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**Miller Center**  
for Social Entrepreneurship

# **UNIVERSAL ENERGY ACCESS**

## An Enterprise System Approach



SEPTEMBER 2015



# EXECUTIVE SUMMARY

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Lack of energy access afflicts approximately 2.6 billion people globally: one-third of the human population of the planet. The problem affects individuals, households, communities, local institutions, and small and medium-sized businesses across the developing world.

Defining acceptable energy access has traditionally been expressed as an energy ladder, a hierarchy of energy uses ranging from basic lighting and cooking needs “up” to things like running a sewing machine or powering small tools. Rather than this linear progression, however, we prefer the more holistic Total Energy Access (TEA) standards developed by international non-governmental organization, Practical Action, which focus on “customers” of energy rather than “people without energy.”

Despite billions of development and charity dollars spent on energy access by government aid agencies, foundations, and corporations, we still lack a viable scenario for offering everyone the energy they need to survive and thrive.

Miller Center for Social Entrepreneurship believes that solving the problem of energy access starts with reframing the problem. When the problem is reframed, it becomes possible to envision and enact more viable solutions.

Instead of framing energy access as fragmented and complex, and viewing the 2.6 billion sufferers of energy poverty as potential aid recipients, we in the social enterprise sector see a total market of more than 500 million potential consumers for public and private energy supplies.

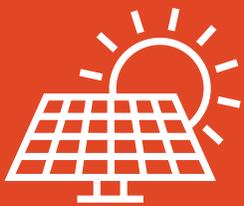
With this reframing, the central question of energy access becomes, *How best can we serve the needs of this market?* Miller Center proposes a further step: to focus on how many and what kind of enterprises are needed to serve this market made up of thousands of segments with different requirements depending on geography, economics, culture, and other factors.

Enterprises that deliver energy must act as part of a robust value chain, whose participants include:

- Customers
- Energy delivery enterprises
- Intermediaries such as product suppliers, finance providers, and direct enterprise supporters
- Enabling actors such as specialist market enablers, advocates, and governments

Our own experience at Miller Center, along with those of many other social entrepreneurship endeavors across the globe, indicates that the following 4-tactic strategy can have immediate, deep impacts on energy access:

## SUSTAINABLE ENERGY ACCESS



### ENTERPRISE BUILDING

A large number of smaller enterprises, or units of a large enterprise, can bring the most appropriate technology, market-building strategies, and business models to local segments of the highly fragmented energy access market.



### ECOSYSTEM BUILDING

Ecosystem actors will be most effective if they adopt a country- or region-centric strategy to achieving energy access; identify all direct and indirect participants in the ecosystem; and engage policy and decision makers.



### CAPACITY BUILDING

Support organizations, such as Miller Center's Global Social Benefit Institute (GSBI®) can best grow capacity by improving the knowledge base of all actors in the ecosystem.



### IMPACT BUILDING

All the value chain actors must develop and adopt user-friendly tools and uniform reporting standards for measuring the impact of human and financial resources being invested toward energy access.

Reframing the issue of universal energy access as a market services problem still begs an important question: How many energy access delivery enterprises will it take to make energy accessible to all the 500 million potential consumers — comprised of households and small businesses — who now lack it?

We conducted a thought experiment based on the 4-tactic strategy outlined above. We conclude that the number is between 7,000 and 20,000 local energy enterprises — a reasonable and achievable number.

With the energy access problem reframed, a 4-tactic strategy to guide us, and an approachable target number of energy enterprises needed, we can apply the experiences and expertise of various actors in the energy access ecosystem.

In other words, rather than approaching energy access as a daunting, monolithic effort, we can engage in market-based programs and activities proven to achieve tangible results. We know a great deal about what it takes to begin, grow, and scale successful energy enterprises. The problem of energy access remains a serious concern, but now it can be addressed with greater confidence and effectiveness.



# The Energy Access Problem

The problems of energy access have been well documented.

Fully one-third of humanity lacks access to energy. Approximately 1 billion people have no electricity for lighting, communications, entertainment, cooling, and other needs. Another billion or more live with unreliable electricity. Well over 2 billion (maybe as many as 3 billion<sup>1</sup>) cook and warm themselves under primitive conditions, meaning over open fires or crude stoves using solid fuels such as wood, coal, crop residues, and animal dung.

Affordable technologies such as solar lights and improved cookstoves can provide appropriate energy access at costs often lower than the kerosene or coal that these technologies are designed to replace. Each country also has a grid expansion strategy that will reach an estimated 30% of off-grid households across

the developing world. Yet, as shown in Table 1, in the central (new policies) scenario of the World Energy Outlook 2013 the International Energy Agency (IEA) projects that much of the expected progress will be offset by population growth. In sub-Saharan Africa, population growth is outpacing energy access so badly that by 2030 there are expected to be 46 million more people without access to electricity than there are today.

In addition to individuals and families in households, communities and local institutions also endure the same conditions. The growth of small and medium-sized businesses is hampered by lack of energy. According to World Bank estimates, this problem affects 10 million of the estimated 15 million such businesses in Africa alone.<sup>3</sup>

**Fig. 1: Number of people without access to electricity by region in the *New Policies Scenario* (millions)<sup>2</sup>**

	Without access to electricity		Without access to clean cooking facilities	
	2011	2030	2011	2030
<b>Developing countries</b>	<b>1257</b>	<b>969</b>	<b>2642</b>	<b>2524</b>
Africa	600	645	696	881
Sub-Saharan Africa	599	645	695	879
Developing Asia	615	324	1869	1582
China	3	0	446	241
India	306	147	818	730
Latin America	24	0	68	53
Middle East	19	0	9	8
<b>World</b>	<b>1258</b>	<b>969</b>	<b>2642</b>	<b>2524</b>

## The Link Between Energy and Sustainable Development

For decades, the connection between energy access and other global development challenges — poverty, health, education, food security, safety, economic growth, gender equity, job creation, livelihood improvement, and others — went unrecognized. In fact, the United Nations Millennium Development Goals, which expire at the end of 2015, and the Sustainable Development Goals (SDGs), which will be defined for 2016-2030, are — and will be — impossible to achieve without greater energy access for the world's peoples.

As an example of energy access interconnectivity, collecting cooking fuels is often a labor-intensive burden borne by women and children. It results in deforestation. The smoke inhaled by women and children while cooking causes serious, often fatal illnesses, including respiratory infections, bronchitis, pneumonia, cardiovascular disease, and lung cancer.

Universal energy access is integral to sustainable development and to addressing the crisis of climate

disruption. The transition to more sustainable forms of energy use by the global poor will not only increase household savings and health outcomes, but also lower greenhouse gas emissions.

As global temperatures increase and the effects of climate change become more prevalent, the same developing world populations that lack reliable energy access — and for that reason alone, the populations least responsible for causing climate change — will also experience its greatest impacts. Enhancing sustainable energy access will increase the household incomes of the poor, helping them to manage the stresses brought about by climate disruption.

Put another way, accelerating universal energy access will foster climate resilience, which is the capacity to withstand climate-related disruption. Climate resilience and energy access strategies need to go hand in hand.

“Modern energy services are the key to changing people’s quality of life. Clinics can store life-saving vaccines. Children can study after dark. Cleaner cookstoves can save the lives of millions of women and children every year. Electricity can power streetlights that will make women safer.”

UN Secretary General, Ban Ki-moon at the launch of UN Decade of Sustainable Energy for All



Photo credit: Eco-Fuel Africa

# What Is Acceptable Energy Access?

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Stringing an electrical line to a pole in a village allows someone (often a government) to declare, “This village has access to electricity.” But if the electrical lines do not extend to houses or carry electricity only a few hours a day, this supposed energy access is not acceptable to the residents. For our purposes, when we speak of access, we mean active, regular use by households, communities, *and* small and medium-sized enterprises.

What is the minimum amount of energy needed to declare “access”? The definition is fluid, but the characteristics tend to include the following features (see International Energy Agency’s *World Energy Outlook*<sup>4</sup> and Practical Action’s *Poor Peoples Energy Outlook*<sup>5</sup>):

- A household has a minimum level of illumination (300 lumens) and cell phone charging capability; reliable electricity (4 hours per night); safer and more sustainable cooking and heating fuels and stoves; and acceptable energy for space heating and cooling.
- Households, communities, and small businesses can engage in productive economic information and communications activity. This includes

household-based micro-enterprises and farming, as well as small businesses independent of the household unit.

