**Introduction**

Husk Power Systems (HPS) started in 2007, to light up villages in far flung rural areas of Bihar, by experimenting with decentralized ways of providing power to people using rice husk, the locally available renewable biomass resource. HPS took the first step towards green energy revolution, with financial assistance (subsidy) from the Ministry of New and Renewable Energy (MNRE), targeting villages off the grid and/or those with grid but negligible or no power supply, strategically focusing primarily on the existing demand for home lighting. HPS got its gasifier fabricated at a local workshop in Bihar and procured a cheap Compressed Natural Gas (CNG) engine, modified to suit its purpose from a small supplier.

HPS installed the first plant in Tamkuha village in East Champaran district, Bihar on 15 August 2007 and has so far installed more than 70 mini-power plants that power approximately 30,000 households, covering more than 250 villages and hamlets and impacting lives of approximately 150,000 people in rural India. On an average, each power plant of capacity 32 kVA (25 kW) serves about 400 households and replaces approximately 42,000 litres of kerosene and 18,000 litres of diesel per year. More importantly, HPS has employed and trained more than 300 local people in rural India for running and managing the power plants.

**Growth Models of HPS Power Systems**

HPS has adopted a demand driven approach and quantifies the potential demand in watt-hours. Households are required to pay an installation charge of Rs 100. This money ensures compliance by the users, and also covers a substantial portion of grid distribution expenditure, which in totality brings down the fixed investment in infrastructure like power plant shed and storage space, which is almost around 5% of the total investment. HPS, on one hand, ensures that the power plant machinery meets the requirement of the power plant and, on the other hand, makes it cost effective by procuring gasifiers from local manufacturers and coupling it to modified gas engine, which makes it possible to operate on 100% producer gas.
Husk Power System - Electrifying Rural India with Rice Husk

HPS business models for its growth since inception

Four business models by HPS for promoting husk based decentralized power plant for rural electrification are:

- **BOOM**: Build, Own, Operate and Maintain
- **BOM**: Build, Own and Maintain
- **BM**: Build and Maintain
- **BTM**: Build, Train and Maintain

**Operation of typical 32 kVA HPS plant**

The typical HPS power plant is mostly of 32 kVA capacity, which is operated generally for 6-8 hours daily and the typical operational costs are:

- 4 man power per plant (1 operator, 1 husk loader, 1 person for fuel purchase and 1 for revenue collection) - approximately Rs 12,000 per month per person
- 10 Tons of feedstock (at Rs 1.5 per Kg) - approximately Rs 15,000
- Maintenance and repair - approximately Rs 10,000 per month
- Management overhead - approximately Rs 5,000 per month
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Possible revenue from 6-8 hrs daily operations of 32 kVA plant:
- Monthly revenue from electricity sales > Rs 50,000 (from sale of average 20kW, as many of the households don’t pay the tariff. Charge rates are Rs 80 per month for two CFLs of 15 Watt each and mobile recharge)
- Revenue from approximately 2 ton of char per month > Rs 15,000 - Rs 45,000 (at a rate of Rs 7.5 per kg to Rs 22.5 per kg)
- Revenue from additional potential option

HPS has a cluster level manager who looks after the plants in the range of 20-25 km, or about 5-7 plants. Besides trained manpower, HPS has also taken due care to ensure smooth supply of low cost raw material. At the market end, the promoters have evolved strong relationship with the rice husk suppliers. This husk is transported by tractors simultaneously to about 7-8 plants in one cluster. HPS has plans to have one rice mill in each operational region to ensure sustained fuel supply at a reasonable price.

Plant Economics
A 32 kVA system costs Rs 16 lakh. MNRE subsidy works out to around 50% of the total project cost that comes to nearly Rs 8 lakh. The rated capacity of typical HPS systems installed in Bihar is around 32 kVA that generates nearly 25 kW of electricity. Out of this, 1-1.5 kW goes as transmission losses; average theft amounts to around 1 kW; and approximately 18-19 kW is available for consumption, usage or saleable purpose.

Villagers use kerosene as fuel for lighting purpose. In case of unavailability of electricity, the local people commonly use diesel generators. Approximately Rs 85-90 per month per household is charged for three hours of electricity with which user gets lighting using 8-10 W CFL bulb. Consumers are willing to pay this amount for lighting their houses, for television, commercial and social use (Xerox machines, fax, printing machines, education, etc.). However, so far, almost all HPS plants are serving mainly lighting load for domestic and commercial purpose.

A differential pricing method is adopted by HPS to calculate the electricity charges. Accordingly, every household has to pay a fixed monthly charge of Rs 45 per CFL of 15 W, whereas shops pay a per month charge of Rs 80 per CFL. For households seeking connection to operate fan, television etc., charges are calculated on similar wattage basis.

HPS has been using the term Husk Power System Unit (HPSU) for tariff purpose.

1 unit of HPS (HPSU) = 15W * 6hrs * 30days = approx. 2.7 kWh equivalent

On an average, the monthly revenue collection of a typical 32 kVA HPS plant is around Rs 60,000. A plant consumes around 50 kg of husk per hour, and the cost of rice husk is nearly Rs 1.10-1.30 per kg. The plant operates for six hours a day. Thus fuel (husk) cost works out to
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around Rs 11,500 per month. The plant operating cost, including the cost of manpower, works out to Rs 25,000 per month. This ensures a profit margin of approximately Rs 35,000.

In case of BOOM models, the local entrepreneur has to pay a sum of Rs 15,000 to HPS per month, making the project financially sustainable, whereas in case of BM model, the pricing mechanism is to be finalized by the owner of the project.

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