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TECHNO-COMMERCIAL PROJECT REPORT RECYCLED PLASTICS BOARD FOR CONSTRUCTION USE.

> Introduction

Plastics Packaging is one of the fastest growing industries and stands at \$700 billion globally. It has grown higher than GDP in most of the countries. In a developing country like India, it grew at a CAGR of 16 % in the last five years and touched \$32 billion in 2015. The Indian packaging industry constitutes 4 percent of the global packaging industry. The per capita packaging consumption in India is low at 4.3 kg compared to developed countries like Germany and Taiwan where it is 42 kg and 19 kg respectively. However in the coming years Indian packaging industry is expected to grow at 18 % per annum wherein, the flexible packaging is expected to grow at 25 % per annum and rigid packaging to grow at 15 % per annum. The growth of Plastics processing industry has also catalysed growth in plastics recycling industry.

WHAT IS RECYCLING?

Recycling refers to the process of collecting used materials which is usually considered as "waste" and reprocessing them. In this process these used materials are sorted and processed to be used as "raw materials" for the production of new products. Recycling varies from "re-use" in the sense that re-use just means using old products repeatedly, where as recycling means using the core elements of an old product as raw material to manufacture new goods.

PROCESS OF RECYCLING -

The recycling process involves three stages.

In the first stage the old products are collected, where they are sorted, cleaned and made ready for recycling or manufacturing new products.

The second stage involves the manufacturing of new products from the raw material obtained by the processing of the old products.

Finally, the process ends with the purchasing of recycled goods by the consumers.

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WHY RECYCLING IS IMPORTANT?

Recycling is very important as -

- Recycling Saves Energy.
- Recycling Saves Environmental Conditions and Reduces Pollution.
- Recycling Saves Natural Resources.
- Recycling offers Economic Benefits.
- Recycling process creates employment opportunities.
- Recycling Saves Space for Waste Disposal.
- RECYCLING IS NECESSITY OF THE TIME.

Recycling technology for Plastics like Poly ethylene, Polypropylene, PVC, PET, and other engineering plastics is a most mature and common case among all polymers.

Recycled Plastics can be used again to produce plastic products, e.g. bottles, containers, bags, sheets, films etc. for various packaging applications.

This recycling chain not only reduces the pollution to environment but also reduces production cost. The recycled materials can be used solely or blended with the virgin materials as per choice and end use.

Most of the plastics in India is reused prior disposal. Waste disposal and segregation systems are not existing and or they are not functioning effectively, as such most of the plastics is going in a municipal waste system.

Recycled plastics are widely used in domestic & house hold market, Industrial sector, Automobile sector, etc.

Recycled materials can be used solely or mixed with the virgin materials to make new item.

Items made with recycled materials have the similar appearance and other properties.

THE LANGUAGE OF PLASTICS RECYCLING

Common Plastic Scrap Terms -

- Rigid Plastic Container: A package (formed or moulded container) which maintains its shape when empty and unsupported.
- Plastic Bottle: A rigid container which is designed with a neck that is smaller than the body. Normally used to hold liquids and emptied by pouring.
- Plastic Film: A thin flexible sheet which does not hold a particular shape when unsupported.
- Recycled Plastic: Plastics composed of either post-consumer or recovered material or both.
- Recovered Plastic: Plastic materials which have been recovered or diverted from the solid waste stream. Does not include materials generated from and commonly reused within an original manufacturing process.
- Post-Consumer: Products generated by a business or consumer that have served their intended end use and have been separated or diverted from the solid waste stream for the purpose of recycling.
- Natural: Plastics that have no colour and are clear or slightly opaque such as milk jugs, and the typical clear uncoloured water bottles. Natural is different from White.
- Pigmented/Dyed: Plastics that may be clear or opaque and are coloured white, black or any other

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colour. A clear water bottle that is green is considered pigmented. Additionally, white plastics are considered pigmented

Plastic recycling in general is a very big subject, and as such we will discuss the subject of recycled Plastics boards in construction industry.

