



BETARENEWABLES

Bioraffineria a partire da biomassa: risultati conseguiti e prospettive per il futuro

November 28th
Dario Giordano

SUMMARY



- **The biorefinery concept**
- Beta Renewables: who we are
- Biofuel and Biochemicals

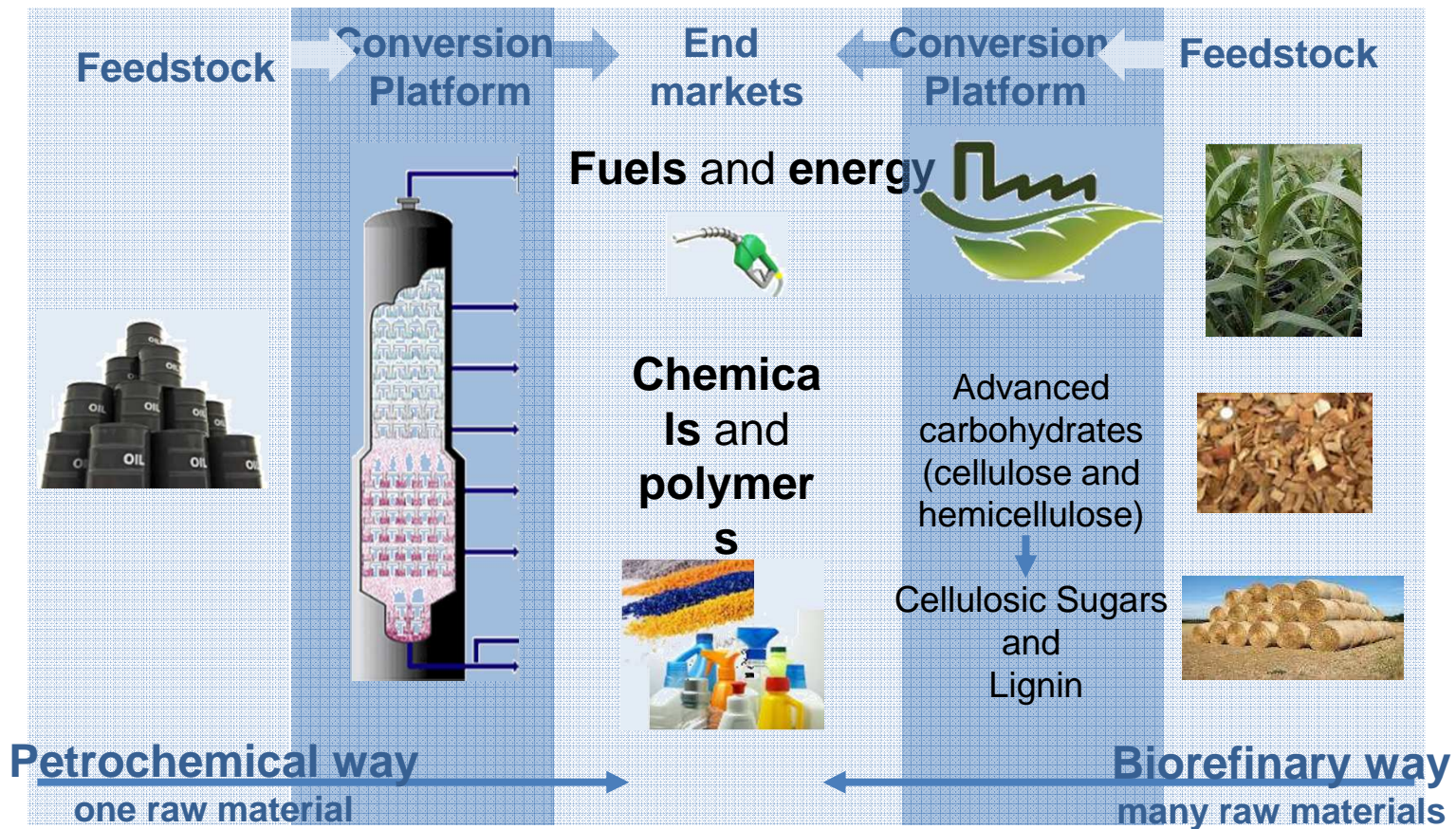


The Biorefinery Concept



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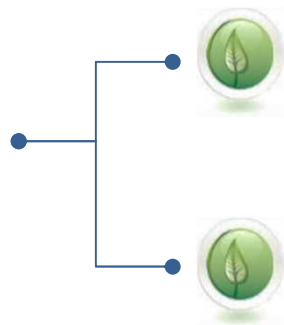
The biorefinery concept is analogous to today's petroleum refinery, which produce multiple fuels and chemicals from petroleum



The Biorefinery Opportunity: Reality or dream?



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Competing with oil

Commodities and consumer goods from biomass

Is it possible?



Common position of the industry

«Traditional biocommodities are too expensive [...] and cellulosic sugar is far away of being at low capex and low opex»



The Biorefinery Opportunity: Reality or dream?

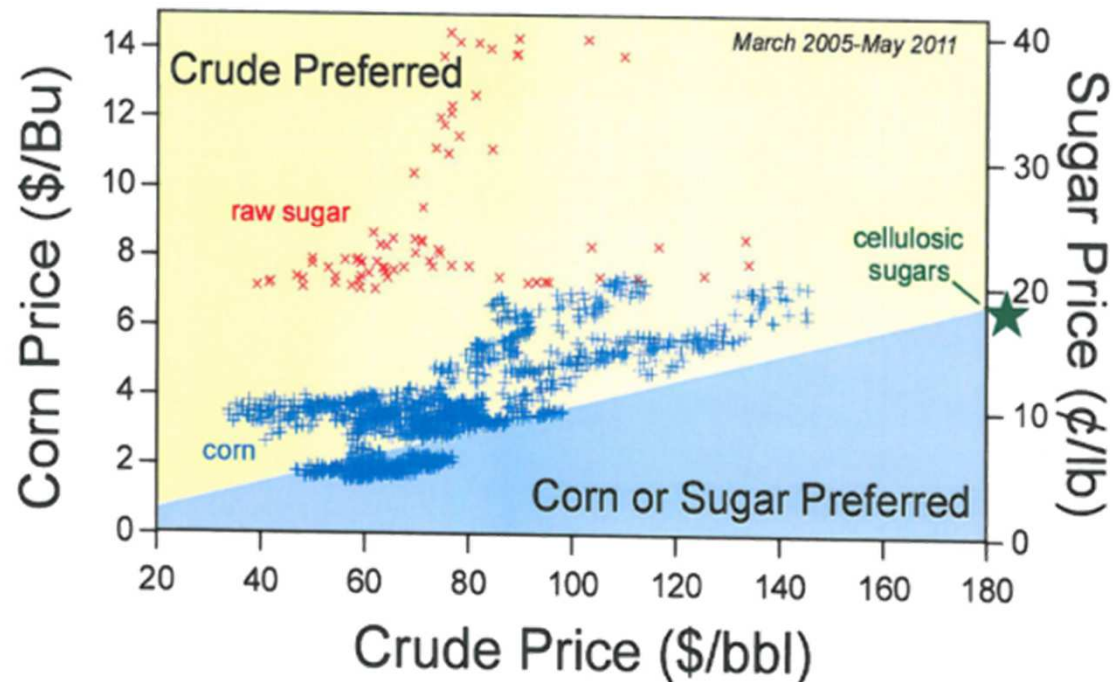


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Bio Commodities Too Expensive



