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Social Entrepreneurship Track

2nd Place

Husk Power Systems: Lighting up the Indian Rural Lives

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"I can guarantee that the pleasure and happiness you will get when you see a village light up every evening is literally "priceless". No amount of Wall Street bonuses or Hedge Fund's profit sharing can bring you that level of satisfaction, happiness, and of course recognition."[1]

– Manoj Sinha, Co-founder, Husk Power Systems, in September 2011.

In June 2011, Husk Power Systems (HPS), a social enterprise based in Bihar, Eastern India, won the prestigious Ashden Award for Sustainable Energy[2], considered as the 'Green Oscar'. The international award carried prize money of £[3]120,000. On this occasion, Gyanesh Pandey[4] (Pandey), Co-Founder and Chief Executive Officer (CEO) of HPS, said, "Winning the Ashden awards is a big achievement for Husk Power Systems. Almost a third of India's population has no access to electricity and the role of energy is vital in catalyzing the economic development in India"[5]. Jacqueline Novogratz, CEO, Acumen Fund[6] said, "Companies like HPS are working to impact positively not only the environment, but to ensure that someday everyone, including the poorest of the poor in rural India, will have access to clean and affordable electricity."[7]

Even as of 2012, Electricity and electrification remained a major problem in India, especially rural hinterlands. Around 125,000[8] villages in the country do not have any kind of electricity connection. This situation was worse in Bihar, third most populous state in the country. In Bihar, per capita consumption of electricity was just 117.48[9] kilowatt hour (kWh) in 2009-10 whereas the average per capita consumption in India as a whole was 570.9[10] kWh.[11] Due to lack of electricity 89.3% (94.5% in rural areas and 39.9%[12] in urban areas) of the households in Bihar use kerosene[13] to light up their houses after sunset. Raghunath Prasad Chauhan (Chauhan), a farmer in Tamkuha, Bihar, describing the situation, said, "It was dark and because of that there were so many problems. There used to be a lot of thefts and snakes and dogs would bite. There was the problem to go out in night. My children could not study at

1 "SOCAP11 Social Entrepreneur Spotlight: Manoj Sinha, Husk Power Systems (India)," http://socialcapitalmarkets.net, September 3, 2011.

2 Started in 2001, Ashden Awards for Sustainable Energy is the internationally recognized annual awards in the field of green energy.

3 £ = British pounds sterling. As of September 2012, US$1 was approximately equal to £ 0.6279.

4 Gyanesh Pandey is a native of Bihar. He did his B.Tech in Electrical Engineering from Benaras Hindu University before moving to the US for his Master's degree in Electric Power and Power Electronics Engineering from Rensselaer Polytechnic Institute. He worked in the Power Management Semiconductor industry before HPS.

5 Pranava K Chaudhary, "Husk Wins Intl Award for Clean Energy," http://articles.timesofindia.indiatimes.com, June 18, 2011.

6 Acumen Fund is a non-profit global venture fund started in April 1, 2001

7 "Acumen Fund to Invest $375,000 in Bihar based Husk Power System," www.siliconindia.com, March 24, 2010.

8 Pranava K Chaudhary, "Husk Wins Intl Award for Clean Energy," http://articles.timesofindia.indiatimes.com, June 18, 2011.

9 "Per Capita Power Consumption," http://pib.nic.in, May 18, 2012.

10 "Data - Electric Power Consumption (kWh Per Capita)," http://data.worldbank.org.

11 On the other hand, in the UK and the US average per capita consumption in 2008 was 6067 kWh and 13,647 kWh respectively.

12 "Chapter III - Households using Kerosene for Lighting," www.tcpomud.gov.in.

13 Kerosene is thin liquid blue colour fuel. It mostly use by households for lighting and heating purpose.

night."[14] The slow economic development, political corruption, and red tape were the root causes for absence of electrification in Bihar according to analysts.

However, things changed after HPS set up its first power plant in Tamkua, Bihar, on August 15, 2007. HPS was the brainchild of Pandey and his friend Ratnesh Yadav[15] (Yadav). Later, Pandey's friend Manoj Sinha[16] (Sinha) and Sinha's friend Charles W. (Chip) Ransler, IV[17] (Ransler) joined them. The plant generated power using rice husk[18] which was abundantly available in Bihar.

As of September 2011, HPS made impact on the lives of almost 250,000 people in the rural and remote areas of India. Moreover, HPS had plans to become a global provider of off-gird electrification and to reach out to millions of people in the underdeveloped countries. But, such expansion requires quick availability of funds and dip and clear understanding with local knowledge.

Also, experts stated that the HPS model was the cheapest in the world as it was able to generate and distribute electricity for capital expenditure less than US$ 1 per watt[19]. However, some experts expressed doubts over HPS's ability to generate cheap electricity in the long run due to rising input costs.

Electricity crisis in India

As on September 30, 2012, India had the fifth largest[20] power generation capacity in the world with installed capacity of 207,876.04[21] Mega Watt (MW). However, the per capita electricity power consumption in India was just 570.9 kWh significantly lower than the global consumption of 2,806.9 kWh in 2009.[22] According to experts, around 400 million people, living primarily in rural areas, did not have access to power. It was necessary to add 160,000 MW of capacity by 2018 to satisfy the needs of the second fastest growing economy in the world.

Experts stated that almost all the cities in the country including the Mega cities experienced at least 360 hours of power cut per year. Tier II and Tier III cities had almost 1,000 hours of power cut per year. The situation was worse in the small towns and villages. Many of them

[14] "Bringing Sustainable Light to Communities off the Grid," www.youtube.com.

