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CRESCENTINO DEMO PLANT

Challenges and opportunities

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**BIOLYFE: Demonstrating large-scale bioethanol production
from lignocellulosic feedstocks**



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Our Group



Mossi Ghisolfi is a multinational, family-run business established in 1953 by Vittorio Ghisolfi and Domenico Mossi.

- It is one of the world's leading producers of PET resin.
- It is Italy's second largest chemical company.
- It is a forward-looking company that is continuing to invest significant funds into bio-fuels and green chemistry research and development as part of its commitment to sustainability.

BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks



Biochemtex



Rivalta Scrivia, Piedmont, Italy

4500 m2 dedicated to renewable resources biochemistry and technology



- Biochemtex is a global engineering and technology company wholly-owned by Italy's Gruppo Mossi Ghisolfi.
- Biochemtex is specialized in delivering value-added project solutions for its clients in the bio-fuels, renewable chemicals, energy, environmental.

BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks



The Green Revolution

Wednesday, October 9th 2013

Official Opening Ceremony of the World's 1st commercial-scale
cellulosic ethanol plant: the Crescentino bio refinery.

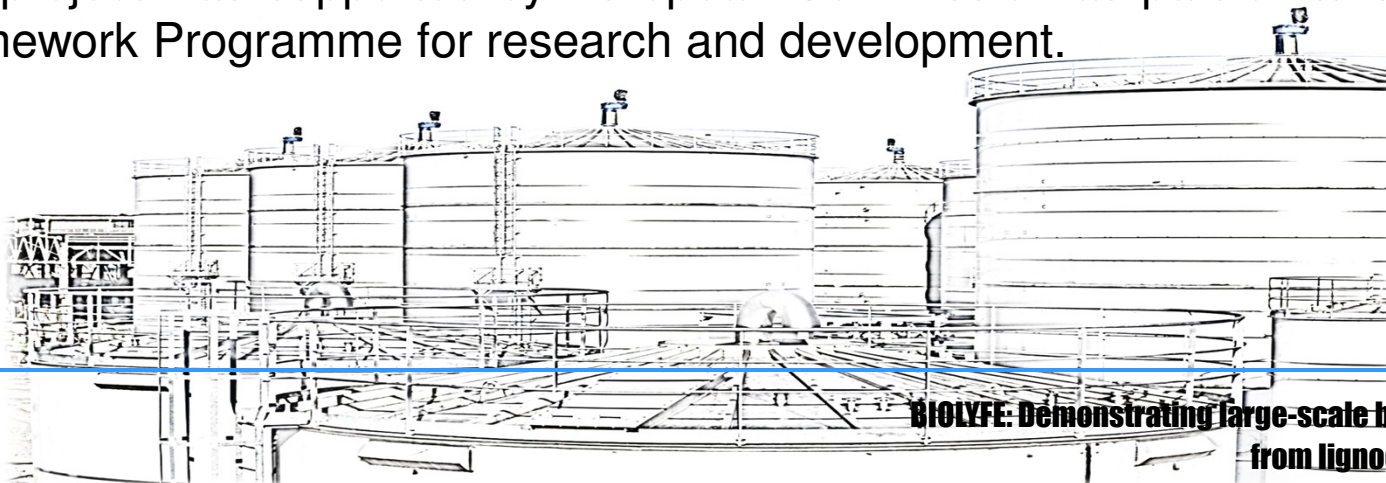


**BIO LYFE: Demonstrating large-scale bioethanol production
from lignocellulosic feedstocks**



Crescentino

- The Crescentino Plant is the first in the world to be designed and built to produce bio-ethanol from agricultural by-products or plants not suitable for food consumption.
- This has been made possible thanks to PROESA™ technology, developed in the Biochemtex laboratories .
- The expertise developed in Crescentino will enable similar plants to be built in USA, Latin America, Europe and Asia.
- The project was supported by European Commission as part of its Seventh Framework Programme for research and development.



BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks



Crescentino Plant is located in the province of Vercelli

The Bio-refinery stands in an area which previously housed the Teksid foundry (Fiat Group) inoperative for many years