Cash cost indifference analysis for ethylene from crude oil and bio feedstocks



*Excludes Capital

Slide from the presentation of W. F. Banholzer (Executive VP and CTO - The Dow Chemical Company) – Berkeley 2012

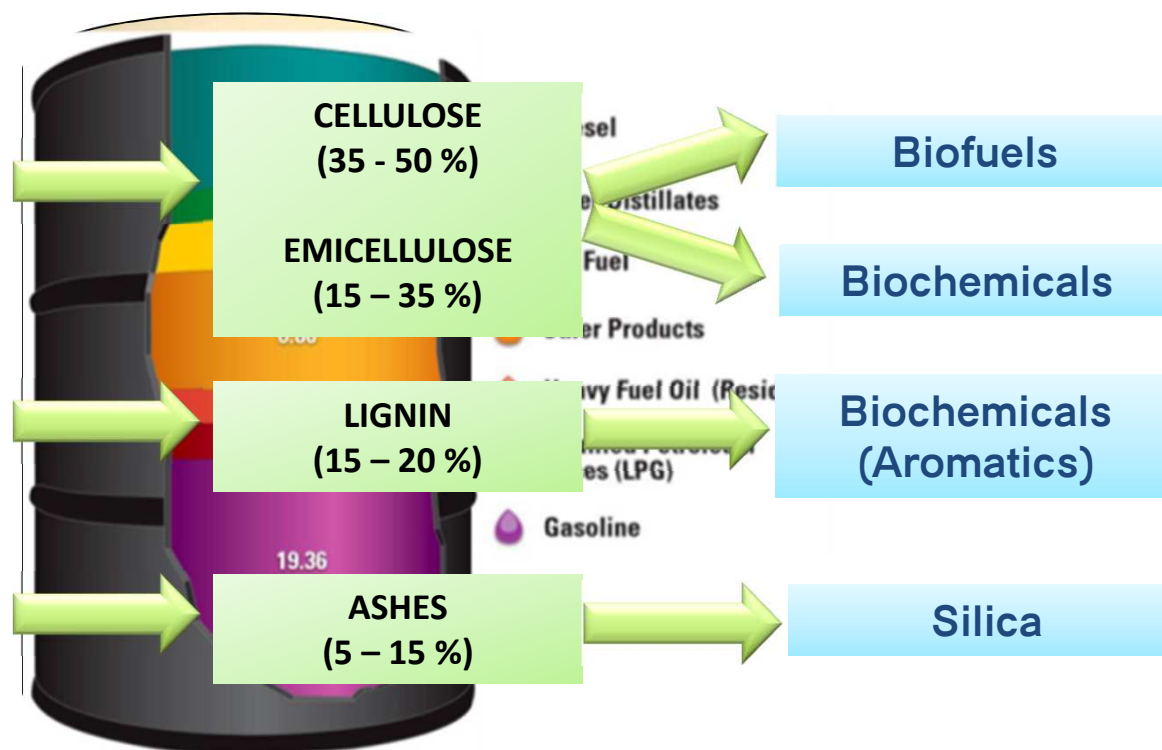


Sustainability of the Biorefinery: a question of energy



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The barrel of oil is replaced by the **new biomass barrel**



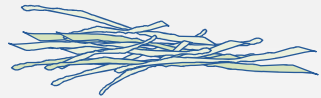
Producing **multiple products** and **integrating waste treatment**, Biorefineries can maximize the values derived from biomass feedstock and turn biomass processing into real opportunities



Conversion of biomass opens up for a wide array of applications



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Sugarcane
bagasse



Corn stover



Arundo Donax



Wheat straw



Wood chips



Cellulose

Hemicellulose

Lignin



Ethanol



Textiles



Diapers



Chemical
intermediates
& Plastics



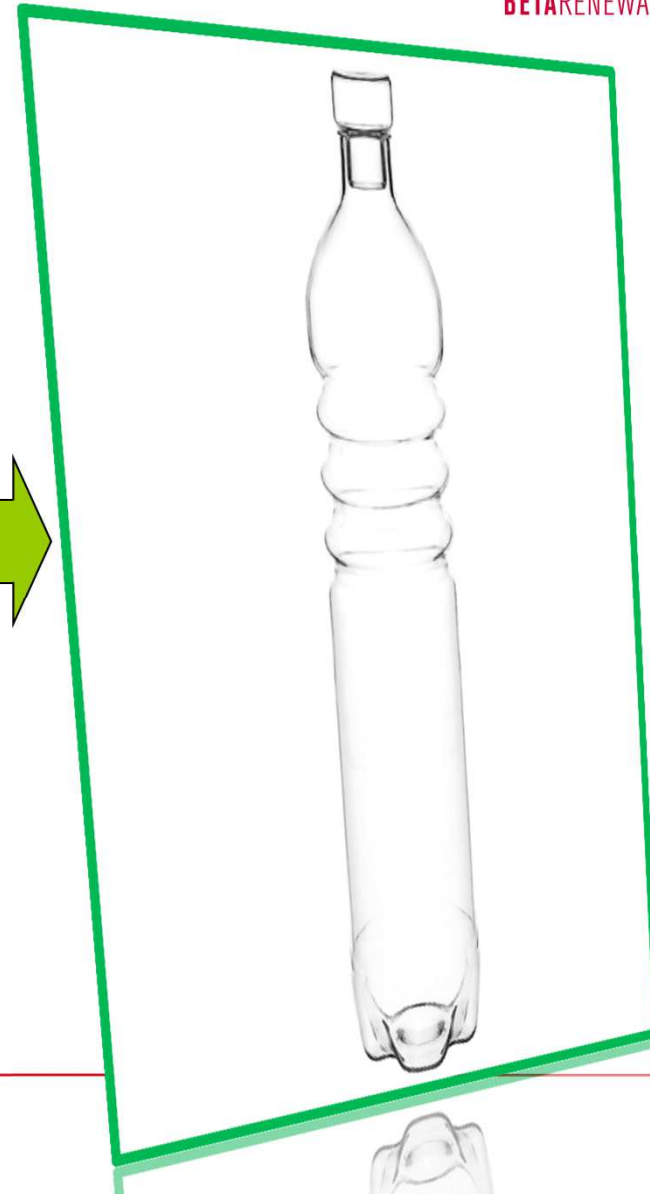
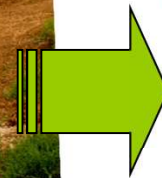
Detergents



BIOBASED CHEMICALS FROM BIOMASS: IS IT POSSIBLE?



