Energy Access Entrepreneurship:
Challenges & Recommendations
From a North American Perspective

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What is AE4H?

The Affordable Energy for Humanity Global Change Initiative is a global consortium of researchers and practitioners committed to ending energy poverty through the sustainable deployment of clean technology.

Since its founding in 2015 by core partners at the University of Waterloo (Canada) and Karlsruhe Institute of Technlogy (Germany), AE4H has grown to over 150 members from 50 institutions in 25 countries. Members develop innovations and proliferate insights on technologies, policies, business models, socio-cultural issues, and many other aspects of clean energy deployment in communities facing energy poverty across the globe.

AE4H brings members together through workshops, conferences and other meetings, on joint projects to scope and develop impactful interventions, and through supporting the involvement of students and other stakeholders in the emerging energy access sector.

Please visit our projects pages for more information and reach out to us to find out how to get involved.

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Executive Summary

More than 1.2 billion people world-wide lack access to electricity [1]; however, recent advancements in distributed energy technologies have created viable opportunities for entrepreneurs to electrify this population with innovative new products and business models.

However, there are many challenges in the developing world that may deter potential Energy Access entrepreneurs from entering this market. This report endeavours to create a foundation on which to discuss the challenges facing Energy Access entrepreneurs as seen from the perspective of an entrepreneur in the developed world.

Interviews with subject matter experts highlighted the following ten unique challenges:

1. *Balancing social impact with financial return*
2. *Establishing product/market fit*
3. *Accessing the market*
4. *Threats of anti-competitive practices*
5. *Access to finance and investment*
6. *Finding and attracting talented employees*
7. *Access to data*
8. *Friendliness of the business environment*
9. *Developing local partnerships*
10. *Risks to personal safety*

Recommendations are presented for both entrepreneurs and the Energy Access community at large to help mitigate these challenges. This report advocates for new platforms for data and knowledge sharing to leverage the experience of industry veterans and foster collaboration within the community. Also recommended is the expansion of innovation centres that offer programs and services to incubate innovation and provide mentorship for founders.

The challenges of starting a social enterprise in the developing world are daunting, but they are not insurmountable. The scale of the challenge is proportional to the immense opportunity to achieve constructive and sustainable changes.

1 Introduction

More than 1.2 billion people world-wide lack access to electricity and many more suffer from intermittent and unreliable service [1]. Access to electricity is a vector to poverty alleviation by providing opportunities for improving education, healthcare, entrepreneurship and quality of life. Recent advancements in various enabling technologies (ex. solar photovoltaics, batteries, etc.) have led to a significant increase in the affordability of distributed energy systems. Consequently, a viable market opportunity has emerged to deliver products that meet the energy needs of these off-grid customers through for-profit social enterprise [1].

Attractive opportunities encourage entrepreneurship and competition. Having a variety of innovative solutions developed in a healthy competitive market should ultimately benefit the end customer and thereby maximize the social benefit from a high rate of electrification. Therefore, entrepreneurs can play a vital role in providing the products and services to end energy poverty. Thousands of enterprises will be needed to find innovative solutions matched to the energy needs of the diverse people, climates and cultures around the world [2]. The global community should help entrepreneurs by identifying and breaking down barriers that might deter them from pursuing opportunities in developing world markets. This report endeavours to create a foundation on which to discuss the set of challenges facing Energy Access entrepreneurs leading to recommendations on how these challenges could be mitigated.

1.1 Context

The challenges and recommendations presented in this report have been written from the perspective of an entrepreneur in the developed world who is considering starting a for-profit social enterprise in the energy sector. It's important to note that the challenges outlined below apply quite generally to entrepreneurship in the developing world: the challenges aren't unique to the Energy Access sector.

The author is born and raised near Toronto, Canada and spent months investigating the opportunity for entrepreneurship in Energy Access after living off-grid in Malawi. There are many perspectives not expressed in this report including the point of view of local entrepreneurs in developing world markets. A complementary report or addendum written by a local entrepreneur would be welcome.

