing countries are most successful, so it is important for us to get your honest feedback. There are no right or wrong answers/opinions and if you do not feel comfortable answering a question, we will move to the next one. We will anonymize all the information gathered during our analysis. If it's ok with you we'd like to record the conversation so we can refer back to it, however if you aren't comfortable with this we can rely on note-taking. We'll start with a few general questions.

1. What type of relationship does your organization have with startup companies in your industry?
2. What are the most significant challenges the industry faces?
3. How do you think the industry will change in the next five years? Why?

### **2. Internal Success Probes**

*[Note to Interview: Probe on key items below that haven't been addressed in upfront discussion]*

Great, thank you. There are a few things that I'd like to get your perspective on. First, I'd like to ask you a bit more about evaluating specific energy companies.

4. What factors do you consider to be enablers when evaluating whether a startup company in your industry might be successful? What factors do you consider to be barriers? Why are those factors important?
5. How would you describe the competitive landscape for startup companies in your industry? What types of startups are best poised to succeed?
6. How easy or difficult is it for startup energy companies in your industry to access financing? Why?
  1. Government financing?

2. Private investment?
3. Philanthropic grants?

### **3. External Success Probes**

Great. There are a few things we've heard regarding different market forces and how they impact businesses that I'd like to ask you about.

7. How would you describe the domestic energy policy of the country?
  1. Is there a strong government commitment to renewable energy research & development?
8. What government policies most impact startup companies in your industry?
  1. Taxes & subsidies?
  2. Are interconnection regulations in place?
  3. Is corruption a challenge in the markets in which you operate? If so, how?
9. How do startup companies interact with the utilities? What are the resulting opportunities and challenges?
10. How do startup companies complement the country's grid infrastructure?
11. What institutions exist to help support local communities access energy?
12. How do the goods and services offered by startup energy companies typically compare to rival goods such as grid electricity, diesel generators, etc. in terms of price?
  1. How much are those prices impacted by the prices of raw materials vs. operational issues like shipping/distribution?
  2. What other customer needs (besides price) do energy entrepreneurs meet?
  3. Probed about market saturation for solar, free products from donors, etc.

### **4. Closing + Advice**

Thank you. And now we just have a few final wrap-up questions before we finish.

13. What advice would you give to entrepreneurs trying to enter your industry today?
14. Who else should we talk to during our research?
15. Is there anything that we haven't talked about today that you think is important?

#### *Wrap-up*

Thank you again for your support of our project. Your answers will provide invaluable insight into the topic of successful renewable energy entrepreneurship. We plan to conclude our project by April 2019. If you would like a copy of the final product or have any further questions or

comments regarding this study at any time, we can be reached at the following email address:  
[WDIMastersProject@umich.edu](mailto:WDIMastersProject@umich.edu).

## Appendix 5: Summary of Coding Changes

*The below document describes the changes made between coding rounds to modify the factors that were being over- or underutilized and to accommodate needed additional factors.*

Some factors that were originally outlined in the initial framework were removed due to the lack of references made by interviewees. Changes were made after the India trip, but before the Uganda trip. The reference count for the removed factors from the 14 India interviews is listed to the right of the factors.

### Remove/Combine:

- Cellular penetration (0)
- Currency Volatility (0)
- Data-driven decision making (2)

A number of factors were consistently mentioned during the India interviews that were not included in the original framework. To adjust, these factors were added into the framework.

### New Codes:

- Product quality & consumer trust: includes issues with product reliability, industry standards
- Productive use: targeting industry/manufacturing instead of home usage
- After-sales service: working with customers after sales
- Societal benefits: downstream impacts in health/education etc.
- Working capital: need for businesses to have working capital
- Consumer creditworthiness: difficulty for consumers to secure personal loans
- Strategic partnerships: finding good partners throughout the industry value chain
- Cultural expectations: norms around working with suppliers and familial expectations related to careers.
- Political Landscape: political actions influencing the operation of the entrepreneurs or the industry as a whole.

More factors could be slightly altered to better reflect the ideas behind those being interviewed. This entailed retitling the code name and/or combining two codes into one.