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A continuous Industrial Growth And Global market Development

MOSSI GHISOLFI
GROUP



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1953 – 1979

Packaging
production

1953 - Tortona - Italy

Mossi Ghisolfi Group
founded HDPE and PVC
packaging production,
respectively

1979 – 2000

Special chemical
production

Development and
production of **PET resins**
for food packaging

2000 – Today

Acquisition and
PET expansion

Acquisition of PET **Shell**
activities and Rhodia from
Rhône Poulenc

Acquisition of **Chemtex** from
Mitsubishi Corporation

Construction of the **world's
largest plants** for PET
production in Altamira
(Mexico) and Suape (Brasil)

Plans announced for a new
plant in Corpus Christi
(Texas, USA)

2005 – Today

Renewables

2008 - New Research Centre
fully dedicated to renewables

**2009 - First pilot plant for
2nd generation biofuels
production**

2011 - Beta Renewables
is founded, (Biochemtex+TPG)
dedicated to sustainable
chemistry

2012 - Partnership
between Beta Renewables
and **Novozymes**

Start up of the world's
**1st commercial-scale
plant** that produces **biofuels**
from **non-food biomass**
(40.000 ton/year)



Beta Renewables: Sustainable Chemistry



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Beta Renewables is a joint venture, created in October 2011, between Biochemtex and the American private investment firm TPG (Texas Pacific Group), with a capital of **250 million Euros**

Novozymes, Denmark-based world-class biotech company, has recently acquired **10% share** of Beta Renewables

The JV is the owner of the Proesa™ technology, used to produce biofuels and chemical intermediates

It has invested in the construction of **the world's 1st commercial-scale plant in Crescentino** (Italy) that will produce 2nd generation ethanol

Beta Renewables develops **global alliances and partnerships** to license the Proesa™ technology



Biochemtex Engineering and R&D



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Biochemtex, acquired in 2004, is a wholly owned subsidiary of the Mossi Ghisolfi Group

An engineering company **specializing in the design and construction** of petrochemical, polymers, fibers, energy, biofuels plants and environmental technologies

Main engineering offices in **Tortona** (Italy), Wilmington (USA), Bangalore (India), Beijing and Shanghai (China)

Annual Turnover: USD 300 MM

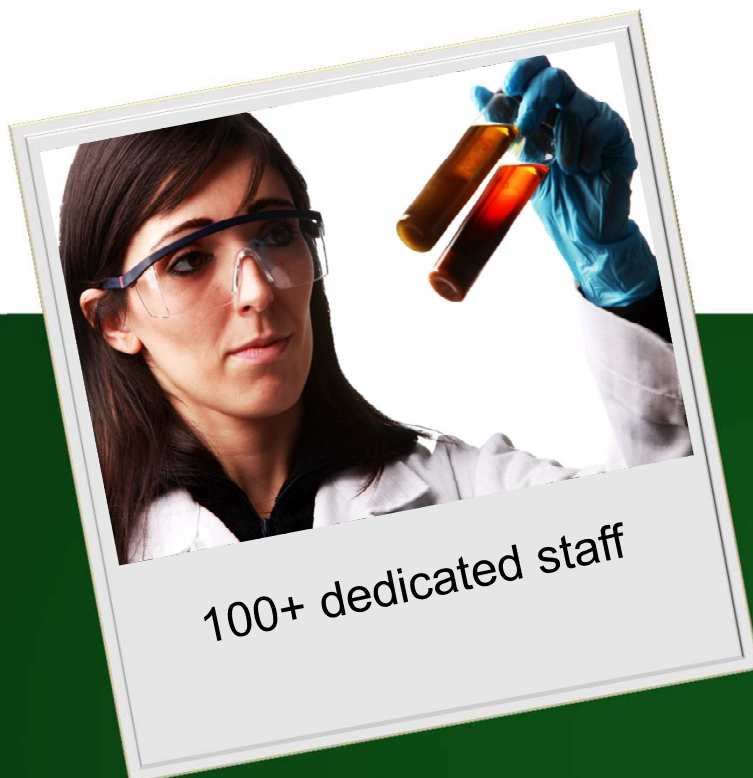
Employees: 1000



Our R&D Centers

Rivalta, Italy

4500 m² dedicated to renewable resources **biochemistry** and **technology**



100+ dedicated staff



Biochemtex also operates an R&D center in **Sharon Center, Ohio and in Bari (Italy)** focused on cellulosic sugar chemistry and engineering research