[15] Ratnesh Yadav is the co-founder of HPS. He is a native of Bihar. He has a Bachelor of Arts degree from Delhi University. He has experience in bio-diesel (Jatropha plantation), fisheries, and floriculture. He founded a nonprofit organization - Samta Samriddhi Foundation — before he founded HPS with Pandey and the others.

[16] Manoj Sinha is a co-founder of HPS. He did his B.Tech in Electronics Engineering with honors from Benaras Hindu University in 1999. He did his MS in Electrical & Computer Engineering from the University of Massachusetts Amherst He also has a Master's in Business Administration (MBA) from Darden Graduate School of Business associated with the University of Virginia.

[17] Charles W. (Chip) Ransler, IV (Ransler) is a co-founder of HPS. He holds a bachelor's degree and an MBA degree from the University of Virginia and Darden Graduate School of Business Administration associated with the University of Virginia, respectively.

[18] Rice husk or rice hull is the yellowish color outermost layer of paddy grain. It separated from rice when rice is milled in rice mill.

[19] "Rural Electrification using Biomass," www.oasyssouthasia.info, February 2, 2011.

[20] After the US, Japan, China, and Russia.

[21] "Highlights of Power Sector," www.cea.nic.in, September, 2012.

[22] "Data - Electric Power Consumption (kWh Per Capita)," http://data.worldbank.org.

were not electrified and those which did have electricity got on an average only 2,500 hours of electricity per year. The variation in the consumption of power differed across the country. Dadra & Nagar Haveli, a Union Territory, had the highest per capita power consumption at 11,708.59 kWh in 2009-10 (11,567.67 kWh in 2005-06) whereas Bihar had the lowest at 117.48 kWh (85.86 kWh in 2005-06) in the same period.[23,24]

According to the official website of energy department of the Bihar government, out of 45,103 villages in the state, only 18,217 villages[25] (40.38% of total villages) in the state were electrified. The state electricity board had only 2.18 million consumers (out of around 100 million population in the state) across eight transmission circles in the state as of in March 2009[26].

It was this shortage and unavailability of power which eventually became a driver for entrepreneurs like Pandey and Yadav, to develop a sustainable business model around this need.

Idea behind husk power systems

Pandey and Yadav, childhood friends, had faced the problem of non-availability of electricity as both hailed from rural Bihar. Even after they moved to different cities– Pandey was in Los Angeles, US, and Yadav was in New Delhi, India – the electricity problem that they faced during their growing up years in Bihar, remained a point of discussion between them. They wanted to supply electricity to the rural areas at a low price as conventional electricity system was unable to deliver power to everybody especially in remote, and undeveloped areas, and to people in the Bottom of the Pyramid segment who earned less than US$ 2 per day.

The duo came to the conclusion that there was a need for a cheap, village-based non-conventional system to produce & supply electricity in place of the power grid system which required huge investment and a trained manpower. They realized that only a non-conventional system would be able to produce electricity in the least possible cost without much capital investment and without educated and skilled workers. Pandey said, “The conventional technologies and grids had failed to deliver for the pervasive energy starvation in the country and I wanted to find an environmental-friendly non-conventional source and low cost of energy.”[27]

Initially they tried installing solar-power lights and generating electricity through Jatropha seeds[28]. However, very soon they realized that these would not work out when the goal was to serve a large rural population which mostly lived below the poverty line. In their search for

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23 “Per Capita Power Consumption,” http://pib.nic.in, May 18, 2012.

24 “Per Capita Power Consumption – Rajyasabha,” http://pib.nic.in, August 20, 2007.

25 “Important Indicators,” http://energy.bih.nic.in.

26 “Bihar, November 2010,” www.ibef.org, November, 2010.

27 “Rice Husk Power to Light up Villages,” www.hindu.com, July 26, 2010.

28 Jatropha is a species of flowering plant belonging to the spurge family. The jatropha seed contains oil which can be processed to produce high quality biodiesel fuel.

an alternative, they met with Krishna Murari (Murari), a salesman of a gasifier system[29]. Murari told them about a decades-old biomass gasification system that rice millers powered their mills with, which used rice husk as input. Pandey and Yadav learned that the millers used diesel engines to power their mills but did not use 100% diesel to run these engines. They used the 'duel-fuel' mode of operation in which they used only 30-35% of the actual required diesel in conjunction with the 'Producer Gas'[30] generated by the gasification system to run the engines. This helped the millers save around 50-60% on diesel costs.

The duo thought that the gasifier system could be used for electrification of rural and remotes areas as rice husk was easily available in these areas. As per an estimate, Bihar alone produced 1.8 billion[31] kgs of rice husk every year. Experts, however, pointed out that having to use 30-35% diesel would make it unviable for rural people because it would increase the cost of the electricity produced. Pandey and Yadav learnt that using only rice husk as a fuel to produce electricity was not viable, as it produced gas with high tar content.

Here, Pandey's educational background and experience in power management semiconductor industry helped. He did not see much of a problem in using the gasifier system with single fuel. According to him, a dirty (polluted) gas could clog up the engine but if the engine was cleaned before it became clogged, then such a problem would not arise. His reasoning convinced S.K. Singh (Singh), Scientist, Ministry of New and Renewable Energy[32] (MNRE), Government of India. Though Pandey and Yadav did not have any experience in biomass gasification, they took it up as a challenge with Singh's assistance in the form of accepting the idea eligible for government subsidy.

