+ A self sustained agri-industrial method for transforming biomass into valuable bioproducts for the green industry

Green Chemistry

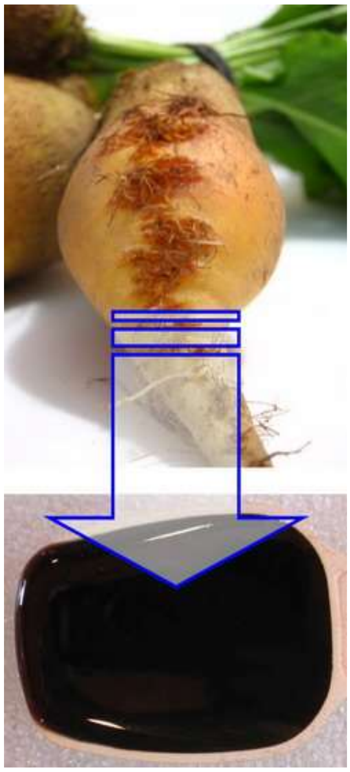

Hydrophonic Greenhouse
intensive sugarbeet farming

GREEN
Power Industries Ltd
Power Technologies Ltd
Future Srl
Industries Malta Ltd

GPI Bio Sugar

an innovative refining method

from
SUGARBEET
to
BIO MELASSE
for the
GEEN CHEMISTRY



The "Multiphase Cold Crystallization"

A proprietary method that does not use chemicals and therefore may use larger beets, reducing the use of valuable land to produce the same tonnage.

C) SUGAR PRODUCTION AT FARM LEVEL

A network of Bio Refineries can replace large factories, eliminating most of the draw-backs common to these structures.

A Bio Sugar plant is positioned near the farming area, offering a number of benefits:

- **No cost to transport beets to the plant.**
- **No pollution due to road traffic.**
- **No chemicals needed for refining.**
- **Higher yield by using Super Beets.**
- **Lower refining costs (less machines).**
- **Lower maintenance costs.**
- **Lower operating costs.**

A) SIMPLIFIED REFINING PROCESS

Traditional refineries are too expensive.
For their industrial process they use too much energy and many expensive chemicals.

A new patented method:
" Multiphase Cold Crystallization " able to reduce the number of machines for the industrial process.

Refining costs are significantly reduced:

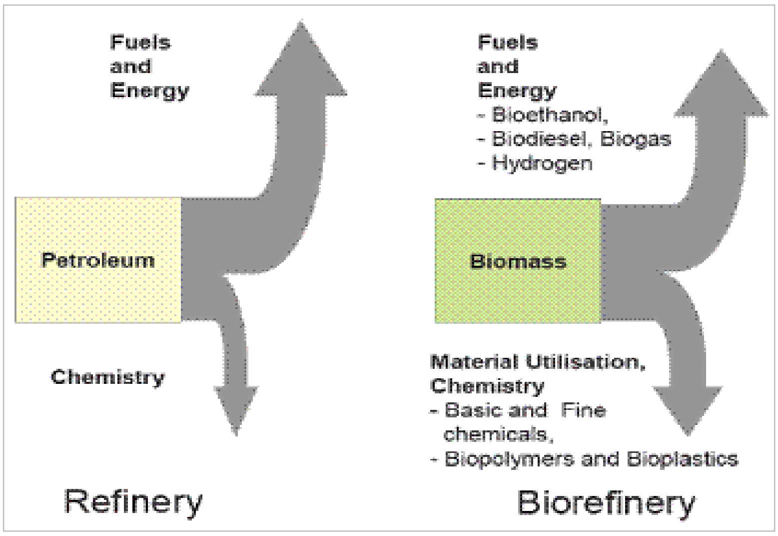
- No expensive chemicals
- Reduced investment in machinery
- No cost to transport beets

B) SUPER BEETS

“Super Beet" Seeds give more yield per hectare, from standard 60-70T to over 100T.

These larger beets cannot be used by traditional refining mehod due to their high content of nitrates. Its elimination would be too costly due to the large amount of chemicals required for it.

GPI Bio Refinery
for the Green Chemistry



This bio refining method is perfect for transforming sugar melasses into byproducts for Biorefineries
(polymers, bio-solvents, etc.)

A concept that involves the integration of three innovative farming and industrial methods:

INNOVATION "A"

Greenhouse for Sugar Beets farming

Sugar Beets may be intensively grown in a controlled greenhouse environment.
A multi-level Hydroponic structure designed to reduce the greenhouse footprint.
With 3.000 m2 hydroponic surface it is possible to grow 1.000 t/ha of beets, 17 folds more than open field farming (70 t/ha),
For this result it is necessary to:

I. Install four Hidroponic layers.
II. Induce three crops a year.
III. Use Super Beets seeds and special organic fertilizers.

