

**Waste Tyre Recycling
To
Wood Replacement Manufacturing Plant**



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ABOUT DENA GROUP

Dena Group was established over 24 years ago in 1990 by Dr Brian Sulaiman, PhD, BSc, PGD, MAC, M.AusImm, Founder and Chairman of Dena Group, in the field of advanced Nano-technology. The Company utilises a patented Reactor that modifies particles to achieve dramatic improvements in productivity, quality and profitability, with a diverse range of applications from pharmaceuticals to inks and more recently, in the eco-products arena where we are converting waste tyres in to high value and durable construction products. We have worked with Clients from different backgrounds include Glaxo Smith-Kline, ICI, CIBA, BP, Boots, BASF, 3M, Crown, Akzo Nobel, Astra Zeneca, Asian Paints and many more, with Joint Venture projects world-wide exceeding sales in 2010 of £500M.

List of companies within Dena Group

<ul style="list-style-type: none"> • Dena Nano Ltd • Lena Nanoceutics Ltd • Dena Nanotech Ltd • Nanoplas Technologies Ltd • Dena Energy Ltd • Dena-Wafi Nanotechnology Ltd • Dena Nano-Wood Ltd • Dena Contract Management Ltd • Nano-Advanced Industries Ltd • Dena Resources (Ireland) Ltd • UDPL Dena India Pvt Ltd 	<ul style="list-style-type: none"> • Dena Technology (Qatar) Ltd • Dena Technology (Jordan) Ltd • Dena Nano Technology Pvt Ltd • Oyster Dena Pvt Ltd • Royal Dena Nano Techno Industries Ltd • Arab British Environmental Industries Ltd • Dena Synergy Pvt Ltd • Dena Nano Technology Lanka Pvt Ltd • Dena Global Resources • Dena Technology (Brazil) Ltd
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DENA TECHNOLOGY: -ZERO WASTE & ZERO EMISSIONS - END OF LIFE (EOL) TYRE CONVERSION

Dena Nano-Wood Ltd has developed an End of Life (EOL) tyre recycling technology that creates a range of high value and durable construction eco-products **whilst using zero emissions and zero waste**. As the tyres are available worldwide for a fraction of price compared to virgin rubber, the raw materials cost is negative and there is also steel and fibre that can be reclaimed and sold off to provide an additional income. Whilst tyre crumbing is established, the material forming technology is completely new and has no competitors as it is proprietary and covered by several International Patents since 1991. Dena Nano UK Ltd uses a unique process to produce these materials using micronized rubber and a special **Nano-particle composite**. The resulting material has an almost endless range of final products, **all of which are infinitely recyclable** using the same processes that created them in the first place. These range from super-strength and durable 'wood replacement' to special porous irrigation hose. A copy of one of the Patents registered for this technology is shown in **Appendix A: Patent Copy**

INTERNATIONAL CERTIFICATIONS

The products manufactured are available in different specifications, shapes and sizes and are all Certified to British Standards (BS) as well as meeting the equivalent European Regulations and International Standards. The Company is certified to Quality Standard ISO 9001 under the UK CCAS certification.

HELPING TO SOLVE A GLOBAL ENVIRONMENTAL CRISIS



- The demand for wood products is causing deforestation and severely damaging precious rainforests, killing thousands of species and ecosystems globally. Furthermore, **illegal logging is costing US\$10 Billion per annum and destroying lives**.
- In terms of atmospheric impact, **1 tonne of living trees produces 1 tonne of oxygen per annum and consumes over 1.5 tonnes of CO2**.
- This is Nature's 'antidote' to excessive CO2 and it is ³ essential that we preserve it and by switching to replacement wood, we can achieve it.

KEY TYRE FACTS



- According to the WBCSD (World Business Council for Sustainable Development), a total of 1 billion end-of-life (EOL) tyres are generated globally every year
- There are approximately 4 billion EOL tyres in landfill and stockpiles globally and as they do not decompose, they can be a fire risk affecting the air with toxic fumes as well as a breeding area for mosquitoes
- Some landfill tyre-fires have been burning for years

There are fewer places to dump EOL tyres and most developed Countries are struggling to find viable alternatives to landfill which is now illegal in most regions. In recent years, an increasing number of tyre crumbing Plants have opened up, only to find that the market is saturated with an over-supply of shredded and crumbed rubber with nowhere to go. As a result, thousands of such businesses have been stockpiling these tyres for the Gate Fee alone and in many cases have been shut down by the EPA (Environmental Protection Agencies)

The EU Landfill Directive banned whole tyres from landfills in 2003. By 2006, tyres in any shape or form were banned from landfills in EU Member States. In order for the EU Landfill Directive to be implemented in a timely manner, new disposal routes for scrap tyres need to be developed with great urgency in all EU Member States.

