**Profile No.: 217 NIC Code:19204**

**FUEL BRIQUETTING**

**(Based on Agri. Waste & Municipal Solid Waste)**

**1. INTRODUCTION:**

Briquetting involves the compression of a material into a solid product of higher bulk density, lower moisture content and uniform size, shape and materials properties that would allow them to be used as fuel just like wood or charcoal. Briquetting is also used for metallurgical coke fines to make it suitable for use in steel foundries.

Fuel briquettes are made of low cost coal fines and agri waste solid waste materials for domestic or restaurant industry which largely depends on such solid fuel sources. For fuels with smokeless burning that offers minimal atmospheric pollution can be made by fuel briquettes with help of technology. However the cost benefit analysis is must for this product for selected location.

It is noted that one of the major challenges is of Solid Waste Management viz Municipal solid waste in developing countries is to transform the informal sector to improve livelihoods, working conditions and efficiency in recycling materials found in the waste stream. Organizing and training informal recyclers into micro and small enterprises is a very effective way to upgrade their ability to add value to collected waste materials. It is suggested to consider agri waste and Municipal Solid waste for fuel briquette.

**2. PRODUCT & ITS APPLICATION:**

Municipal Solid Waste is a poor-quality fuel and its pre-processing is necessary to prepare fuel pellets to improve its consistency, storage and handling characteristics, combustion behavior and calorific value. The calorific value of raw MSW is around 1000 kcal/kg while that of fuel pellets is 4000 kcal/kg. On an average, about 15–20 tons of fuel pellets can be produced after treatment of 100 tons of raw garbage.

Since pelletization enriches the organic content of the waste through removal of inorganic materials and moisture, it can be very effective method for preparing an enriched fuel feed for other thermochemical processes like pyrolysis/ gasification, apart from incineration. To improve the properties, agri waste with carbonization and low quality fine coal available in market may be blended with Solid waste.

The briquetted Pellets can be used for heating plant boilers and for the generation of electricity. They can also act as a good substitute for coal and wood for domestic and industrial purposes. The important applications of RDF are found in the following spheres:

Cement/ceramic kilns

Power plants and Industrial steam/heat boilers

Pellet stoves in restaurants / rural domestic use

**3. DESIRED QUALIFICATIONS FOR PROMOTER:**

Preferably science / engineering background with some exposure to fuel industry. NGOs devoted to environment and small co-operative development may have good scope for such a plant.

**4.** **INDUSTRY OUTLOOK/TREND**

The Fuel briquette industry in India is very small and mostly confined to using coal fines briquette. Several various medium and small companies manufacture briquettes.

Large players in public sector are looking at sewage and municipal solid waste in partnership with various medium and small companies in private sector located all around industrial and urban centers in India to provide waste to energy services. SELCO International Limited, SELCO setup the first commercial Municipal Solid Waste-processing unit in India in 1999 and installed 6.6 MW using RDF pellets as energy source. Mailhem Engineers Pvt Ltd. Pune has adopted modified UASB technology and installed about 250 waste-to-energy plants. Hanjer Biotech Energies are developing 15 MW combustion power plant in Surat District with MSW based RDF pellets as fuel. Other players such as UPL Environmental Engineers Pvt Ltd, M/S Asia Bio- energy Pvt Ltd, (5.1 MW MSW to energy project), Cicon Environment Technologies, Chennai, Bermaco/WM Power Ltd, Sound craft Industries, Hydroair Tectonics Limited, Ramky Enviro Engineers Ltd, Zanders Engineers Limited, etc. have collaborative gasification technology to process multiple feed stocks including MSW for power, destruction efficiency of 99.9% and emissions well below thresholds. Some of these units provides complete solution in relation to collection to segregation and recycling of municipal waste, landfill, compost plant and waste to energy plant etc.

A new technology known as Plasma Thermal Destruction Recovery technology, has emerged as an environmentally friendly process that converts wastes into non-toxic synthetic gas and other useful end-products. It is considered a proven, cost-effective, environmentally clean and commercially viable solution for waste remediation.

**5. MARKET POTENTIAL AND MARKETING ISSUES. IF ANY:**

With the energy crisis leading to increased cost of oil and natural gas and also due to the concerns of deforestation and use of wood from environmental consideration, the focus has again shifted to coal and solid waste of agri sector and urban centers. Besides there is no value of agricultural waste today and most of it is burnt, causing air pollution problems. This indicates scope for briquetting units in rural areas to provide cheaper fuel from agri-waste.

In view of conserving oil and gas for more productive purposes, and also to dispose of the mounting volumes of municipal solid waste which has considerable fuel value can be more usefully exploited for domestic / industrial application by way of Fuel/Coal briquettes.

