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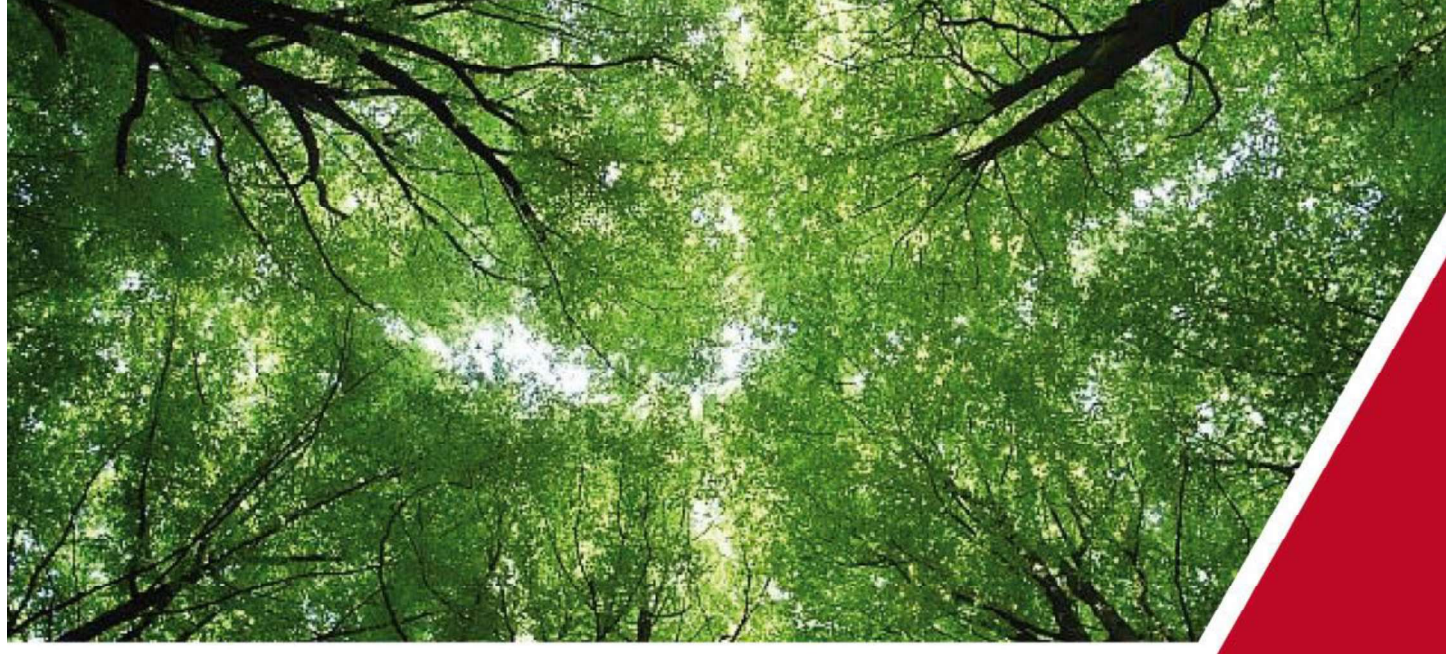


*High performance bio-based
components for gasoline
and jet fuel:*

- **REWOFUEL**
- **IBN-One**

*ADEME-NEDO Workshop
2019 March 12th*

Bernard CHAUD

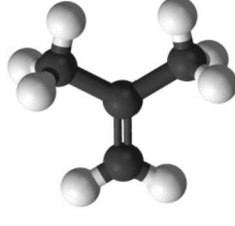


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These factors include, among other things, commercial, technical and other risks e.g. associated with estimation of the price of carbohydrate resources, the meeting of development objectives and other investment considerations, as well as other matters not yet known to the Company or not currently considered material by the Company.