THE BUSINESS OPPORTUNITY: Replacement Wood Products from scrap (EOL) Tyres

The Global Market for replacement wood products is in excess of **US\$ 300 Billion** per annum and is growing at a rate of 9% per annum, due significantly to the continued demand from emerging Global markets [*source: WBCSD 2010*].

The environmental impacts mentioned previously are serious and pave the way for a



substantial opportunity for Dena Partners to do 'green business' that achieves the following goals:-

- Re-cycles end-of-life tyres that are impacting landfill sites and are an environmental hazard
- Reduces reliance on wood that is now superseded by Dena's synthetic material for thousands of applications like decking, external construction and marine applications
- Provides the marketplace with an alternative to wood that is cheaper, water-resistant, impervious to chemicals, will not rot or decay, is stronger and harder and incredibly, is 100% recyclable

Business Process

The Plant will manufacture finished products from waste materials like waste tyres and waste thermal materials. Crumb rubber of size 30 -50 mesh and thermal waste of similar size is required for the manufacturing process. The plant is capable of producing 0.5 tons of finished products per hour. Mainly, the Business will involve manufacturing of finished products and then exporting those finished products worldwide as per required.

Technology to be used

<Insert your company name> will buy all the machines and Technology from Dena Nano-Wood Ltd. Dena Nano-Wood Ltd has developed a new technology, which is first of its kind in the entire world and has been honoured with 5 different business innovative awards. The technology is based on the principles of Nano-Technology, which is the technology of this decade and the future. Through this technology we can convert the waste rubber material from the tyres and similar products into useful and valuable wood replacement and different construction eco-products. These products perform and look just like wood and carry all the good attributes of wood but eliminate the negative side of wood, like effects from weather, insects and water. Our finished products are green and environmental friendly.

Competitors

This is a new technology and its process is patent by Dena Nano-Wood Ltd. No one



other than Dena Nano-Wood Ltd knows how to use this technology. <Insert your company name> will be the first company to open Tyre to Wood recycling plant in <our country>. Because there is no other company involved in similar business the competition is almost zero. Not only the competition is zero in <Our country> but this is true for international market.

The machine can be used to produce range of products, which can easily compete against existing products. For example, construction tiles (cladding) currently are being manufactured using steel, aluminium, wood or PVC. All these materials are costly to buy and at the same time these materials are not durable and strong as our material. As known that our products are made up of 100% waste materials, which helps us lower the production cost.

Demand of the product

Being a green product, many big construction firms have approached us for our product. They have given a letter of intent, which clearly states that, their requirement for this product is huge. Currently, the capacity of the machine is limited to roughly 2400-3000 tons a year. From the above, one can figure out the demand of our product. This is just one client and we have many others buyers similar to this client.

Location of the plant

According to the plan, the plant is to be setup in <our address>. The land on which the plant will be setup should be connected via highway and ports are not too far.

The raw material and other inputs

Raw material, rubber crumb and waste thermal material will be bought from the local market. The only material that client needs to import from outside <our country> is the Nano particles, which is only produced by Dena Nano-Wood Ltd in UK. Raw material cost for making 1 ton of finish product will be around £ 500 and the operational cost per ton will be £150. The plant will produce around 250 tons of finished products each month.

Dena can supply complete raw material as a package for £ 550 FOB. Only colour/pigments need to be bought from local market.

The machine is capable of running 24 X 7. We accept it to run 24 X 6 and 1 day in a week for cleaning and maintenance. Labour required to run the machine for 24 hours is 10 (9 labours and 1 technician), Generally 3 labours are required to run the machine for 1 shift i.e. (8 hours).

Electricity consumption is around 350 Kw/h for running the full production machine all other equipment's

Example: Cost of 1 ton material

Material	Cost
Rubber crumb	150
Thermal Materials	250
Nano Particles & Additives	100
TOTAL	500

Processing cost	
Electricity cost per ton	80
Labour cost per ton	60
Plant rent	10
Total	150

The Production capacity and the space required

The production capacity of the plant is 0.5 ton/hour. The machine can produce around 12 tons of finished products in 24 hours. The expected production per month is 250 tons, which will sum up to 3000 tons a year.

All the production activities will be carried in the plant. No work will be outsourced.