This hierarchy of energy uses is often called an *energy ladder*: Once basic lighting and cooking needs are met, the next objective is to provide energy for charging various devices, primarily cell phones and, increasingly, smartphones (in February 2015 *The Economist* predicted that 80% of the world will have smartphones by 2020<sup>6</sup>), and for low energy-using productive uses such as running a sewing machine or powering small tools. This progression of access is generally referred to as “moving up the energy ladder.” As one progresses up the ladder, options for cleaner fuels increase, as does self-reliance.

## Going Beyond the Energy Ladder

In our view, however, such a linear progression no longer serves the purpose it once did. We prefer Practical Action’s more holistic *Total Energy Access* (TEA) standards. We find these standards speak in terms of the unit of “customers” rather than the broader “number of people with and without.”



**Fig. 2: Practical Action's Total Energy Access (TEA) Standards<sup>7</sup>**

Energy Service		Minimum Standard
1	Lighting	<ul style="list-style-type: none"> <li>• 300 lumens at household level, 4 light bulbs, and 4 hours of light per nights<sup>8</sup></li> </ul>
2	Cooking and water heating	<ul style="list-style-type: none"> <li>• 1 kg wood fuel or 0.3 kg charcoal or 0.04 kg LPG or 0.2 litres of kerosene or ethanol per person per day, taking less than 30 minutes per household per day to obtain</li> <li>• Minimum efficiency of improved wood and charcoal stoves to be 40% greater than a three-stone fire in terms of fuel use</li> <li>• Annual mean concentrations of particulate matter (PM2.5) &lt; 10 Qg/m<sup>3</sup> in households, with interim goals of 15 Qg/m<sup>3</sup>, 25 Qg/m<sup>3</sup> and 35 Qg/m<sup>3</sup></li> </ul>
3	Space heating	<ul style="list-style-type: none"> <li>• Minimum daytime indoor air temperature of 12°C (54°F)</li> </ul>
4	Cooling	<ul style="list-style-type: none"> <li>• Food processors, retailers, and householders have facilities to extend life of perishable products by a minimum of 50% over that allowed by ambient storage</li> <li>• All health facilities have refrigeration adequate for the blood, vaccine, and medicinal needs of local populations</li> <li>• Maximum indoor air temperature of 30°C (86°F)</li> </ul>
5	Information and communications	<ul style="list-style-type: none"> <li>• People can communicate electronic information beyond the locality in which they live</li> <li>• People can access electronic media, including TV and radio, relevant to their lives and livelihoods</li> </ul>
6	Earning a living	<ul style="list-style-type: none"> <li>• Access to energy is sufficient for the start-up of any enterprise</li> <li>• The proportion of operating costs for energy consumption in energy-efficient enterprises is financially sustainable</li> </ul>

# Why Energy Access Isn't Happening as Fast as It's Needed

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Billions of development and charity dollars are being spent on energy access by government aid agencies, foundations, and corporations. The topic has international attention; technologies and deployment models exist; innovations and price reductions are being realized; and there are many actors in the sector.

Energy access has recently moved up as a priority in international development dialogue. Universal energy access is now its own United Nations Sustainable Development Goal.<sup>9</sup> With all that is known about the issues of energy access, and with development aid aimed at solving the problem, why are we not able to envision a scenario that offers everyone the energy they need to survive and thrive?

Miller Center believes that solving the problem of energy access starts with reframing the problem. When the problem is reframed at a systems level, it becomes possible to envision and enact more viable solutions.

Energy access is typically subdivided by the nature of the need (e.g., cooking, fuels, and electricity); by resources (e.g., solar, wind, or biomass); by technologies (e.g., hydro, anaerobic digestion, solar photovoltaic); and by the goals of organizations involved (e.g., to invest, to advocate, to reform policy, to sell products, to improve international relations).

This fragmentation creates the illusion of an extraordinarily complex situation. The implicit framing of energy access as fragmented and complex invites a divide-and-conquer mentality that favors the search for new answers, often at the expense of supporting the diffusion of proven solutions. Seeing energy access as a problem affecting one-third of humanity is too daunting to tackle in its totality, so charities and aid organizations tend to champion particular fragments and miss opportunities for higher leverage impact that could be achieved through a systems level approach.

Tens of trillions of dollars are projected to be spent on improving the world's existing energy systems, according to the International Energy Agency (IEA).<sup>10</sup> Yet, as demonstrated by the projections in Figure 1, this massive investment is expected to put only a dent in the problem. We believe that reframing the problem at a systems level will allow a more efficient use of these funds.

## Taking an Enterprise System Approach to Energy Access

Instead of looking at these 2.6 billion sufferers of energy poverty as potential aid recipients, the social enterprise sector sees a total market of more than 500 million potential consumers for public and private energy supplies.<sup>11</sup> Then, the issue of energy access becomes, *How best can we serve the needs of this global market?* Miller Center proposes to take this thinking one step further by focusing on, *How many and what kind of enterprises are needed to serve this market?*



## A Value Chain View of the Energy Access Ecosystem

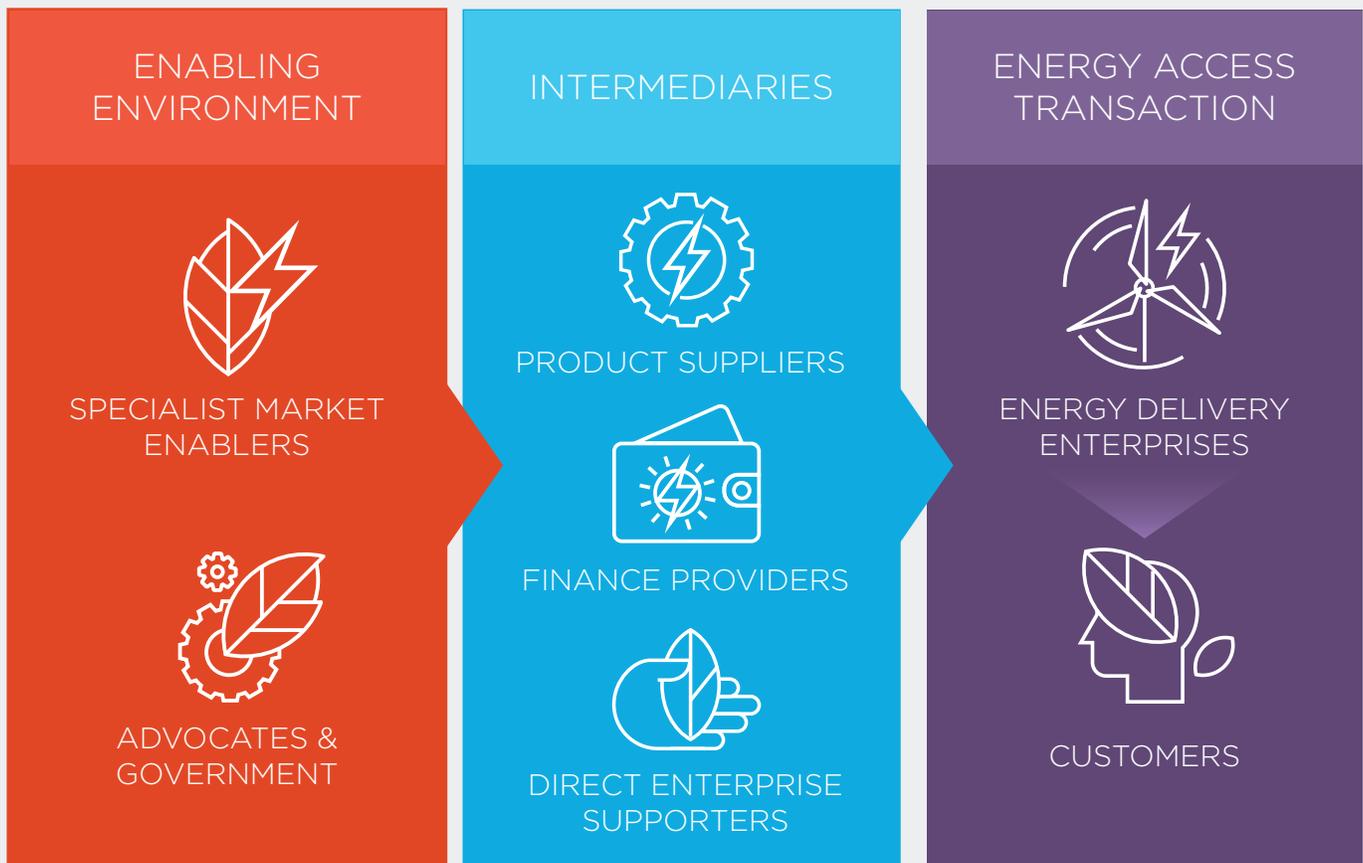
Enterprises that deliver energy will flourish only when they are part of a robust value chain. The value chain must include intermediaries that provide products, financing, and technical assistance to the energy delivery enterprises. Further, national and global organizations have a role to play in creating an enabling environment.