The impetus for this report originated at an Affordable Energy for Humanity (AE4H) meeting at the Waterloo Institute for Sustainable Energy (WISE) on December 15th, 2016. At this meeting the author presented a short list of significant challenges that had been identified as considerable deterrents from entering this market. This initial conversation inspired further exploration of this subject and ultimately this report.

2 Challenges

Ten challenges have been identified as being unique or particularly acute in Energy Access entrepreneurship.

The challenges are:

1. *Balancing social impact with financial return*
2. *Establishing product/market fit*
3. *Accessing the market*
4. *Threats of anti-competitive practices*
5. *Access to finance and investment*
6. *Finding and attracting talented employees*
7. *Access to data*
8. *Friendliness of the business environment*
9. *Developing local partnerships*
10. *Risks to personal safety*

These challenges have been identified from a combination of industry publications and interviews with industry leaders in the Energy Access community. Over a dozen independent interviews have been conducted with Subject Matter Experts (SMEs) whose expertise covers 10+ countries. SMEs, who were either founders or

senior members of Energy Access companies, were asked to speak to the challenges they faced when building their businesses in the developing world.

2.1 Balancing Social Impact with Financial Return

Companies in the Energy Access industry frequently have dual objectives of providing a social good by electrifying low income customers while also striving for profit to sustain and grow their operations. These objectives are frequently at odds with each other. Companies that remain focused on social impact frequently suffer from low profit margins and/or dependence on grants to sustain their operations. Other companies chase profit towards higher income customers and consequently lessen their social impact.

These challenges are particularly acute with hardware products that have expensive development cycles and high initial production costs. In other industries, companies might find early adopters within their target market who are willing to pay a premium for their products before economies of scale can be leveraged to make the product affordable for the mass market. This strategy doesn't work when your target market is, by definition, some of the poorest people in the world.

To maximize social benefit, a social enterprise would ideally be electrifying customers who stand the most to gain from access to energy. This is generally considered to be rural customers in the lowest income bracket, also called the Bottom of Pyramid (BoP). BoP customers typically have no stable income, savings or access to credit so it can be hard to predict with certainty how willing these customers will be to pay for energy services. It's for this reason that many Energy Access companies have targeted higher income consumers in larger urban centres, with the trade-off of being potentially less socially impactful.

Rural electrical infrastructure projects are far less profitable than urban projects so there is little incentive for an electric utility to extend the grid into remote rural areas [3]. People in rural communities in the developing world want electricity, but they haven't been able to pay enough to make it financially viable [4].

2.2 Establishing Product/Market Fit

Product/market fit is a term used to describe when a company has successfully optimized their product to the unique needs of their target market [5]. Attaining a truly deep understanding of how customers perceive the value of a good or service is the defining challenge of any start-up company in any market. Subtle changes in the perception of product value can have a massive influence on the success of the product in the market. The company who best optimizes product/market fit will ultimately be the most successful.

There are several considerations that make finding product/market fit uniquely challenging for Energy Access companies operating in the developing world. Attaining product/market fit necessitates frequent consultation and interaction with customers to validate assumptions on the perceived value of product features. Entrepreneurs developing products or services for a foreign market will face language and cultural barriers that will interfere with their ability to truly understand the unique perspectives of their customers.

Mini-grid projects provide an illustrative example of the level of commitment and investment that is required to achieve product/market fit. Some community-scale mini-grid projects necessitate years of community engagement to ensure all stakeholders agree the proposed system will meet the needs of the community. [6]

2.3 Accessing the Market

In many ways, rural off-grid people in the developing world are quite possibly the hardest customer to access in the world. Prospective customers are thinly spread over large geographic areas with a lack of well-developed infrastructure for last mile distribution and retail sales [1]. It's also hard to create product awareness because the target market consumes little media and advertisements. The net result is that customer acquisition and distribution costs are typically high in relation to the expected lifetime value of each customer. Even after a successful sale, there are substantial logistical challenges in providing ongoing service and support to paying customers [1].