Urbanization in the country and proposed plan for Clean India as per government policies, there is a good scope for such a project in partnership with local governments of Metro and other large cities. A modular design approach of plant can be useful for other towns as well. It is assumed that the solid waste of one ton will result in 550 kg of briquettes as the dust and dirt, metal glass and toxic waste removal, in segregation process will result in substantial reduction of fuel grade material for briquetting.

**6. RAW MATERIAL REQUIREMENTS:**

Coal fines, agri waste, waste oil, and most important the municipal solid waste is the main input materials. The binders like sodium silicate, waste oil and molasses are also required.

It is considered that the municipal solid waste will be made available at free of cost or Amy earn the unit some value for disposal of waste and segregation. While other wastes viz. Agri waste and waste coal/ oil will be available at marginal cost.

**7. MANUFACTURING PROCESS:**

Pelletization of agricultural and municipal solid waste involves the processes of segregating, crushing, mixing high and low heat value organic waste material and solidifying it to produce fuel pellets or briquettes, also referred to as Refuse Derived Fuel (RDF) pallets.

The production process involves the following steps:

* Crushing/grinding of waste below 2mm.
* Preparation of binders in semi-liquid form.
* Mixing and blending of waste with binders.
* Briquette making.
* Drying.
* Carbonization of briquettes in the furnace to remove volatile matter.
* Cooling of briquettes by spraying water
* Packing.

Refuse Derived Fuel production line thus consists of several unit operations in series in order to separate unwanted components and condition the combustible matter to obtain the required characteristics. The main unit operations are screening, shredding, size reduction, classification, separation of metal, and glass some toxic substances or wet materials. Some of the solid waste may or may not undergo pyrolysis to carbonize the organic materials to improve heat value as also to reduce moisture levels.

The segregated material is dried to reduce moisture levels and blended with high calorific value fuels like coal dust/ dry agri waste and waste oil as well as binders. The blended materials then undergo densification / briquetting to get the final product that can be sold in bulk to trading channels. The unit operations can be arranged in different sequences depending on raw Municipal and agri waste composition and the required end fuel quality that can find ready market.

**8. MANPOWER REQUIREMENT:**

The unit shall require highly skilled service persons. The unit can start from 36 employees initially and increase to 127 or more depending on business volume.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. No** | **Type of Employees** | **Monthly Salary** | **No of Employees** | | | | |
|  |  |  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| 1 | Skilled Operators | 15000 | 6 | 6 | 12 | 16 | 16 |
| 2 | Semi-Skilled/ Helpers | 7000 | 24 | 48 | 72 | 100 | 100 |
| 3 | Supervisor/ Manager | 30000 | 2 | 3 | 4 | 5 | 5 |
| 4 | Accounts/ Marketing | 16000 | 2 | 3 | 3 | 4 | 4 |
| 5 | Other Staff | 8000 | 2 | 2 | 2 | 2 | 2 |
|  | TOTAL |  | 36 | 62 | 93 | 127 | 127 |

**9. IMPLEMENTATION SCHEDULE:**

The unit can be implemented within 9 months from the serious initiation of project work.

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Activities** | **Time Required in Months** |
| 1 | Acquisition of Premises | 2 |
| 2 | Construction (if Applicable) | 2 |
| 3 | Procurement and Installation of Plant and Machinery | 3 |
| 4 | Arrangement of Finance | 3 |
| 5 | Manpower Recruitment and start up | 2 |
|  | Total Time Required (Some Activities run concurrently) | 9 |

**10. COST OF PROJECT:**

A plant to process approx. 30 MT of solid waste per day is considered here, and subsidy of Rs 300 per MT for solid waste reduction from municipal waste dump. It is considered that the plant will also recover value from segregated glass, metal and misc. materials to be sold as scrap. It is also estimated that the fuel briquette will fetch sale price at 70% the cost of fuel grade coal in the market.

The unit will require total project cost of Rs 194.45 lakhs as shown below:

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Particulars** | **In Lakhs** |
| 1 | Land | 20.00 |
| 2 | Building | 25.00 |
| 3 | Plant and Machinery | 122.00 |
| 4 | Fixtures and Electrical Installation | 4.60 |
| 5 | Other Assets/ Preliminary and Preoperative Expenses | 5.00 |
| 6 | Margin for working Capital | 17.85 |
|  | TOTAL PROJECT COST | 194.45 |

**11. MEANS OF FINANCE:**

The project will require promoter to invest about Rs 62.00 lakhs and seek bank loans of Rs 132.45 lakhs based on 70% loan on fixed assets.

