

Seeking an End to Energy Starvation

*Innovations Case Narrative:
Husk Power Systems*

Husk Power Systems (HPS) provides end-to-end renewable energy solutions in India by installing and operating 25-kW to 100-kW “mini power plants,” and then wiring villages and hamlets of up to 4,000 inhabitants to deliver electricity on a pay-for-use basis. HPS has created a proprietary technology that cost-effectively converts biomass waste (e.g., rice husks, mustard husks/stems, corn cobs, certain grasses, etc.) into electricity. The company’s total cost of installation is less than US\$1,200 per kW, which is approximately half the cost of solar panels of a similar scale. HPS, which has been operating for four years, maintains reliability/uptime at its power plants of over 93 percent, and it has successfully installed 80 power plants that supply electricity to more than 325 villages. HPS is currently scaling at a rate of two to three power plants per week, and plans to accelerate to five plants per week in 2012.

HPS has faced many challenges in building its business to this point. One major challenge was to tap the right mix of capital from sources that enabled it to stay true to its mission of bringing renewable and affordable electricity to people in underserved villages in India, while also allowing it to make the necessary investment of US\$5 million. This case focuses on how a social enterprise blended various sources of capital to achieve its expansion objectives and aligned its long-term vision with funders’ financial and nonfinancial goals.

BACKGROUND ON ENERGY ACCESS

Access to energy is intricately related to human well-being, as it can have a significant impact on people’s health, education, and livelihoods. According to the International Energy Agency of the United Nations Development Programme, the lack of access to modern energy services is an important challenge in the social and economic development of people around the world. Unless the world community addresses issues of energy accessibility, it will be extremely difficult to meet the UN Millennium Development Goals.¹

Manoj Sinha is the Cofounder of Husk Power Systems, where he leads fundraising and international business development activities.

Various statistics paint a stark picture of inequity in access to modern energy sources. Almost 1.4 billion people in the world do not have access to electricity; 85 percent of these people live in rural areas where access is not expected to improve without significant policy changes.²

THE POWER SECTOR IN INDIA AND BIHAR PROVINCE

There are areas of severe energy poverty in India. About one-third of the country's population, or approximately 125,000 rural Indian villages, lack access to electricity. The region that remains the darkest is Bihar. It is not a coincidence that Bihar is also one of the poorest states in India. Bihar has 90 million people, of which about 85 percent live in households with no grid connection. With a population of 90 million, 37 million of them living below the poverty line,³ Bihar has a per-capita annual income of around US\$160, making it one of the most densely populated agglomerations of poor people anywhere in the world. While the state accounts for 8 percent of India's population, it contributes only 1.6 percent of the country's GDP. Its per-capita income has averaged a mere 1.5 percent growth per year, the slowest among major Indian states.

Because Bihar has nowhere near the capacity needed to meet its current power demands, even the few people who do have power connections receive electricity only at odd hours, when households use it the least. At the end of 2009, the Bihar State Electricity Board had about 2.96 million consumers in a state that has a population of 90 million people. No new power-generating units have been built in the state in the last 25 years, and the Economic Survey of Bihar has candidly acknowledged that "the power supply position in Bihar is very poor and the deficit in relation to peak demand is ever increasing."⁴

The government of India has undertaken significant policy reforms in the power sector during the last decade to augment power generation and distribution capacity. These changes include private participation and diversification of the fuel mix within an enabling policy environment. Passage of the Electricity Act of 2003 has brought many changes, including public-private partnerships in transmission and distribution systems, private participation in nuclear power generation projects, demand-side management, franchised distribution systems, renewable energy, and many other activities in the Indian power sector. These policy changes, along with opening the power sector to private companies, will definitely help bring a reliable power supply to bigger cities and midsize towns in India in the next 10-15 years. However, most of the private players still use the centralized production and long transmission lines for distribution, which does not fit well with the needs of remote villages. Per-capita energy consumption in villages is very low, which makes any centralized system (a hub-and-spoke model) uneconomical, as the distribution loss would be much higher than the energy demand of a small village. Hence, there is a need for the decentralized electricity that a few social enterprises have been providing in India for the past five years. Social enterprises such

as Selco, India, have been actively involved with Solar Home Lighting System, and d.light has been providing solar lanterns to remote households.