The World Bank works to mitigate some of these issues through an initiative called Lighting Global [7]. This initiative is designed to accelerate adoption of solar lighting products and limit damage to the reputation of the industry from extremely low-cost, low-quality competitors (see section 2.4). Lighting Global's awareness campaigns have had a major impact on reducing the cost of customer acquisition and increasing sales growth for Energy Access companies [8].

2.4 Threats of Anti-Competitive Practices

Because of the tangible positive impact that Energy Access can have on quality of life, there can be a temptation for NGOs, private companies or governments to donate or heavily subsidize solar equipment to people at the BoP. Although altruistic in nature, these giveaways can have detrimental effects on the operation of a burgeoning free market [9]. Heavy subsidies aren't sustainable and can eliminate opportunities for distributers and retailers who make a living selling their products into the local economy.

Another problem facing the Energy Access industry is the widespread availability of sub-standard quality and even fraudulent consumer products. The availability of extremely low quality solar products negatively affects consumer perception of the technology. Examples of this includes fake (paper) or cracked solar cells, faulty wiring connections and misleading performance data on the device label [10]. Lighting Global has been working to combat these issues by increasing customer awareness of high quality products certified their quality standards. The International Electrotechnical Commission (IEC) is also working on publishing a visual inspection guide to help anyone in the developing world identify sub-standard quality PV modules [11].

2.5 Access to Finance and Investment

Accessing finance can be particularly challenging for Energy Access companies. Finance can be broken down into three areas: grants, investment and loans.

Grants have become highly competitive as a result of the recent influx of market entrants [1] [12]. Large, lucrative grants will logically go to larger companies with an established track record and therefore a lower risk profile. Start-ups competing for the remaining, smaller grants can expect to spend significant time and resources on overhead to support the application and administration of awards.

There is limited Venture Capital (VC) available for seed and early stage Energy Access companies [1]. The vast majority of VC money comes from outside the target market, so an investor would need to have a unique understanding of the opportunities and risks of investing in a foreign market. VC investment is typically coupled with mentorship by an experienced industry professional through their inclusion on the Board of Directors. Since the majority of Energy Access start-ups don't attract VC money they miss out on the benefits of this formal mentorship opportunity.

Business loans from traditional financial institutions are also challenging to secure in developing world markets. Energy Access companies have high working capital requirements to finance the cost of deploying systems which have long payback periods. Demand for debt financing outstrips supply [1]. Local financial institutions frequently offer loans at unfavourable interest rates while foreign institutions typically perceive investment in developing world markets to be high risk [12].

2.6 Finding and Attracting Talented Employees

Finding and retaining talented employees in many developing world markets is a well-documented challenge for Energy Access start-ups, particularly for management-level positions. Rates of higher education amongst local populations are relatively low and start-ups are competing against large, high profile NGOs who can offer higher salaries and a greater sense of stability. The ability to recruit and retain local talent is considered vital for many Energy Access companies because local people can provide key cultural insights that would be impossible to observe for a foreigner. Training local talent is expensive and time consuming, but is necessary because there are particular administrative skills that notably rare amongst the workforce in parts of the developing world [12].

Internationally trained employees with prior lived experience in the target market can be invaluable in interpreting business customs and expectations on both sides of a transaction.

The other option that Energy Access companies have tried is to import talent from abroad. Feedback from SMEs illustrates that it can be hard to attract and relocate high performing employees for the modest salary that an Energy Access start-up can afford. If and when the imported talent arrives, there can be language and cultural barriers that limit their effectiveness.

2.7 Access to Data

One of the challenges for Energy Access entrepreneurs is in the limited availability of economic, sector and census data. Data plays a critical role in strategic decision making for entrepreneurs entering new markets. Data in the developing world can be either non-existent, not easily accessible, out-of-date or is susceptible to political manipulation [6].

Economic data includes both micro- and macroeconomic statistics on the local and national level. Sector data might include statistics on Energy Access deployments, business models, maintenance costs, etc. In other words, sector data might describe what's working and what isn't working across the Energy Access industry. Census data provides valuable statistics on demographics and geographic distribution of the population.