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Particulars** | **In Lakhs** |
| 1 | Promoters Contribution | 62.00 |
| 2 | Loan Finance | 132.45 |
|  | TOTAL : | 194.45 |

**12. WORKING CAPITAL REQUIREMENTS:**

Working capital requirements are calculated as below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr. No** | **Particulars** | **Gross Amount** | **Margin %** | **Margin Amount** | **Bank Finance** |
| 1 | Inventories | 9.20 | 40 | 3.68 | 5.52 |
| 2 | Receivables | 10.94 | 50 | 5.47 | 5.47 |
| 3 | Overheads | 5.02 | 100 | 5.02 | 0.00 |
| 4 | Creditors | 9.20 | 40 | 3.68 | 5.52 |
|  | TOTAL | 34.36 |  | 17.85 | 16.51 |

**13. LIST OF MACHINERY REQUIRED:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr. No** | **Particulars** | **UOM** | **Quantity** | **Rate** | **Total Value** |
|  | Main Machines/ Equipment |  |  |  |  |
| 1 | Waste removal and ferry trucks and Excavator | Nos | 6 | 400000 | 2400000 |
| 2 | Conveyor with sieves and manual as well as automatic segregation stations | Nos | 3 | 350000 | 1050000 |
| 3 | Crushers and thrashers for size reduction | Nos | 4 | 250000 | 1000000 |
| 4 | Blending and mixing Machine for crushed waste | Nos | 2 | 500000 | 1000000 |
| 5 | Briquette machines | Nos | 4 | 150000 | 600000 |
| 6 | Briquette drying Ovens with continuous conveyor | Nos | 2 | 1200000 | 2400000 |
| 7 | Pollution control system for waste gas and dust | Nos | 1 | 800000 | 800000 |
| **Sr. No** | **Particulars** | **UOM** | **Quantity** | **Rate** | **Total Value** |
| 8 | Air handling and dust collection system for plant | Nos | 1 | 650000 | 650000 |
| 9 | Air compressor system with Piping | Nos | 2 | 150000 | 300000 |
| 10 | Water supply and sprayer unit | Nos | 1 | 300000 | 300000 |
| 11 | Fire safety system for Plant | Nos | 1 | 200000 | 200000 |
| 12 | Misc. conveyors for carrying glass / metal etc. to dump bins | Nos | 3 | 150000 | 450000 |
| 13 | Gen Workshop Machines for Maintenance | Nos | 1 | 300000 | 300000 |
| 14 | Bagging machine | Nos | 4 | 50000 | 200000 |
|  | subtotal : |  |  |  | 11650000 |
|  | Tools and Ancillaries |  |  |  |  |
| 1 | Misc. equipment like plant cleaning / sweeping machines | LS | 1 | 400000 | 400000 |
| 2 | silos and bins etc. | LS | 1 | 150000 | 150000 |
|  | subtotal : |  |  |  | 550000 |
|  | Fixtures and Elect Installation |  |  |  |  |
|  | Storage and transport bins and trolleys | LS | 1 | 30000 | 30000 |
|  | Office Furniture | LS | 1 | 40000 | 40000 |
|  | Telephones/ Computer | LS | 1 | 40000 | 40000 |
|  | Electrical Installation | LS | 1 | 350000 | 350000 |
|  | subtotal : |  |  |  | 460000 |
|  | Other Assets/ Preliminary and Preoperative Expenses | LS | 1 | 500000 | 500000 |
|  | TOTAL PLANT MACHINERY COST |  |  |  | 13160000 |

All the machines and equipment are available from local manufacturers. The entrepreneur needs to ensure proper selection of product mix and proper type of dies and tooling to have modern and flexible designs. It may be worthwhile to look at reconditioned imported machines, dies and tooling. Some of the machinery and dies and tooling suppliers are listed here below:

1. Unitek Hydraulics

SF No. 62/1, Sambaraya Thottam,

Athipalayam Road, Chinnavedampatti Post  
Coimbatore- 641049, Tamil Nadu, India

1. Ronak Agrotech Engineering Pvt. Ltd.Plot- 39,

Atlas Industrial Area, Near Kothariya Railway Crossing,

Opposite Hotel Krishna Park Off Rajkot Gondal, NH - 27,   
Rajkot-360022, Gujarat, India

1. G K Agency

Perumbaikad, Kottayam-686016, Kerala, India

1. Greenviron India

60/A, Gurukula Building, First Floor 11th Cross, 1st Block, Rajaji Nagar,  
Bengaluru-560010, Karnataka, India