Air temperature is not chritical for beet's crops and therefore little heathing is needed. Most energy is required to control the soil-mix temperature and its flow through the growing beds. Beet's processing will also produce sufficient biomass to feed a power unit for generating electric and thermal energy. An energy self-sufficient structure.

Hydroponic Farming: One section of the greenhouse is used as beet's nursery for controlling the plants during the initial growing phase. When the small plants are 10 cm, they are transferred into the hydroponic soil-mix. With this procedure we eliminate all those early-stage growing risks common with open field farming, guaranteing a 100% crop integrity and success. Beet roots grow in a compound carefully blended to allow an easy flow through the growing beds (soil-mix, fertilizers and water). This soil-mix will circulate at set intervals allowing nutrients to feed the roots.

Some studies have been made on the most suitable blend for Super Beets farming, using larger quantity of nitrates.
The air is thermally adjustable. The soil-mix may be heated at set times of the year for inducing plants to start a new crop (three crops a year are possible). The Hydroponic architecture is designed to ease the soil-mix flow with simple pumps.
The liquid fertilizers fed into the soil-mix are computer controlled, according to a special farming protocol.

INNOVATION "B"

Larger sugar beets and nitrates control.

Sugar Beets love Nitrates and given the chance they could generate a crop exceeding 100 T/ha instead of 50-70 T. However farmers are requested by the traditional sugar refineries to limit the amount of nitrogen and azote since their refining process is not able to eliminate these substances. The Bio Sugar Cold Crystallization method does not have this limitation.
Many farmers and animal breeders produce an excess of nitrogen and nitartes and have problems to meet the Autority's strict disposal rules. This surplus may be easily used in the Super Beets Hydroponic farming system.

INNOVATION "C"

Industrial Process / Multiphase Cold Crystallization method

This bio industrial process needsone fraction of the energy and half of the machines used by traditional sugar refineries.