2.8 Friendliness of the Business Environment

Any start-up that operates in the developing world must be aware of the factors that influence how friendly the local environment is to business. This applies to a range of topics including government bureaucracy, the regulatory environment, the legal system and other factors that contribute to the overall ease of doing business.

Many Energy Access markets are plagued with inefficient government bureaucracies that slow business operations [1]. Standard practises such as incorporating a company, filing taxes, etc. can take unusually long to complete and there is often a lack of clarity on the process.

The legal system in many developing world counties can make it hard to protect Intellectual Property (IP), enforce contracts (see Section 2.8) [12] and prosecute theft. Protecting IP and enforcing contracts are key requirements that prospective investors consider when evaluating a venture.

Poorly defined and inconsistently enforced regulations [12] are a common complaint amongst the SMEs. For example, when importing equipment there might be ambiguous rules for product inspections or inconsistent tariffs and duties.

The above symptoms of inefficient bureaucracy, weak legal systems and ambiguous regulations can all combine to effectively incubate corruption. Corrupt government officials have been known to request bribes in return for accelerating inefficient bureaucratic processes. Some established players in the market have taken a strong stand against enabling corruption by refusing to pay bribes under any circumstances [13].

High rates of inflation are common in the countries with the highest off-grid populations [14]. High and unpredictable inflation rates add cost to the financing and influence the payback of an off-grid energy system. High rates of inflation ultimately affect the affordability of the system for the end customer.

2.9 Developing Local Partnerships

A partnership in this context may include any business relationship that might typically be governed by a contract. Examples of partners can be found across the supply chain, such as local component suppliers, distributors, retailers and even the customers for large projects. Other partners may include professional services such as lawyers, accountants, engineers, contractors, etc. The ability to form a dependable and trustworthy network of partners is essential for any successful organization.

The combination of a challenging business environment and a weak legal system means people generally rely on trust throughout their business relationships. Because contract enforcement is often so poor, business people in these environments often prefer to deal with family

and other reputed members of the community. Building trust takes time and foreigners have no means of leveraging the existing social structure to accelerate the process of gaining trust from the community. Language and cultural barriers undoubtedly compound this challenge.

2.10 Risks to Personal Safety

Many of the target markets for Energy Access companies suffer from higher rates of crime, risk of geopolitical instability and exposure to infectious diseases. Any employee of an Energy Access start-up who spends time in the market must expose themselves to increased levels of personal risk. The variability of these risks by region play a large strategic role in evaluating which potential markets to enter.

3 Recommendations

The Subject Matter Experts were asked to provide recommendations on what action could be taken to mitigate the challenges they outlined. Further insights where drawn from the discussion at the AE4H innovation lab. [15]

Entrepreneurship is a challenging endeavour at the best of times, but success in the Energy Access industry takes an extra level of dedication, passion, adaptability and risk tolerance. The challenges presented in this report don't have easy answers: every challenge must be addressed uniquely by an entrepreneur in the context of the product or service they wish to provide in the market they serve.

Consequently, it is difficult to gather recommendations that are both general enough to apply across the Energy Access industry and specific enough to be useful.

Recommendations have been divided into two parts: recommendations for entrepreneurs and recommendations for the Energy Access community. In this context, the Energy Access community refers to any organization or institution that plays a role in supporting entrepreneurs and start-ups. This includes for example governments, NGOs, academic institutions, industry associations, and international development organizations.

3.1 Recommendations for Entrepreneurs

The following recommendations also apply to entrepreneurship beyond the Energy Access industry. Recall that this report is written from the perspective of a prospective entrepreneur from the developed world; one would expect a different set of recommendations for entrepreneurs who are indigenous to developing world markets.

3.1.1 The founding team should relocate to their target market

The founding team may elect to have their technology designed and manufactured elsewhere, but the reasons below will illustrate why living in the target market is invaluable when trying to mitigate many of the challenges outlined in this report.