India's rural areas and small towns bear the brunt of this scarcity of power, remaining without electricity more often than bigger towns and cities. Opening up the power sector to the private sector has created an opportunity for decentralized power generation based in villages and small towns, and businesses that distribute power are beginning to take shape. However, such small-scale undertakings should be financially sustainable and able to compete with the large private- and public-sector power corporations. A groundbreaking and frugal innovation undertaken by Husk Power Systems satisfies these criteria. Furthermore, the following narrative of HPS's successful business application of small-scale power plants powered by rice husks clearly shows that the company is also contributing to a cleaner environment, generating local employment, and significantly changing rural lives in other important ways. These other roles establish HPS as a socially responsible business organization.

The duo recognized the urgent need for rural development in India, in Bihar in particular, and they considered rural electrification a necessity rather than an option. The conventional technologies and grids had failed to deliver, and they saw immense opportunities to address the country's pervasive energy starvation.

STARTING HUSK POWER SYSTEMS

The genesis of Husk Power Systems was a casual conversation in 2002 between two childhood friends—one in his office in Los Angeles (Gyanesh), the other in his office in Patna (Ratnesh). The result of that conversation took more than five years to develop. The duo recognized the urgent need for rural development in India, in Bihar in particular, and they considered rural electrification a necessity rather than an option. The conventional technologies and grids had failed to deliver, and they saw immense opportunities to address the country's pervasive energy starvation. The need for a solution that used nonconventional technology to develop a system for the decentralized generation and distribution of electricity was a no-brainer.

Gyanesh had a change of heart about his life plans after a failed *Vipasana* (meditation) course in late 2006, and by early 2007 he was back home for good,

having chucked a promising career in the greener pastures of the U.S. semiconductor industry. He began to explore technologies that could provide solutions for the electrification in his rural area of Bihar.

Having run through the gamut of the most commonly talked about and presumed promising options (solar, wind, fuel cell, biofuel, etc.), a chance encounter with a gasifier salesman provided a fresh ray of hope in the so far rather frustrating pursuit of the two old friends. They learned how several rice millers in Bihar were using the decades-old technology of biomass gasification and powering their mills with rice husk—a low-value byproduct of milling operations. Rice husk—perhaps the only bio-waste produced by rural folks—was a promising, locally available source of power for the dream of rural electrification.

There was, of course, a catch: all of the prevalent rice husk-based gasifier systems operated in what is called the dual-fuel mode, where the gas produced was used in conjunction with 35-50 percent diesel fuel to power the engines. This saved up to 50 percent of diesel costs, which suited a rice miller but not the economic model of rural electrification. The pair wondered whether they could use the gasifier systems in single-fuel mode—that is, without any diesel. Rice husk is an amorphous and low-density fuel that produces a gas with high tar content, and it is considered a dirty fuel source. Experts therefore deemed it unfit for the single-fuel mode of operation.

Having produced remarkable improvements and yield levels in one of the oldest semiconductor fabrication units in North America, Gyanesh didn't see the drawbacks of rice husk as much of a problem. Acknowledging that a dirty gas can clog the engine, he argued that if the engine were cleaned regularly to prevent such clogs, the single-fuel mode should work. Dr. S. K. Singh, a scientist with India's Ministry of New and Renewable Energy, agreed. Although neither man had previous experience with biomass gasification, the pair undertook the task of developing this technology for rural renewable energy. They had a gasifier constructed at a local workshop, procured a cheap compressed natural gas engine from a small supplier, and modified it to suit their purpose. What had been a rather lofty and unyielding idea for over five years took Gyanesh and Singh less than five months to realize. On the 60th anniversary of India's independence, the remote village of Tamkuha, which means fog of darkness, in the state of Bihar received electricity for the very first time.

This technological and operational breakthrough now needed a business model and exposure. These were provided by Gyanesh's college friend, Manoj Sinha. Manoj had been aware that the product was being developed, and he used that knowledge to build a coherent business plan and strategy that would bridge the gap between a working prototype and a sustainable business. Manoj was assisted in his efforts by his University of Virginia classmate Charles Ransler. The model proved to be a great success in various business plan competitions, and Husk Power Systems was born. By the end of 2008, the founding team had invested a total of US\$180,000 (US\$80,000 from their personal savings, the rest earned in the competitions) to start the first few pilot power plants.



