# THE POTENTIAL OF BAMBOO BASED VALUE ADDED PRODUCTS IN THE CDM

By

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## IPIRTI VISION

**CONSERVATION OF NATURAL FORESTS THROUGH RESEARCH & DEVELOPMENT and ADOPTION OF EFFICIENT TECHNOLOGIES IN THE FIELD OF WOOD AND PANEL PRODUCTS FROM RENEWABLE FIBERS INCLUDING PLANTATION TIMBERS AND BAMBOO WHILE MEETING THE VITAL NEEDS OF THE DEVELOPING SOCIETY.**



## IPIRTI MANDATE

- RESEARCH & DEVELOPMENT
- TRAINING & EDUCATION
- TESTING & STANDARDIZATION
- INFORMATION & EXTENSION

**RELATING TO PANEL PRODUCTS FROM WOOD, BAMBOO AND OTHER RENEWABLE FIBRES INCLUDING AGRO AND FOREST RESIDUES**



## CENTRE FOR BAMBOO DEVELOPMENT

**ESTABLISHED AT IPIRTI, BANGALORE**

**(January 2001)**

**for**

**FOCUSSED RESEARCH & DEVELOPMENT AND TECHNOLOGY ADOPTION**

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## CENTRE FOR BAMBOO DEVELOPMENT

**THE CENTER FOCUSES ON**

- **DEVELOPMENT OF BAMBOO COMPOSITES AS ENGINEERING MATERIALS FOR VARIOUS END USE APPLICATIONS**
- **TECHNO-ECONOMIC FEASIBILITY ANALYSIS OF BAMBOO BASED TECHNOLOGIES**
- **EVOLVING TRANSFER OF TECHNOLOGY MODELS FOR ADOPTION OF BAMBOO TECHNOLOGIES**



## DISTRIBUTION OF BAMBOO IN INDIA

MAIN SPECIES

| | |
|---|---|
| D. strictus | 45% |
| M.bamboosoides | 20% |
| B.arundenacia | 13% |
| D.hamiltonii | 7% |
| B.tulda | 5% |
| B.pallida | 4% |

MAJOR BAMBOO GROWING REGIONS / STATES

| | AREA | GS (percent) |
|---|---|---|
| North East | 25 | 66 |
| Madhya pradesh | 20 | 12 |
| Maharashtra | 10 | 5 |
| Orissa | 9 | 7 |
| Andhra Pradesh | 7 | 2 |
| Karnataka | 5.5 | 3 |

## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

### BAMBOO MAT BOARD

- BETTER MECHANICAL PROPERTIES ie, HIGH MODULOUS OF RIGIDITY AND FLEXIBILITY COMPARED TO PLYWOOD
- ECONOMICAL COMPARED TO PLYWOOD FOR UP TO 6mm IN THICKNESS
- ENCOURAGES EMPLOYMENT OF WOMEN IN RURAL AREAS BY ENGAGING THEM IN MAT MAKING LEADING TO POVERTY ALLEVIATION
- PROMOTES ENTERPRENUERSHIP & SELF RELIANCE



## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

### BAMBOO MAT VENEER COMPOSITE

- USE OF PLANTATION TIMBERS FOR MANUFACTURE OF HIGHER GRADE PLYWOOD
- AN ALTERNATIVE TO STRUCTURAL AND SHUTTERING GRADE PLYWOOD WITHOUT WARPAGE
- SUFFICIENT AVAILABILITY OF BAMBOO
- INDIAN STANDARD SPECIFICATION IS ALREADY EXISTING : IS:14588 :1999 BMVC for general purpose.



## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

### HIGH DENSITY SHUTTERING GRADE PANEL

- REPLACEMENT OF HIGH PRICED IMPORTED VENEERS WITH BAMBOO MAT
- RESIN FORMULATIONS OPTIMIZED FOR HIGH DENSITY SHUTTERING GRADE PANELS OF 1.1gm/cc TO 1.2gm/cc.
- 2 DIFFERENT CONSTRUCTIONS VIZ., BAMBOO MATS AND COMBINATION OF BAMBOO MATS & VENEERS
- THE STRENGTH PROPERTIES MEETS THE REQUIREMENT OF IS: 4990 - 1993 SPECIFICATION FOR SHUTTERING GRADE PLYWOOD IN ALL CONSTRUCTIONS.
- EASE THE PRESSURE ON IMPORT OF TIMBER



## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

### BAMBOO MAT MOULDED DOOR SKIN FOR DOOR SHUTTERS

- REDUCTION IN THE CONSUMPTION OF TIMBER FOR MAKING DOORS AS THEY ARE HOLLOW DOORS WITHOUT WOOD BATTENS
- SAVES ABOUT 1/3 QUANTITY OF TIMBER
- THEY ARE MORE STRONGER THAN IMPORTED SKIN BOARDS MADE FROM HIGH DENSITY FIBRE BOARD BECAUSE OF ITS HIGH IMPACT RESISTANCE
- LEADS TO IMPORT SUBSTITUTION.
- MOU SIGNED FOR TECHNOLOGY TRANSFER TO KERALA STATE BAMBOO CORPORATION