They developed their gasifier at a local workshop, arranged for a cheap CNG engine from a small dealer, and customized it to produce electricity. Though there were some initial hiccups, they succeeded in producing electricity from the gasifier system using rice husk under the single-fuel mode. At last, on August 15, 2007, on the occasion of India's 60th Independence Day, the commercial operation of the HPS started at Tamkuha a remote village in the Dhanaha region of West Champaran district in Bihar, with electricity generated using HPS's proprietary, cost-effective technology. On the occasion, Rambalak Yadav, a local teacher, commented, "After sixty independent[33] years, we have found freedom from darkness"[34].

However, just having the right technology was not enough to ensure successful business model. Neither Pandey nor Yadav had the experience to know how to go further, and to expand and run business, nor had they studied business management. It was at this juncture that Pandey's friend Sinha stepped in to help. At that time, Sinha was studying business at Darden Graduate School of Business associated with University of Virginia in the US. Sinha

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29 The gasifier system is a system in which the husk burns in a controlled manner to generate gases (smoke). These gases are further filtered and fed into an engine that drives an alternator to generate electricity. The process of generating gas from the gasifier system is known as gasification.

30 Producer Gas is a low-grade fuel gas. It has different gases including nitrogen, methane, carbon monoxide, hydrogen etc.

31 "An Electric Idea," http://articles.timesofindia.indiatimes.com, July 20, 2012.

32 Before October 2006, Ministry of New and Renewable Energy was known as a Ministry of Non-Conventional Energy Sources.

33 India got independence on August 15, 1947, from the British.

34 "Husk Power System- Background," www.huskpowersystems.com.

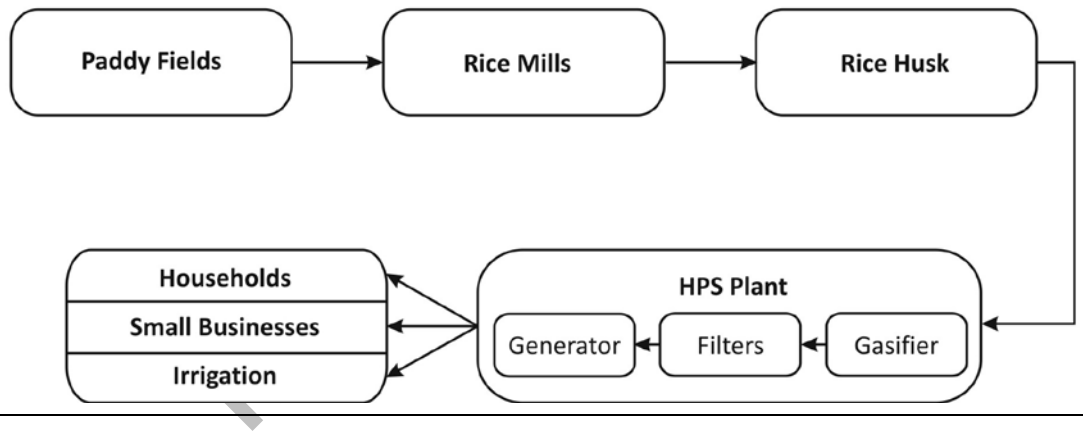
and his friend Ransler put their experience to good use and presented their business plan for the project at various business plan competitions and forums (Refer Exhibit I for various award and recognition to HPS) in 2008. Their idea was highly appreciated and they won several of those competitions.

This success fetched recognition and the much needed funds (they won US$ 96,000 in prize money from various competitions) and also attracted investors (Refer to Table I for various investors of HPS). The prize money helped HPS to expand and it started three more power plants in the same year.

In 2009, HPS won the Global Business Plan competition and received an investment of US$ 250,000 from Draper Fisher Jurvetson[35] (DFJ) and Cisco TelePresence[36] (Cisco) (Refer to Table I for various investors of HPS). By the end of December, 2009, HPS had Installed 19 power plants. By August 2010, the number of installed plants had increased to 50. As of mid-2011, the company had 80 installed power plants in operation (Refer to Exhibit II for time line of HPS growth).

Figure I

Basic Model of Electricity Generation and Distribution by HPS Plant



Compiled by the author from various sources.

Developing sustainable business model

The objective of HPS was to provide a comparatively cheaper, eco friendly, reliable power system for the poor living in the rural and remote areas of Bihar (initially), while making sufficient profit to ensure that the business model could function smoothly in the long run.

[35] Draper Fisher Jurvetson (DFJ) was California, US-based venture capital firm.

[36] Cisco TelePresence is a product of Cisco Systems, Inc. which was launched in October 2006. It helps in face to face collaboration.

Pandey said, "Our goal is to have our model help to deliver rural electrification to India's villages and eventually to rural areas around the world."[37]

To achieve its objectives, HPS carried out a detailed study before setting up the husk power plant. It first tried to understand the types of electricity, existing source of energy, and the per kWh (kilowatt hour) cost to the target customers. After understanding the target customers and their energy needs, HPS did a feasibility study of the potential for using a husk power plant in the target area. It tried to understand the target locality's access to biomass and the total energy need of the target locality, the availability of rice mills in nearby areas, the size and operation period of the rice mills, what the different uses of rice husk in the target locality were, and the use of diesel generators, specifically for providing electricity, cost of diesel, , and the cost of electricity provided by diesel generators per kWh *(Refer to Exhibit IV for detailed questionnaire used to assess the feasibility of HPS plants).*

HPS followed two business models. The first was the Build, Own, Operate, Maintain (BOOM) model while the second was the Build, Transfer, Maintain (BTM) model. If the BOOM model was used, then a detailed study was conducted by HPS. Otherwise, the interested parties conducted the study.