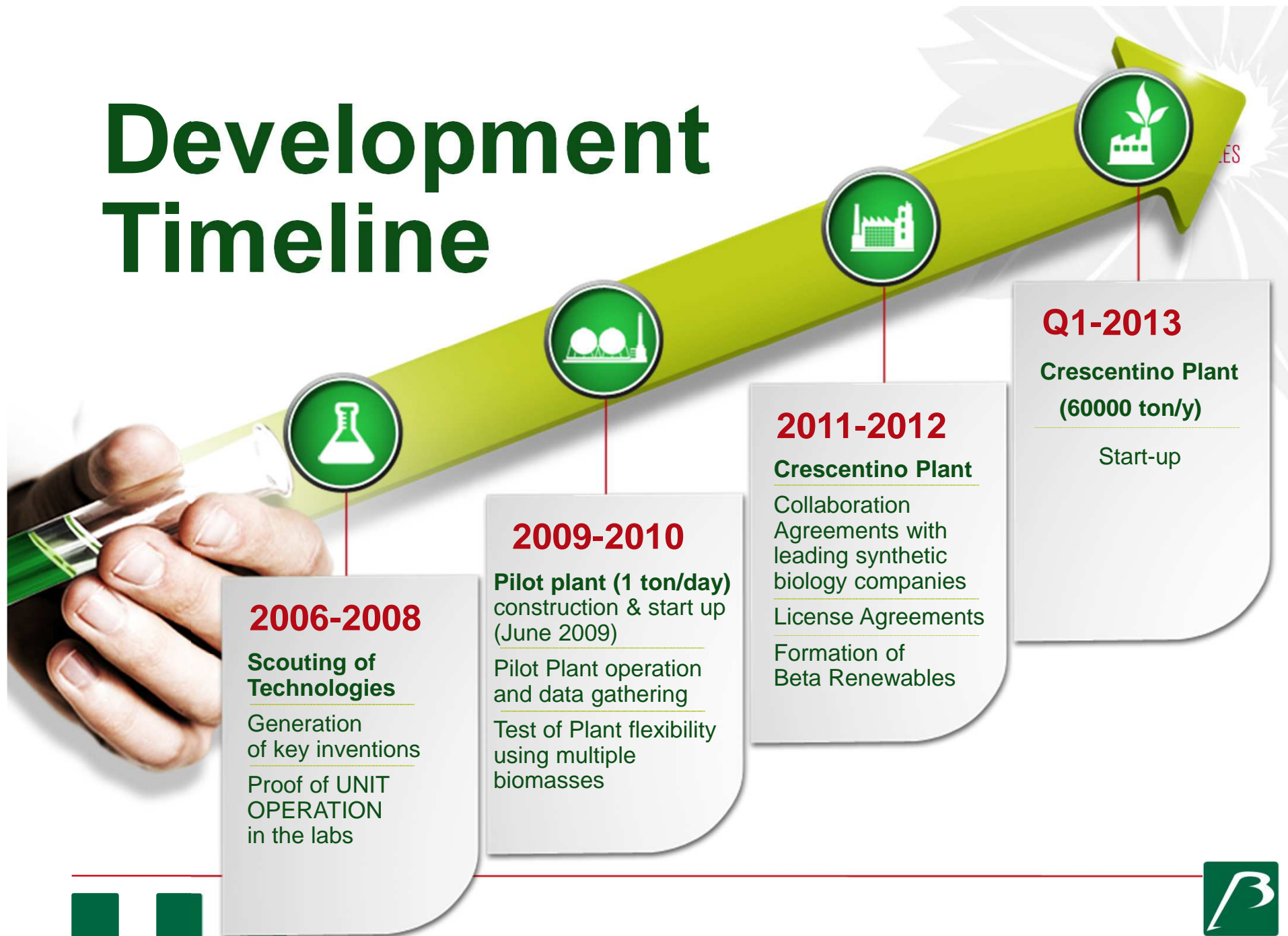
Catalytic Conversion of Sugar

Lignin conversion

Intermediate and final product separation technologies



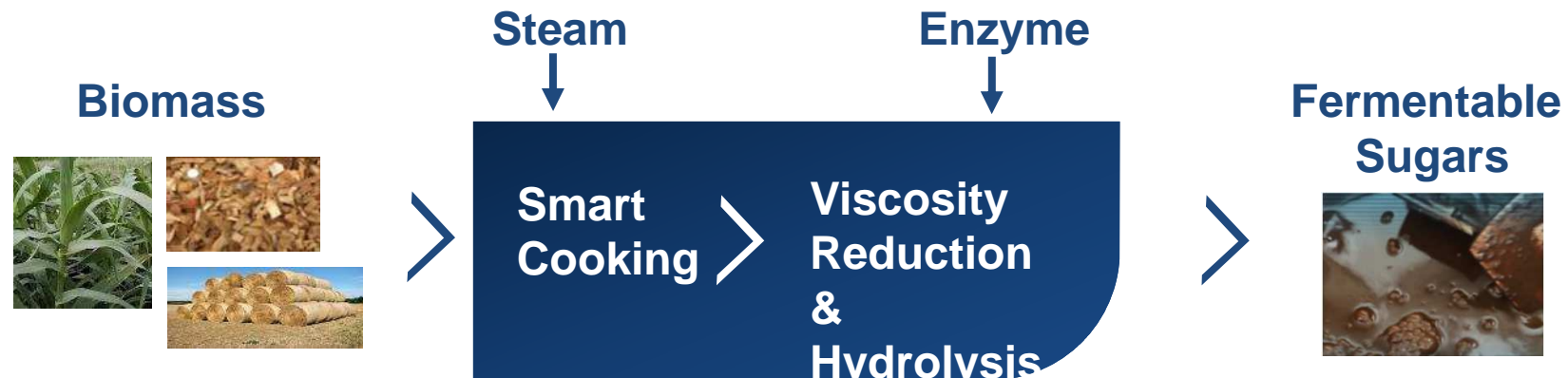
Development Timeline



PROESA® Technology - the sugar platform



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PROESA® sugar platform benefits



enabling the production of **price competitive** and **clean cellulosic sugars**



flexibility in parameters and **versatility** in project solutions based on client needs



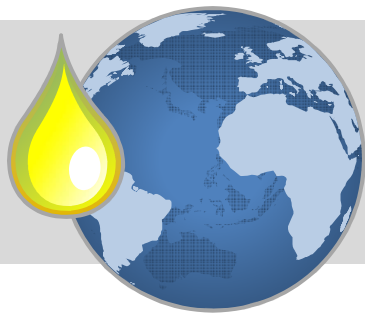
readily integrated with **biology** pathways or **catalytic conversion platforms** to produce fuels or bio-chemicals



Transforming Beta Renewables' vision into a sustainable business



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Our Vision

- contribute to a more sustainable use of our world's resources
- using non-food biomass
- cost-effective with petroleum without subsidies

Market Need

- creating value for all stakeholders involved: from farmers, to industrial players

Our Business Model

- licensing PROESA to ensure global deployment and faster uptake of the technology
- developing packaged solutions with our partners for their needs