Installed Power Plant and HPS Team

EMERGING BUSINESS MODEL

HPS provides off-grid power to rural Indian villages. Each plant powers approximately 500 households or 50 shops and other small businesses. The firm designs, installs, and operates 25-kW to 100-kW plants with their own mini-grid at no cost to the village. HPS then enters into contracts with farmers and local rice mills to procure rice husks and other biomass waste at fixed rates. The firm generates electricity using this feedstock, and distributes power using a point-to-point system that connects each household and business directly to the HPS power station. Households prepay an average of \$1.75 per month for a package that lets them operate two compact fluorescent lamps and a fan, and to charge cell phones as often as they like. The pricing strategy for these packages was driven by two main factors: HPS's electricity needed to be at least 30 percent cheaper than competing sources, such as kerosene lanterns and electricity supplied by diesel generators, and the lighting package needed to be sufficient to light an entire house, rather than just one room. HPS pricing also needed to be on a par with subsidized power the state government provided.

HPS has also devised a process to utilize the waste produced by the gasification process, rice husk char. Rather than trying to dispose of the char at each plant, HPS devised a way to roll it into unscented incense sticks and sell it to channel partners in the local market. HPS's power plant saves 125-150 tons of CO₂ per year by not



Plant Operator in Action

using fossil fuels, which provides an additional source of revenue, as much as 10 percent of the total. The firm is also expanding its sales model by partnering with electrical appliance and consumer goods manufacturers to channel quality products directly to rural customers in a cost-effective manner.

One of the stickiest problems in the power-distribution arena in India is electricity theft, which averages 35-40 percent across India. With the low pricing and small footprint of each HPS power plant, this high theft rate would have made financial sustainability impossible.

HPS has applied a multipronged strategy to address this challenge. The primary way of addressing this issue is to include the local community and allow them to have their voices heard in the decision-making process. This can be as simple as selecting the appropriate location, hours, and timing of operations. HPS also has a policy of recruiting only local people, who are then trained at the company's training facility. These steps ensure a community buy-in and generate local economic activity as employees receive their HPS salary. HPS also developed an in-house smart, prepaid meter (arguably the world's cheapest smart meter) that is deployed at the household level to prevent the stealing of electricity. These steps and processes have resulted in HPS losing less than 5 percent of generated electricity to theft and leakage.

As HPS embarked on its aggressive yet achievable goal of installing at least 2,000 plants in the next four years, it launched two variants of its franchise model.

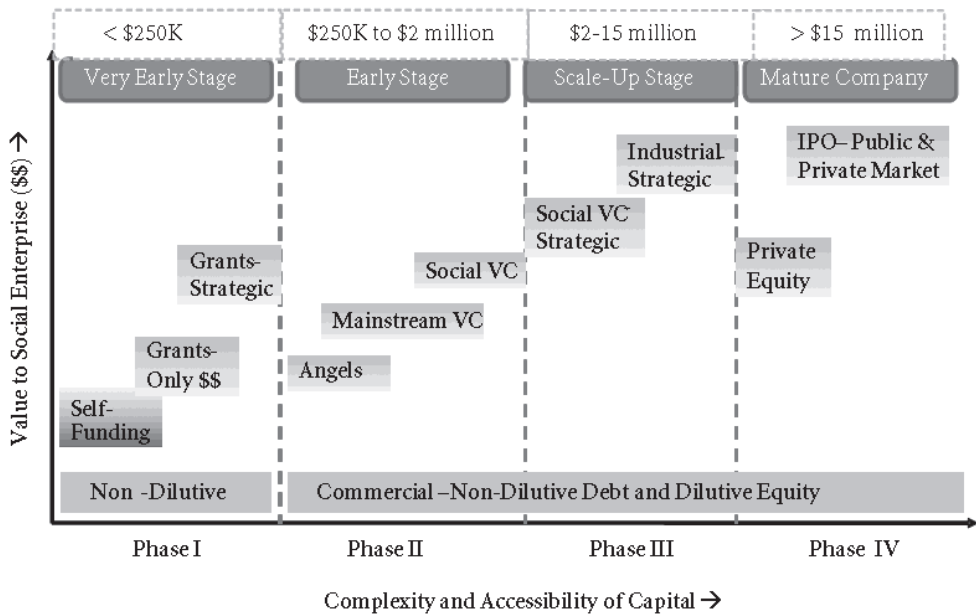


Figure 1. The Financing Spectrum

This was necessary so HPS could expand to serve rural populations in countries such as Uganda, Tanzania, Bangladesh, and more. To meet its long-term goal and manage an aggressive growth strategy in the rural electrification market, HPS needed to raise a large amount of capital from a variety of sources while maintaining its focus on the founding team’s vision.