Bamboo Mat Moulded Skin Board

Door with Bamboo Mat Moulded Skin Board



## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

### BAMBOO MAT CORRUGATED SHEET

HAS IMMENSE POTENTIAL AS ROOFING MATERIAL

- ECO-FRIENDLY
- HIGHLY RESILIENT
- LOW WEIGHT
- LOW THERMAL CONDUCTIVITY
- AESTHETIC APPEARANCE

THE TECHNOLOGY DEVELOPED UNDER A PROJECT SPONSORED BY BUILDING MATERIAL TECHNOLOGY PROMOTION COUNCIL, NEW DELHI



## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

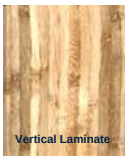
### RIDGE CAP FOR BAMBOO MAT CORRUGATED SHEETS [BMCS]. [SPONSORED BY BMTPC]

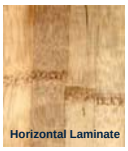
- DIMENSIONALLY STABLE
- FIRE RESISTANT
- NON PERMEABLE
- BOILING WATER PROOF
- ANTI-TERMITE AND WEATHER RESISTANT
- DURABLE
- ECO-FRIENDLY
- COMPATIBLE WITH BMCS
- SUITABLE FOR WIDE RANGE OF ROOF ANGLES
- REPLACEMENT FOR THE PRESENT PRACTICE OF USING FLAT BOARDS TO AVOID PERFORATIONS.
- READY & EASY TO FIX.

## BAMBOO PRODUCTS DEVELOPED AT IPIRTI

**BAMBOO LAMINATES**

- CAN BE MADE TO ANY WIDTH AND THICKNESS.
- STRENGTH PROPERTIES COMPARABLE TO TEAK WOOD
- ACCEPTANCE OF THE PRODUCT IS WIDE BECAUSE OF EXCELLENT PHYSICAL AND MECHANICAL PROPERTIES
- NORMALLY USED FOR FLOORING PURPOSE


Vertical Laminate


Horizontal Laminate



## BAMBOO HOUSING


Prefabricated BMB- wood shelter at IPIRTI campus


Demonstration house at IPIRTI campus


Multi purpose portable BMB shelter


Two bedroom guest house at IPIRTI campus


Two storied bamboo house built at IPIRTI campus


Pre-Fab Double Walled Modular House



## BAMBOO HOUSING TECHNOLOGY

**PRE-FAB HOUSES USING BAMBOO COMPOSITES-BMTPC SPONSORED**

- BAMBOO PANEL WALL & ROOF COMPONENTS CAN BE USED IN PREFABRICATED HOUSES FOR THE EMERGENCY RELIEF AND TEMPORARY USE.
- THE PEOPLE AFFECTED DUE TO NATURAL DISASTER NEED IMMEDIATE RELIEF SUCH AS SHELTERS AND REHABILITATION WORKS.
- DEVELOPMENT OF SHELTERS UTILIZING BAMBOO COMPOSITES ARE EASILY TRANSPORTABLE, ERECTABLE AND RE-USABLE AT A REASONABLE COST.
- BY USING SCREWS AND STEEL CONNECTORS, THE BAMBOO PANEL COMPONENTS CAN BE FIXED TO LIGHT STEEL FRAMES AND ASSEMBLED INTO PANEL FOR PREFABRICATED HOUSES.
- STEEL SECTIONS FOR STRUCTURAL FRAMEWORK. BMB FOR WALL CLADDING & FLOORING & BMCS FOR ROOFING ARE USED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## FEATURE PROPECTS

- INDUSTRIAL PROCESSING OF BAMBOO HAVE SHOWN A HIGH POTENTIAL FOR PRODUCTION OF COMPOSITE MATERIALS WHICH ARE COST EFFECTIVE AND CAN BE SUCCESSFULLY UTILIZED FOR STRUCTURAL AND NON- STRUCTURAL APPLICATION
- TECHNOLOGY EVOLVED CAN BE EFFECTIVELY ADOPTED FOR AFFORDABLE HOUSING
- TECHNOLOGY CAN BE EASILY ADOPTED BY SKILLED MASON CARPENTERS, BUT ORIENTATION TRAINING PROGRAMME RECOMMENDED
- BASED ON THE WORK DONE SO FAR THE TECHNOLOGY CAN BE ADOPTED IN AREAS WITH NORMAL WIND PRESSURE OF 100Kg/m$^2$ MAXIMUM HEIGHT OF WALL LIMITED TO 2.4 METER WHEN USED WITH A BAMBOO OF 80– 100 mm DIAMETER, 12 mm WALL THICKNESS SPACED AT 1.2 METER CENTRE-TO- CENTRE