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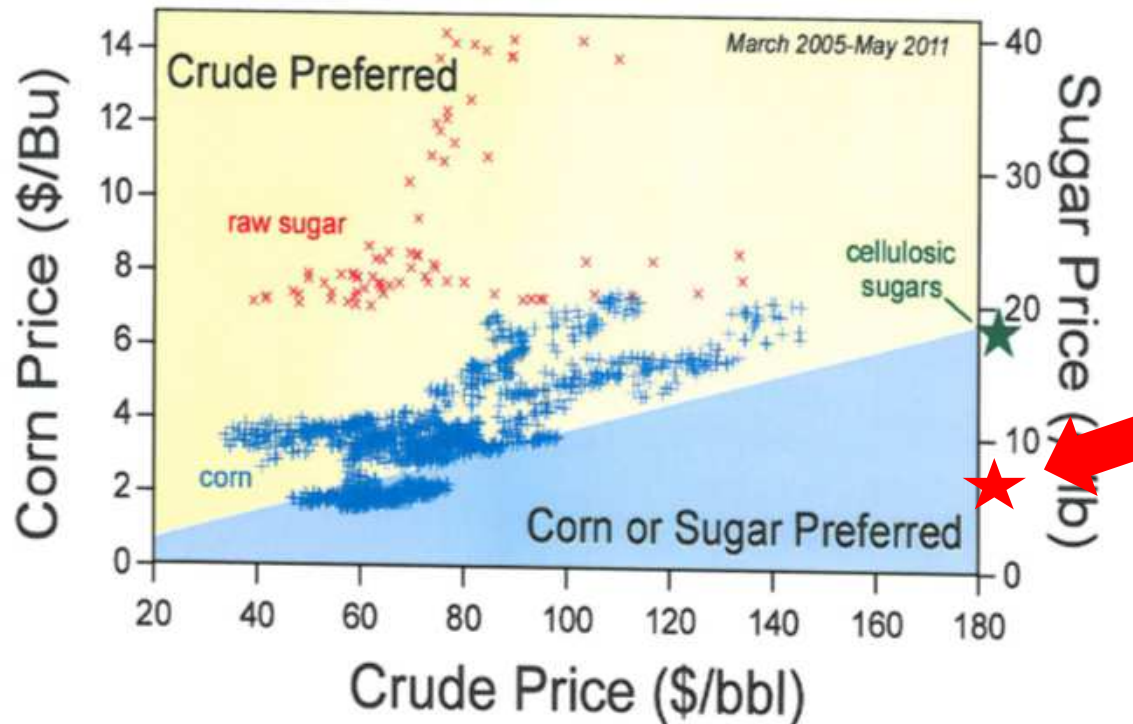
The Biorefinery Opportunity - Now a reality through PROESA® Technology



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PROESA® Technology is a cost competitive, low carbon alternative to petroleum derived chemicals in a short term horizon