BOOM was the primary model that HPS had followed since inception. The company later adopted the BTM model to fuel its expansion plans, especially into other territories. Under the BOOM model, HPS developed, operated, maintained, and owned the power plant. Under this model, the major source of revenue was electricity sale, followed by the sale of Rice Husk Ash[38] (RHA). In addition, HPS also earned revenue by selling the products of partner corporations. Carbon credit created another stream of revenue for the company as husk plant reduced the use of kerosene and diesel.

Under the BOOM model, HPS generated revenue by selling electricity to households and business customers. Household customers paid Rs. [39] 80 per month in advance and they got electricity for 6-8 hours a day, which was sufficient to light up two 15W Compact Fluorescent Lamps (CFL) and to recharge their mobile phones. While explaining the pricing of HPS, Yadav said, "The baseline price is Rs. 80 per month for two CFLs + mobile charging [approx 50W] per month. Users get discount if they purchase more than 100W. The idea is to slash the cost of the alternative (kerosene lamps etc) by at least half."[40]

electricity for 6-8 hours a day

Business customers used more electricity — around 60-75W — and had to pay around Rs. 145-164 per month in advance. Customers with different electric appliances had to take additional electricity if they wanted to run their appliances. They could do so by paying Rs. 40 per month for every additional 15W of power. Industry experts stated that HPS was providing the cheapest lighting that was reliable, safe, and environment friendly compared to other available sources like candles, kerosene lamps, and Light Emitting Diode (LED) lanterns which fulfilled only lighting needs.

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[37] "Acumen Fund to Invest $375,000 in Bihar Based Husk Power System," www.siliconindia.com, March 24, 2010.

[38] It is sold to cement companies and others.

[39] Rs. = Indian rupees. As of September 2012, US$1 was approximately equal to Rs. 55.57.

[40] "Rice Husk Power to Light up Villages," www.hindu.com, July 26, 2010.

Under the BTM model, HPS built and transferred the plant to partnering agencies in exchange for a lump sum amount[41]. These partnering agencies were independent owners and operators of the plant. They were liable for all costs and entitled to all the revenue of the plant. After transferring the plant, HPS generated revenue for itself providing fee-based maintenance and repair of the plant. HPS also generated revenue by assisting the independent owner in product channeling (channelization), selling of by-products, and in obtaining carbon credit in exchange for a certain percentage of additional revenue generated. In the BTM model, HPS also helped the partnering agencies in getting an MNRE subsidy.

On the capital expenditure side, Pandey said, "Each plant costs less than Rs. 15 lakh (Rs. 1.5 million) for generation as well as for the distribution grid, and generates about 32 kilowatts of electricity."[42] The major running costs of HPS came from what it spent on rice husk followed by workers' salaries. According to a company source, a plant required around 300 kg of husk to produce 32 kilowatt of energy, sufficient to supply about 6 hours of electricity per day to around 500 households. Husk was available at the rate of Rs. 1-2 per kg. Where the second major cost — salaries — was concerned, each plant required four employees – one operator, one husk loader, one collector, and one electrician. The average cost of four employees was Rs. 12,000 per month. However, HPS reduced the number of employees to 3 or 2 with the help of process and technology improvement, which would help the HPS to reduce costs and to increase the salary of employees to some extent. Other costs were maintenance and repair, management overheads, and land rent.

According to an International Finance Corporation[43], typically, it took two to three months for a plant to reach operational profitability, and three to four years to recoup capital expenditures, depending on whether (and how much) government subsidy was received[44]. According to experts, HPS was able to manage a short pay-back period[45] mainly due its ability to maintain an above normal net profit margin. The ability to keep non-payment and other losses under 5%, where national average was around 30%, was another reason for the better margin.

A very conservative estimate showed that HPS was able to run its power plants at 35% to 51% net margins[46] *(Refer to Exhibit V for approx revenue and cost of husk power plant)*. While commenting on profitability and breakeven point, Pandey said, "This is definitely a very profitable business. We are working on a margin of 46 per cent at the unit level, which is considerably good. We will start generating profits by the end of this year (2010)."[47] Large net margins and a short payback period helped HPS to generate the funds needed for expansion without any major difficulties.

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41 According to HPS source, a minimum investment required by the interested parties (independent owner and operator) was Rs. 10 million which was sufficient to developed 6+ plants.

42 "He is Lighting Up Villages With Rice Husk!," www.rediff.com, July 6, 2010.

43 The International Finance Corporation is a member of the World Bank group. It provides financing and advisory services to private social ventures and projects in developing countries.

44 "Husk Power Systems," www.ifc.org, 2011.

45 A period in which cost of the investment is recovered is known as 'Pay-back period'. It is calculated by dividing the cost of project by annual cash flows.

46 A net margin is the ratio between net profit and revenue. Entrepreneurs always try to increase net margin as a higher net margin is better than a lower one. If any company has 10% net margin than it means that it earned net profit of Rs. 10 on every Rs. 100 sale.

47 "He is Lighting up Villages With Rice Husk!," www.rediff.com, July 6, 2010.