Space required for setting up the whole plant is nearly 60 X 20 meters. One Machine will take roughly 40 X 6 m and the remaining space can be used for storing raw materials and finished products.



Any by-products turned out in the Production Process

The production process is very efficient and due to that there is no waste during production. For example, if you put 1 ton of raw material in the machine, the machine will produce similar quantity of finished product. Efficiency of this machine is 99% and therefore there are no wastes and no by-products.

Packaging and shipment

Packaging will be carried out by the manufacture according to the requirements of the buyer. Shipment responsibility will be of the buyer and they will be responsible for collecting the packed products from production site. The buyer will be responsible for arranging and collecting the 20 ton container to and from production site in which the finished products will be shipped.

Power Consumption

350-380 Kw of electricity is required to run the plant for 1 hour or say to produce 0.5 ton of finished product. We have similar machines in smaller sizes as well. The plant can be run using the normal electricity grid and there is no need of a captive power plant for this purpose. For backup, a diesel power generator producing 450 Kw is advisable to purchase.

TECHNOLOGY OVERVIEW

Dena Nano-Wood Ltd Tyres-to-wood like Materials production line



The Stages of the complete process are as follows:

- Stage 1 Mixing of all raw material together with Nano particles in Surface reaction chamber
- Stage 2 Processing the raw material through surface intensification extruder
- Stage 3 Moulding, forming and cooling process
- Stage 4 Cutting and packaging

This is a proven technology that utilises the latest processes to transform waste tyres into replacement wood products and exhibits zero emissions and zero waste

Stage 1:

Mixing of all raw material together with Nano particles in Surface reaction chamber



To blend all the ingredients together and also heat the material to remove all moisture and unwanted gases. The surface reaction process occurs at this point (which facilitates material bonding later on in the process). This system also cools the material to the required temperature for further processing

Stage 2:

Processing the raw material through surface intensification extruder

- This is a key stage in the formulation process whereby Nano-composite particles are combined with waste plastics as a 'matrix binder' together with pigments as needed and transforms the raw materials into the unique replacement wood material.
- This Patented low-temperature process allows creation of a variety of finished products of varying density, shape, tensile strength etc. and utilises a unique zero emissions, zero waste process.
- Ultimately, all products are 100% RECYCLABLE, which is also a unique benefit of this technology

Stage 3

Moulding, forming and cooling process



- After the product comes out from mould it goes on to forming mould where it is cooled to retain its shape.
- Pulling table pulls the product at required and steady speed. The speed can be controlled by the controller provider as per required.

Stage 4

Cutting and packaging



- The Cutting Machine is designed to cut the required length of sheet either automatically or manually
- Once cut, labour can collect and stack the products

Our recommendation

We suggest starting with 2 wood-replacement lines initially. The crumb rubber can be purchased locally or outside.

In future if you expand and have more than 4 production Lines of Wood-Replacement, then the Shredding and crumbing plant is recommended.

Business Model

Royalty

This technology to be supplied on a 3% Royalty Basis on Sales of the Finished Product and this gives exclusivity in your country on a specific product. The Royalty Agreement includes full technical support and standardisation support, plus help in ensuring the Finished Product meets Market Requirements.

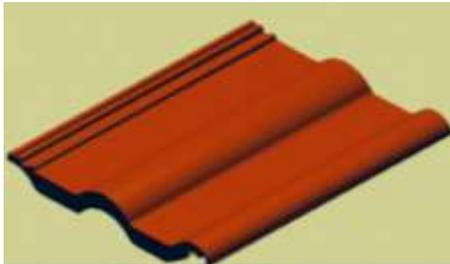
Technology Transfer and Services provided with Royalty

- ❖ **Technical Support – Remotely or In Person**
- ❖ **Exclusivity for a Specific Product in a specific Territory as agreed**
- ❖ **Technology Transfer & Know-how**

- ❖ **Formulation & Design of Products as necessary**
- ❖ **Manufacturing Licence**
- ❖ **Marketing Support & Assistance utilising Dena Offices world-wide**
- ❖ **Standardisation Assistance**
- ❖ **Quality Control – ISO 9008**
- ❖ **On-going Training**
- ❖ **Assistance in reducing the costs for raw materials etc. as available**
- ❖ **Provision of New Developments in relation to Products and Market Quality etc. to be passed to the client**