The representation in Fig. 3 of the energy access value chain is consistent with those developed by others (e.g., Practical Action<sup>12</sup>) and can be applied to all subdivisions and fragments of the energy access ecosystem. Some examples of these subdivisions are urban versus rural, electricity versus cooking, sunlight versus biomass, and policy reform versus retail transactions.

## Participants in energy access transactions include:

- **Customers:** *Those who acquire improved products and services.* For example, the households, communities, and small businesses in the Great Lakes Region of sub-Saharan Africa, or the street merchants of Bangalore, India, or the improved charcoal stove buyers of Accra, Ghana, or the households connected to a pay-as-you-go energy delivery service.
- **Energy Delivery Enterprises:** *Those who distribute improved products and services directly to customers.* For example, ONergy, Solar Sister, Tecnosol, Toyola, and M-KOPA, all of which are profiled in this paper.

**Fig. 3: Energy Access Value Chain**



## Intermediaries include:

- ➔ **Product Suppliers:** *Those who primarily produce and distribute products and services to delivery enterprises, and sometimes directly to customers.* For example, d.light, Envirofit, One Earth Designs, and Wisdom Stoves.
- ➔ **Finance Providers:** *Those who provide capital to product suppliers, delivery enterprises, and customers.* For example, Shell Foundation, Doen Foundation, Netherlands Development Finance Company, Bamboo Finance, Low Carbon Enterprise Fund, and German Technical Cooperation Agency.
- ➔ **Direct Enterprise Supporters:** *Those who primarily provide capacity development and other support services to delivery enterprises, and sometimes to product suppliers, financiers, or customers.* For example, Miller Center's Global Social Benefit Institute (GSBI®), Unreasonable Institute, Bid Network, and World Bank's Climate Innovation Centers.

## Enabling environment actors include:

- ➔ **Specialist Market Enablers:** *Those who improve specific energy access market conditions.* For example, Lighting Africa or United Nations Environment Program's Financial Initiative in southern India.
- ➔ **Advocates and Governments:** *Those who improve broader market conditions and organize resources into programs.* For example, Government of Tanzania, United Nations Development Program's Multifunction Platform Program in West Africa, or United Nations Sustainable Energy for All.

Utilities do have a role to play in this ecosystem, but they represent a special case. According to the IEA, 30% of energy access will be via grid extensions and 70% by mini-grids and stand-alone products.<sup>13</sup> Many energy access actors do not currently collaborate with a national or state utility, and more coordinated effort is needed. In our value chain, utilities are best thought of as energy delivery enterprises.



# A 4-Tactic Strategy for Addressing Energy Access

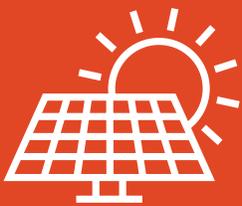
Universal energy access will require that all actors in the ecosystem maximize their efficiency by putting resources into strategies that have the highest leverage. Our own experience at Miller Center, along with those of many other social entrepreneurship endeavors across the globe, indicates that the following 4-tactic strategy will have immediate, yet deep, impacts:

- ➔ **Enterprise Building:** The energy access market is highly fragmented and requires local sales and support. It will be best served by a large number of smaller enterprises, or units of larger enterprises, able to bring the most appropriate technology, market-building strategies, and business models to their local market segments.
- ➔ **Ecosystem Building:** Ecosystem actors will be most effective if they adopt a country- or region-centric strategy to achieving energy access; identify all direct and indirect participants in the ecosystem; and engage policy and decision makers.

- ➔ **Capacity Building:** Support organizations can best grow capacity by improving the knowledge base of all actors in the ecosystem, including: customers, entrepreneurs, service providers, product suppliers, utility decision makers, and local and international financiers.
- ➔ **Impact Building:** To maximize impact of the human and financial resources being invested in energy access, it is important to measure impact across the entire ecosystem, using standards that span geographies and technologies. All the value-chain actors must develop and adopt user-friendly tools and uniform reporting standards.

Let's take a closer look at each of these tactics.

## 4 TACTICS FOR SUSTAINABLE ENERGY ACCESS



ENTERPRISE  
BUILDING



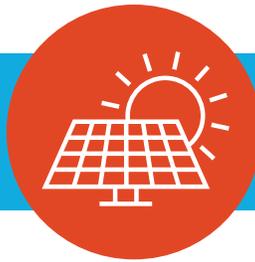
ECOSYSTEM  
BUILDING



CAPACITY  
BUILDING



IMPACT  
BUILDING



Energy access requires local energy delivery. Local energy delivery enterprises may be backed by more distant product manufacturers, financiers, or direct enterprise supporters, but a direct delivery model needs to be local so that enterprises can tailor the marketing, financing, and after-sales support as needed. In a system-oriented approach, energy access delivery enterprises require:

- Direct input from customers
- Access to affordable, appropriate products
- Market-building activities appropriate for the local context
- Financing compatible with their business plans
- Support services to begin, succeed, and grow
- Human capital for sales and after-sales support

The primary energy-access actors need to acknowledge and roughly quantify the challenge of enterprise building, as well as the need for tools, standards, and reporting. These enterprises seek to serve a total market of 500 million customers, made up of thousands of segments with different requirements depending on geography, economics, culture, and

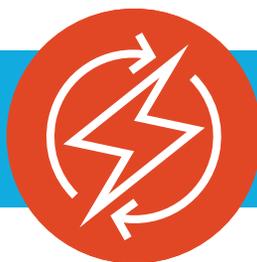
other factors. For example, cookstove customers who purchase fuelwood represent a different segment from those who gather firewood. In a similar way, an enterprise selling solar home systems in a country where mobile phones and mobile money has a high penetration (e.g., Kenya) will reach customers with a different model than a similar enterprise in a country where mobile phones and money has yet to gain a significant user base (e.g., Ethiopia).

The challenge is thus to create thousands of individual enterprises or units within larger enterprises that can serve these thousands of market segments by identifying the optimum products, business models, and financing strategies to serve a specific segment in a sustainable manner.

While some enterprise models might be widely replicable across other market segments, it is rare that an entrepreneur most able to build a business that serves local needs will also possess the skills and ambitions to grow an enterprise into an entity serving millions of customers. Therefore, new enterprises are needed to replicate — with appropriate local adaptations — the solutions provided by successful energy enterprises.



## Ecosystem Building



In a system-oriented approach, energy access is a country- or region-centric system comprising various subsystems and participants that need to be mapped and seen whole. These subsystems include: local product producers or suppliers, retailers, financiers, after-sales service enterprises, projects, and programs. Decisions and resource allocations destined to build the ecosystem must be made not based on the attractiveness of any one idea or transaction, but by strengthening existing actors and enabling new actors to close critical gaps. This approach would lead to more efficient use of human and financial resources, which are currently often incentivized to focus on special interests or “the next new thing” – in lieu of a concerted effort to overcome the hurdles that stand in

the way of deploying proven solutions through proven models.

Additionally, it is important to highlight the challenge of enterprise building and ecosystem improvements at the country level. The country or regional ecosystem must be mapped, the players on the sidelines identified and engaged, and this information (and related recommendations on improvements and priorities) made available to policy- and decision-makers. This mapping will enable and encourage all the value-chain actors to move away from an a la carte approach and instead map their key actions and priorities according to the 4 tactics in a holistic, balanced way.