## ESTIMATED EMPLOYMENT OPPORTUNITIES FOR VARIOUS BAMBOO TECHNOLOGIES

DEVELOPED AND COMMERCIALIZED BY IPIRTI

| SL NO: | PRODUCT | EMPLOYMENT IN PERSON DAYS (Three Shift Basis) WITH ONE HOT PRESS, 10 DAY LIGHTS | | | |
|---|---|---|---|---|---|
| | | UNSKILLED | SEMISKILLED | SKILLED | TOTAL |
| 1 | BAMBOO MAT BOARD(BMB) | 600,000 | 54000 | 6000 | 660,000 |
| 2 | BAMBOO MAT VENEER COMPOSITE(BMVC) | 400,000 | 10500 | 15000 | 425500 |
| 3 | BAMBOO MAT CORRUGATED SHEET(BMCS) | 300,000 | 36000 | 6000 | 342000 |
| 4 | BAMBOO MAT MOULDED TRAY(BMMT) | 900 | 2700 | 900 | 4500 |
| 5 | BAMBOO WOOD(LAMINATES) | - | 120000 | 9000 | 129000 |
| 6 | BAMBOO MATCH STICKS | 5,000 | 15000 | 3000 | 23000 |



## ENERGY REQUIRED FOR PRODUCTION OF WOOD PRODUCTS AND NON-WOOD ALTERNATIVES

| MATERIAL | ENERGY REQUIRED MJ/Ton |
|---|---|
| Aluminium sliding | 209705 |
| Steel joists | 51371 |
| Plastics | 39600 |
| Clay bricks | 8755 |
| Concrete | 8544 |
| Hardboard(wet process) | 20675 |
| Particle board | 10760 |
| Plywood | 8508 |
| Medium density fibre Board(MDF) | 7806 |
| Bamboo Mat Veneer Composites | 6000 |
| Bamboo Mat Board/Bamboo Mat Corrugated sheets | 5000 |
| Rice Particle Board | 5000 |
| Laminated Veneer Lumber(LVL) | 4008 |
| Seasoned sawn wood | 1669 |
| Bamboo | 950 |

## CARBON (CARBON DIOXIDE) RELEASED AND STORED IN THE MANUFACTURE OF BUILDING MATERIALS

| MATERIAL | CARBON (DIOXIDE) RELEASED Kg/t | Kg/$m^3$ | CARBON (DIOXIDE) STORED Kg/$m^3$ |
|---|---|---|---|
| ROUGH SAWN TIMBER | 30 (110) | 15 (55) | 250 (917) |
| STEEL | 700 (2567) | 5320 (19510) | 0.00 |
| CONCRETE | 50 (183) | 120 (440) | 0.00 |
| ALUMINIUM | 8700 (31903) | 22000 (80675) | 0.00 |
| BAMBOO | 29(106) | | 350(1283) |

* OLDER PLANTS HAVE LOWER $CO_2$ UTILIZATION CAPABILITY COMPARED TO GROWING ONES
* BAMBOO BEING FASTEST GROWING PLANT IS MOST FAVOURED
* USE OF TIMBER FOR DURABLE PRODUCTS ENSURES FIXATION OF $CO_2$ FOR LONG PERIODS
* IN THE MANUFACTURE OF 'Fe' & 'Al', OTHER TOXIC GASES LIKE CO, $SO_2$, NITROGEN OXIDES TOTALLING ABOUT 40 Kg/ton OF STEEL RELEASED. APART, ABOUT 150,000 LITRES OF CONTAMINATED WATER CONTAINING TOXIC GASES, METALS, OILS, ETC., THEREBY POLLUTING AIR AND WATER.



## Employment Opportunities for Mat Weavers in Mat Weaving for Industrial Panel Products from Bamboo(BMB, BMVC & BMCS)

| | |
|---|---|
| No. of units proposed | 50 units for the production of BMB, BMVC and BMCS |
| No. of Hot Presses proposed for each unit | 1 each for BMB and BMVC with 10 Day-lights and 1 for BMCS with 6 Day-lights |
| Production capacity per annum 3- shift basis | 5,50,000 cum [1,75,000 BMB, 3,75,000 BMVC and 30M.Sq.M BMCS eqlt. to 2% Roofing Sheets |
| Employment Opportunities I)Mat weaving activity @ 2 mats/person/day II)Skilled factory workers III)Supervisor/managerial | 2,50,000 persons throughout year [75 million person days] 32,500 persons throughout year 4,500 persons throughout year |
| Quantity of Wood replaced | 0.9 million Cum |
| Reduction in use of hazardous/energy intensive materials | 0.112 million tons |
| Annual requirement of green bamboo [60% m.c.] | 1.3 million tons [Rs.195 crores @ 1500/ton] |
| Dry weight of bamboo | 0.812 million tons(35% of Biomass is carbon) On an average 0.28 million tons of carbon can be stored |



## CONCLUSION

LONGIVITY(LIFE) OF BAMBOO PRODUCTS @ 25 YEARS FOR EXTERIOR GRADE PRODUCTS

1 TON OF DRY BAMBOO WHEN CONVERTED INTO EXTERIOR GRADE BAMBOO PRODUCT WILL STORE 350Kgs OF CARBON(1283 Kgs OF $Co_2$)




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