Main reasons to use recycled plastic materials in construction projects are:

- Recycled Plastics boards lasts at least 5 times longer than treated timber/plywood.
- There are no maintenance and replacement costs - whole life savings are about 80% when used instead of wood

MARKET FOR RECYCLED CONSTRUCTION BOARD

A reusable construction board made from recycled plastics is available off the shelf in most countries like USA, UK, Australia, New zeland, China etc.

The use of recycled plastics board in construction industry currently in India is very limited however the same is likely to increase at fast speed.

Plywood demand in construction industry was 22.1 Million m³ and expected to be 26.1 m³ by the year 2015.

The market for plywood and allied products in India is estimated to be about Rs 12000 cr. (USD 2.50 bn.) with 70% dominated by a multitude of mutely players in unorganized sector, the organized sector has been growing at between 25% and 30%. Estimated turnover in the year 2016 is at Rs 13000cr, with expected Future growth rate at 10% p.a.

In INDIA, wood based panel consumption details are not available, as this is not an organized sector.

Global demand for building boards will rise 6.2 percent per year through 2017 to 398 million cubic meters. China will see its share of global demand rise to half of the total, with solid gains also expected in North America and other regions such as South America and Eastern Europe. Structural boards will outpace non-structural. The demand of 295 million cubic meter is estimated by world building board industry.

There are about 15 manufacturers of recycled plastic construction board/WPC manufacturer in India with about 150 Million SFT capacity installed, however it is mostly for the in-house consumption.

There are large quantity imports from China, and about 5-10% materials are imported from Auatralia / Newzeland / UK and Europe.

The real estate sector is one of the most globally recognised sectors. In India, real estate is the second largest employer after agriculture and is slated to grow at 30 per cent over the next decade.

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The Indian real estate market has become one of the most preferred destinations in the Asia Pacific as overseas funds accounted for more than 50 per cent of all investment activity in India in 2014, compared with just 26 per cent in 2013.

The real estate sector comprises four sub sectors - housing, retail, hospitality, and commercial. The growth of this sector is well complemented by the growth of the corporate environment and the demand for office space as well as urban and semi-urban accommodations.

The construction industry ranks third among the 14 major sectors in terms of direct, indirect and induced effects in all sectors of the economy.

The Indian real estate market is expected to touch US\$ 180 billion by 2020. The housing sector alone contributes 5-6 per cent to the country's Gross Domestic Product (GDP).

In the period FY08-20, the market size of this sector is expected to increase at a Compound Annual Growth Rate (CAGR) of 11.2 per cent.

Mumbai is the best city in India for commercial real estate investment, with returns of 12-19 per cent likely in the next five years. Delhi-NCR was the biggest office market in India with 110 million sq ft, out of which 88 million sq ft were occupied.

Infrastructure construction accounted for 23.0% of the total industry's value in 2015. According to Timetric's CIC, it will continue to expand over the forecast period, driven by public and private sector investments in public transport infrastructure. Consequently, infrastructure construction is anticipated to be the industry's fastest-growing market over the forecast period, with a CAGR of 9.94% in nominal terms, to value INR9.5 trillion (US\$140.1 billion) in 2020

Residential construction was the largest market in the Indian construction industry during 2011-2015, and is anticipated to remain relatively sizeable over the next five years, with a 30.6% share of the industry's total value in 2020. Construction activity in the residential market will be supported by rapid urbanisation, population growth, and positive developments in regional economic conditions. Government efforts to clear slum areas by 2022 and reduce the country's housing deficit will also help the market grow.

ROHAN BUILDERS has in-house consumption of about 100,000 boards per annum at present. The quantity is equivalent of about 160 days production volume. ROHAN BUILDERS being a leader in the industry, others follow the same practices, so it is very easy to sale the balance production in the market.