FINANCING SPECTRUM

The founders of Husk Power Systems did not start the company by building a business and operations plan around available funding. The team instead took the route of finding a good solution that fulfilled the fundamental energy needs of rural people and depended on the principle, “Do the business well and funding will follow”—meanwhile spending their own money to get things going. The initial research and experiments were funded by the founders’ personal savings. Once the principle was proven and the working prototype provided electricity to the first three villages while also generating real revenue, the cofounders began the journey to find available funding.

Figure 1 presents a simple framework we devised, which social entrepreneurs can use to understand the funding landscape. They may apply this framework to raising different types of funding, depending on what stage a company is in. In the figure, the Y-axis represents how much blended value (Social + Financial + Operational + Environmental) any form of funding brings to a social enterprise. The exact interpretation of (\$\$) value on the Y-axis is company specific and fluid, depending on the company’s situation. The figure presents a viewpoint HPS took

while going from the Very Early Stage to the Scale-Up Stage of fundraising. The X-axis represents the complex types of funding and how accessible they are to social enterprises.

There are several questions one should ask while raising equity financing, including convertible notes: Does the fund and its offer fit the business needs? How does the structure of the convertible note address any concern for potentially unfair company valuation by the investors? Should funding be accepted from any institutional investor? If not, what are some criteria for filtering out those that may not be in sync with a long-term social enterprise vision?

NON-DILUTIVE FUNDING

Self-Funding

Entrepreneurship is about following one's passion to solve prevalent pain points in an efficient way, and that passion should also be aligned with how much monetary risk one is willing to take. This is just one dimension of social entrepreneurship, which essentially equates with what affordable loss(es) entrepreneurs can take. In other words, social entrepreneurs should invest their own money in building prototypes and testing the products/services in the market. Sweat equity or opportunity cost is not a good indicator of how vested one is in a particular venture. In short, business founders need to invest a substantial amount of capital, for various reasons:

- There is a lack of access to commercial equity and debt capital at the ideation stage
- Self-funding the construction of a working prototype sends a strong message about one's commitment and builds credibility for entrepreneurs, especially first-timers
- It prevents dilution, as any external capital will apply a very high discount, due to the many unknowns at the ideation stage

At HPS, the cofounders provided the early funding and did not draw salaries for over 20 months after the start of the first power plant in August 2007.

Competitions: Business Plans and Others

Husk Power Systems was fortunate that two of its founding members, Sinha and Ransler, were in the U.S. They participated in seven mainstream and social venture-oriented business plan competitions. Business plan competitions bring a lot of additional value in terms of providing mentoring and unparalleled access to seasoned entrepreneurs and capitalists, and they turned out to be a great vehicle for HPS. The company ended up raising US\$100K in non-dilutive funding over a period of 15 months. But it did not just benefit from the cash prizes; it also made valuable connections by participating in these competitions, which validated the HPS business plan and opened doors that the founding team never dreamed of.

Winning money in a business plan competition is the easy part; investing the money appropriately to maximize its benefit is a lot harder and takes a lot of dis-

cipline. The HPS founding team invested every dollar of their winnings into plant expansion, market assessment, and forming manufacturing partnerships, and the whole team was disciplined about not drawing a penny for salaries in the early stage. Winning competitions also brought a lot of media attention and press coverage for HPS, which generated a good deal of interest from potential future investors. These competitions also gave the founders exposure and helped them articulate their business plan in a way that was more palatable to venture capitalists, including impact venture capitalists, which essentially meant learning the “VC lingo.”

Grant Funding

There are two types of grant funding: one that comes with no strings attached, and the other wherein the funder attaches its own goals and metrics to those of the enterprise receiving the grant; these sometimes are or become conflicting. It is highly recommended that a company go with a fund whose goals are aligned with its vision, that can provide strategic help, and that works with the organization to define and measure performance indicators, which is essential in teaching the social enterprise to be disciplined about using the money.

While free money such as a grant may seem to add value, HPS took a disciplined approach in soliciting money only from funds whose mission aligned with the company’s goals. In the early stage, HPS approached a few grant providers that had some restrictive guidelines around the geography the company needed to serve or metrics that the company needed to report. Some of the qualitative metrics proposed (e.g., the impact of electricity on children’s education) were not easily measurable, which combined with other factors to deter HPS from pursuing such funds.