## Capacity Building



Capacity building must incorporate a balanced set of improvements including the:

- Knowledgebase of customers
- Business planning of delivery enterprises
- Market knowledge and awareness by product suppliers
- Market and business climate information for finance providers as well as an understanding of local investment and business conditions at the transaction level
- Strengths, weaknesses, and needs assessment information and tools for incubators, accelerators, advisers, and others to supply needed support

services for enterprises to launch, succeed, and grow

- Specific and general market-building activities connected to organizations’ and governments’ priorities for business climate

The last decade has seen the establishment of a significant number of accelerators and other targeted training programs. Capacity-building activities must span the spectrum from customer to policymakers to local financial institutions. However, because each accelerator and training program will support only certain categories and often only particular subcategories of value chain actors, it is important for enabling environment actors and intermediaries to map the gaps and identify ways to fill them.

# Impact Building



The greatest impact across an entire country or regional energy access system will occur when actors along the value chain converge on common measures and goals. Some requirements include:

- Simplified and harmonized methods for data collection and verification by donors and enabling impact organizations such as the Aspen Network of Development Entrepreneurs (ANDE)
- Incentives such as social impact bonds to encourage delivery enterprises to report impact data in addition to sales data
- Easily used tools to measure performance (e.g., the Global Tracking Framework by Sustainable Energy for All<sup>14</sup>)
- The acceptance of Practical Action's Total Energy Access (TEA) statistics<sup>15</sup> as the minimum standard for energy poverty, rather than diverse country-level definitions of electrification
- Documentation and dissemination of best practices and lessons from successful and failed activities
- Global replication and recognition of successful methods as essential to system-wide change



# How Many Enterprises Will it Take to End Energy Poverty?

Reframing the issue of universal energy access as a market services problem still begs an important question: How many energy access delivery enterprises will it take to make energy accessible to all of the estimated 500 million households and small businesses that now lack it?

We conducted a thought experiment to estimate that number, based on the 4-tactic strategy outlined earlier. We began with two major premises:

1. Local energy enterprises have to be profitable enough to sustain their existences, and
2. Startup costs and risk have to be attractive to investors.

“After working with over 100 enterprises in the energy access space in the last decade, we believe that solving the problem of energy access starts with reframing the problem at a systems level. Creating 7,000 to 20,000 energy access enterprises is a challenging, but achievable goal. Most importantly, it is a goal that can align all actors from governments to investors to entrepreneurs.”

Andrew Lieberman,  
Miller Center for Social  
Entrepreneurship

Appendix A shows the detailed reasoning and calculations, as well as a chart of figures, that we use to arrive at our estimate of how many local energy enterprises are needed worldwide to lay the groundwork for universal energy access.

*We conclude that the number is between 7,000 and 20,000 local energy enterprises, each growing to serve an average of 25,000 customers over its lifespan. Dividing 500 million by 25,000 gives us the 20,000 upper boundary. However, this number could be reduced to as few as 7,000 if grid extensions are implemented as planned and if significant numbers of enterprises scale beyond the 25,000 customer estimate.*

We believe this is a reasonable, achievable number.<sup>16</sup> There are already many energy delivery enterprises serving or on track to serve 25,000 customers. Collectively, they reach a broad range of market segments, including some of the more challenging geographies such as South Sudan (Potential Energy) and Haiti (Earthspark International).

Whether the answer is closer to 7,000 or 20,000, this thought experiment gives credible data to guide a workable strategy for addressing energy poverty. Rather than trying to grapple with delivering solutions to 2.6 billion people — an almost incomprehensible number — the energy access sector can instead focus on the challenges of creating 7,000 to 20,000 energy delivery enterprises, or units within larger enterprises.

We choose to present our thoughts as a range from 7,000 to 20,000 to remind readers that we are illustrating the order of magnitude of enterprises needed. The estimate will no doubt be refined as enterprises mature and are analyzed over time, and as investor trends change and develop. However, at present, the numerical range is credible, workable, and tangible.

# Tapping Entrepreneurs and Energy Enterprises

Knowing that 7,000 to 20,000 energy enterprises will be needed to address universal energy access, the next question is: How can those energy enterprises best be established and scaled? Fortunately, there is a tremendous amount of knowledge and experience about what it takes to do this.

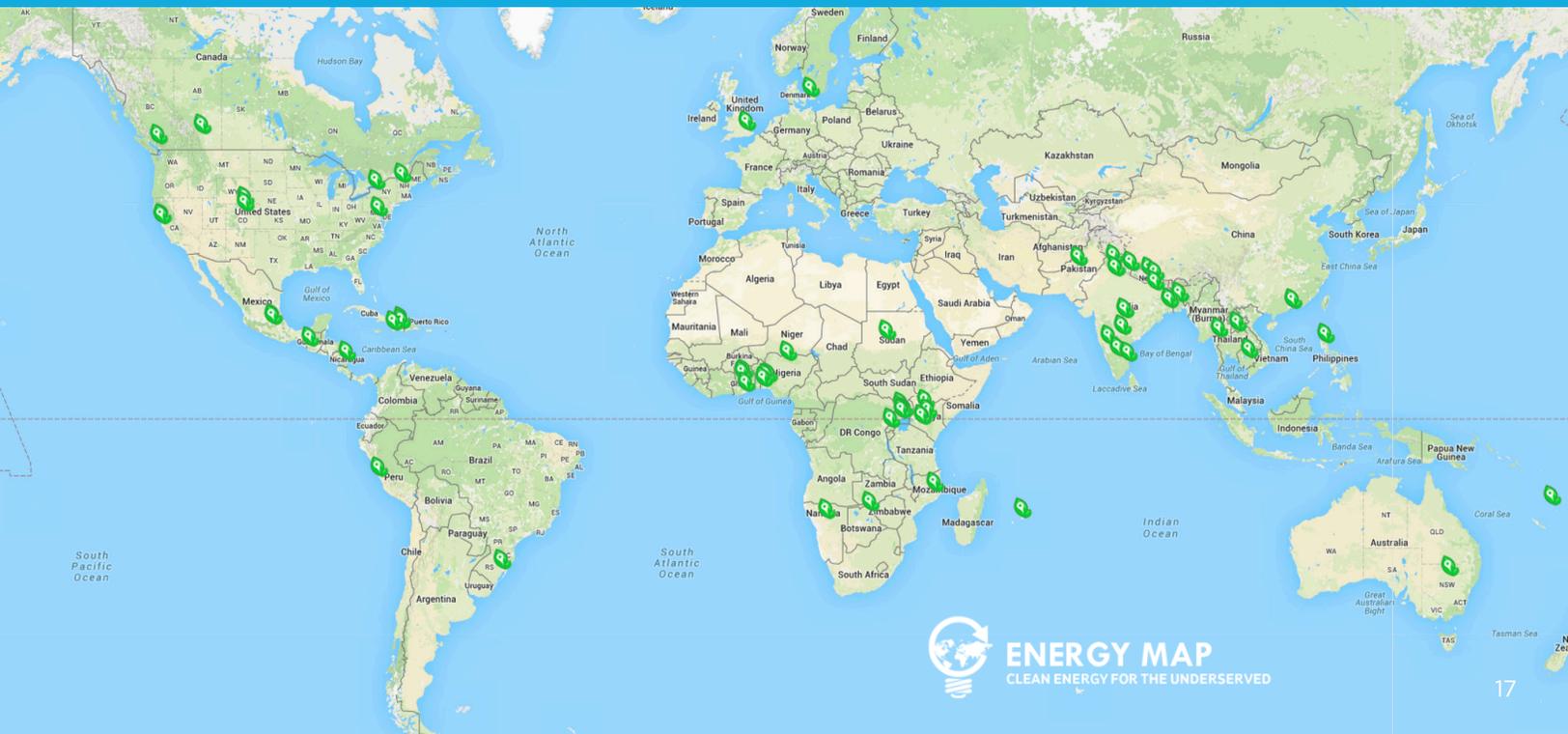
Market-based approaches to provide BOP (base of the economic pyramid) customers with energy access have been around for many decades.<sup>17</sup> The experiences of various providers offer a useful resource in analyzing our 7,000 to 20,000 proposed energy enterprises. They also help us make useful categories and distinctions.

The Energy Map website<sup>18</sup> profiles more than 60 energy access enterprises spanning a wide range of geographies, technologies, and business models. Most have participated in capacity development programs through the GSBI. Others have been included because they offer unique and innovative technologies and models that complement the GSBI enterprises.