WPC Market

The wood-plastic composites market is projected to reach USD 5.84 Billion by 2021, at a CAGR of 12.4% from 2016 to 2021. Based on application, the wood-plastic composites market has been segmented into building & construction products, automotive components, industrial & consumer goods, and others. Based on type, the market has been segmented into polyethylene (PE), polyvinylchloride (PVC), polypropylene (PP), and others. The building & construction products segment is expected to be the largest consumer of PE and PVC wood-plastic composites, followed by automotive components segment where wood-plastic composites are used for manufacturing lightweight automotive components.

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Currently overseas market mainly exists for exterior furnishing. Majority of star hotels, restaurants, swimming pools, and fitness clubs use WPC for exterior decking and wall cladding. The furniture industry is increasingly using WPC for chairs and shelf elements. So far WPC is not used in the construction industry for shuttering purpose in India, although, it is used extensively overseas. Casting with WPC gives very good finish and does not require further surface treatment like plastering, saving huge labor, materials & cost. There is huge scope for WPC in coastal areas, where exterior items degrade easily due to extreme climate. WPC is touted as a good option as it is highly durable and requires least maintenance. WPC is quite popular in the Middle -East and Australian markets. WPC is the most ideal material that can substitute wood for its durability and that can substitute plastic for its flexibility. From manufacturer's perspective, it's 100% clean business, with no by-products or pollutions.

WPC manufacturer's in INDIA.

Currently there is no big player in this business in INDIA. There are few parties importing the materials from China, Australia, and trading.

The vast market is still unexplored, unlike USA, Germany, China, Australia, S.Korea etc.

The market for WPC is growing every day, and this is the good opportunity to start the business.

WPC Consumer perspective.

Some of the manufacturers mentioned here above for construction board are manufacturing WPC.

From consumer perspective, the quest of minimal maintenance requirements, excellent weather ability and high resistance to wear and tear in construction application is reason why WPC is preferred over other materials.

Cost wise WPC cost about 1.5, thermoplastic cost 2 to 2.2, compared to wood.

Life wise WPC is much better and can be used for much longer duration.

Compared with U-PVC (Un-plasticized PVC), MDF, and FJP (finger jointed pine) WPC is aesthetically better, resistant to moisture, and more durable. Also PVC does not give the appeal of wood, and is not recyclable more than once.

OTHER APPLICATIONS OF RECYCLED PLASTIC BOARD

Recycled plastic has been used for many other applications in construction industry, in overseas market. Some other applications of recycled Plastics in the construction industry are like Indoor application, flooring, out-door decking, Fencing, Frames, columns, temporary construction, furniture, garden railings, stairs etc.

PRODUCT SHORT LISTED

There are varieties of boards that can be manufactured from recycled Plastics and used for variety of applications in construction industry.

After analyzing the products available, and the intended end use, following products are short listed for the manufacturing.

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- 1) Recycled plastic honeycomb construction board, with hollow/square pattern.
- 2) Recycled Plastics Dimple type construction board.
- 3) Recycled plastics multi layer foam board.
- 4) Foamed WPC board.

End use of the board is mainly for the shuttering purpose in the RCC frame work.

PRODUCT DESCRIPTION AND SPECIFICATION -

Plastic honeycomb/hollow, Foamed construction board is a multi layered plastic materials with honeycomb/.hollow or solid multi layered structure. The boards offer high strength and minimum weight as the hollow structure and or foamed centre layer minimize the weight. The materials may be mixed with different fillers and additives as per the end use.

The construction board made of recycled Plastics have a capacity to replace the PLYWOOD completely.

