

# INNOVATION TOURNAMENT 2021



**Project Name:** Greennovation Technologies: *Energy Efficient and Low-cost Housing Material*

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## THE PROBLEM

*What can 7.4 million pieces of corrugated iron sheets do?*

On one hand, they can be used to build 152,000 houses. On the other hand, on a worse note, they can emit 652,000 tons of CO<sub>2</sub> during their production process and consume at least 1,000 MW of electricity. Moreover, they require 900°C temperature per batch which is created through consumption of extensive amounts of non-renewable energy sources.

But how widespread is the use of corrugated iron sheets and therefore what is the magnitude of this environmentally threatening issue?

Corrugated iron sheets are the most popular and widespread materials in the housing sector in a developing country like Bangladesh (46% or 14,751,280 houses are made of corrugated iron sheets). Production of these corrugated sheets harms the environment in the following ways:

**1) Consumption of Non-renewable Energy Sources:** As elaborated above, huge amount of electricity is needed to produce corrugated iron sheets. And in an electricity-torn country like Bangladesh, production of electricity is solely dependent of non-renewable energy sources like gas, oil, and coal.

**2) Deleterious Effects of Green House Gases (GHGs):** Apart from consumption of extensive amounts of non-renewable energy sources, the production processes emit good amount of Green House Gases, CO<sub>2</sub> being the prime one. And in a resource constrained country like Bangladesh, there is hardly any way to keep this GHG emissions to a tolerable level.

**3) Use of Toxic Chemical Materials:** Another way through which the manufacturing process of corrugated iron sheets harms the environment is the use of toxic chemical materials like lead, sulphur, and different types of acids.

*But how do we come into play in tackling this environmentally threatening issue?*

The idea is to introduce an energy-efficient, low-cost, and sustainable (having superior mechanical properties) housing material named Jutin<sup>®</sup>, which has the exact product appearance as the current corrugated iron sheets but is produced mainly from natural jute fiber.

The idea directly contributes in reduction of burning of non-renewable fossil fuels, thus minimizing consumption of non-renewable energy sources.

The idea also reduces emission of CO<sub>2</sub> by burning significantly less amount of fossil fuel and thus provides for ways of mitigating the deleterious effects of Green House Gases.

Unlike the corrugated iron sheets manufacturing process, the idea doesn't use toxic chemical materials like lead, sulphur, and different types of acids.

## WHO ARE WE?

We are a partnership venture named Greenovation Technologies, founded by four aspiring students and social-entrepreneurs from the University of Dhaka, Bangladesh and one innovator-entrepreneur from Maulana Bhashani University of Science and Technology, Tangail, Bangladesh.

## WHAT ARE WE GOING TO DO WITH JUTIN®?

### CURRENT BANGLADESHI HOUSING SCENARIO:

Bangladesh, a country of 142.319 million people living in 32.068 million households<sup>1</sup>, has only 2% (641,360 households) brick-built houses (locally known as *pucca* houses) and 46% (14,751,280 households) use corrugated-iron (CI) and galvanized-plain (GP) sheets (known as „tin-built“ houses, *semi-pucca* in nature<sup>2</sup>). The rest 52% (more than 73 million people<sup>3</sup>) either don't have access to basic housing or live in houses built of temporary inferior housing materials like tree leaves (31%) and thatch (21%)<sup>4</sup>. These inferior materials are both temporary and unsecured in nature. Also noteworthy is the current housing backlog in the country: “In Bangladesh, housing needs extend to about 5 million units, with 1.0–1.5 million needed in urban areas”<sup>5</sup>.

### JUTIN®-THE GREEN SOLUTION:

As mentioned earlier, Jutin is a green solution to this huge housing problem in Bangladesh. Apart from addressing the negative impacts created by corrugated iron sheets manufacturing, Jutin® has the potential to contribute greatly to the overall sustainability of the lives of people in Bangladesh. Produced mainly from natural jute fiber, this innovative, cost-effective, and superior product has the potential to reduce the pain of millions of people lacking a proper house.

Mainly two categories of people constitute our market: poor people having temporary houses made of inferior materials who would graduate to better tin-built houses if the prices were low; and price sensitive users of CI and GP sheets.