Only with the founding team embedded in the market can they hope to attain the intimate understanding of their customers that they need to attain product/market fit. Living in the market allows the founders to develop the relationships that will be imperative to their success. Face-to-face interactions foster the trust required to create successful strategic business partnerships. Being in the market allows founders to find trusted professional services such as accountants, lawyers, etc. to help navigate the challenging business environment. Charismatic founders can attract top local talent at the modest salaries that start-ups can afford by sharing their compelling vision. Lastly, the founders' willingness to relocate to a developing world market is necessary to send a strong signal to prospective

investors of the founders' commitment to their mission.

3.1.2 Build a strong support community

Founders should seek out advisors and mentors to help overcome the formidable challenges of Energy Access entrepreneurship. Connect with social enterprise veterans who can provide new insights into the unique challenges that may be encountered in the developing world.

Members of the AE4H community [16] are examples of industry and academic professionals that may be able to provide advice related to challenges such as balancing social impact with financial return, retaining talented employees or navigating ineffective government bureaucracies. Competent and experienced mentors can guide entrepreneurs through the tough times and increase their likelihood of success.

3.2 Recommendations for the Energy Access Community

Energy Access entrepreneurship has the potential to generate tremendous positive social change on a global scale. Consequently, the global community should continue to support and encourage this budding industry. Two themes emerged in conversations with SMEs; the first is to create platforms for knowledge and data sharing, and the second is to create Energy Access Innovation Centres. More details on these recommendations are outlined below.

3.2.1 Create platforms for knowledge and data sharing

It's clear from the interviews with SMEs that access to information is a major challenge. More and better tools are needed to aggregate disparate data and foster knowledge transfer across the industry.

3.2.1.1 Platforms to aggregate and organize data

There are many organizations and institutions collecting data and publishing reports related to the Energy Access industry. Recent advancements data analytics have created powerful tools to solve incredibly complex problems that affect billions of people world-wide. Players in the Energy Access industry could derive massive benefits from increased access to the raw and synthesized data collected from the private sector, academic institutions, governmental and non-governmental organizations. To make unlinked resources more accessible and useful to Energy Access entrepreneurs, platforms should be developed to aggregate disparate sources of data from the web. Some organizations are already working to achieve this goal, examples are outlined below.

Renewable Energy and Energy Efficiency Partnership (REEEP) and REN21 provide a portal called Reegle which helps distill and consolidate energy and climate data from many sources [17]. They also provide a free tool called Climate Tagger, which is designed to sort through energy and climate data to make it more searchable and accessible [18].

Power For All is developing the Platform for Energy Access Knowledge (PEAK) which is:

"…an interactive information exchange platform designed to help aggregate and repackage the best research and information on Energy Access into
compelling data-driven stories for a range of target audiences to ensure maximum visibility, usability and discoverability." [19]

The fact that these platforms are under development is encouraging; however, further efforts in the collection, aggregation and sharing of data are needed to sufficiently empower entrepreneurs to tackle the many challenges across the Energy Access industry.

3.2.1.2 Platforms to foster knowledge transfer

Within the Energy Access community there is a wealth of knowledge that, if available, could help entrepreneurs overcome many of the challenges outlined in this report. There has been a lot of experimentation performed over decades and across continents to understand what works and what doesn't in electrifying remote populations. Expertise could be drawn upon from academia, the private sector, as well as governmental and non-governmental organizations. A vibrant community on an engaging platform could connect

experienced and passionate people and help the best ideas spread around the world.

Some platforms have been developed for this type of collaboration, for example the Energy Access Online Forum created by Sustainable Energy for All. The Energy Access Practitioners Network created by the United Nations Foundation, leverages widely used social media platforms like Facebook and Twitter to engage the community. Feedback from the SMEs is that engagement on these platforms hasn't yet scaled to the point where they are meeting the industry's needs for greater knowledge transfer and collaboration.