Cash cost indifference analysis for ethylene from crude oil and bio feedstocks



*Excludes Capital

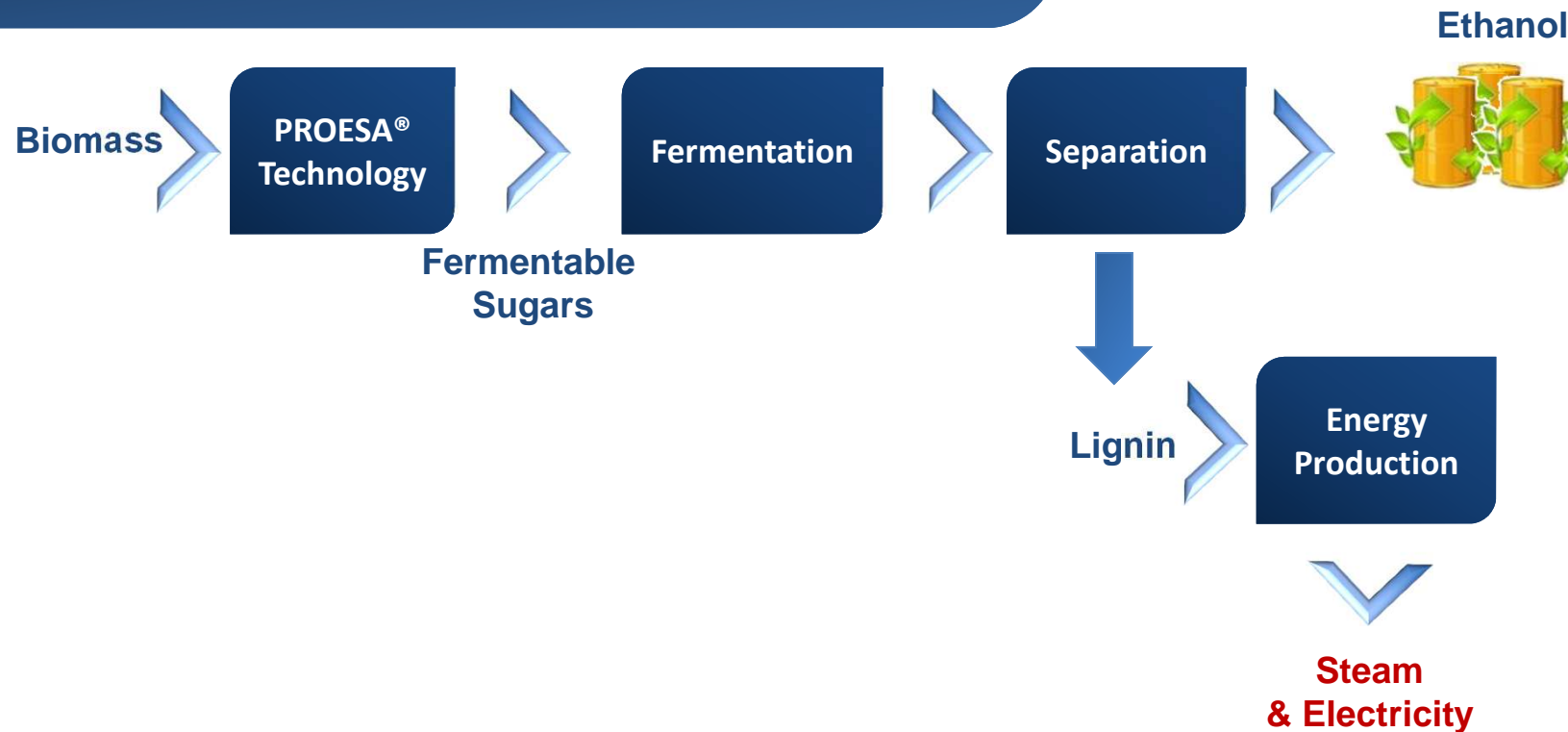


The Biorefinery Opportunity - Now a reality through PROESA® Technology



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The Biorefinery today and

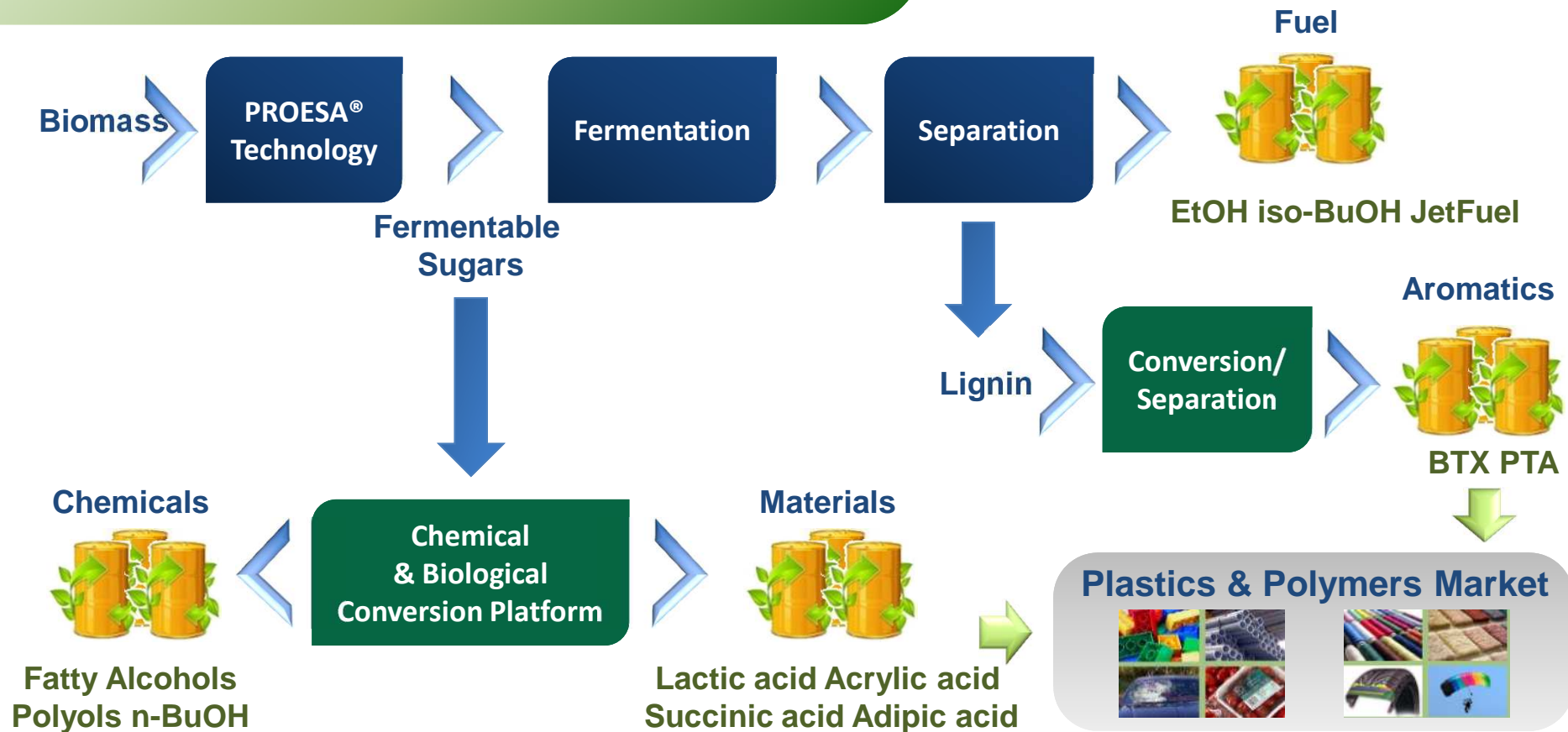


The Biorefinery Opportunity - Now a reality through PROESA® Technology



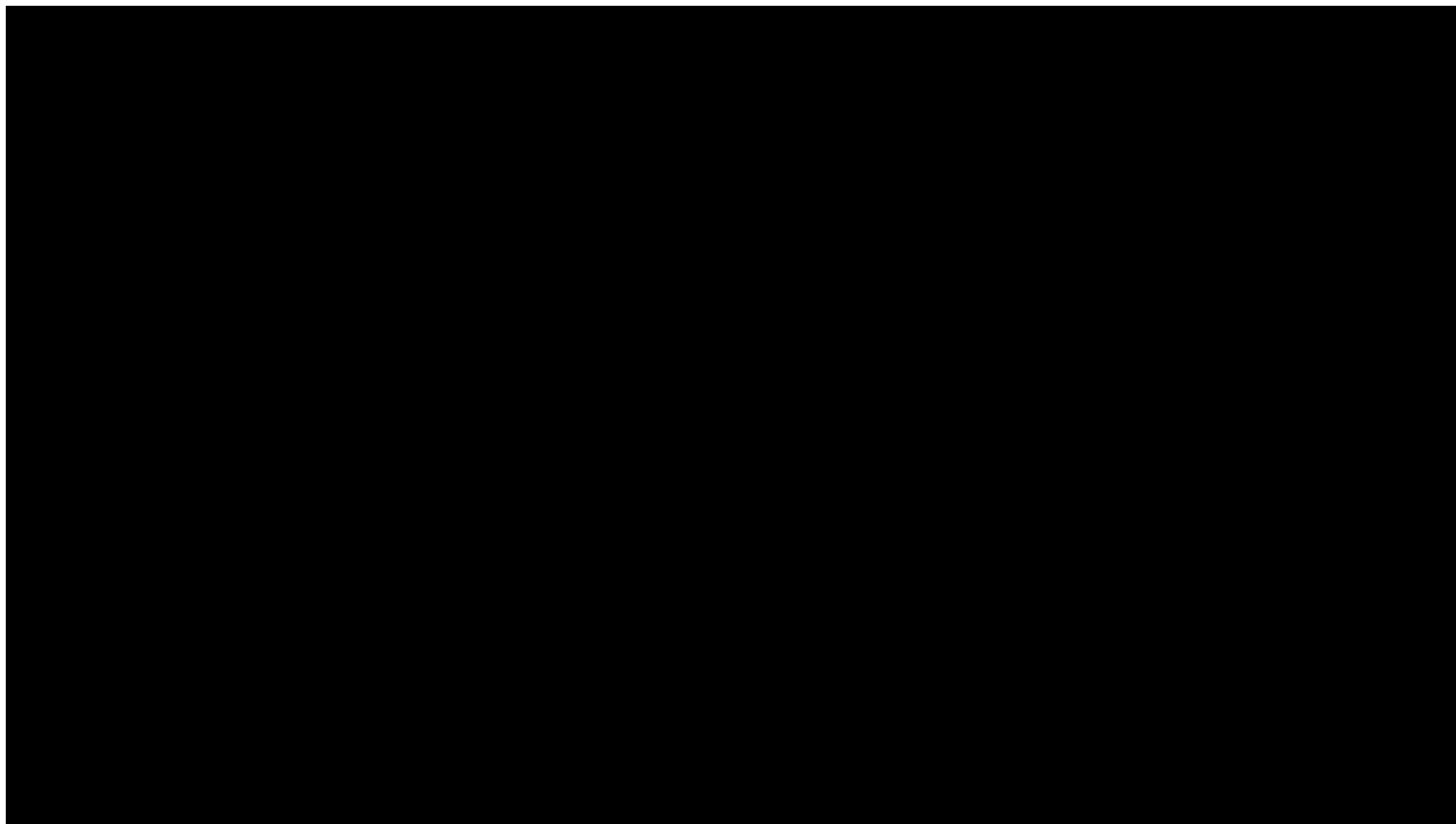
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.... tomorrow