<sup>1</sup>POPULATION & HOUSING CENSUS 2011, Preliminary Results, July 2011, Bangladesh Bureau of Statistics (BBS)

<sup>2</sup>Ministry of Housing and Public Works, Government of Bangladesh, 2009

<sup>3</sup>16,675,360 households containing 4.4 people on an average

<sup>4</sup>Seraj, S. M. and Ahmed, K. I., (2004); "Building Safer Houses in Rural Bangladesh", Dhaka, BUET, p. 10

<sup>5</sup> Bangladesh Housing Finance, World Bank Report on South Asian Real Estate Sector, October 2010

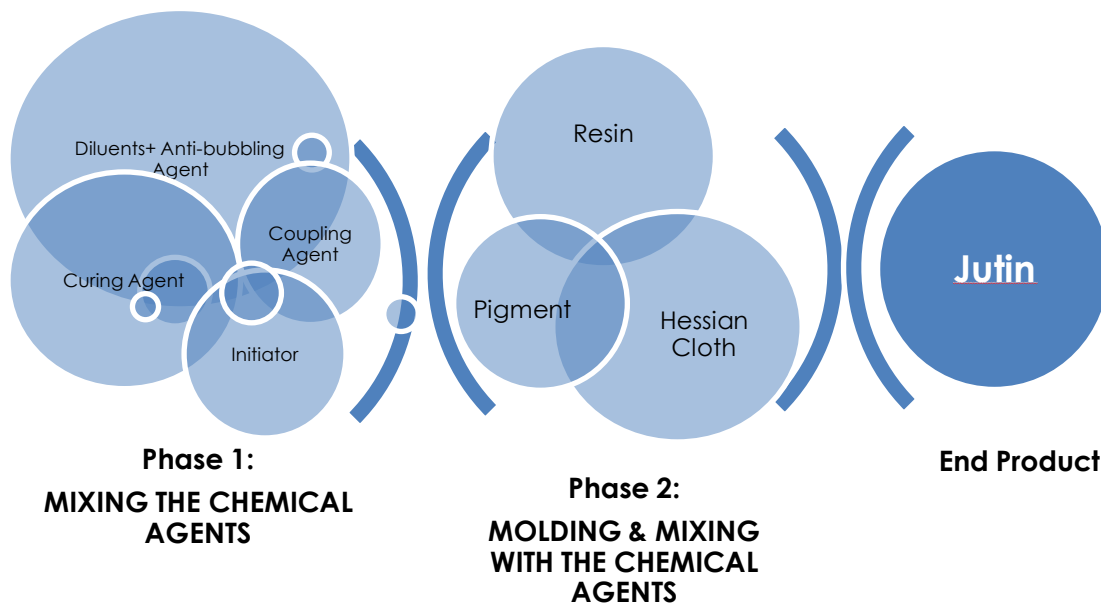
## WHAT ARE THE BENEFITS OF THIS IDEA?

In brief, this idea provides the following benefits:

1. Energy efficiency
2. Enhancing sustainable living by providing people with affordable and mechanically superior housing material

## TECHNOLOGY OVERVIEW

The technology requires coupling of two completely opposite types of materials: jute fiber (which is hydrophilic) and small amounts of unsaturated oligomer resin (which is hydrophobic). The innovation lies in the invention of the coupling agents. Jutin®'s technology is a patent-protected one. This patent-protected unique technology (Patent no-BA1005012) has been developed by an experienced jute and polymeric researcher Dr. Mubarak A Khan. We are already in the process of transferring the patent in the name of the company. We protect our intellectual property rights by making Dr. Khan as an equity partner. He will also be provided with a separate royalty fee for the exclusive right to use the technology.



*Figure 1: Technology in brief of Jutin*

## CURRENT STATUS

Development of patented commercial prototype of Jutin® has already been done (Patent No.: BA1005012). Also, pilot projects based on manual production process has been

undertaken by partnering with different entities like UNICEF, Department of Public Health Engineering (DPHE) of the Government of Bangladesh, Buildtrade Engineering Ltd. etc. for around 14 months.

## CERTIFICATIONS

Jutin® has already gone through various rigid local as well as global certification procedures. As of the submission date, Jutin® has been certified by the following bodies: “Weather Testing” by Bangladesh University of Engineering and Technology (BUET); “Tensile Strength and Thermal Ageing Testing” by American Society for Testing Materials (ASTM); and DIN (German Testing Method).