Husk Power Systems was fortunate to have partnered with the Shell Foundation at a very early stage, when the company had only two operational power plants. The Shell Foundation is a virtually picture perfect example of what “strategic” funder means in the case of Husk Power Systems. HPS and the Shell Foundation entered into a multiyear grant-funding partnership, and each round of funding was completely dependent on HPS meeting mutually agreed to performance metrics. While the Shell Foundation takes a hands-on approach, it is important to mention that they do not interfere in the HPS management team’s strategy or its execution.

Husk Power Systems’ partnership with the Shell Foundation, which began in 2008, has helped HPS in the following ways:

- It built credibility around the HPS operation by enabling it to reach a critical mass of five new operating power plants that served 18 villages in early 2009
- Shell Foundation assisted in facilitating strategy sessions, recruiting new senior managers, and raising global awareness of the HPS brand
- It funded R&D activities to decrease capital expenditure costs per plant and for building the world’s lowest cost “smart, prepaid” meter

- It allowed leveraging of the Shell Foundation's links across the Shell Group to dramatically improve safety conditions at its operational sites, thereby reducing low-probability, high-impact risks (black swan events). Such events include human casualty, equipment mishandling resulting in a village wide fire, etc.

With an ambitious endeavor like rural electrification, the biggest challenge is to build and arrange the required components—manpower, equipment, partnerships, etc.—that don't readily exist in underserved rural markets. Shell Foundation's support, both financially and operationally, has allowed HPS to maintain its focus on serving people in extremely poor rural regions of India who make less than \$2 per day, and yet to attract capital from commercial sources.

Husk Power University is an initiative HPS launched to build a platform that would fuel its aggressive expansion plan. The company is building a high-quality training program to train 2,000-plus operators and mechanics, 500-plus mid-level managers and small business owners, etc. This is an ambitious and crucial project for HPS. The Shell Foundation has provided the seed funding and high-quality consultant support for planning the project, and it developed some of the learning materials.

COMMERCIAL CAPITAL: DILUTIVE FUNDING

In April 2009, having built a solid foundation with funding from the Shell Foundation and with eight plants serving 30 villages already installed, HPS started looking for commercial financing. It is important to note that although HPS started looking for investors in the second quarter of 2009, it had started building relationships with the Acumen Fund, Venture Well, and a few other angel investors in Virginia, Washington, D.C., and California in mid-2008.

In early 2009, social investing was not as popular in India as it is today, therefore the company focused on attracting capital from like-minded social venture capital firms in the U.S. and Europe. As far as the funding landscape in India is concerned, all reputable venture capital firms—such as Kleiner Perkins Caufield & Byers, Sequoia Capital, DFJ, New Enterprise Associates, Battery Ventures, and SAIL Venture Partners—had set up offices and were actively investing in India. Even with the global economic slowdown, venture capital flows to India continued to be strong, with investments totaling \$864 million in 2008, up 3 percent over 2007.⁵ With 1.1 billion consumers and a 450-million-strong middle class, India was a very large, very fast growing, and, hence, very attractive market. With the profitability of foreign investments in India at 19.33 percent⁶ and the GDP expected to grow at an average annual rate of 8 percent, everyone rushed to find their place in the market. India was expected to move from being the tenth-largest to the third-largest economy in the world by 2020.

FUNDING CONSIDERATIONS FOR HUSK POWER SYSTEMS

The founders of Husk Power Systems were concerned that equity investors were immediately discounting numbers, and Husk Power's locations in very rural parts

of India exacerbated the discounting. Valuing the firm at this nascent stage depended on several factors: the growth of a number of power plants, each plant's profitability, the time each plant would take to break even, the increase in energy consumption in each village, monetization of waste streams from the gasification plants, government subsidies, carbon emissions reduction pricing, and the international partnership capabilities of the firm. It was a lot to account for, but the resulting valuation dictated the company share the investors would receive. After a number of attempted pitches and long hours spent with investors and foundations, the HPS management team finally simplified their financial projections. The conservative financial projections contained only revenues from the projected plants and excluded any additional revenue streams. This simplified approach pushed the bottom-line numbers downward but eliminated the upper hand the investors had in arguing that alternative revenue streams such as carbon credits were unlikely to be realized.

The financing structure offered was a convertible note. The management team had to carefully evaluate whether this structure addressed their concerns. They knew this was only the first stage of raising funds to expand the business, and growing it to its full potential would require as much as US\$12 million in additional investments in 2011-2012. Subsequent rounds were not out of the question.