We define an “energy enterprise” as any enterprise engaging in energy projects, products, and directly related services that relieve energy poverty. Thus, an energy delivery company such as SELCO (India) that installs home systems qualifies as an energy enterprise, as do product designer-manufacturers such as Thrive or Nokero (solar lanterns and phone chargers). A national utility extending an electricity grid, or OneEarth Designs (China) and Envirofit (global) making and selling improved cookstoves, also qualify.

Through market forces, the 7,000 to 20,000 energy enterprises could largely organize themselves over time. Scale will be achieved through an enterprise-driven, bottom-up approach. Using the fast-food model as an example, some or even many of these thousands of small and medium-sized enterprises might be owned and administered by larger organizations, just as individual fast food establishments are often owned and operated in bundles of 5 or 50. Further building upon the fast food analogy, it may be possible to accelerate the organization and scaling of these energy enterprises.

Fig. 4: Illustrative Map – social enterprises active in BOP markets



Tecnosol (see inset) is one example of an early successful energy enterprise in this range. Over 10 years, they have built a business through impact and commercial investments, delivering more than 70,000 solar systems in Nicaragua. Tecnosol's growth has leveled off, but the company remains a viable business and can serve as a model for the entrepreneurs who aspire to create the needed 7,000 to 20,000 businesses of a similar size. Insets later in this paper highlight other delivery enterprises that are early models for the thousands more that need to be launched and scaled.

## What is Not Included in Our Model?

The 7,000 to 20,000 target does not include the enterprises, non-profits, and government initiatives that make up the rest of the energy access value chain described above. The needed delivery enterprises will launch and thrive more quickly with the support

of organizations that *facilitate* energy access without providing it directly. These include:

- Product Supply Firms — such as Envirofit (stove producer) and Angaza Design (pay-as-you-go technology)
- Finance Providers — such as the Shell Foundation
- Direct Enterprise Supporters — such as Miller Center's GSBI

Enabling environment actors are also not included in the calculation, but they are critical to eradication of energy poverty. Many of these enabling and support organizations already have a strong focus on creation and strengthening of energy delivery enterprises. However, we feel that a sharper common vision of success in global energy access through enterprise building will improve the efficacy and efficiency of these value-chain actors.

# Tecnosol

In 2001, a Nicaraguan solar energy provider, Tecnosol, participated in a USAID-funded program supporting the launch and growth of clean energy enterprises.

In 2003, E+Co provided its first US\$100,000 loan to Tecnosol to finance additional inventory purchases to expand its market and provide short-term credit to its customers. In 2004, E+Co invested another US\$190,000 for the expansion of Tecnosol's operations, which allowed the company to open four additional branch offices in rural communities in Nicaragua.

By 2006, Tecnosol had grown from 8 to 60 full-time employees, and it was providing clean energy to more than 11,000 households via 10 branch operations. A third E+Co loan of \$1 million was provided in 2007 for further expansion through the establishment of more branches across Nicaragua and in neighboring countries. By 2009, Tecnosol closed on a \$1.3 million private equity investment from local investors and by 2012 had expanded its operations to El Salvador,

Honduras, and Panama. Tecnosol has directly created 95 permanent jobs and numerous others for installation and maintenance. More than 70,000 systems have been installed to date, serving more than 400,000 people.

***Tecnosol, an energy delivery enterprise, exemplifies the power of business development services. Its participation in the USAID-funded incubator-like program and the ongoing support from E+Co validates the impact that a small amount of funding can have for a business. Additionally, Tecnosol demonstrates how early-stage businesses can become attractive to traditional investors for a later-stage investment.***



# Breaking the Code — Parallel Perspectives

The 4-tactic strategy outlined here is based on Miller Center’s capacity development work with more than 60 energy access enterprises and our study of research done by respected organizations. Our analysis of reports by important actors in the energy access sector shows marked concurrence with the 4-tactic strategy of enterprise building, ecosystem building, capacity building, and impact building.

We present 12 perspectives from different actors in the energy access ecosystem, whose roles range from the delivery of products to a customer’s doorstep, to the elimination of market-crushing subsidies, to the

measurement of results and progress. Collectively, they illustrate the broad agreement and emerging consensus we believe already exists in the energy access sector to focus on establishing and scaling energy enterprises. The presentation of these reports is complemented by case studies of energy delivery enterprises that can be role models for the needed new enterprises.

Terminology varies among the reports, but the ideas they present tend to intersect. The following chart shows areas of agreement with our 4 tactics by 12 important actors in energy access.

**Fig. 5: How Important Actors Address Our 4 Proposed Tactics**

	 ENTERPRISE BUILDING	 ECOSYSTEM BUILDING	 CAPACITY BUILDING	 IMPACT BUILDING
Practical Action	✓	✓	✓	
Ashden	✓	✓		
Hystra	✓	✓	✓	
Ashoka	✓	✓	✓	
Shell Foundation	✓	✓	✓	✓
International Finance Corporation	✓	✓	✓	✓
World Bank	✓	✓	✓	
Deloitte Touche Tohmatsu Indian Private Ltd	✓	✓	✓	
Consultative Group to Assist the Poor	✓			✓
Miller Center for Social Entrepreneurship	✓	✓	✓	
SELCO-India	✓		✓	✓
Global Alliance for Clean Cookstoves	✓	✓	✓	✓

In a report from the October 2013 *Base of the Pyramid Summit*<sup>19</sup> hosted by the William Davidson Institute, authors London, Sheth, and Hart offered the proposition that the total BOP domain, including all segments, needed to be re-invigorated through four tactics related to those we suggest:

1. Enterprises need to be both scalable and sustainable.
2. Partners and actors need to work in a viable, holistic ecosystem.
3. There needs to be mutual value creation for all actors to create a sustainable value chain.
4. Training and knowledge needs to be created, delivered, and shared among all ecosystem actors.



Photo credit: Iluméxico's Communication Department

# ILUMÉXICO

ILUMÉXICO, a Mexican social enterprise, designs and manufactures solar charge controllers and integrated solar solutions ranging from 2 LED bulbs for homes to large systems for water pumping and energy for schools. It creates innovative last-mile distribution networks and provides micro-loans to rural inhabitants. ILUMÉXICO saves its customers an average of 18% of total monthly income by displacing other energy sources, primarily candles and diesel.

Since its establishment in 2010, ILUMÉXICO has reached 3,500 households, benefitting 18,000 people and offsetting 1,720 tons of CO<sub>2</sub>. With 4 branch offices, the company has created 15+ jobs for rural community members.

ILUMÉXICO participated in GSBI programs in 2013, leading them to become the first investee of a social enterprise fund launched by Banamex. This funding provided them with capital for expansion through an innovative variable payment investment mechanism, the **demand dividend**, that links investor payback and returns to the enterprise's free cash flow.

***ILUMÉXICO is both a product supplier and an energy delivery company executing direct transactions with customers. ILUMÉXICO illustrates the reach of one enterprise and its potential long-term impact.***

# Perspectives on Energy Access by Important Actors

**Practical Action** informs a customer-centered approach. With over 45 years' experience (in more than 45 countries), Practical Action produced its *Poor People's Energy Outlook* series (2010-2014), focusing on its perspectives. These perspectives include increasing financing for decentralized solutions, encouraging an ecosystem's understanding of the energy landscape, and fostering capacity-building activities for a sustainable ecosystem.<sup>20</sup>

**Ashden** (founder of Ashden Awards) informs a high-level, policy-oriented perspective. In *Lessons on Supporting Energy Access Enterprises* (2014), a report prepared by Ashden and Christian Aid, recommendations include helping energy enterprises to thrive by supporting an enabling environment; creating space and conducive operating environments for energy enterprises, including access to finance; and taking a holistic national approach.<sup>21</sup>

## ONergy

ONergy is one of the leading early stage energy access social enterprises providing complete solar solutions to underserved populations in India. ONergy has developed innovative solar solutions focusing on rural energy access for solar lighting, solar microgrids, solar computers, solar pumps and micro cold storage.

Established in 2009, ONergy participated in the GSBI and Unreasonable Institute capacity development programs in 2011. Additionally, ONergy received support from solar energy pioneer SELCO.