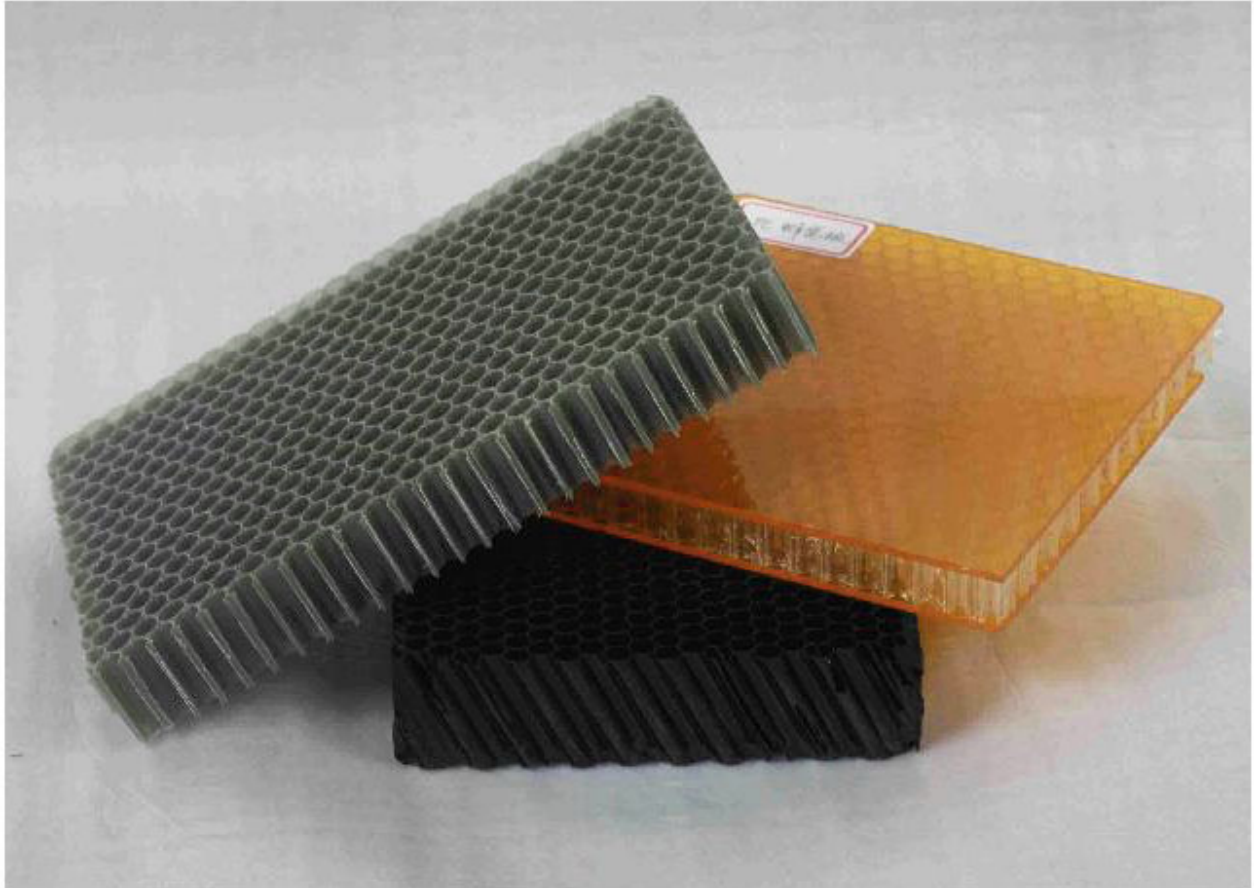
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PHOTOGRAPH OF THE HONEYCOMB BOARD



INTENDED BOARD SIZE & QUANTITY TO MANUFACTURE

Board Thickness - 12 mm, 18 mm, & 24 mm.

Board size - 6 feet 3 feet and/or 8 feet x 4 feet

Quantity of Boards planned for - 200,000 per annum.