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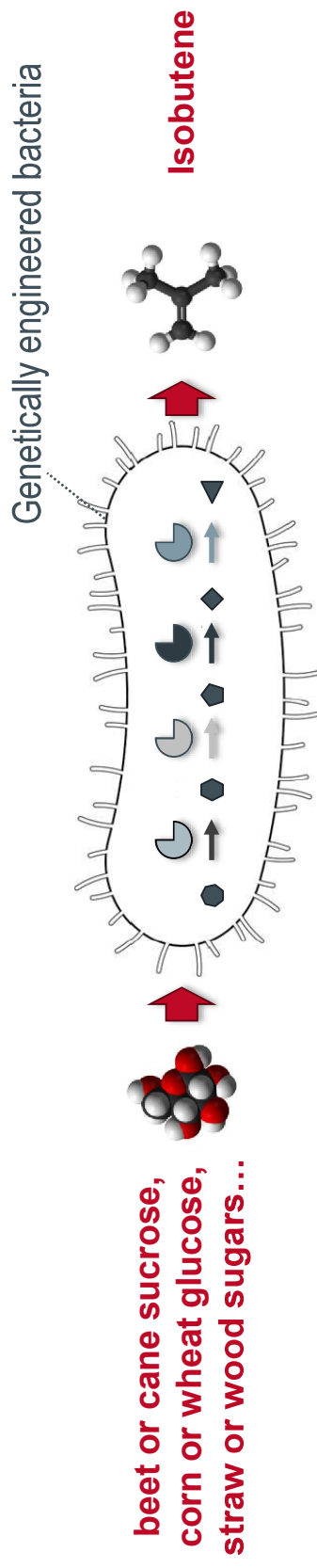
Producing and converting bio-isobutene



- Created in October 2008, **Global Bioenergies** is a french SME,
Listed on Euronext Growth: ALGBE
- has developed a unique, innovative process to convert **renewable feedstocks into bio-isobutene**, a platform molecule (building-block) which can substitute existing fossil-isobutene.
- Isobutene derivatives are widely used as **high-performance cosmetic ingredients and fuels components**