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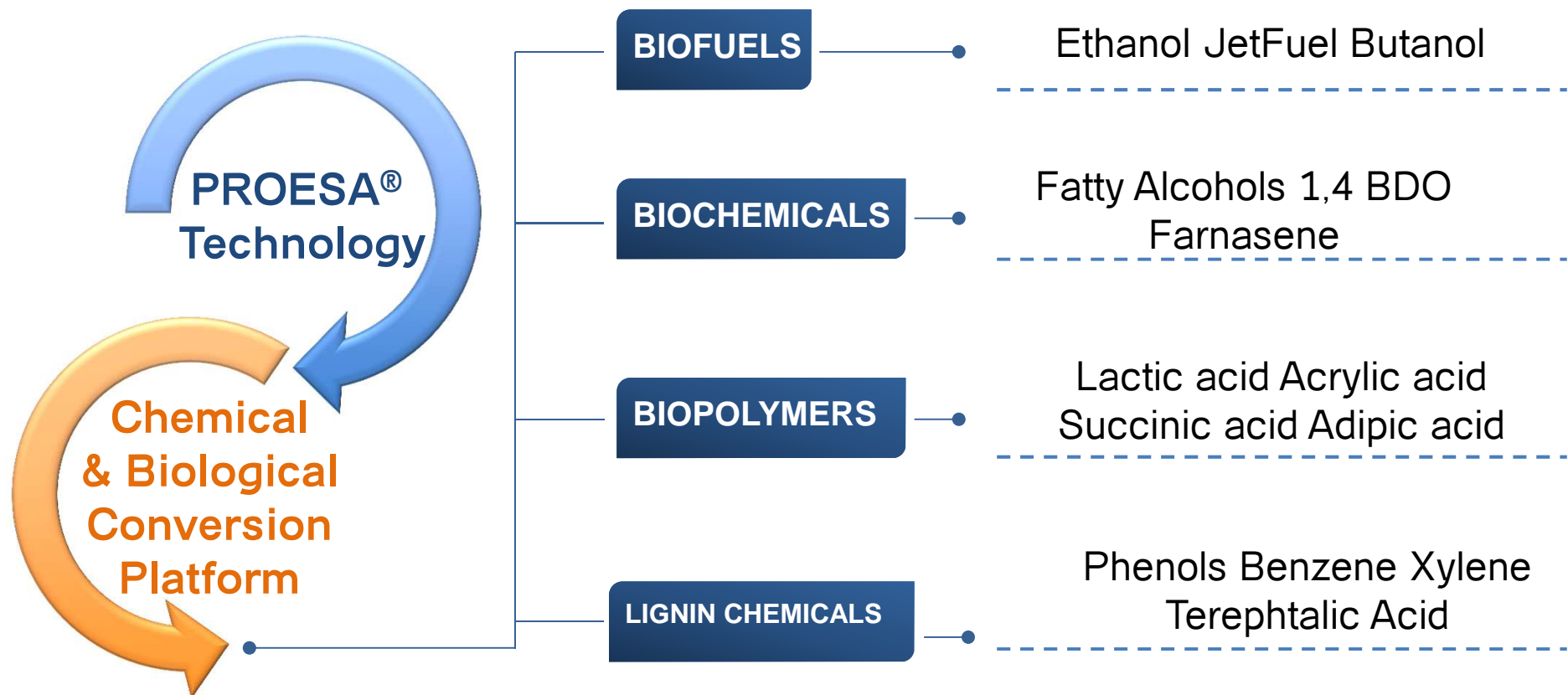


A Platform for Sustainability



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PROESA® Technology for cellulosic sugars production



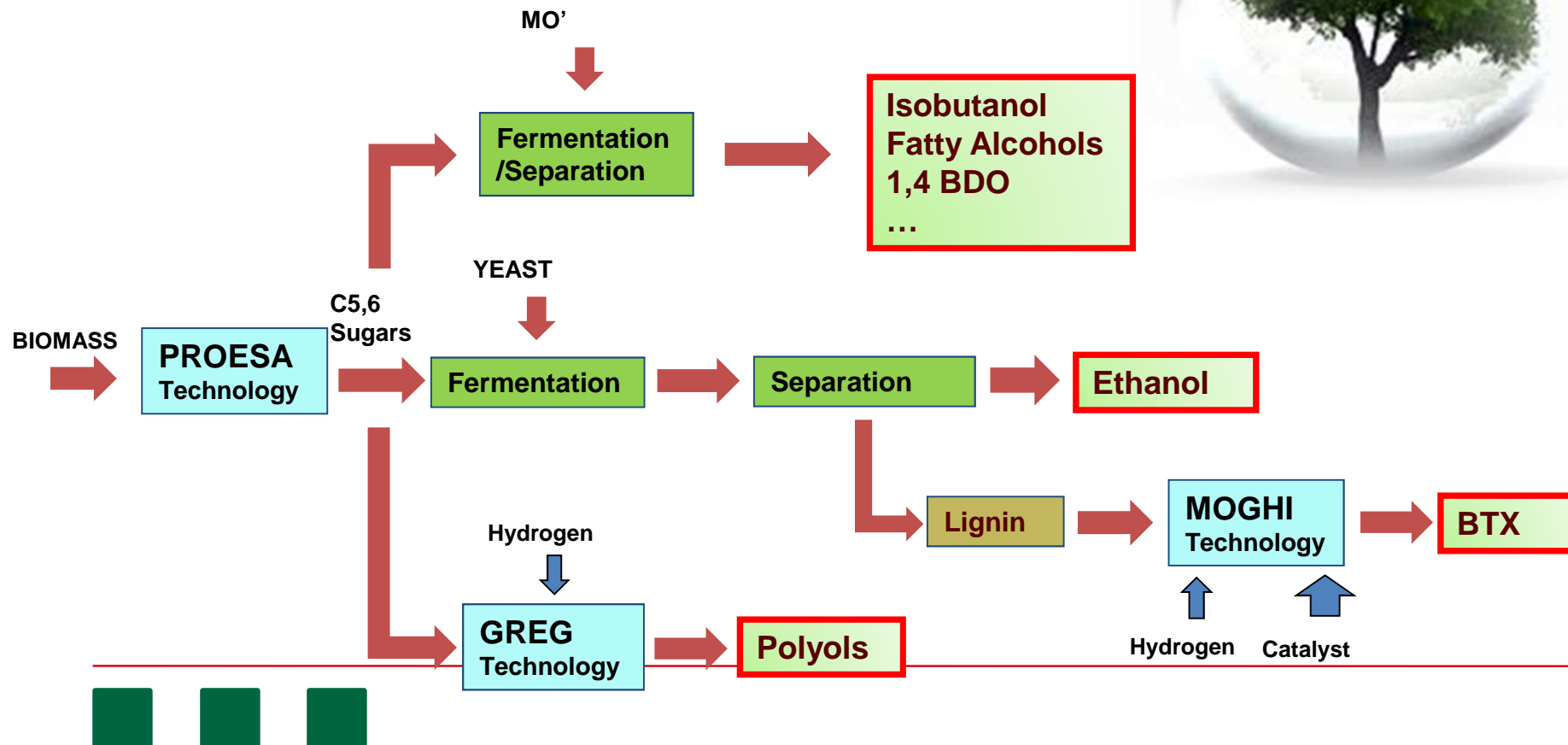
*production of all the reported chemicals have been already proven at lab /pilot scale in collaboration with Beta Renewables partners