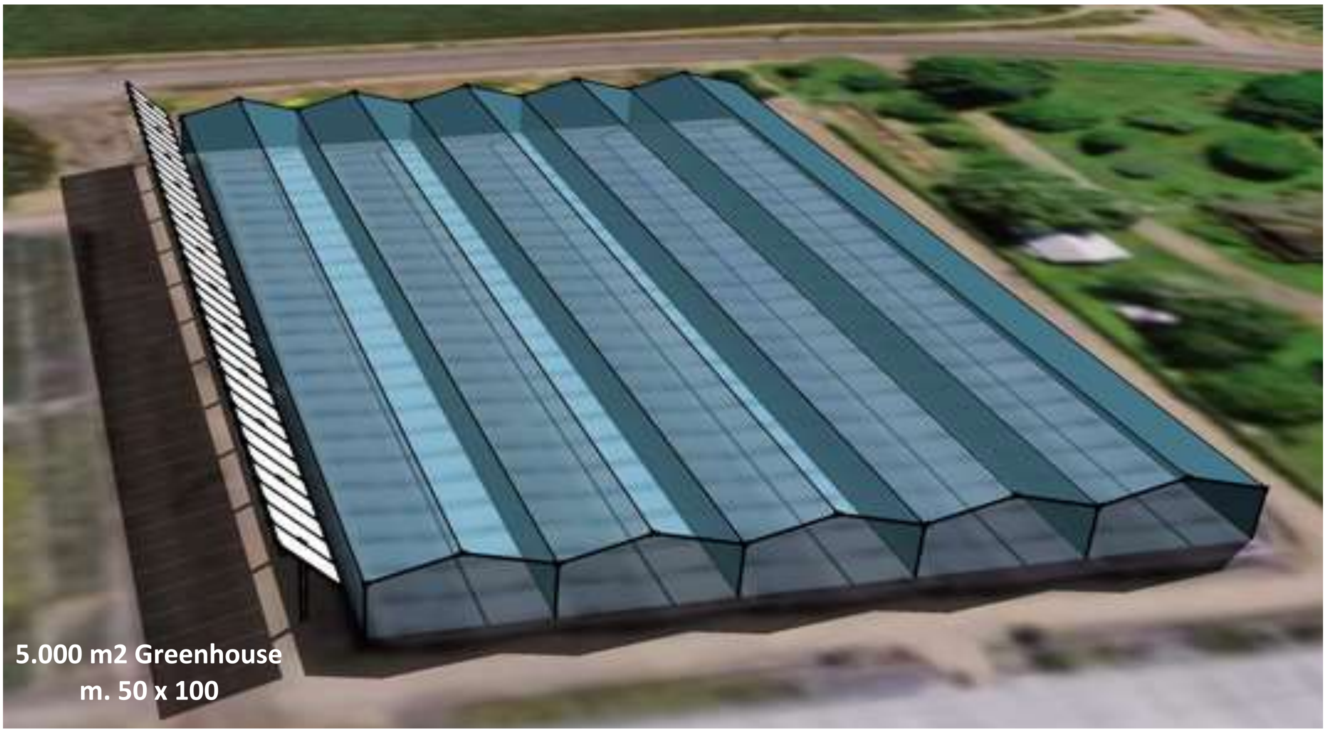
Greenhouse
intensive farming method

Hydroponic system designed to minimize greenhouse footprint.

Framing structure integrated to the Bio Sugar refinery

An agri-industrial unit for processing 2.5 T/hour of beets

- 400 m2 of prefabricated light industrial building
- 4 - 5.000 m2 of greenhouse light structure
- One Biomass power unit



GREENHOUSE INTENSIVE FARMING – MULTI-LEVEL HYDROPONIC SYSTEM

SUGAR BEET FARMING	1 Level	4 Levels	N. Beets m2	N. Beets x Level	Kg Beets m2	Yield 1 Shift 1 Crop	Yield 3 Shifts 1 Crop	Yield 3 Shifts 3 Crops
Tot. Greenhouse area	5.000 m2							
1 Hydroponic level	4.000 m2		10	40.000	10 Kg	40 Tons	120 Tons	360 Tons
4 Hydroponic levels		16.000 m2	10	160.000	10 Kg	160 Tons	480 Tons	1.440 Tons

Development of biochemicals

from renewable sources

through

biotechnological processes

List of known products whose technical characteristics are replicable by PHAs extracted from Sugarbeet:

- Low density polyethylene (LDPE)
- High density polyethylene (HDPE)
- Polypropylene (PP)
- Polyvinylchloride (PVC)
- Polystyrene (PS)
- Polyethylene (PE)
- Polyethylene terephthalate (PET)

1.000 T/year of sugar beets will generate:

- 100 T (10%) Sugar Melasse suitable for conversion into bio chemical elements.
- 150 T (15%) Biomass (dry pulp) usable as animal feed (excellent for dairy farms)
- 100 T (10%) Sugar Syrup usable as bio fuel for the industrial process.
- 650 T (65%) Clean Water usable by the hydroponic farming system

Top Bio chemicals from sugar beet

Ability to obtain biochemicals from biomass through the application of biotechnological processes, not in competition with the food chain.

Bio-based polymers offer important contributions by reducing the dependence on fossil fuels and through the related positive environmental impacts such as reduced carbon dioxide emissions.

High performance PHAs biopolymer

A new family of biodegradable polyesters derived from sugar beets.
PHAs is a polyester produced in nature by bacterial fermentation of sugar.

More than 100 different monomers can be joined by this family to create materials with extremely different properties.
Thermoplastic or elastomeric materials ca be created with melting points ranging from 40 to 180°C.
These elements are the result of bacteria nourished by beet juices.

Bio-degradable polymers

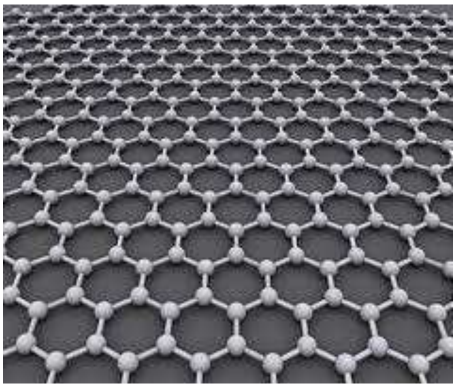
Obtained from Sugar Beet Waste.
A Product that fully exploits its excellent bio degradability factor in water. This type of polymer biodegradation represents the 'future' of biodegradability worldwide.

Natural elimination of a biopolymer in water in just a few days.
Produced from sugar co-products or sugar waste material.
It dissolves in 10 days in normal river or sea water. It leaves no residues.

Less Electronic Waste with Bioplastics

Bioplastics used to design electronic devices with low environmental impact.
Recovery of materials is easier and cheaper With 50 million tons of waste produced worldwide every year, smartphones, tablets, computers, etc. are now a serious problem for the environment.

To reduce the impact of this e-waste has arrived the revolutionary bioplastics: this polymer (100% naturally biodegradable in water and soil) can be used as a substrate for electrical circuits.
Furthermore when combined with suitable nanofillers, it can act as an electricity conductor, with extraordinary, as yet unexplored potential.