In 2011, ONergy was serving 18,000 people with energy services. As of 2015 ONergy has impacted lives of 250,000 people across 2000 villages in east India by promoting a range of solar solutions. It has established a unique full service distribution infrastructure by setting up Renewable Energy Centers and operates through a network of trained rural entrepreneurs; local NGOs, MFIs, and banks.

**ONergy is an energy delivery enterprise providing products directly to households and small businesses. By supporting other businesses through the provision of energy services, ONergy is improving the lives of numerous people, creating job opportunities and a better quality of life.**



Photo credit: ONergy

**Hystra & Ashoka** informs an experience- and example-based approach to energy access. In *Access to Energy for the Base of the Pyramid* (2009), 5 market-based segments were examined in relation to problem solubility, economic viability, and ability to grow in scale. Among their 25 recommendations were:

- Invest in programs designed to support the ecosystem for energy access
- Solidify the relationship between public utilities and energy enterprises
- Reduce market distortions and examine portfolios that make it difficult for enterprises to succeed

- Organize local communities for grid (and mini-grid) connection
- Train micro-entrepreneurs
- Expand range of offerings
- Examine the best “value-add” aspects as new firms enter the sector.<sup>22</sup>

## Eco-Fuel Africa

Eco-Fuel Africa (EFA), a social enterprise, is focused on eradicating dependence on wood fuel in sub-Saharan Africa by making organic charcoal from agricultural waste. EFA trains more than 2,500 farmers on how to turn locally sourced biomass waste into char using locally made kilns. EFA uses the char for its green charcoal, a carbon-neutral cooking fuel that functions the same as traditional fuel wood but costs 20% less, is not smoky, and burns longer than fuel wood. EFA then sells its green charcoal through a network of women retailers.

EFA has created a network of 460 women retailers in Uganda, who can increase their disposable incomes by over 80%; farmers are augmenting their income by selling char. EFA also creates micro-franchises generating income for poor people mainly in rural sub-Saharan Africa. EFA provides almost 20,000 households with green charcoal daily — saving over US\$3 million on energy-related expenses and mitigating over 500,000 tons of CO<sub>2</sub>.



Photo credit: Eco-Fuel Africa

In February 2015, shortly after completing the GSBI Accelerator program, Eco-Fuel Africa was awarded \$1 million from Verizon’s “Powerful Answers” Challenge.

***Eco-Fuel Africa, a product supplier and energy delivery enterprise, validates a business’s ability to have a social, environmental, and financial impact. One company is lifting women out of poverty, providing additional income to farmers, offering an affordable alternative fuel source to families, reducing deforestation, and displacing CO<sub>2</sub>. EFA’s business training, mentoring, and support from GSBI provided invaluable assistance in growing EFA.***

**Shell Foundation** works with a small number of entrepreneurial partners to identify the market failures that underpin many of the world's problems and co-create new social enterprises to solve them. They provide patient grant funding, extensive business support and access to networks to help pioneers to validate new models, achieve financial independence and to expand across geographies. Once a new

solution is proven to be viable they create specialist intermediaries (supply chain, financial, institutions) to facilitate growth and replication at an industry level.<sup>23</sup>

# Thrive

Based in India, Thrive Energy Technologies designs, develops, manufactures, and promotes low-cost, solar-powered, LED-based lighting systems to replace kerosene lamps. With 14 types of solar-powered LED lights, Thrive meets the lighting needs of children, women, households, and villages. Its lights are used by tea estate workers, farmers, weavers, vendors, dairy workers, and those engaged in any other village-level activities who need a clean, safe, and reliable light. Thrive partners with NGOs, women's self-help groups, micro-finance institutions, banks, donors, educational institutions, and businesses to promote and distribute its lighting products to base-of-the-pyramid (BOP) communities.

Thrive believed from the beginning that the key to delivering an innovative and sustainable solution at the BOP is keeping the supply chain as short as possible. It also believes in customized financing mechanisms to help the poor to acquire and own the light.

Thrive Solar evolved from the technology innovations of the THRIVE NGO, which started its own solar technology division. In 2007, Thrive Energy Technologies Pvt. Ltd. (TET) was born; in 2013 it was renamed as Thrive Solar Energy Pvt. Ltd.

Thrive is manufacturing 2 million lights per year at prices as low as \$2 per lamp. They are expanding production by partnering with local entrepreneurs to launch assembly and manufacturing hubs in Africa and Southeast Asia.

***Thrive's participation in the GSBI supported its evolution from an NGO to a for-profit company. GSBI's training provided Thrive with the tools and mentoring to develop a sustainable and scalable business strategy.***



## International Finance Corporation (IFC)

informs an investment-oriented perspective. The International Finance Corporation's (World Bank Group) publication *From Gap to Opportunity* (2012) provides an overview of energy access ventures by subsector, model, and customer base. It quotes the IEA that energy access will cost the energy ecosystem actors \$48 billion per year, and approximately \$14 billion is available from government aid agencies, impact investors, donors, and the private sector. It points out, too, that people are spending \$37 billion yearly on kerosene and biomass. The IFC surveyed 100 businesses and offers more than 20 recommendations, including:

- For local energy enterprises, such as tapping local, multi-product distribution networks
- For the ecosystem level, such as creating quality standards
- Providing information, finance, and training
- Helpful governmental regulations<sup>24</sup>

## M-Kopa

M-Kopa, a “pay-as-you-go” market leader for off-grid customers, makes solar products affordable to low-income households on a pay-per-use installment plan. With a small deposit, customers buy a solar system and purchase “credits” to use daily. This cost is less than what most customers pay for kerosene. After a year of regular payments, customers own the system.

Since M-Kopa's launch in 2012, it has served more than 150,000 homes or 750,000 people in East Africa. M-Kopa represents a fast-growing company, adding 25,000 customers a year.

M-KOPA Solar closed its most recent funding round, raising US\$20 million to fund its expansion throughout Africa to reach a customer base of 1 million homes by 2018. It is positioned to have a larger-than-average impact for an energy delivery enterprise, but it should be noted that its expansion throughout Africa is being done by partnering with local entrepreneurs,

which would then count as multiple enterprises for the purposes of our thought experiment.

***M-Kopa, an energy delivery company with a financing product, demonstrates a creative approach to serving its market. By providing a mechanism for customers to pay small amounts over time, products originally deemed too expensive become affordable. Additionally, securing a \$20 million investment validates the financial viability of the energy access market.***



Photo credit: Georgina Goodwin

**World Bank** informs a policy and regulatory perspective. In its publication *From the Bottom Up* (2014), the World Bank outlines factors needed to create a regulatory and policy environment supportive of sustainable, decentralized, small power producers to complement national strategies for grid extension. These factors include access to finance, human, and technical capacity, as well as conducive policies and regulations.<sup>25</sup>

“Crucially, all of these actions are specific to local markets and industries, because that is the level at which barriers and risks can be meaningfully understood and therefore where they must ultimately be addressed.”

World Bank Group,  
in “*From the Bottom Up*”

“We need to better share our collective experience and be ready as a more integrated community to address the challenges ahead.”

Harish Hande, Selco’s Founder

**SELCO-India** informs the investor-investee perspective. In a workshop organized by SELCO Foundation in April 2014, 30 participants made recommendations outlined in *Bridging Gaps: Impact Investors and Social Energy Enterprises*. These recommendations include a change in mindset, creating exposure programs for investors and practitioners, shortening the due diligence process, impact reporting, and using model investment instruments.<sup>26</sup>

**Consultative Group to Assist the Poor (CGAP)** informs the customer and end-user finance perspective. CGAP is a global partnership of 34 leading organizations that seeks to advance financial inclusion. It says in *Access to Energy via Digital Finance: Overview of Models and Prospects for Innovation* (2014) that modern energy products are beyond affordability to poor end users; financing by energy product distribution companies is rarely available; and formal finance providers have failed to design financial products and services that meet the financing needs of the energy poor.<sup>27</sup>

“For most people living off-grid, lack of access to financing options — loans, leasing, payment mechanisms, and so on — is a primary barrier to adopting modern solar solutions.”