Social and environmental impact

Each HPS plant served around 400 households and helped save on approximately 42,000 liters of kerosene and 18,000 liters of diesel per year which was used to generate electricity. This contributed to, reduced home pollution, and improved the lives as well as health of the villagers, especially the women and children who used to huddle around the kerosene lamps after sunset to work and study. According to a company source, it had already saved 9,244,800 liters of kerosene by August 2012. *(Refer to Exhibit VI for social and environmental impact of HPS).*

With HPS plants, the villages had a far better lighting system in the form of CFL lamps which gave out bright white light which helped the children to study and helped women to do their household work better without having to face the problems associated with using kerosene lamps and diesel generators. As Chauhan said, "We did not have electricity before the power plant. It has helped a lot toward people's happiness, and the local economy. I want my children to study and find a good job somewhere. I want my son to be an engineer. Since the electricity came, my children can study even after the sun goes down. It is also good for business. I used to live in darkness and now I live in a world full of light. It makes me feel very happy from the bottom of my heart. What other big power plants could not do, this one did. It has gone from dark to light."[48]

HPS helped to generate direct as well as indirect employment for the local youth of the villages. In addition, it brought about a lot of tangible savings to the households and businesses. Earlier, each household spent around Rs. 150 per month on kerosene. This went down to Rs. 80-100 per month, a saving of at least 33%. Besides, kerosene lamps met fulfilled the lighting needs of the people. Now, they could charge their mobile phones, run other electrical appliances. Earlier, the villagers had to travel around 10 to 15 kilometers and spend up to Rs. 20 to charge their mobiles. As Garak Yadav, a liquor store owner, said, "I used to pay 5 rupees each day to have my mobile phone charged, now I can just charge it in my shop."[49] According to a company source, by August 2010, HPS had saved US$ 1.25 million in cash for all the households served by it[50]. This figure went up continuously with each new husk power plant coming into existence.

In the same way, HPS saved money for farmers as irrigation costs reduced by 45%[51]. Various other businesses also benefited. Anush Kumar, is a businessman running a hostel for schoolboys in Sariswa, had a grid connection through which he got electricity only once or twice a month. He therefore, had to pay Rs. 1700 to run a diesel generator to get three hours of electricity between 6 pm and 9 pm. However, after taking electricity connection from HPS, he got electricity from 6 pm to 1 am and that too, for a monthly payment of only Rs. 1,200. According to experts, it was not only existing businesses that benefited from the cheap

48 "Bringing Sustainable Light to Communities off the Grid," www.youtube.com/watch?feature=player_embedded&v=6MpTmckocYQ.

49 "Case Study Summary Husk Power Systems India," www.ashdenawards.org, April, 2011.

50 "Home," www.huskpowersystems.com/index.php.

51 "2008 Dell Social Innovation Challenge Winner: Husk Power Systems," http://content.dell.com.

and reliable power connection and extended business hours. Some new business such as a photocopier shop also profited from it.

Lighting also reduced the fear of snakes and dogs bites and small crimes. Sinha said, "Poisonous snakes typically kill up to two villagers every year. But we have been told that in villages where our plants operate, the death-toll is down to zero. We don't have a clear explanation, although we suspect that snakes fear the white light from the electric light bulbs."[52]

HPS not only lighted up the lives of the villagers, it also lighted up the lives of the village children by providing them with education support. HPS helped around 250 students as part of its corporate social responsibility through the Samta Samriddhi Foundation. It took care of the educational expenses of these students. Haresh Kumar Yadav, a 14-year-old, was one such student. The boy used to work in the fields in the evenings to earn enough to pay his school fees and studied under the yellow light of a kerosene lamp in the night till he was 11 years old. However, HPS changed his life completely. He said in delight, "I can study late into the night (under the white CFL light) and the (Husk) power plant pays my school fees of Rs. 50 a month."[53] HPS planned to train local primary school teachers and set up an internet facility and a radio station to improve the quality of education.

HPS also worked toward women empowerment. It developed a method to produce incense sticks using a char[54] and a binder. This not only opened up a new revenue stream for the company but also provided a source of income to the women. An article in the *Economics Times*[55] described the simple model that HPS used. HPS brought the bamboo sticks and the women made them into incense sticks using the char and the binder. The company bought the incense sticks and added extras like color, perfume, and packaging.[56] HPS trained around 200 women in incense stick making in 2010. These women were able to earn around Rs. 60 per day. HPS also developed a machine to make incense sticks which increased production (output of sticks) and improved the quality of the sticks. On the incense stick maker, Rajini said, "We've been trying out the new way to make agarbattis (incense stick) and it seems to be working out. I am earning Rs. 60 to Rs. 80 per day."[57]

Challenges in the way

Social entrepreneurs are responsible not only to their shareholders but also to the government (which provides a subsidy) as well as to society (which is impacted positively or negatively by the act of the social entrepreneur). Commenting on the challenges faced by this

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52 Terrence Murray, "Cornerstone Conversation: Manoj Sinha, Co-Founder, Husk Power Systems," www.greenenergyreporter.com, June 2, 2010.

53 Ahona Ghosh, "The New Colours of Venture Capital," http://business.outlookindia.com, March 6, 2010.

54 Char is the burned husk and by-product of gasification process.

55 *The Economics Times* is one of the leading business newspapers in India.

56 Pranava K Chaudhary, "Incense Sticks Empower Women, Courtesy HPS," http://articles.timesofindia.indiatimes.com, September 25, 2011.

57 Preeti Mehra, "Whiff of a New Livelihood," www.thehindu.com, February 28, 2012.

project, Pandey said, "The biggest challenge always is to get the right people for the right job. Besides, convincing villagers about the need to bring about a change in their lives was tough. We need a continuous supply of machines and manpower to effectively implant our plans."[58]

Early on, when HPS started buying rice husk for their power plant, rice millers began to realize that there was money to be made from the husk. They started hoarding the husk, which consequently became dearer. To tackle this challenge, HPS came up with a unique solution. It set up its own rice mill and offered to dehusk farmers' rice free of cost in exchange for keeping the rice husk. As a result, the other rice millers who had been charging a price for the dehusking, soon went out of business. However, running a rice mill had never been HPS's objective. At the end, it entered into a contract with the rice millers. Under the contract, HPS gave a guarantee to the rice millers that it would buy rice husk from them for six to eight years at an affordable price. In return, it would stop the free dehusking.