### Revised:

- Re-title “Ability to facilitate customer adoption of technology” to “Consumer education to facilitate the adoption of technology”
- Re-title “Government commitment to R&D” to “Domestic Energy Policy”
- Re-title “Prevalence of clandestine grid connections” to “Percent of country off-grid”
- Re-title “Interconnection regulations” to “Utility structure”



- Combined “Cost of shipping/distribution” with “Cost of inputs/raw materials”, keeping the title of “Cost of inputs/raw materials”

Initially, a single code titled “Business Model” was referenced the most by Indian stakeholders. Understanding this was an important concept to introduce more detail into, the original code was split into three distinct codes to better articulate the motivation behind interviewee comments.

Splitting the singular code of “Business Model” into distinct codes:

- Positioning/Strategy
- Company Structure
- Business Model Flexibility

All India interviews were subsequent recoded against the updated framework to ensure consistency within the coding process.

## Appendix 6-A: Summary of Code Counts

Below is a summary of the top factors noted in interviews, split by stakeholder group.

Overall Summary	
Factor	Code Count
1. Accessibility of private investment	65
2. Positioning/Strategy	58
3. Domestic energy policy (net energy metering, feed-in tariffs, etc)	56
4. Consumer education & product trust to facilitate adoption of technology	41
5. Competitive landscape (# of competitors)	41
6. Talent attraction/retention	40
7. Customer financial resources	36
8. Strategic partnerships	32
9. Grid structure	31
10. Profitability/financial sustainability	30

Stakeholder Summary			
Entrepreneur		Industry Expert	
Factor	Code Count	Factor	Code Count
1. Positioning/Strategy	49	1. Accessibility of private investment	30
2. Talent attraction/retention	38	2. Domestic energy policy (net energy metering, feed-in tariffs, e	26
3. Accessibility of private investment	35	3. Customer financial resources	21
4. Domestic energy policy (net energy metering, feed-in tariffs, e	30	4. Grid structure	20
5. Competitive landscape (# of competitors)	28	5. Consumer education & product trust to facilitate adoption of te	19
6. Future strategy/growth plans	25	6. Competitive landscape (# of competitors)	13
7. Profitability/financial sustainability	24	7. Utility structure	13
8. Company Structure	23	8. Distribution infrastructure	13
9. Consumer education & product trust to facilitate adoption of te	22	9. Strategic partnerships	11
10. Strategic partnerships	21	10. Positioning/Strategy	9

Country Summary			
India		Uganda	
Factor	Code Count	Factor	Code Count
1. Positioning/Strategy	43	1. Domestic energy policy (net energy metering, feed-in tariffs, e	26
2. Accessibility of private investment	42	2. Accessibility of private investment	23
3. Talent attraction/retention	34	3. Customer financial resources	23
4. Competitive landscape (# of competitors)	31	4. Grid structure	20
5. Domestic energy policy (net energy metering, feed-in tariffs, e	30	5. Consumer education & product trust to facilitate adoption of te	19
6. Profitability/financial sustainability	26	6. Distribution infrastructure	17
7. Strategic partnerships	25	7. Positioning/Strategy	15
8. Company Structure	23	8. Domestic skilled labor supply (installation, electrician, etc.)	12
9. Consumer education & product trust to facilitate adoption of te	22	9. Product quality	11
10. Future strategy/growth plans	21	10. Competitive landscape (# of competitors)	10

## Appendix 6-B: Summary of Normalized Code Counts

Below is a summary of the top factors noted in interviews, split by normalized stakeholder group.

Normalized Overall Summary	
Factor	Code Count
1. Accessibility of private investment	7.41%
2. Positioning/Strategy	6.61%
3. Domestic energy policy (net energy metering, feed-in tariffs, etc)	6.39%
4. Consumer education & product trust to facilitate adoption of technology	4.68%
5. Competitive landscape (# of competitors)	4.68%
6. Talent attraction/retention	4.56%
7. Customer financial resources	4.10%
8. Strategic partnerships	3.65%
9. Grid structure	3.53%
10. Profitability/financial sustainability	3.42%