Approximate daily production in terms of weight - 18 Tons/day

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ADVANTAGES OF RECYCLED PLASTIC BOARD OVER PLYWOOD/WOOD

- Protecting Our Forests,
- Durability,
- No Termites and no paste growth,
- Easy or No Maintenance,
- Tool Compatibility,
- Stain Resistant,
- Color Selection,
- Contraction and Fading problems are minimized,
- Recycle Benefits, and used boards can be recycled,

Wood Plastic Composite

As name indicates WPC is a combination of wood and Plastics extruded together or molded together in different forms.

WPC is relatively new materials especially for Indian markets, where as widely used in other parts of world.

Wood Plastic composite is weather proof, rigid, can be machined and screwed, for fabrication purpose, and recycled at least 5 times. WPC use up to 70% of composite materials and 30% of plastics.

WPC can be used for heat, and sound insulation purpose. It does not content any formeldihyde, benzene and other harmful substances.

WPC is non radioactive materials.

WPC is made of Plastics composite with Wood Flour, Wood Chips, Saw Dust, Rice Husk, Cotton Plant Stalk Powder, Bagasse, Bamboo, etc.

WPC - main use

- 1) Interior decoration, furniture, falls sealing, etc.
- 2) Out door use, decking, railing, garden furniture, etc.
- 3) Construction lumber & boards.
- 4) Industrial use, low level heat and sound proofing partitioning, cabin dividers, mezzanine flooring, etc.

WPC advantages -

- 1) Natural materials are used.
- 2) Various colors.
- 3) Anti surge, anti mil-dew, anti decay.
- 4) Heat insulation and sound insulation.
- 5) Anti-aging, fire retardant (with addition of additives).
- 6) Non radio active materials.

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- 7) Green materials, as no harmful gases or substances.
- 8) Can be recycled 100% after life.

Raw materials, It's availability & sourcing from market -

The raw materials used for processing is in the form of flex for the construction board, where as in the form of granules for making WPC.

Since the raw material used is of broad PE category (LDPE, LLDPE, HDPE, HMHDPE), PP, which are mostly general purpose packaging materials the availability is not a problem. The materials required for processing can be of mixed colors and as such it is available at a low price band. There are dealers for the recycled materials, in Pune, Mumbai, and other parts of country who can supply the required quantities. Even a materials pick up arrangements with major industries may be done, to get the good clean materials.

Since the end use of board is for construction purpose a grey board is acceptable. The grey board can be processed by using the mix colored recycled materials without sorting for colors.

"Kandla" is a very big market for recycled materials, Mr. OZA is one of the trader in the recycled materials from "Kandla", who can supply the entire quantity requirements.

There is another major dealer from Indore. The dealers from "Dharavi" can be explored.

MANUFACTURING PROCESS

Recycled plastic board or sheets can be made by three different processes.

- A) Extrusion process.
- B) Molding process.
- C) Powder Impression molding process.

A) Extrusion process -

In this process molten polymer is extruded in to continuous sheets, to the desired thickness and then cut to the required lengths. Extrusion process use only one polymer for one layer. No. of layers in the sheet may vary as per requirement. Extrusion process can be used for composite fillers like calcium carbonate, wood dust, rice husk, fly ash, etc.

Up to 70% of the composite materials can be added to get the finished sheets.

Depending upon the end use and requirements different additives are added to enhance the properties. Sheets with additives can be antistatic, fire retardant, with very high strength, and very good esthetic finish.

Extrusion process is most established and proven process. Extrusion equipments are manufactured in India, Taiwan, China, Korea, and European countries.

Recycled extruders have totally different requirement than the virgin plastic processing extruder, as the recycled materials may have some contamination, dust and dirt etc. The

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materials for screw and barrel needs to be of very high quality and abrasion resistant to ensure the longer life.