1. Advance Hydrau-Tech Pvt. Ltd.  
   Khasra No. 86/23,

Village Ghevra Near Hiran Kudna Mor,

Mundka, Udyog Nagar, Rohtak Road,

New Delhi – 110081, Delhi, India

1. Green Revolution Engineers

No. 548, Sector 37, Faridabad-121003, Haryana, India

1. Areeba ContractorKhasra No. 2 M,

45 Futa Road, Hindon Vihar, Meerut Road,   
Ghaziabad-201001, Uttar Pradesh, India

**14. PROFITABILITY CALCULATIONS:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. No** | **Particulars** | **UOM** | **Year Wise estimates** | | | | |
|  |  |  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| 1 | Capacity Utilization | % | 45 | 55 | 70 | 80 | 80 |
| 2 | Sales | Rs Lakhs | 131.22 | 160.38 | 204.12 | 233.28 | 233.28 |
| 3 | Raw Materials & Other Direct Inputs | Rs Lakhs | 73.64 | 90.00 | 114.55 | 130.91 | 130.91 |
| 4 | Gross Margin | Rs Lakhs | 57.58 | 70.38 | 89.57 | 102.37 | 102.37 |
| 5 | Overheads Except Interest | Rs Lakhs | 21.60 | 21.60 | 21.60 | 21.60 | 21.60 |
| 6 | Interest | Rs Lakhs | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 |
| 7 | Depreciation | Rs Lakhs | 15.66 | 15.66 | 15.66 | 15.66 | 15.66 |
| 8 | Net Profit Before Tax | Rs Lakh | 1.78 | 14.58 | 33.77 | 46.57 | 46.57 |

The basis of profitability calculation:

A plant to process approx. 30 MT of solid waste per day is considered here, and subsidy of Rs 300 per MT for solid waste reduction from municipal waste dump. It is considered that the plant will also recover value from segregated glass, metal and misc. materials to be sold as scrap.

It is also estimated that the fuel briquette will fetch sale price at 70% the cost of fuel grade coal in the market. The fuel gas emanating from may be used as fuel for the drying oven.

The segregated /separated scrap is sold at @ Rs 18 ~ 50 per Kg. and the income of same is added. Energy Costs are considered at Rs 7 per Kwh and fuel cost is considered at Rs. 65 per liter. The depreciation of plant is taken at 10 % and Interest costs are taken at 14 -15 % depending on type of industry.

**15. BREAK EVEN ANALYSIS**

The project is can reach break even capacity at 42.02 % of the installed capacity as depicted here below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No** | **Particulars** | **UOM** | **Value** |
| 1 | Sales at Full Capacity | Rs Lakhs | 291.60 |
| 2 | Variable Costs | Rs Lakhs | 163.64 |
| 3 | Fixed Cost incl. Interest | Rs Lakhs | 55.80 |
| 4 | Break Even Capacity | % of Inst Capacity | 43.61 |

**16. STATUTORY/ GOVERNMENT APPROVALS**

The unit shall have to get state industrial unit registration from DIC, IEC Code for Export and local authority clearance. Depending on structure of finance the company shall need to register company with registrar of companies. The registration and approval for factory plan, safety for Fire etc. requirement, registration as per Labour laws ESI, PF etc. shall be required as per rules and applicability. Before starting the unit will also need GST registration for procurement of materials as also for sale of goods. As such there is no pollution control registration requirements, except installation of chimney/ blowers for heat treatment furnace / pickling line and ensure safe environment as per rules of factory safety. Solid waste disposal shall have to meet the required norms. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

**17. BACKWARD AND FORWARD INTEGRATION**

The machines and equipment offer scope for diversification in to producing the continuous flux cored and coated electrode range of products and also take up import substitution for welding electrodes by ensuring metal and flux compositions. The unit can also of other consumer and industrial wire products / components etc. by using the spare capacities and machine capabilities. As such there is not much scope for organic backward or forward integration.

**18. TRAINING CENTERS/COURSES**

There are no specific training centers for wire drawing technology. There are training for dies and tools development run by several centers of excellence viz Indo German Tool Room at Ahmedabad, Rajkot, Chennai, and CTTC Bhubaneswar etc. shall be helpful.

The most important scope of learning is in new product design and development by associating with institutes like NID etc. Entrepreneur may also study the new product designs, product range, features and specifications of leading Brands / competitors across the world by scanning the Internet and downloading data. Viz. North American, Europe, China etc. markets.

Udyamimitra portal (link : [www.udyamimitra.in](http://www.udyamimitra.in/) ) can also be accessed for hand-holding services viz. application filling / project report preparation, EDP, financial Training, Skill Development, mentoring etc.

Entrepreneurship program helps to run business successfully is also available from Institutes like Entrepreneurship Development Institute of India (EDII) and its affiliates all over India.

**Disclaimer:**

Only few machine manufacturers are mentioned in the profile, although many machine manufacturers are available in the market. The addresses given for machinery manufacturers have been taken from reliable sources, to the best of knowledge and contacts.  However, no responsibility is admitted, in case any inadvertent error or incorrectness is noticed therein.  Further the same have been given by way of information only and do not carry any recommendation.