In the early days, HPS also faced regulatory hurdles. Under the Indian Electricity Act, 2003, anyone generating and distributing electricity in rural areas did not require a license. According to the act, "A person intends to generate and distribute electricity in a rural area to be notified by the State Government, such person shall not require any licence for such generation and distribution of electricity."[59] However, when HPS had 25 power plants, an official of the MNRE pointed out that state government had not defined what constituted the rural areas. In such a situation, HPS would have had to close down all its plants. However, a clause of the Electricity Rules, 2005, saved the day for HPS. Pandey said, "We would have had to shut down, but we found the clause of a 2005 ruling that all areas governed by panchayats[60] are rural areas. Some luck, some good people have helped us."[61]

According to analysts, financing would have been another big challenge for HPS if it had not won business plan competitions in the early stage as banks and other financial institutions would have hesitated to fund the project, especially in a state like Bihar which did not attract many businesses or industries. According to experts, getting the right mix of capital was a challenge for any business including social enterprises like HPS. It also needed the right kind of capital mix. Sinha said, "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."[62]

Getting suitable human resources was another challenge for HPS. It was really tough to find the right kind of educated and trained persons in the villages where literacy rates were negligible and those who were literate had migrated to other places in search of better opportunities. HPS planned to scale up its business by starting 5 power plants per week. Each plant needed 3 to 4 persons. At this rate, HPS would require around 2,340 trained persons over the following three years *(Refer to Table II for man power required by HPS)*.

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58 "He is Lighting up Villages With Rice Husk!," www.rediff.com, July 6, 2010.

59 "The Electricity Act, 2003," http://powermin.gov.in, June 2, 2003.

60 A panchayat is a group of five wise and elder persons. Panchayats settled disputes between individuals and villages.

61 Usha Rai, "Bihar's Husk Power," www.thehindubusinessline.com.

62 "SOCAP11 Social Entrepreneur Spotlight: Manoj Sinha, Husk Power Systems (India)," http://socialcapitalmarkets.net, September 3, 2011.

There was no government or private infrastructure which could train the rural people in the required skills. Understanding this challenge, HPS started the 'Husk Power University' in Bihar, the first of its kind, to train people in the various skills required for rural electrification. Sinha said, "A power company does not have a core business to open a university, but it is essential for us to do it."[63]

Table II

Estimation of Human Resource Requirement by Husk Power Systems

(in numbers)	**Scenario I (four employees per plant)**				**Scenario II (three employees per plant)**			
Plant per week (A)	2	3	4	5	2	3	4	5
Employees required per plant (B)	4	4	4	4	3	3	3	3
Employees required per week (C) = (A) × (B)	8	12	16	20	6	9	12	15
Employees required per year (in 52 weeks) (D) = (C) × 52 weeks	416	624	832	1,040	312	468	624	780
Employees required over next three years (E) = (D) × 3 years	1,248	1,872	2,496	3,120	936	1,404	1,872	2,340

Prepared by the author.

According to experts, communication between members of the management was one of the challenges for HPS. In villages and remote areas, mobile phones and the internet did not work due to a poor network. HPS developed its own technology to overcome this challenge. This technology was a combination of SMS and Wi-Fi technology and it helped the management team to monitor power plants even without being physically present at each plant each time.

Electricity theft in distribution is the major problem in the India. HPS had also faced such problem. However, it had developed a smart metering solution for a total landed cost of under US$9/meter (arguably world's cheapest smart meter) with the help of IDEO[64]. This solution would help HPS expand and keep the total default and/or stealing rate under 5% (as compared to a national average of ~ 30%).

On the other hand, reducing costs and bringing in efficiency would be an ongoing challenge for HPS. In May 2012, HPS received a grant of €[65]90,000 from Alstom Foundation under

[63] Stephanie Hanson, "Energy for the Masses: Husk Power Helps Fuel India," www.ecomagination.com, January 9, 2012.

[64] IDEO is innovative product designing company.

[65] € = Euro. As of September 2012, US$1 was approximately equal to € 0.7915.

the Dry Gasifier project. The grant money was used to upgrade existing power plants by reducing the water usage by as much as 80% and significantly reducing operational cost."[66]

HPS faced challenges from other social enterprises such as SELCO Solar Pvt. Ltd[67], D.Light[68], and Mera Gao Micro-Grid Power[69]. National Thermal Power Corporation[70] (NTPC), a Public Sector Enterprise, who also played a significant role in the off-grid industry. But according to experts, the off grid market was huge and could accommodate even more players.

The road ahead

HPS was looking forward to massive expansion based on its award winning business model and the huge demand for off-grid electricity in its home country as well as in different parts of the world. The company planned to expand its business into other states in India like Maharashtra, West Bengal, Uttar Pradesh, and Tamil Nadu. Outside India, it planned to expand into Bangladesh, Cambodia, Ethiopia, Indonesia Nepal, Tanzania, and Uganda. Pandey said, "We plan to have 2,014 plants by 2014. Besides, electrifying other villages across India, we also plan to make a foray into countries like Nepal, Indonesia, Cambodia, and Ethiopia in the near future."[71]

HPS planned to expand its reach to 6,500 villages by the year 2014. This would create 7,000 local jobs. The expansion would also help to save 750,000 tons of CO_2 and US$ 50 million[72] in cash for more than 5 million people by 2014. But, HPS ability to achieve its massive expansion in India and other parts of the world would depend upon its ability to successfully attract new funding. Company still had to prove that its operating model would work effectively in other developing and underdeveloped nation as it worked in India in order to attract large funding. [73]

Familiarity and local knowledge also played an important role in the success of HPS. The founders of HPS were well versed with Bihar as they grew up there. Whether they can

[66] Debjoy Sengupta, "Alstom grants Euros 90K to Husk Power Systems Project for a green project," http://economictimes.indiatimes.com, May 22, 2012.