3.2.2 Develop Energy Access Innovation Centres

The Energy Access community should continue to collaborate to expand the presence of innovation centres located in close proximity to unelectrified populations. An innovation centre is:

"…an organization designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections." [20]

Innovation centres, sometimes called business incubators, are employed extensively in the technology industry to support start-ups and increase their probability of success. In addition to the services listed above, a vibrant and well-resourced support community at Energy Access Innovation Centres (herein referred to as EAICs) located in key Energy Access markets could provide unique programs and services to address many of the challenges outlined in this report.

3.2.2.1 EAICs could provide a gateway to the community

Being embedded in the target market, EAICs could provide an anchor point for international Energy Access entrepreneurs to relocate their operations to their target market and thereby gain intimate access to their customers. Likewise, a network of EAICs could provide an avenue for successful start-ups to expand their operations to multiple markets. EAICs would provide their services equally for locally founded and international start-ups; a shared office environment would facilitate collaboration between the diverse groups of like-minded entrepreneurs.

EAICs could leverage their credibility in the community to create partnership opportunities for their residents and to increase awareness of new energy technologies. EAICs could provide credible advocacy and could lobby of government officials to help streamline complex bureaucratic processes. EAICs could help international start-ups recruit high performing and trustworthy employees from within the community who can provide a bridge between cultures and languages. A network of EAICs could standardize their operations and share best practices with each other to maximize their effectiveness.

3.2.2.2 EAICs could be sources of knowledge

EAICs could play an important role in training, mentoring and facilitating the flow of information within the Energy Access community.

Typically, innovation centres provide founders with mentorship or coaching from resident staff. An alternative, complementary model might be for a community of EAICs to produce standardized digital content with the goal of providing a library of high quality educational resources for Energy Access entrepreneurs. An excellent example of this type of media for is the Entrepreneurs Toolkit from the MaRS Discovery District, an Innovation Centre in Toronto [21]. Portions of this content library could be customized each local market as required.

To increase the flow of information, residency at an EAIC could come with some minimal obligation to participate in the community. Participation could include peer mentorship, sharing of market research data or presentations at seminars or conferences. EAICs could facilitate the sharing of information and best practices both locally within their centre and through the international network of EAICs.

Interdisciplinary subject matter experts from around the world could be recruited to volunteer their time with the objective of mentoring start-ups and raising the global profile of the Energy Access industry. EAICs could also potentially collaborate

with academic institutions for scientific research both domestically and abroad.

3.2.2.3 EAICs could benefit the community

In addition to the benefits for the entrepreneur, there would also be notable benefits for the local community. A thriving EAIC and their growing community of start-ups could incentivise infrastructure investment in the region, stimulate job creation, create capacity building programs, and empower the local unelectrified population with early access to innovative products and services.

3.2.2.4 EAICs in action

This is not a new or revolutionary idea; there are examples of innovation centres in operation already with a mandate to focus on Energy Access. This report's recommendation to expand and improve innovation centres is meant to show support for these existing institutions and will hopefully serve to advocate for their replication and expansion.

For example, the World Bank operates Climate Innovation Centres in seven countries including Ghana, the Caribbean, Ethiopia, Kenya, Morocco, South Africa, and Vietnam [22]. Another example is from an Energy Access industry leader, Mobisol, who has recently founded the Access to Energy Institute based in Arusha, Tanzania.

Funding innovation centres may originate from a mix of local and international grants, corporate sponsorship and potentially through the revenue from renting out office space to larger established organizations who seek new avenues to inspire innovation.

4 Conclusions

There are many unique challenges for entrepreneurs targeting opportunities in the Energy Access industry. A discussion of challenges has been presented from the perspective of an Energy Access entrepreneur in the developed world. Many of these challenges could be mitigated by increasing access to information and by developing Energy Access Innovation Centres to incubate entrepreneurs and encourage them to relocate into their target market.

With more than 1.2 billion people worldwide lacking access to clean and affordable energy, this industry presents one of the world's greatest economic opportunities to achieve a positive social and environmental impact. The challenges presented in this report are daunting, but they are not insurmountable; they are proportional to the immense opportunity to achieve constructive and sustainable change.

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