PRODUCT RANGE

Some examples of the Dena wood replacement products are illustrated below:-

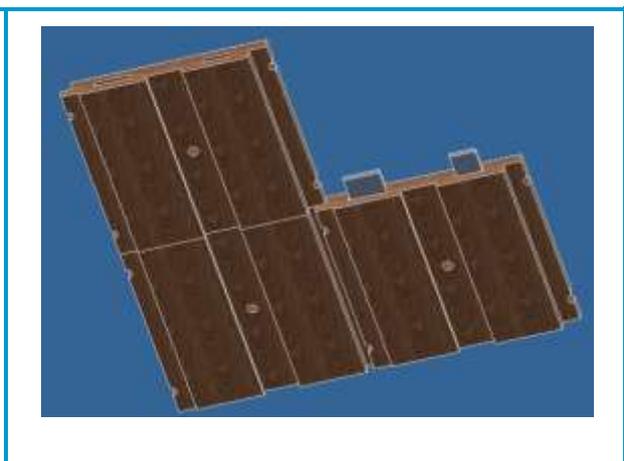
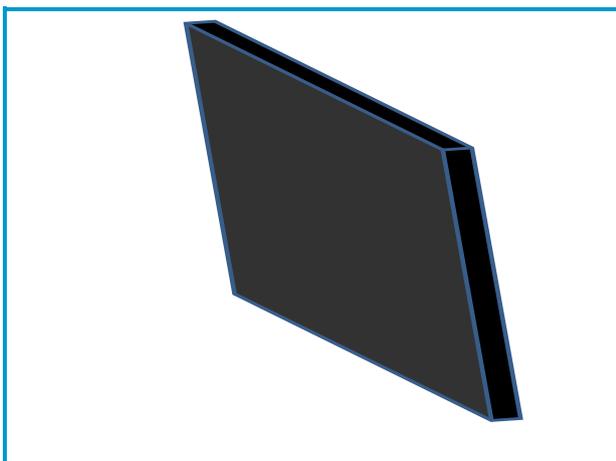


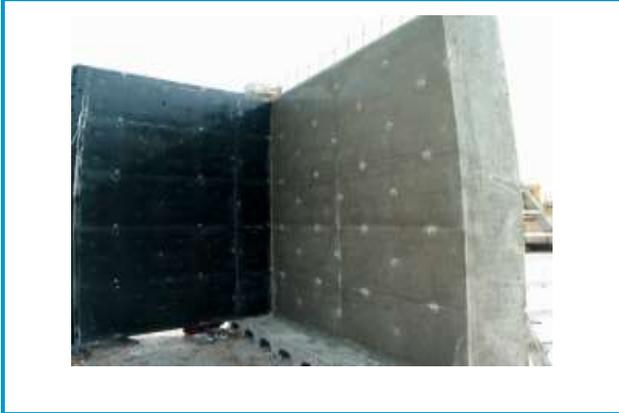
The applications of this product are endless. As the **hardness and shape of the material can be totally controlled and customized**, it can be used to produce over 120 different wood replacement products including outdoor flooring/decking, roofing tiles, construction sheets & outdoor furniture etc.

Applications



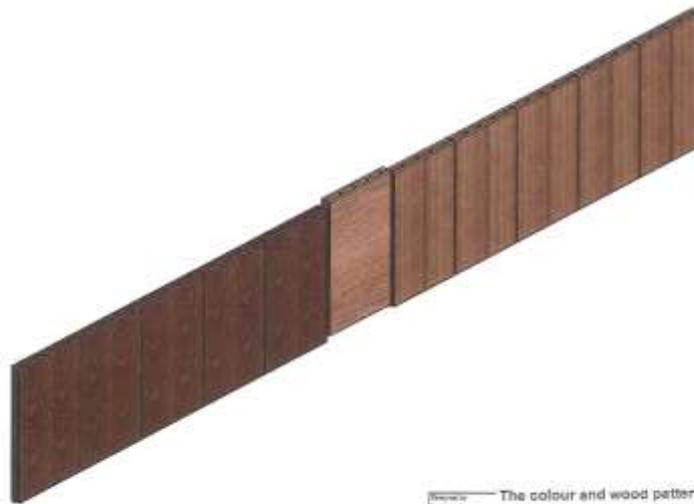
The process can also be used to manufacture diverse solutions including special rubber matting for high-resilience applications (e.g. military) and a range of irrigation hoses, including a special **“leaky hose”** that provides watering without wasting precious water







The colour and wood pattern is for illustration. The Colour depends on Pigment used at the time of production



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Low cost bottom line: - These products are the most cost-effective option as they are easy to maintain and last longer.

Application: - Replacement of plywood casing for production of concrete walls and ceilings.