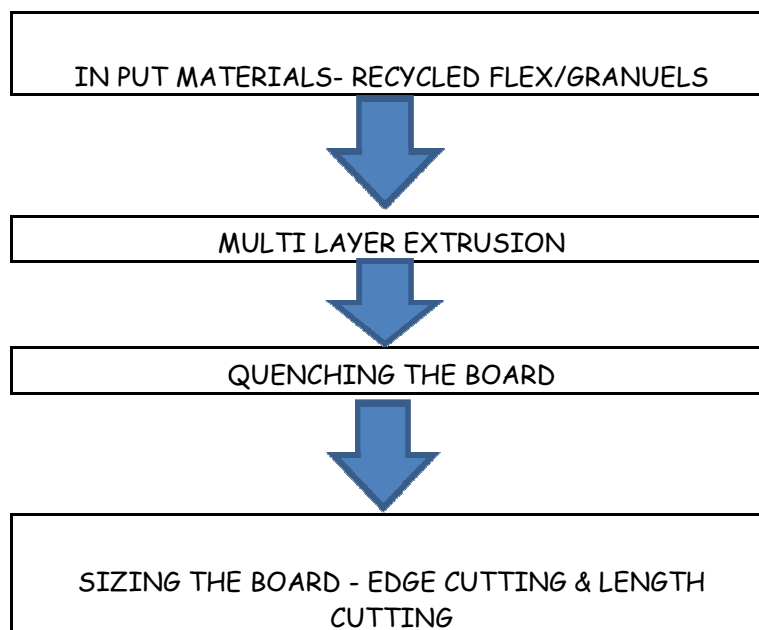
Recycled plastic extruders also requires a very good filtration system and gas venting arrangement. Most of the high throughput extruders are equipped with hydraulic screen changer. Fine filtration gives good finish and texture on the sheet, however the frequent screen changes are required. Vented extruders allow the escape of gases generated, resulting better quality of the finished products.

WPC is also made with extrusion process, by using WPC granules as input materials.

During the extrusion process foaming agents are introduced to make the foam boards.

- B) Moulding process is used when the size and quantity required are small and in batches.
- C) POWDER IMPRESSION MOULDING is very costly process and the use for construction board is not financially viable. The process is used for making furniture, industrial components and critical shaped items.

PROCESS FLOW CHART

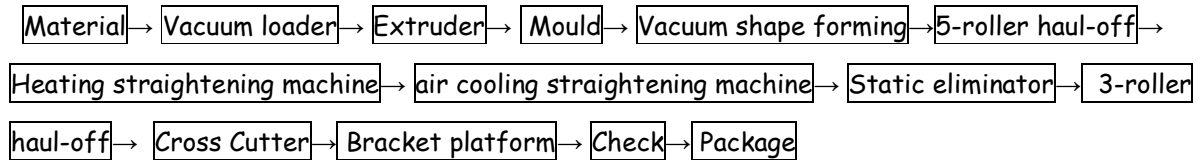


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FLOW DIGRAM IN DETAILS.



PLANT & MACHINERY -

The main machinery required for the project consist of -

- Single screw extruder (venting type is preferred)- multiple in no as per the sheet requirement.
- Hydraulic screen changer
- Control cabinet
- Distributor
- Hollow sheet mould or profile sheet rollers
- Vacuum forming mold
- Roller haul-off
- Heat straightening equipment
- Air quenching station
- Wire cutting
- Stacker/bracket platform

INFRA STRUCTURE, ANCILLARY & CONSUMABLE REQUIREMENTS

Typical plant to process 1 ton capacity per hr shall require enlisted facilities.

- 1) Land approximately 1 acre, building of about 10,000 to 15,000 sq. feet with clear 6 meter height.
- 2) Water chiller as per the process requirement.
- 3) Process water about 5000 litre, shall use close loop and open loop system. The top up requirement per day will vary depending upon the ambient temperature, but shall not exceed more than 1000 litre a day.
- 4) Compressed air at about 8 bar pressure, air volume depends upon the process layout, process equipment and the automation level.
- 5) Connected power 750 KW to 1000 KW, three phase 415 V, 4 wire connection, with separate earthing.
- 6) Material movement equipments like loader, Forklift/stacker etc.
- 7) Scrap grinder for re-use of damaged boards and any other materials.