[67] SELCO Solar Pvt. Ltd is a Bangalore based social enterprise established in 1995. It provides energy solutions and after sale services to underserved households and businesses by using solar photovoltaic modules. It also provides financing facilities for purchasing solar lighting and thermal systems.

[68] d.light was founded in 2007 by Sam Goldman, Ned Tozun, and Sandeep Singhal. It provides lighting and energy solutions to underserved households and businesses especially in India and Africa. The company's vision is to replace every kerosene lantern with clean, safe, and bright light.

[69] Mera Gao Micro-Grid Power (MGP) is a for profit company of the VDI Group (Value Development Initiatives Group). It started working in August 2010 to cater to the energy needs of off-grid rural areas.

[70] The National Thermal Power Corporation[70] (NTPC) was largest power generator company in India.

[71] "He is Lighting Up Villages With Rice Husk!," www.rediff.com, July 6, 2010.

[72] "Husk Power Systems Win Int'l Sustainable Energy Award," www.business-standard.com, June 17, 2011.

[73] Stephanie Hanson, "Energy for the Masses: Husk Power Helps Fuel India," www.ecomagination.com, January 9, 2012.

operate successfully in the countries where they are planning to expand would remain a challenge as they were not familiar with the local context. [74]

Funding would only come if the investors are clear about the cash flow and the source of revenue. This happens only when there is a demand for the product. There exists a persistent misconception that people at the bottom of the pyramid are not willing to pay for electricity. It would take quite a bit for convincing the investors on this. On the success of HPS, Simon Desjardins, Program Manager at the Shell Foundation[75] said, "Bihar is the poorest of the poorest states in India. These are the bottom of the bottom of the pyramid consumers. These consumers are not only willing but desperately able to pay for this service."[76]

The company was confident about the funding for such a massive expansion program. Sinha said, "We've seen a tremendous shift in investor expectations and understanding. People are more willing to invest in social enterprises now."[77] Vandana Gombar, Analyst, Bloomberg New Energy Finance, was equally positive. She said, "Once the wider investment community sees the opportunity, you're going to see more private equity funding."

A confident HPS planned to expand its scope keeping in mind the needs and wants in the rural market and play an important role in the development of the country. Pandey said, "In India, our vision will be rural development with focus on education, healthcare, power, and women's empowerment. In the coming years, we will implement programs to address the most critical needs of rural people."[78]

[74] Stephanie Hanson, "Energy for the Masses: Husk Power Helps Fuel India," www.ecomagination.com, January 9, 2012.

[75] Shell foundation was started by Royal Dutch Shell in 1997.

[76] Stephanie Hanson, "Energy for the Masses: Husk Power Helps Fuel India," www.ecomagination.com, January 9, 2012.

[77] Ben Edwards, "Rice Husks Follow Solar to Power Indian Towns off Utility Grid," www.bloomberg.com, July 26, 2011.

[78] "He is Lighting up Villages With Rice Husk!," www.rediff.com, July 6, 2010.

Exhibit I: Award and Recognition to Husk Power System

When	Where	Award Details	Position in Competition	Prize Money
April 7, 2008	US	Darden's Annual Business Plan Competition, University of Virginia	Winner	US$ 10,000
April, 2008	US	Global Social Venture Competition, University of California, Berkeley	Finalist	NA
May, 2008	US	Social Innovation Competition, University of Texas	Winner	US$ 50,000
May, 2008	US	People's Choice Award at Social Innovation Competition, University of Texas	Winner	US$ 1,000
May, 2008	US	Dell Social Innovation Competition for "Most Compelling Idea to Change the World"	NA	NA
May 12, 2008	US	Ignite Clean Energy competition, Massachusetts Institute of Technology	IInd Price winner	US$ 35,000
December, 2008	US	FastCompany recognized HPS as one of the Top-10 Social Enterprises of 2008	NA	NA
June 29, 2009	US	Draper Fisher Jurvetson (DFJ) and Cisco's Global Business Plan Competition.	Winner	NA
May, 2010	India	Sankalp's Emerging Enterprise Award under the category of Technology for Development	Winner	NA
July, 2010	US	In Changemakers Competition - Leveraging Business For Social Change: Building The Field Of Social Business	Finalist	NA
September, 2010	US	The Tech Museum under the category of BD Biosciences Economic Development Award	NA	NA
September, 2010	UK	Finalist in the BBC World Challenge	Finalist	NA
June, 2011	UK	International Ashden Award for Sustainable Energy	Winner	£ 120,000
August, 2011	India	Real Heroes award to Gynesh Pandey under the category of Social Welfare	Winner	NA

Source: "News & Updates," www.huskpowersystems.com.

Exhibit II: Time Line of Husk Power Systems Growth

Month	Year	Number of Power Plant
August	2007	First Plant
December	2008	3
December	2009	19
August	2010	50
December	2012	500*
December	2014	2014*

* Number of planned power plant.

Adapted from www.huskpowersystems.com.