## MARKET POTENTIAL, SEGMENTATION, AND TARGET MARKET

The total potential domestic market for housing materials is around \$318 million. Using multivariate segmentation method, *geographic segmentation* segments the total market into three geographic regions: salinity affected areas (22,578 villages or 29% of the total land area), non-salinity affected rural areas (53,125 villages or 42% of the total area), and suburban areas (8% of the total land area). Additionally, *behavioral segmentation* entails three segments again: price-driven, quality-driven, and brand-loyal. From the analysis of existing customer behavior we can see that 79% of the consumers are price-driven, 13% prefers quality, and the rests are brand-loyal<sup>6</sup>.

Our primary target market (with the most immediate need) will be the salinity affected coastal areas where rate of poor and hardcore poor people are also have been historically very high. We will target 5% of this primarily in the first 4 years. Secondary target market will be non-saline rural areas. This portion will be reached simultaneously but with a lesser frequency at the beginning.

Initially starting with the districts in the coastal regions, where both poverty and salinity problems are most evident, we plan to start expanding from the very second year. Salinity-resistant feature of Jutin® will help us gain market share quickly. Next we will penetrate in the non-salinity affected rural areas covering more than 14 districts. Once sales start to take off as planned in these areas, our plan is to reaching out to the moderately developed rural and semi-urban areas of the country.

Our competitive advantage stems from two sources: (i) local nature and wide availability of our raw materials, and (ii) very low energy requirements. These give us cost leadership

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<sup>6</sup> Survey carried out in three villages (sample of 90 people) in *Bagerhat* district: *Gangni, Kahalpur, & Rajarhaat*

over our competitors. Also noteworthy is our superior mechanical properties compared to the existing alternatives.

### MANAGEMENT TEAM

The company is run chiefly by the four entrepreneurs who are performing the key management roles. The innovator-entrepreneur is working in the capacity of a Consultant and has his son as a representative in the board. Experienced graduates from relevant production technology field are heading the production activities. Seasoned business leaders are advising the entrepreneurs.

### CAPITAL REQUIREMENT, COMMITTED FUNDING, AND FINANCIAL SUMMARY

The company needs around \$0.3 million of seed capital financing of which approximately \$26,200 has already been committed by the promoter entrepreneurs. Overall 65% of the amount needed is planned to be provided by them. Rest of the funding is planned to be a mixture of SME (Small and Medium Enterprise) loan and venture capital.

Greenovation Technologies has a positive NPV of \$2.3 million with a lucrative IRR of 64% against a cost of capital of 17.11%. The venture pays back its investors within 1.7 years of operation.

### ENERGY EFFICIENCY VALUE OF JUTIN

The energy efficiency benefits of Jutin will be best understood by comparing the production technologies and materials used in producing the corrugated iron sheets. Corrugated iron sheets manufacturers use the following *direct materials*:

Cold Rolled (CR) coils
Zinc Ingots

Along with these, the following *supportive materials* are used:

Chromic Acid      Tin Ingot
Caustic Soda Lead Ingot
Hydrochloric Acid

These coils are used as raw materials for galvanizing under NOF technology. Following such, surface cleaning is done by non-oxidizing furnace at 950°C. Then it goes through molten zinc bath for galvanizing at 460°C.

**In contrast,** Jutin<sup>®</sup> production methodology requires only 70°C temperature to complete the whole process. Thus the production of Jutin<sup>®</sup> requires substantially low amount of burning of fossil fuels for equivalent units of production.

Furthermore, since there's not metallic substance in the Jutin<sup>®</sup>, there's no possibility of rusting either. Therefore it saves the use of a huge amount of use of zinc in the production process for galvanizing.

The overall production process is also free from use of materials like harmful acids and lead. It thus saves our environment from being crammed with toxic waste materials.

In terms of heat absorption, Aluminium absorbs heat more than 5,000 times compared to Jutin<sup>®</sup>. Iron itself is 1,200 times more heat absorbent compared to Jutin<sup>®</sup>. Jutin<sup>®</sup>, being a natural cellulose based product, has significantly lower heat conductivity.