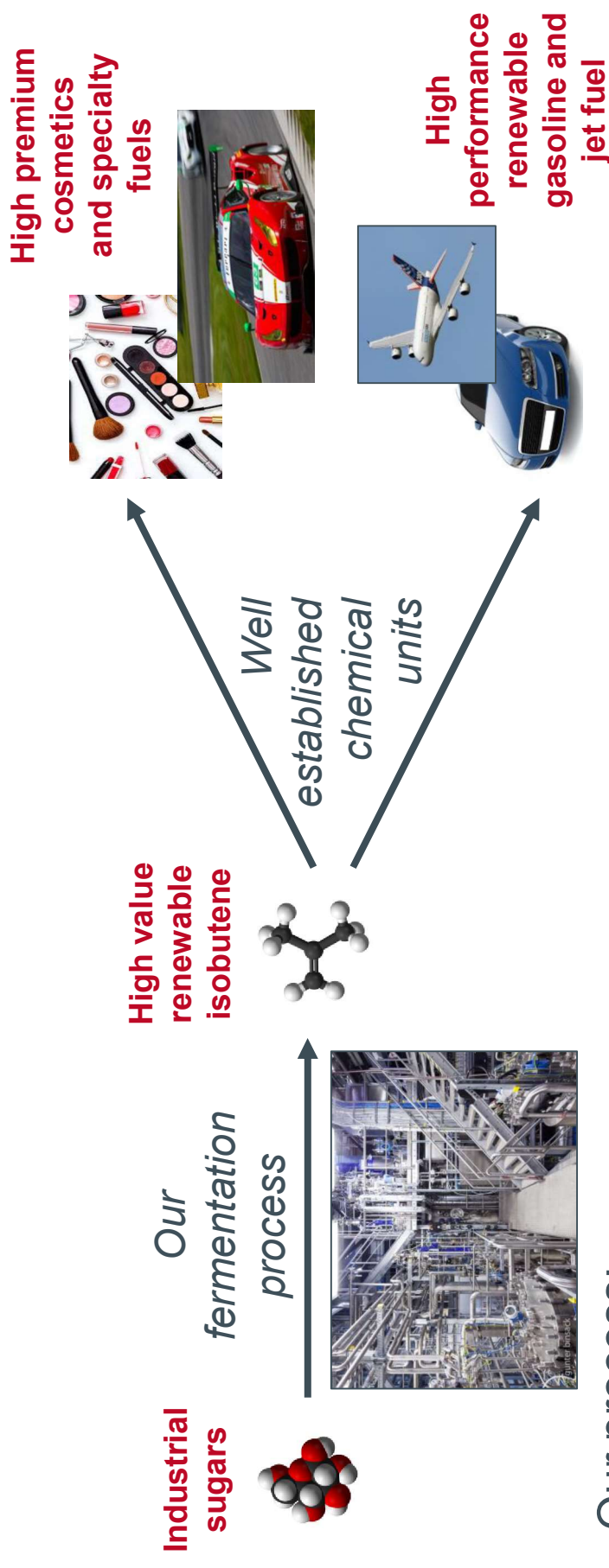
Unique Science and strong IP

- We taught bacteria to convert sugars into isobutene, a gaseous 4-carbons building-block molecule traditionally derived from fossil oil (>15 million tons/yr)



- No biological starting point because Isobutene is not produced in Nature → We created an artificial metabolic pathway, first ever. Huge technology barrier overcome.
- First ever fermentation process to a gas. Brings key benefits: abrogation of product-to-strain toxicity and simple purification scheme. Now validated.
- Metabolic and chemical engineering breakthroughs covered by an IP fortress surrounding a know-how citadel.

Our carbohydrate-to-hydrocarbon fermentation process



- Our process:
 - Engineered bacteria based on a novel synthetic biology approach
 - Fermentation process to a gas, bringing game changing operational advantages
 - **Well established chemical processes** allow to extract and convert bio-isobutene into **high performances end-products**

The technology is now mature

- 2018: Major breakthroughs achieved at lab-scale on yield and productivity, soon expected to be reproduced at demo-scale
- First ton produced in 2017

Commercial Plants

2017
Demo plant in
Leuna, Germany
5,000L
i.e. 100 tons per year capacity

2015
Pilot plant in
Pomacle, France
500L

2012
R&D in Evry,
France
40L



Deployment projects with big names:

- ISOPROD project: **L'Oréal, Cristal-Union**, Global Bioenergies, IBN-One (supported by French state organisation **ADEME**)



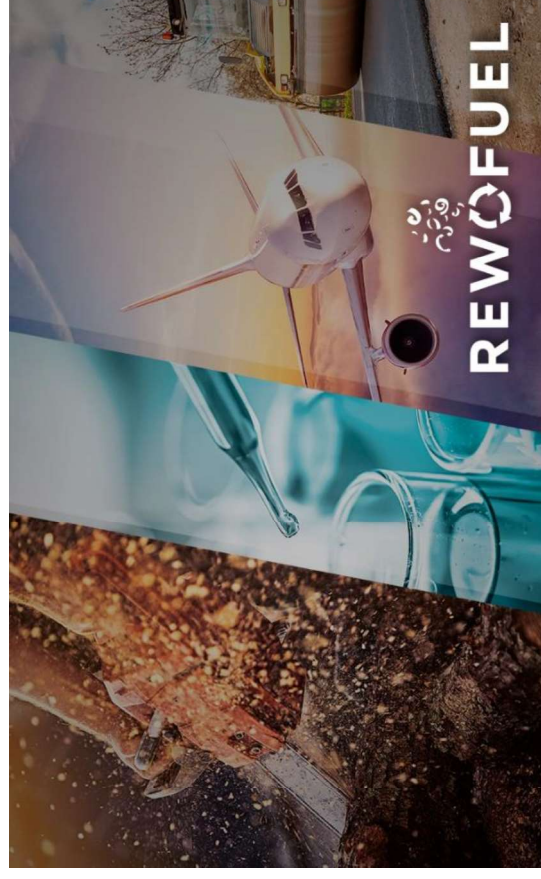
- OPTISOCHM project: **CLARIANT, INEOS**, Global Bioenergies, **TECHNIP-FMC**, IPSB, Energy-Institutue (supported under EU **Horizon 2020** program by BBI-JU)
- REWOFUEL project: **SEKAB, NESTE-Engineering Solutions**, Global Bioenergies, Granul-Invest, **Ajinomoto-Eurolysine**, **REPSOL**, PEAB, **TECHNIP-FMC**, IPSB (supported under EU **Horizon 2020** program by INEA)
- Deal with **AUDI**