Jacob Winiecki, CGAP

## Miller Center of Social Entrepreneurship at Santa Clara University

informs the perspective on where investors and investee intersect, productive uses, and the process of capacity building. Launched in 2003, its Global Social Benefit Institute (GSBI) is focused on social enterprise capacity development. The GSBI serves start-up, early-stage, and mid-stage enterprises. As of May 2015, the GSBI has worked with more than 390 social enterprises, including 80 energy enterprises. These 390

social enterprises are based in more than 60 countries, have raised more than US\$96 million in funding after completing a GSBI program, and have directly benefited the lives of more than 107 million people. Its publication *Accelerating Widespread Adoption of Distributed Energy*<sup>28</sup> advocates for combining productive use, reducing costs, and improving financing of energy solutions.<sup>29</sup>

“Social enterprises need to ensure their impact enterprise strategy aligns with a profit-making business model.” Businesses must show they can be profitable over time. If the company isn’t viable, no impacts can be realized.”

Pamela Roussos, GSBI Senior Director



**Deloitte Touche Tohmatsu Indian Private Ltd (Deloitte)** informs the generic issue of building scale in BOP markets. *Beyond the Pioneer* (2014) shares lessons learned in developing large-scale, market-based solutions. Included in its emphases are engagement of all stakeholders at a local level, plus actions for all actors in the energy access and BOP sectors — with the special note that these players need to coordinate and communicate activities with all involved.<sup>30</sup>

**Global Alliance for Clean Cookstoves** is taking a three-pronged approach to increase access to cleaner, more efficient cooking technologies — enhancing demand for clean cookstoves and fuels; strengthening the supply of clean cookstoves and fuels; and fostering the enabling environment for a thriving market.<sup>31</sup> The Global Alliance for Clean

Cookstoves, a public-private partnership, saves lives, improves livelihoods, empowers women, and protects the environment by creating a thriving global market for clean and efficient household cooking solutions through some of these activities: supporting capacity-building for entrepreneurs, enhancing testing and knowledge centers, integrating the issue of clean cooking as a means of achieving other critical development priorities — health, energy, and environment — and by galvanizing major international organizations and initiatives.<sup>32</sup>

Of course, we cannot do justice to the bodies of work summarized in the preceding section. We recommend that all of these reports be read in their entirety. Terminology varies, but our 4 tactics are readily identifiable, as are the BOP roadmap categories. The skeleton of a consensus is clearly visible among the publications of these important actors in energy access.

# Where Do We Go From Here?

We have shown that despite terminology differences, institutional priorities, narrow technology focus, or self-interests, a strategic and tactical consensus is emerging on how to approach widespread energy access. This consensus reflects the following key points:

- Energy access is a *system*. It needs to be approached as such, meaning that different actors within the value chain need to channel their efforts to the activities that will have the largest impact on the entire system and provide energy access to the most people.
- The creation of 7,000 to 20,000 delivery enterprises — the number estimated to serve the 2.6 billion energy poverty sufferers with a market-based approach — represents a manageable (though still formidable) challenge.

Our over-arching recommendation is to adopt a strategic and tactical “Energy through Enterprise” approach to energy access. This strategy should be based on seeing the energy access sector whole, embracing local enterprises as high leverage points, and connecting the dots along the value chain of actors. There is general agreement that country (or province or state in large countries, and regions for small countries) represents the unit of geography or market that system improvements should address to support enterprises.

While all development is local, there are useful lessons, examples, and market-improving initiatives to imitate and adapt throughout an energy access system and its subsystems. These include acknowledgment that:

- Change requires substantial time, as well as different types of resources at different times.

- Learning and accountability need to be improved through improved metrics and reporting.
- Interests, especially between investors and investees, need to be aligned to increase the flow of capital.
- Successful enterprises, regardless of size, are building blocks in increasing the scale and impact of energy access initiatives.

An energy access system requires specific, coordinated, and different interventions over time to grow and improve. Though expressed differently, the common ingredients of these interventions involve:

- Enterprise building
- Ecosystem building
- Capacity building
- Impact building



Each actor in the energy access value chain has a role to play. Miller Center recommends these lines of action:

## Energy delivery enterprises

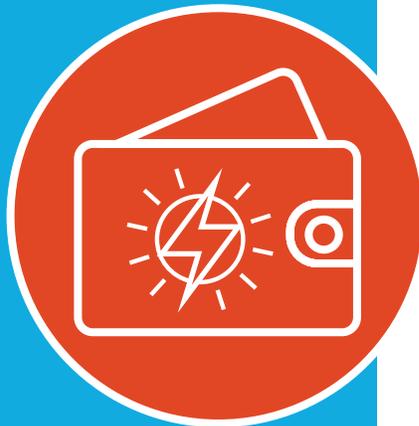
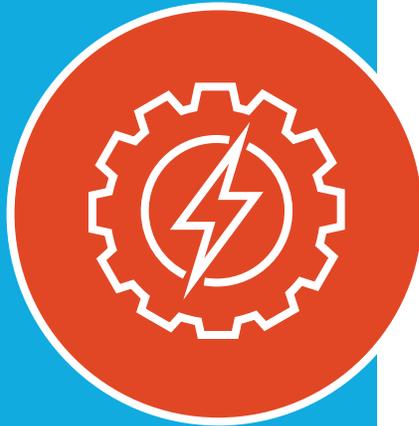
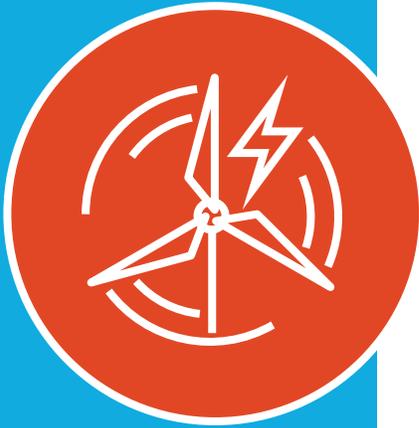
- Build business plans that align to the optimum conditions laid out in Appendix A: total gross margins in the \$67,000 to \$375,000 range and investment requirements from \$287,000 to \$1.6 million.
- Focus on serving a specific local market that supports 900-5,000 transactions/year, and once ramp-up has been achieved, look strategically at other markets and decide the best way to serve them — which could be through either a new unit of the same enterprise or partnering with a new or existing local enterprise in the new geography.

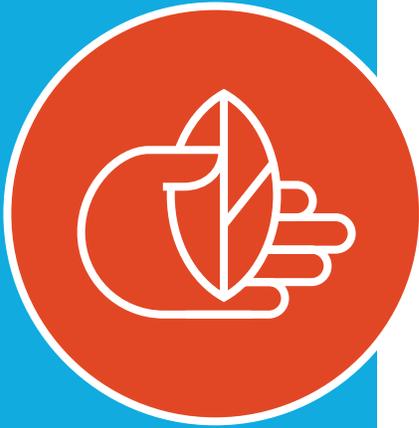
## Product suppliers

- Study energy access markets to see which segments can be served through existing products, which segments are not well-served by existing products, and what products could increase economic productivity in multiple market segments. Innovate new products for those services.
- Pro-actively seek new or existing local entrepreneurs, or train local entrepreneurial talent, to create distribution channels that can scale to the 25,000 customer range.

## Finance providers

- Develop and share investment criteria specific to local energy enterprises in target geographies so that aspiring energy access entrepreneurs can build their businesses to be more investable.
- Invest in local enterprises with viable plans to ramp up to the recommended gross margin ranges mentioned above; aggregate substantially similar energy enterprises or units of enterprises to enable larger investors to deploy capital.
- Invest in replication of successful energy access enterprises to other geographies, either through adding operational units to an existing enterprise or through a partnership arrangement with an entrepreneur local to the new geography.
- Experiment with alternative investment mechanisms including variable payment obligations such as the demand dividend that enable local entrepreneurs to retain ownership of community-scale enterprises.





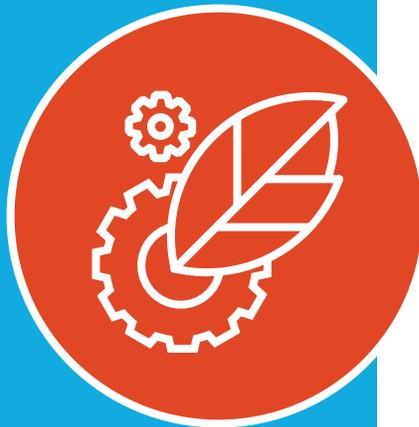
## Direct enterprise supporters

- Provide capacity development and mentoring programs that guide entrepreneurs toward business plans that fit the parameters discussed in this paper, thereby increasing their likelihood of success.
- Connect actors throughout the value chain to realize economies of scale and increase focus within energy delivery enterprises.