After carefully considering all the factors, Husk Power Systems received a pre-Series A round of financing from Acumen Fund, Bamboo Finance, LGT Philanthropy, DFJ/CISCO (part of the 2009 Global Business Plan Competition winnings), and International Finance Corporation. As HPS received funding, it formed a board of directors and offered one seat each to Acumen and Bamboo representatives and all the founding team members. Every investor was offered board observer rights, and they have been invited to all board meetings in order to foster collaboration and solve issues together. The board also created guidelines for the approval process for any major expense item or any major change in strategy. In fact, the HPS management team invited board members to help the team when they embarked on any major initiatives, such as forming strategic corporate partnerships. The management team considered the following factors while partnering with these firms:

- Alignment of Husk Power Systems' long-term vision with these financing institutions
- Market perception, depth (size of funds), and reach of the funding institutions
- Tactical (fellows, consulting, etc.) and strategic (operational and technical, international business development, corporate partnership, etc.) help that funds can bring to the table
- Patience of the funds to associate with the company for the long run, as the management team was aware of the five-plus years it takes for a social enterprise to reach a certain scale and a possible exit

SCALE-UP CAPITAL: DILUTIVE AND NON-DILUTIVE FUNDING

Husk Power Systems has just started raising the next round of funding to fuel its expansion plans up to 2014-2015. At this stage, the management team has realized that it is of the utmost importance to partner with funding institutions that can add a lot of strategic value to help the growth of the company. As the company transforms its business model to further fuel its already fast rate of expansion, it would be an understatement to say that unless an investor brings added value in terms of building strategic corporate partnerships and helping launch the business model in other countries, the invested money may not be able to help a good business with a good management team unleash its full potential. HPS is aware of this very important factor and is carefully considering funding sources that can truly help the firm establish global leadership in community scale, and in rural and renewable electrification.

Since Husk Power Systems is an asset-heavy (power plants) company, the management team is strongly considering commercial debt (non-dilutive) to further its expansion plans. It is important to consider the pros and cons of debt financing. While debt is non-dilutive, it brings with it a fair deal of risk that an early stage company may not be equipped to handle. In fact, HPS did not draw any loans until the end of 2010, despite the fact that it had access to a significant amount of debt capital. To state the obvious, knowing about the risks associated with debt capital is the first and foremost task that any company should conduct before availing itself of such funding, even if it is readily available (we all know the pitfalls of NINJA loans in the U.S. housing market). However, it is also important to emphasize that servicing interest and principal on term loans gives a start-up company a great deal of financial discipline—something that is essential for a firm before it embarks into a real scale-up phase. The bottom line of availing debt facility is cash flow stability, financial discipline, and the cash cushion a company should have in place. At this stage, a management team should be capable not only of operational management but also management of asset liability (balance sheet management).

HPS has tapped a number of sources to fund its development and growth. By June 30, 2011, it had installed 80 power plants that serve 325 villages and have impacted the lives of over 175,000 people. HPS directly employs 350 local people and recently launched a training program for women, who are employed by the company to roll incense sticks. Each woman working part-time for HPS now earns up to US\$100 per month.

These sources have been diverse, and the founding team has worked to maintain both a strong social mission—the electrification of rural villages in India—which has attracted grant funding from organizations such as the Shell Foundation, and financial returns, which have attracted impact investors such as Acumen, LGT Philanthropy, and Oasis (Bamboo Finance) funds, development financial institutions such as International Finance Corp., and mainstream venture capitalists such as Draper Fisher Jurvetson.

LOOKING AHEAD

HPS is accelerating its expansion and aims to be serving as many as 10 million people in rural areas in Southeast Asia and Africa within the next 5-6 years. It plans to expand operations in Bangladesh, Cambodia, Tanzania, and Uganda in the next 24 months. As HPS expands its operations to include 2,500 power plants, it will directly employ 7,500 local people to operate the plants and 10,000 women as part-time workers to roll incense sticks and more. Part of the HPS mission statement is to “empower women,” and the company places special emphasis on the recruitment and training of local women for such basic manufacturing processes and similar services.

The company founders believe that providing people with electricity is to give them tools they can use both to save cash and generate additional income. When households and businesses switch from kerosene lanterns to low-cost electricity provided by HPS, the total savings will be over US\$50 million per year. HPS estimates that the additional income its employees, small businesses, and new entrepreneurs will generate will top US\$25 million per year by 2015. And, finally, the company will help keep 325,000 tons of CO₂ out of the atmosphere every year as households and businesses switch to electricity supplied by HPS.

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