List of products:

<ul style="list-style-type: none"> ● Indoor products <ul style="list-style-type: none"> ○ Doors ○ windows ○ cabinets ○ drawer 	<ul style="list-style-type: none"> ● Outdoor products <ul style="list-style-type: none"> ○ Roofing tiles ○ Flooring tiles ○ Decking ○ Plywood ○ shuttering
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PRODUCTS FOR THE CONSTRUCTION INDUSTRY

Sheets/Boards



Decking tiles



Roofing Tiles



Flooring tiles



OUTDOOR WOOD REPLACEMENT AND GENERAL PRODUCTS

There are a number of products with high market demand and others with seasonal demand in various countries worldwide. Products can be customised to suit client requirements or sold in the general marketplace.

These products are impervious to saltwater, treated water and U.V. rays, plus they repel gasoline, diesel and other fuels making them the perfect choice for, docks, seawalls, sea front footpaths seawalls, boat docks and other marina plus many related areas or residential uses.

They are also ideal for other outdoor uses such as roofing tiles, ordinary tiles, and provision of decorative shade, use in Military Installations, for livestock trailer boards and wall liners (e.g. Horse boxes), footpaths, and decking.

KEY PRODUCT BENEFITS

There are significantly increased profit margins with the wood replacement products compared to alternative 'plastic wood' options.

Benefits and Features

- 100% water resistant (water will not penetrate or be absorbed) compared with wood or WPC
- 100% Insect proof
- Fire Resistant
- Ultra Violet resistant
- Stronger and more durable than WPC
- Will not absorb most of the petrochemical products
- Resistant to salts of all types
- Designed to be reusable hundreds of times (finished products can be recycled several times to manufacture new products)
- Ideal for weather insulation (heat, sun radiation)



- Good sound insulation
- Ideal in humid areas.
- Several lengths available. Designed as standard sizes or as special request sizes (subject to quantity)
- Easy to clean.
- Totally safe to use.
- Impact proof
- Can be drilled, nailed and screwed. Will hold nails and screws better than wood or WPC.
- Supports adhesive use
- Paint and coating is not needed to our products. However, if needed can be done
- Easily to change the softness or the hardness of the materials by changing formulations to suit the product applications.
- Available in various colors and shapes

Marketing Assist from Dena of the products

Dena Group will assist in marketing and selling of the products. We can help in following ways

- Link the client directly to the interested buyers around the world. These buyers are willing to purchased products from Dena provided they get their design and price.
- Over these years, we have made some good selling network around the world. Our clients can use our network to sell their product.
- We work with several agents and distributors around the world; our clients can work together with our agents and distributors and their network.

SUMMARY

This summary proposal has outlined a technology that is both timely in its development and critical in its Global demand for the following key reasons:-

- By utilising end-of-life tyres as the prime raw material, both profits and environmental efficiency is assured, because in most cases they are available at a “negative cost” (i.e. waste companies and authorities globally will pay a Gate Fee for EOL tyres to be safely disposed of away from landfill or open incineration)
- The Dena Nano-Wood Ltd technology is **Zero Emissions and Zero Waste**, as the finished products are themselves **100% recyclable**
- The resulting composite materials produced by this ground-breaking technology has a potential market of some **US(\$)** **300 Billion** and
- Our products are highly resilient to chemicals, completely waterproof, adaptable and meets all World-wide standards for tensile strength, durability and safety.
- Typically, the materials produced can be sold at a 70% discount off their wood counterparts
- The demand for wood products is causing deforestation and severely damaging precious rainforests, killing thousands of species and ecosystems globally. Furthermore, illegal logging is costing US\$10 Billion per annum and destroying lives. In terms of atmospheric impact, 1 tonne of living trees produces 1 tonne of oxygen per annum and consumes over 1.5 tonnes of CO₂. This is Nature’s ‘antidote’ to excessive CO₂ and it is essential that we preserve it and by switching to replacement wood, we can achieve it

Installation and Commissioning:

- The installation and commissioning of the plant can be completed within 2 to 4 weeks from completion of the building works and delivery of all items to site.
- Dena will provide 2 experts and will utilise a local engineer who will be trained to assist in the installation and commissioning, and later the maintenance of the Equipment.

Installation & commissioning £50,000 per line

Delivery: 6-8 months from receipt of order and clearance of down payment

Packaging, Transport & Insurance: To be quoted prior to despatch

Client will have to buy some equipment's from the local market, which are

- Chiller for the Extruder
- Small Weighing machine