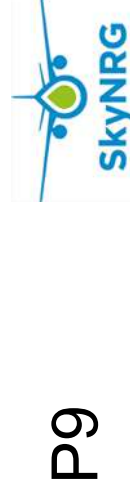
REsidual soft WOod conversion to high characteristics drop-in bioFUELS



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11 Partners from 8 EU Member States:



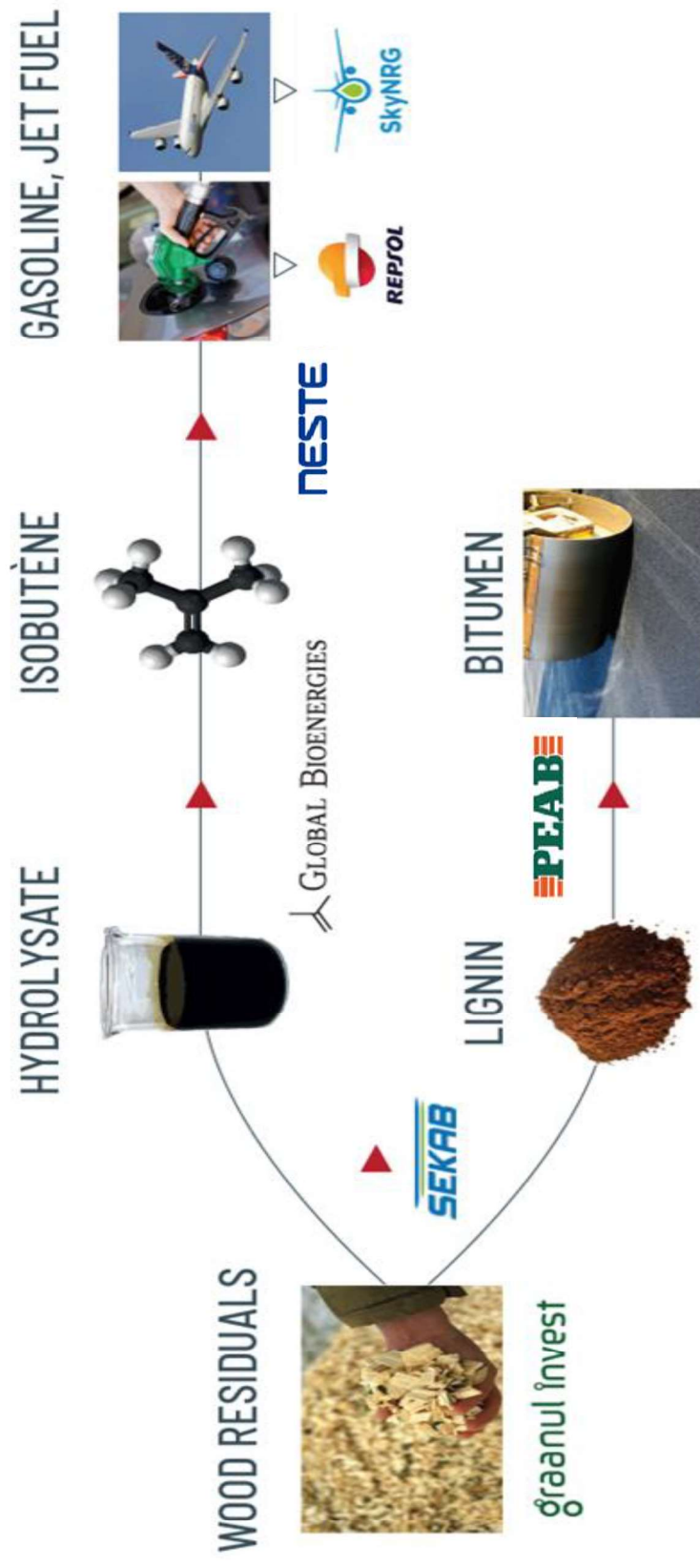
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Process routes and applications