Normalized Stakeholder Summary			
Entrepreneur		Industry Expert	
Factor	Code Count	Factor	Code Count
1. Positioning/Strategy	8.55%	1. Accessibility of private investment	9.87%
2. Talent attraction/retention	6.63%	2. Domestic energy policy (net energy metering, feed-in tariffs, e	8.55%
3. Accessibility of private investment	6.11%	3. Customer financial resources	6.91%
4. Domestic energy policy (net energy metering, feed-in tariffs, e	5.24%	4. Grid structure	6.58%
5. Competitive landscape (# of competitors)	4.89%	5. Consumer education & product trust to facilitate adoption of te	6.25%
6. Future strategy/growth plans	4.36%	6. Competitive landscape (# of competitors)	4.28%
7. Profitability/financial sustainability	4.19%	7. Utility structure	4.28%
8. Company Structure	4.01%	8. Distribution infrastructure	4.28%
9. Consumer education & product trust to facilitate adoption of te	3.84%	9. Strategic partnerships	3.62%
10. Strategic partnerships	3.66%	10. Positioning/Strategy	2.96%

Normalized Country Summary			
India		Uganda	
Factor	Code Count	Factor	Code Count
1. Positioning/Strategy	7.78%	1. Domestic energy policy (net energy metering, feed-in tariffs, e	8.02%
2. Accessibility of private investment	7.59%	2. Accessibility of private investment	7.10%
3. Talent attraction/retention	6.15%	3. Customer financial resources	7.10%
4. Competitive landscape (# of competitors)	5.61%	4. Grid structure	6.17%
5. Domestic energy policy (net energy metering, feed-in tariffs, e	5.42%	5. Consumer education & product trust to facilitate adoption of te	5.86%
6. Profitability/financial sustainability	4.70%	6. Distribution infrastructure	5.25%
7. Strategic partnerships	4.52%	7. Positioning/Strategy	4.63%
8. Company Structure	4.16%	8. Domestic skilled labor supply (installation, electrician, etc.)	3.70%
9. Consumer education & product trust to facilitate adoption of te	3.98%	9. Product quality	3.40%
10. Future strategy/growth plans	3.80%	10. Competitive landscape (# of competitors)	3.09%

## Appendix 6-C: Summary of Total Count Counts for Each Factor

*Below is a summary of the top factors noted in interviews.*

### Overall Summary

	Code	Factor	Code Count
1.	II.2	Accessibility of private investment	65
2.	I.A.16	Positioning/Strategy	58
3.	III.3	Domestic energy policy (net energy metering, feed-in tariffs, etc)	56
4.	I.A.7	Consumer education & product trust to facilitate adoption of technology	41
5.	I.B.4	Competitive landscape (# of competitors)	41
6.	I.A.14	Talent attraction/retention	40
7.	IV.B.1	Customer financial resources	36
8.	I.B.3	Strategic partnerships	32
9.	IV.A.1	Grid structure	31
10.	I.A.10	Profitability/financial sustainability	30
11.	I.A.2	Future strategy/growth plans	29
12.	I.A.17	Company Structure	28
13.	I.A.8	Ability to collect revenue	25
14.	I.A.15	Domestic skilled labor supply (installation, electrician, etc.)	23
15.	I.A.4	Scalability	22
16.	IV.A.2	Distribution infrastructure	22
17.	I.A.18	Business Model Flexibility	20
18.	I.A.3	Product quality	19
19.	I.A.6	Commitment to/culture of innovation	19
20.	II.1	Accessibility of government financing	17
21.	III.2	Utility structure	17
22.	II.3	Accessibility of philanthropic funds/grants	16
23.	III.1	Financial incentives (taxes, subsidies, etc)	16
24.	IV.A.4	Percent of country off-grid	15
25.	IV.A.5	Presence of institutional support	15
26.	I.A.1	Growth to-date (revenue/sales growth, # of customers, rate of new customer acquisition, customer retention, etc)	14
27.	I.A.13	Entrepreneurial experience	14
28.	I.B.2	Cost of inputs/raw materials	14
29.	I.A.9	Existence of multiple/diverse revenue streams	13
30.	III.4	Political Landscape	12
31.	IV.A.3	Productive use	12
32.	I.A.5	Reason for founding company	11
33.	II.4	Accessibility of working capital	11
34.	I.A.12	Strength of relationships with investors	10
35.	I.B.1	Cost of rival goods (products, electricity, alternative fuels, etc)	8
36.	I.A.11	After-sales service	6
37.	I.B.5	Level of corruption (bribes, favors, "greasing the skids")	6
38.	IV.B.3	Secondary benefits	6
39.	IV.B.4	Consumer creditworthiness	6
40.	IV.B.2	Prevalence of clandestine grid connections	1