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MAN POWER REQUIRED -

Man power required for the automated plant is 12 per shift, skilled 2, semiskilled 4, labors 6, maintenance technician, plant in-charge, & stores in-charge

Material in put is considered in bailed form, with automated loading arrangement. Man power requirement shall vary depending upon the automation level in the equipment.

CAPITAL COST REQUIRED

The basic equipment from China shall cost approximately USD 30000/- The change parts required for making different size board and different construction shall require additional capital. Utility equipments like Chiller, Compressor, stacker etc may cost approximately USD 50,000.

Capital requirement is given based on the assumption of using pre-grinded & washed flex sourced locally

LEAD TIME REQUIRED TO START THE PROJECT

Time required to start up the project is about 4-5 months.

Pre-ordering process about 1 month.

Machine building 2 months after order placement.

Shipment about 3 weeks.

Clearing and local transportation 1 week.

Pre-commissioning procedures 1 week.

Installation, commissioning, and product optimization 1 week

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PAYBACK PERIOD CALCULATION AND FINANCIAL FEASIBILITY WORKING.

S. NO.	Recycled Plastic board production		
1	25.824	Area of board in sft	
2	28.8	Feed in the weight of board in kg. Board size 1.2 mtr x 2 mtr, 18 mm thick	
3	70	Feed in the currency exchange value to get the working in local currency.	
4	12.5	Feed in the Energy cost per KWH in local currency.	
5	30	Feed in Resin cost in RS/kg.	
6	625	Per day production	
7	50	Expected sale price per sft	
8	18000	Expected throughput per day in KG	
			Capital out lay Capital out lay
9	Capital requirement -		US DOLLAR RS.
10	Machine & equipment	Ex. Works	450000 31,500,000
11	Land & building	Leased	360,000
12	Electrification		10000 700,000
13	Installation & comissioning expenses		10000 700,000
14	Incidental/contingency expenses 5%		23500 1,645,000
15	Estimated packing freight		15000 1,050,000
16	Fork lift & vehicles		25000 1,750,000
17	TOTAL INVESTMENT FOR PROJECT (IN EURO)		508500 35,955,000
18	MANUFACTURING COST		
19	Resin cost		864
20	Cost of Power expected at 0.5 KW/KG consumption.		180
21	Labour cost - as per the detailed working sheet		45.12
22	Factory over heads & maintenance cost		19.20
23	Adminstration cost		12.80
24	Finance cost at 15% per annum		26.60
25	Estimated processing cost perboard in RS.		1,147.72
26	EXPECTED SALES REVENUE		
27	Expected sales revenue per board		1,291
28	Expected Value addition per board		143.48
29	Expected value addition per month		2,241,875
30	Expected payback period in months.		16.04

Since the payback period is very attractive (less than a year) the project is financially viable. The project being a recycling project is need of the day, as well the product is having in house consumption of more than 50% throughput, project can be executed on priority basis.

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WHO ARE THE EQUIPMENT MANUFACTURER -

To the best of my knowledge in India there is no one who manufacture the equipment for recycled construction board. WPC equipment is manufactured by only one company named Hardy Smith, Gujrath Most of the suppliers for construction boards are from China & Europe. Some of the equipment manufacturer from China are --

Zhangjiagang Sevenstars Machinery Co.,Ltd

Qingdao Shicheng Plastic Machinery Co., Ltd

QINGDAO XINQUAN PLASTIC MACHINERY CO., LTD

Shanghai Major Machinery Co.,Ltd.

QINGDAO LEADER MACHINERY CO.,LTD

ZHANGJIAGANG NEW TECHNOLOGY DEVELOPMENT CO., LTD.

Qingdao Sanyi Plastic Machinery Co., Ltd.

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