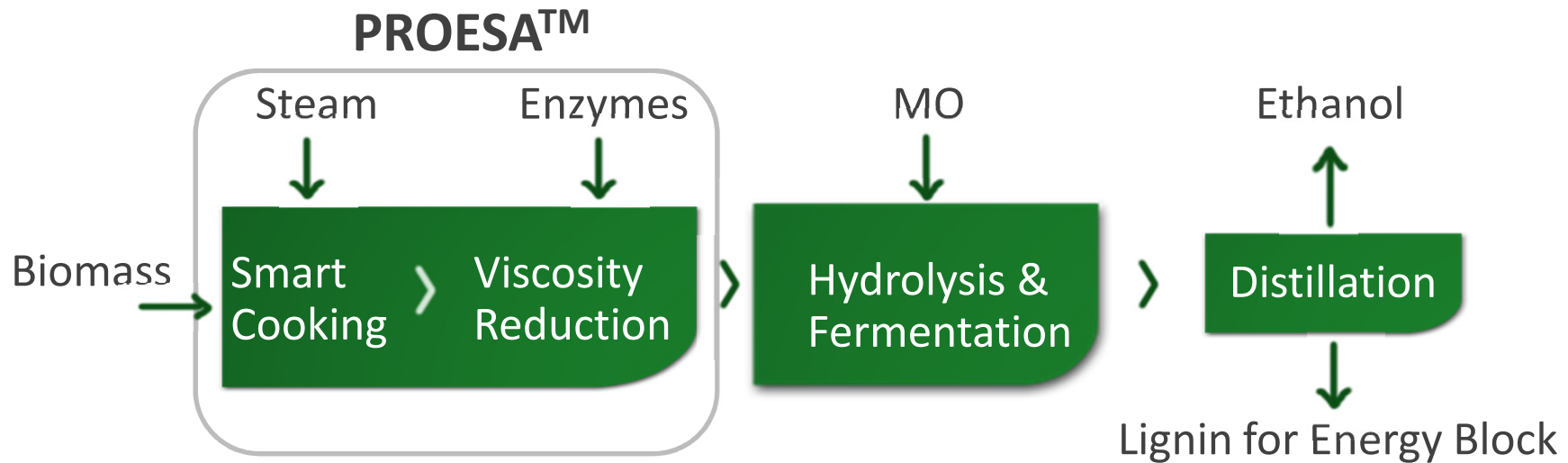
The plant is located in the center of an agricultural area dedicated to rice, wheat and maize production: a «natural reserve» for biomass at limited cost.



BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks



Proesa™ - The Technology



Proesa™ Technology benefits:



Feedstock flexibility



Fully integrated process design using continuous equipment to enable large scale plants



Continuous process
No chemical addition
Optimal sugar extraction with low enzyme dosage



Best in class technology with lowest capex and opex backed with performance guarantees



Crescentino - Development Timeline



Dec 2012



The project was started in 2010, work began in 2011 and the boiler started to produce energy in the autumn of 2012.

In January 2013, bio-ethanol production began.

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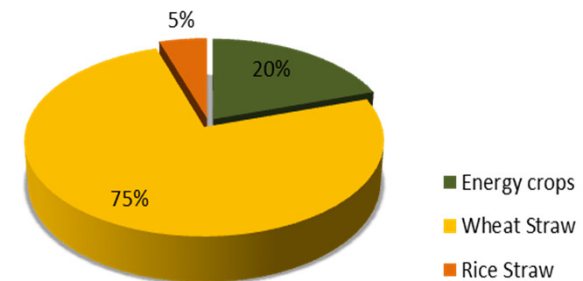
Crescentino – Vital Data

- Value of investment: € 150 million
- Production: 40,000 tons of bio-ethanol per year
- Biomass used: 180,000 dry tons per year (at maximum output)
- Electricity production: 13MW produced entirely from lignin (by-product of the ethanol process)
- Water recycling: 100% = zero water discharge
- Workforce: 100 operators (direct workforce)



The following were required to build the plant

- 370 pieces of equipment
- 1500 tons of steel structures
- 1400 tons of pipes and valves
- 18 km of underground piping



Crescentino Biomass Supply 2014



Crescentino Commercial Plant

- ✓ Commercial-scale
40,000 ton per year
cellulosic ethanol plant
in Crescentino, Italy
- ✓ Price competitive
Benchmark: Oil @ \$70/bbl
- ✓ Cellulosic Costs Less
Estimated cash costs:
Ethanol: <\$1.50/USG
Sugars: 10¢/lb



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The players

- The PROESA™ and the construction of the Crescentino bio-refinery were carried out by Mossi Ghisolfi Group companies.
- The objectives of **Beta Renewables** in partnership with Novozymes, is to promote PROESA™ technology globally.
- **Biochemtex** developed the technology and designed and built the plant.
- **Italian Bio Products (IBP)** is responsible for the operational management of the Crescentino plant.





The impact in Europe



Efficient use of resources, maximizing the potential of agricultural and forest residues, as well as waste

Diversification of agricultural income: potential of up to **40% additional income**

Implementation of new supply chains that can **revitalize the entire agricultural sector**

New generations of products and materials "bio" based in modern **biorefineries**

Creation of **infrastructures** in Europe, with important implications for employment, 80% of them in rural or underdeveloped areas

Replace 30% of fossil chemicals with equivalent obtained from renewable sources (target 2030)

Provide input for the **25% of European transport with advanced biofuels** (2030 target)

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A NEW ERA BEGINS

Crescentino

World's first advanced biofuels facility



Thanks

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