Exhibit III: Management Team at Husk Power Systems

HPS Team	HPS Board of Directors
Gyanesh Pandey, Co-Founder, CEO/CTO	Raj Kundra
Ratnesh Yadav, Co-Founder and COO	Eric Berkowitz
Manoj Sinha, Co-Founder	Charles W. (Chip) Ransler, IV
S.B. Mishra, Director – Human Resources	Gyanesh Pandey
Rama Siva, Senior Director - Training & Technical Aggregation	Ratnesh Yadav
Satish Prasad, Accounts Officer	Manoj Sinha
Alok Bhushan,	Director - Operations & Projects

Source: http://www.huskpowersystems.com.

Exhibit IV: Questions to Assess the Feasibility of HPS Power Plants to Serve the Villages

Understanding the customers and their lighting needs:

1. What kind of electricity uses do your target customers engage in? Is electricity mainly used for lighting purposes and for running small businesses?
2. What does a community/village or small town look like structurally speaking? Are these communities comprised of people living in a radius of 4-5 miles?
3. What do households and businesses use for lighting and running small machines? How much does a household spend on electricity on a monthly basis?
4. What would be the estimated household income on a monthly basis? What are some of the income generators and jobs available in such communities?
5. What is the current energy source for lighting, irrigation, and other such applications for electricity?
6. How much do domestic uses of electricity cost on a per kWh (kilowatt hour) basis? Please include all the costs, that is, taxes, transmission costs, and any other charges that government or local agencies may levy.

Feasibility study of the potential of using Husk Power Systems' plants:

Ques. 1: Do communities have plentiful access to biomass such as rice husk, corn cob, wood chips, etc? How much rice is produced in these areas?

Ques. 2: Do communities engage in local farming? How far does one need to go to procure rice husk? What are some of the current uses of rice husk?

Ques. 3: Are diesel generators widely used as a source of electricity? What is the cost of diesel per liter or per gallon?

Ques. 4: In the case of electricity provided by a diesel generator set, what is the total cost of electricity on a per kWh basis?

Ques. 5: How much would such communities typically need electricity for addressing their daily energy needs? Is that less than 100kW?

Ques. 6: Are there rice mills close to the communities? What is the size of a typical rice mill — that is, how many tons of rice do they mill on a monthly basis? Do these rice mills operate throughout the year?

Financial considerations:

Ques. 1: Are you considering investing money for forming partnership with Husk Power Systems? What is the minimum and/or maximum amount you are considering?

Ques. 2: What kind of interest rates do local banks charge for commercial long term loans?

Source: http://huskpowersystems.com.

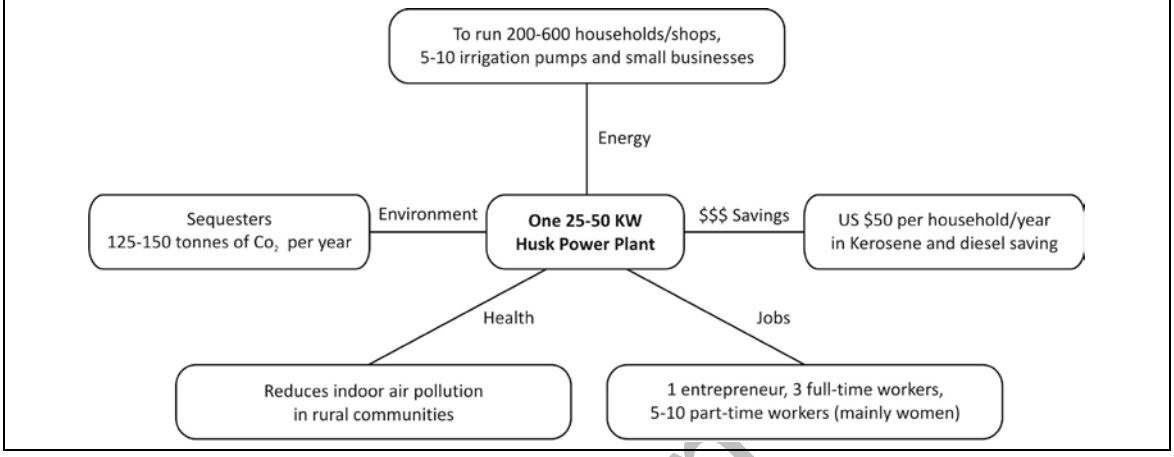
Exhibit V: Approximate Monthly Revenue and Cost for 35kW Husk Power Plant

Particulars		Amount (Scenario I)	Amount (Scenario I)
Revenue:			
Monthly revenue from electricity sales		Rs. 50,000	Rs. 50,000
Monthly revenue from 2 ton of char/month (approx) (Rs. 15000 – Rs. 45,000)		Rs. 15,000 (minimum)	Rs. 45,000 (maximum)
Revenue from Product Fulfillment/channeling		Not Available	Not Available
Revenue from CDM		Not Available	Not Available
Total Revenue		**Rs. 65,000 (approx)**	**Rs. 95,000 (approx)**
Cost:			
Land Rent	Rs. 5,000 (approx)		
Maintenance and repair	Rs. 10,000 (approx)		
Management Overhead	Rs. 5,000 (approx)		
Salary (4 persons) (Rs. 3,000 approx × 4)	Rs. 12,000 (approx)		
Approx 10 Ton of feedstock (at Rs.1.50 per Kg approx)	Rs. 15,000 (approx)		
Total Cost		**Rs. 47,000 (approx)**	**Rs. 47,000 (approx)**
Net Profit		Rs. 18,000	Rs. 48,000
Net Margin		28%	51%

Compiled by the author from various sources.

Exhibit VI

Social and Environmental Impact Husk Power Plant



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