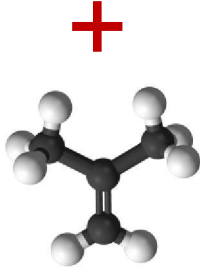


1. ETBE : fact sheet



ETBE

*Well established
chemical unit*



Isobutene

+

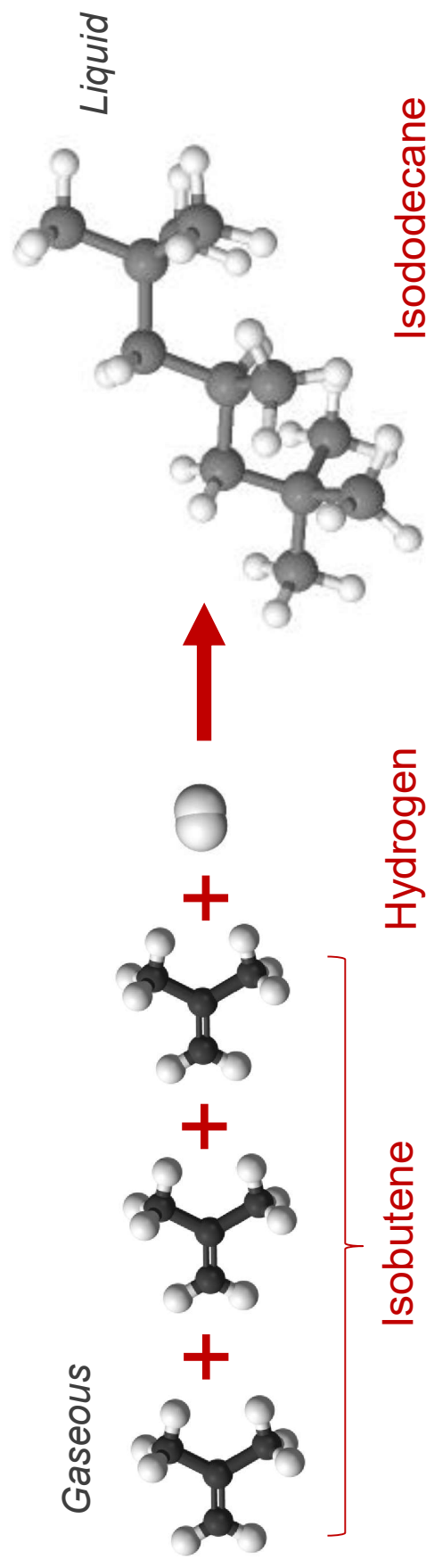


Ethanol

- ETBE is an octane booster additive reducing the level of ultrathin particles at the exhaust pipe. Can be added up to 22% in European gasoline.
- “Traditional ETBE” is only 37 % renewable as only the ethanol part is bio-based.
- full-bio-ETBE, 100% renewable, brings in x 2,7 more renewable than “traditional ETBE” without modifying gasoline formulation.
- Our 100% bio-based ETBE was added in June 2018 to the French list of biofuels eligible to tax incentives.