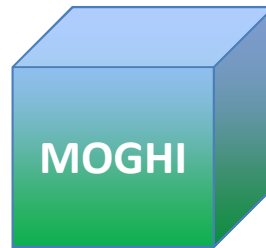
The Concept of Biorefinery



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- **MG is developing its own technologies for sugars conversion and lignin processing.**
- **A biorefinery will produce various products: initially ethanol, then diols, later aromatics.**





BIOREFINERIES ARE POSSIBLE **TODAY!**



Press Release



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M&G Chemicals launches green revolution in the polyester chain

Shanghai – 18 November 2013

M&G Chemicals announces today its decision to construct a second-generation bio-refinery in the region of Fuyang, Anhui Province of China for the conversion of one million metric tons of biomass into bio-ethanol and bio-glycols.

The project is expected to be realized through a joint-venture with Chinese company Guozhen which will make available one million metric tons of straw biomass and use the lignin resulting as a by-product from the bio-refinery to feed a 45 MW cogeneration plant which will be constructed at the same time as the bio-refinery in the same site. M&G Chemicals will be majority partner of the bio-refinery and minority partner of the power plant.

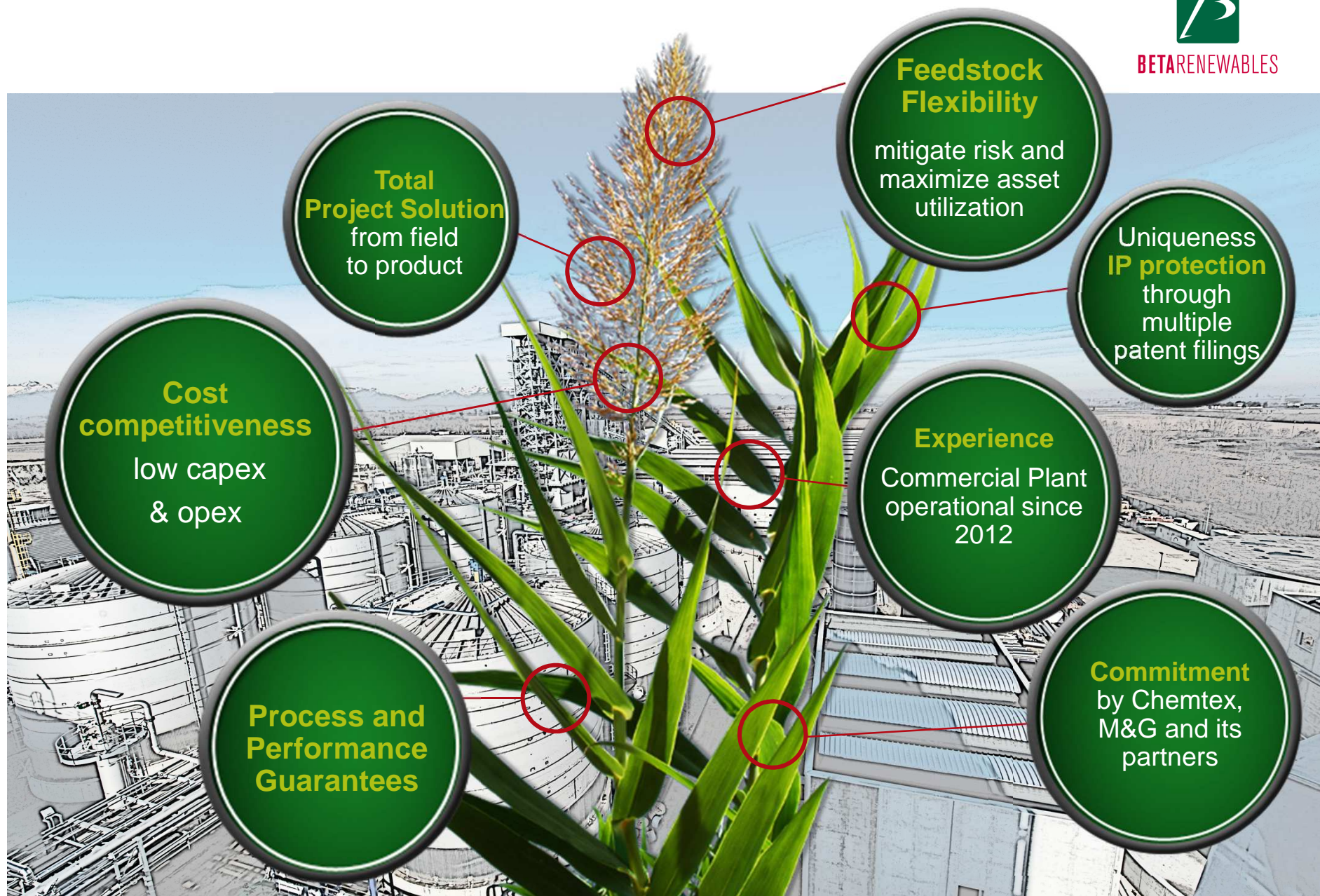
The bio-refinery will employ PROESA™ technology licensed from Beta Renewables, a joint venture between Biochemtex (a company belonging to the Mossi Ghisolfi Group), US private equity fund TPG and Danish enzyme producer Novozymes.



Conclusion



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Proesa[®] Technology is our way to see the future