## Special market enablers

- Conduct and share market studies that elucidate optimal geographies, supply chain considerations, infrastructure deficits, and other factors that affect the ability to successfully launch and scale community-based energy delivery enterprises.
- Develop case studies that highlight the critical success factors for energy access enterprises with an emphasis on creating enterprises with the right size and ramp-up rate to attract financing and become financially sustainable in a reasonable time period.



## Government, advocacy organizations, and international government organizations (IGOs)

- Foster technology, business model, and financing innovations that enable the creation of more community-based energy access enterprises and reduce the investment risks.
- Evolve local and international policies that currently favor fossil fuels to support off-grid, resilient, clean energy solutions.

“Any intelligent fool can make things bigger, more complex, and more violent. It takes a touch of genius — and a lot of courage — to move in the opposite direction.”

E.F. Schumacher, author of *Small Is Beautiful*

# Attachment A — Our Thought Experiment

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Following are the detailed premises, assumptions, and thought processes that led to our estimate of 7,000 to 20,000 energy delivery enterprises needed to eliminate global energy poverty. We invite others to challenge and improve these assumptions and refine the estimate.

Premise: Gross margins (revenue less cost of goods sold) within locally-rooted energy delivery enterprises must be sufficient to support the talent, market access, and financing that an energy access enterprise or a unit within a larger organization requires.

Premise: At the same time, the capital requirements of the initial stages of launching this enterprise or unit within a larger enterprise must be attractive to capital markets of different investment sizes. This is especially true for seed-stage and startups but is equally valid (reflecting risk aversion) in larger organizations.

Testing these two statements in the energy access space requires a relatively simple arithmetic exercise, which we believe can be approached with varying degrees of complexity and still yield the same general result.

1. Volumes and transaction size in the energy access sector must reflect the realities of the market: Transactions to households, communities, and local small businesses will likely be in the \$125-\$500 range. Gross margins (revenues minus cost of goods sold) will be in the 25% - 35% range.
2. What matters more than transaction volume and size of transactions is the total gross margin produced. This must be sufficient to attract talent, tap markets, and access all types of finance to match the maturity of all entrepreneurs and businesses. For example, startup enterprises need \$50,000-\$100,000.
3. We evaluated transaction volumes per year (yearly transaction targets) in 4 orders of magnitude: 50-90 transactions per year; 500-900 transactions per year; 5,000-9,000 transactions per year; and 50,000-90,000 transactions per year. These ranges allow for statistical differences among order-of-magnitude estimates.
4. We evaluated transaction sizes of \$125, \$250, and \$500 and examined gross margins of 25%, 30%, and 35%. We present the 8 cases of \$250 transaction size with a 30% margin.
5. We assume that it takes 3 years for an enterprise or a unit within a larger enterprise to reach its early transaction target.
6. We assume these businesses will be small or medium entities or units, beginning with a small staff and growing as the business grows.
7. We assume that financing will be required from someone other than the enterprise itself (from owner equity or profits) to support the revenue targets. We set this financing requirement at 75% of the first 3 years' revenues, reflecting sufficient funds for inventory and working capital while allowing for owners and investors to finance fixed assets.
8. We further assume one-half of that financing will be required initially.
9. We built a simple model to test 6 variables that could impact the reasonableness of "scale" that a new enterprise or a new unit within an existing larger enterprise might reasonably achieve.
10. We conclude that transaction volumes in the tens of units per year (50-90) are simply too small to generate sufficient gross margin to attract talent, access markets efficiently, and obtain financing.

- It is likely (but subject to debate) that 90 to 500 transactions per year may also be too small to build an enterprise sufficient to matter and grow for the purposes of increasing the scale of energy access.
11. At the other end of the spectrum, we conclude that annual transaction volumes of 50,000 to 90,000 could secure sufficient margins to attract talent, access markets, and attract financing; however, the scale of the financing (“ticket size”) and risk associated with that scale are currently, and we believe for the foreseeable future, beyond what private capital (traditional and non-traditional) and public-purpose investors and donors would assume.
  12. It is unlikely that 5,000 to 50,000 transactions per year could attract sufficient early capital to launch and grow. Despite encouraging dialog, our experience is that during the due diligence process, initially ambitious investors reduce expectations and their risk. There are some investors willing to invest \$500,000 or more to businesses with a 3-5 year track record. Early-stage capital at that level is rarely available.
  13. What remains is a range (900 to 5,000 transactions per year) that could generate sufficient gross margins to succeed and grow while being in a range of capital needs that could be met in the prevailing market conditions.
  14. The lower range (500 to 900 transactions per year) is still problematic because as Aspen Network for Development Entrepreneurs (ANDE)<sup>33</sup> has reported, there are few investors in that small space or ticket size.
  15. The 5,000 target means 25,000 customers served over 6-7 years, allowing for ramp-up. It requires some “stretching” and larger-than-current ticket size by investors. Initial exposure will range from \$500,000 to \$1,000,000, which approaches a point where there is some confluence between expressed investor appetite and actual capital deployment.
  16. If our “customer potential” is 500 million and each enterprise can reach 25,000 customers over 6-7 years including ramp-up to the yearly transaction target, then 20,000 enterprises or units within larger enterprises are needed to fully serve the demand.
  17. Notes and Comments —
    - A) Some entrepreneurial firms might house tens or more of such 5,000-transaction-per-year units, thereby gaining purchasing power, economies of scale in the center of the value chain, and distribution efficiencies — but we need to keep in mind the diverse nature of the energy access market geographically, which experience indicates requires a local approach.
    - B) Some may contend that a 9,000-per-year enterprise unit could be financed. That would cut the upper results of this calculation substantially, from 20,000 enterprises to 11,000.
      - a) Further, this thought experiment also does not include the number of customers served beyond the early years. Conceivably, an enterprise or unit that serves 25,000 in years 1-7 might serve an additional 25,000 in the immediate next 3 years. If a 10-year, 50,000 customers-per-enterprise measure is used, then only 10,000 enterprises or units within larger enterprises are needed.
      - b) Quite possibly 30% of the unserved customers might also be served by grid extensions.<sup>34</sup> If we adjust for this possibility and use a 10-year horizon, the result is the need for 7,000 enterprises.

# “Thought Experiment” Calculations and Results

Case	Transactions per year (1)	Annual revenues US\$ (000) (2)	Gross margin US\$ (000) (3)	Approx. 3-year financing requirement US\$ (000) (4)	Initial investment US\$ (000) (5)	Comment
A1	50	12.5	3.8	15.9	8.0	Gross margins too small
A2	90	22.5	6.8	29.0	14.5	Gross margins too small
B1	500	125.0	37.5	159.0	79.5	Gross margins possibly too small
B2	900	225.0	67.5	287.0	143.5	Feasible gross margin range
C1	5,000	1,250.0	375.0	1,593.8	796.9	Feasible gross margin range
C2	9,000	2,250.0	675.0	2,869.0	1,434.5	Possibly too large to attract capital
D1	50,000	12,500.0	3,750.0	15,937.0	7,968.5	Too large to attract capital
D2	90,000	22,500.0	6,750.0	28,687.0	14,343.5	Too large to attract capital

(1) Assumes three-year ramp up

(2) Based on \$250 average transaction

(3) Based on 30% average gross margin

(4) Based on 170% of 3rd year revenue \* 75%. 70% reflects ramp up period

(5) Based on 50% of 3-year financing requirement

# Acknowledgements

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- Jennifer Twedell, Global Alliance for Clean Cookstoves
- Harish Hande and Sarah Alexander, SELCO
- Jacob Winiacki, CGAP
- Meera Shah, Shell Foundation
- Tim Haley, GSBI Mentor and Partner, Redpoint Ventures
- Jim Koch, GSBI Co-Founder
- Ing. Vladimir Delagneau Barquero, Tecnosol

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7. See endnote 5
8. Frame of reference: A 4.8 watt (Utilitech PRO) LED, which replaces a 40 watt incandescent light bulb, provides 300 lumens. A 53 watt “energy efficient” (GE) incandescent light bulb replaces a 75 watt incandescent light bulb and provides 890 lumens of illumination.
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## Additional Resources

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