Graphene

Sugar has a 43% carbonium content, ideal to be transformed into Graphene.
The use of nanoparticles as additives to enhance polymer performance has long been established for petroleum-based polymers.

Combining these nanofillers with bio-polymers could enhance a large number of physical properties, including barrier, flame resistance, thermal stability, solvent uptake, and biodegradability, relative to unmodified polymer resin.

This nano-reinforcement is a very attractive route to generate new functional biomaterials for various applications.

Bio products from sugar:

Lactic acid is produced by fermentation from sucrose

ETHYL LACTATE

- Biodegradable solvents
- chiral building block

L-LACTIC ACID:

- acrylic acid
- biodegradable polymers
- emulsifiers

POLYLACTIC ACID:

The PLA materials have mechanical properties that lie somewhere in between that of polystyrene and PET:

- Packaging
- Films
- Packaging foam
- Containers (biodegradable)
- Coatings for papers and boards
- Fibres
- Clothing
- Carpet tiles (Interface Inc.)
- Nappies
- Bottles
- Biodegradable bottles

From Biomass to Bio Chemicals through:

a) Physical methods:
b) Thermal methods:
c) Chemical methods:
d) Microbial methods:

To produce any of thse bio feedstock:

- Cellulose,
- Starch derivatives,
- Glucose and fructose,
- Glycerol,
- Fatty acids
- Vegetable Oil
- Bio Ink
- Color Pigments
- Coloranti e pigmenti
- Paints
- Detergents
- Solvents
- Stickers
- Starch
- Natural Rubber
- Tryglicerides
- Flavour and Fragrances
- Farmaceuitcals

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Fast Payback

Hydrponic System

Multi-Level

FINANCIAL EVALUATION Greenhouse Intensive Farming					
		2015	Year 1	Year 2	Year 3
Direct Costs:					
Greenhouse (4 levels Hydroponic farming)		3.000 m2	3.000 m2	3.000 m2	3.000 m2
Yield Super Beets (3 crops/year)	Tons		1.000	1.000	1.000
Melasses for Green Chemistry	Tons		100	100	100
Sugar Syrup (bio fuel for industrial process)	Tons		100	100	100
Biomass (dry pressed pulp as animal feed)	Tons		150	150	150
Sugar beets delivered to the plant (cost)	€/Ton	€ 15	€ 150.000	€ 155.000	€ 160.000
Bio chemicals feedstock processing costs	€/Ton	€ 250	€ 260.000	€ 270.000	€ 280.000
Dry Pressed Pulp cost (Animal feed)	€/Ton	€ 12	€ 12.000	€ 13.000	€ 14.000
Sugar Syrup cost (Bio Fuel)	€/Ton	€ 20	€ 20.000	€ 21.000	€ 22.000
Plant operating cost	€/Ton	€ 20	€ 200.000	€ 205.000	€ 210.000
Plant energy cost (Bio fuel / self sufficient)	€/Ton	€ 0	€ 0	€ 0	€ 0
Hydroponic operating cost	€/Ton	€ 15	€ 150.000	€ 155.000	€ 160.000
Greenhouse/ Hydroponic energy cost	€/Ton	€ 10	€ 100.000	€ 110.000	€ 120.000
Other costs	€/Ton	€ 10	€ 100.000	€ 110.000	€ 120-000
Total Costs:	**€/Ton**	**€ 340**	**€ 992.000**	**€ 1.039.000**	**€ 1.086.000**
Green Chemistry feedstocks	€/Kg	€ 25	€ 2.500.000	€ 2.600.000	€ 2.700.000
Biochemicals from Bio Sugar Melasses	Kg	100.000			
Animal Feed selling price	€/Ton	€ 250	€ 37.500	€ 40.000	€ 44.000
Animal Fedd production	Tons	150			
Sugar Syrup for bio fuel	€/Ton	€ 0	€ 0	€ 0	€ 0
Bio fuel for industrial operations	Tons	100			
Totale Sales:			**€ 2.537.000**	**€ 2.640.000**	**€ 2.744.000**
Gross Profit (before Interests, taxes):			**€ 1.545.500**	**€ 1.601.000**	**€ 1.658.000**
CAPEX	1 yr	€ 2.500.000	€ 0	€ 0	€ 0
Capex - Financial Interests (6%)	15 yrs		€ 230.000	€ 230.000	€ 230.000
Profit (before Tax):			**€ 1.315.500**	**€ 1.371.000**	**€1.428.000**
Payback:	**23 Months**				
IRR:	**70 %**				

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