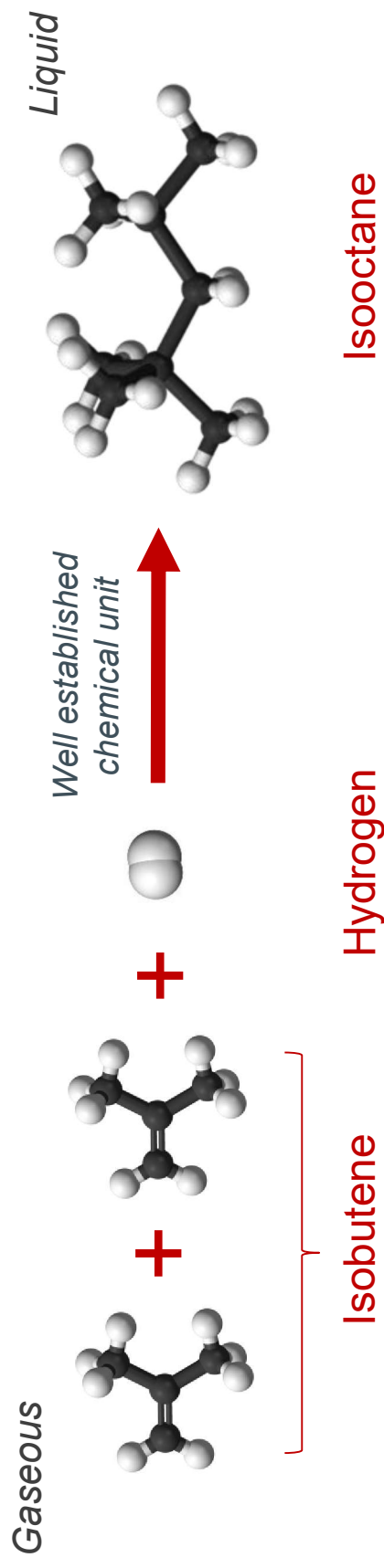


3. Isododecane :fact sheet



- Isododecane is widely used as an emollient in rinsed and non-rinsed cosmetics
- Isododecane is also approved for blending up to 50% into jet fuel. One of the very few options for introducing bio-jetfuel

2. Isooctane : fact sheet



- Isooctane is the gold standard for gasoline engines (octane rating 100)
- It can be blended at a high level (>30%) in fossil gasoline batches, much higher than the ethanol blendwall of 10% for unmodified vehicles
- It has specific high premium markets in specialty fuels

Moving to commercial scale exploitation



IBN-One, the first commercial plant project, is on its way and has the potential to become the most profitable plant in the field.

Global Bioenergies' main milestone is to bring it to life.

IBN-One: Rationale

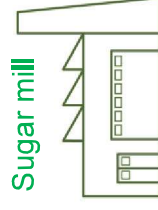
IBN-One is a 50-50 Joint-Venture

between

Global Bioenergies and Cristal Union

(#4 player in the European sugar

industry - €2.5b in revenues)



Sugar mill



- 1** Production – Industrial sucrose is converted into gaseous, low purity isobutene
- 2** Purification – isobutene is isolated from surrounding fermentation gases
- 3** Shipping – Liquid high purity isobutene (99.7%) is stored and shipped for chemical applications
- 4** Conversion – Part of the production is converted on site into bio-fuels and other derivatives

- High availability of sugar because of the end of the European quota system
→ Sugar players are looking for additional markets
- Global Bioenergies' process is a bridge between low quality sugar and high-value markets
- IBN-One's mission is to finance, build and operate the first commercial plant based on Global Bioenergies' Isobutene process
- Capacity: 50,000 tons of isobutene and derivatives:
 - 30,000 tons isobutene + 20,000 tons ethanol to produce ETBE for road transportation, or
 - 30,000 tons isobutene to be converted into isododecane for cosmetics and jet fuel, or

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