## APPENDIX

### APPENDIX 1: THE MANUAL PRODUCTION PROCESS





## APPENDIX 2: THE PATENT

All communication should quote the number of this notice & should be addressed to—  
Controller of Patents and Designs,  
The Patent Office, Government  
of Bangladesh, Dhaka.

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH  
Department of Patents, Designs & Trade Marks  
**THE PATENT OFFICE**  
Patents and Designs Wing  
DHAKA

Notice of Acceptance.....  
Patent Application No..... **279/2008**  
Serial No..... **1005012**  
Reciprocity date..... **X.**  
Patent of Addition to.....

Under section 6 of the Patents and Designs Act, 1911 (II of 1911) notice is hereby given that the application for a patent made by..... **Dr. Mubarak Ahmad Choudhury** registered as above was accepted on the..... **24<sup>th</sup> January, 2010** application, specification and Drawings (if any) are open to public inspection. The acceptance will be advertised in the Bangladesh Gazette and the printed specification and Drawings (if any) will be available in due course at a price of Taka..... each copy. Within four months of the date of that advertisement, any person may, under Section 9 of the Act, give notice of opposition to the grant of the patent. If there is no opposition, or in case of opposition, if the determination is in favour of the grant of a patent, and if the applicant desires a patent to be sealed, he shall file his request on Form 8 in accordance with Rule 23 of the Patents & Designs Rules, 1933.

Date of issue: **11. 2. 10**  
To  
Md. Abul Kashem Munshi,  
P & D-32 Director General (Incharge),  
Atomic Energy Research Establishment,  
Ganakbari, Savar, Dhaka, Bangladesh.

(S M Enamul Haque)  
for Registrar 11. 02. 10  
for Controller of Patents & Designs.

## APPENDIX 3: TESTS OF MECHANICAL PROPERTIES OF JUTIN

### Thermal Conductivity:

Brick = 0.86 W/(mK)  
Concrete = 1.51 W/(mK)  
Iron = 58.15 W/(mK)  
Aluminum 250 W/(mK)  
Natural jute Fiber 0.13-0.17  
W/(mK)  
USP = 0.17 W/(mK)

Hot Air passes through aluminum 5000 times > Jute Composite  
Hot Air passes through iron 1200 times > Jute Composite



## DIN Testing (German Testing Standards)

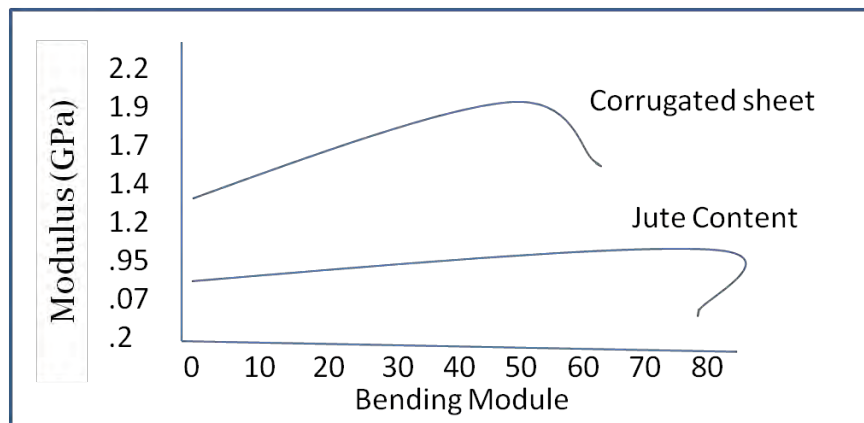


Weather Coating Machine

Material Properties	Approx. Value	Unit of Measurement	Test Standard
Impact Strength	35	KJ/m <sup>2</sup>	DIN 53453
Heat Resistance*	80-100*	°C	
Flammability	94HB	Class	UL 94
Water Absorption	1	%	DIN 53472

## Weather Testing in Bangladesh University of Engineering and Technology

INSTRON 1011- Universal Testing Machine (Humidity level 50%)



## Tensile Strength and Thermal Aging:

	Tensile Strength MPa				
	Normal	0 °C (240days)	4 °C (240days)	50°C (240days)	70 °C (240days)
3L Jute	<b>117</b>	<b>155 (21%)</b>	<b>122 (4%)</b>	<b>113 (-3%)</b>	<b>97 (-19%)</b>

Tested by-

