

biochemtex



A NEW ERA BEGINS

Crescentino

World's first advanced biofuels facility



The Green Revolution

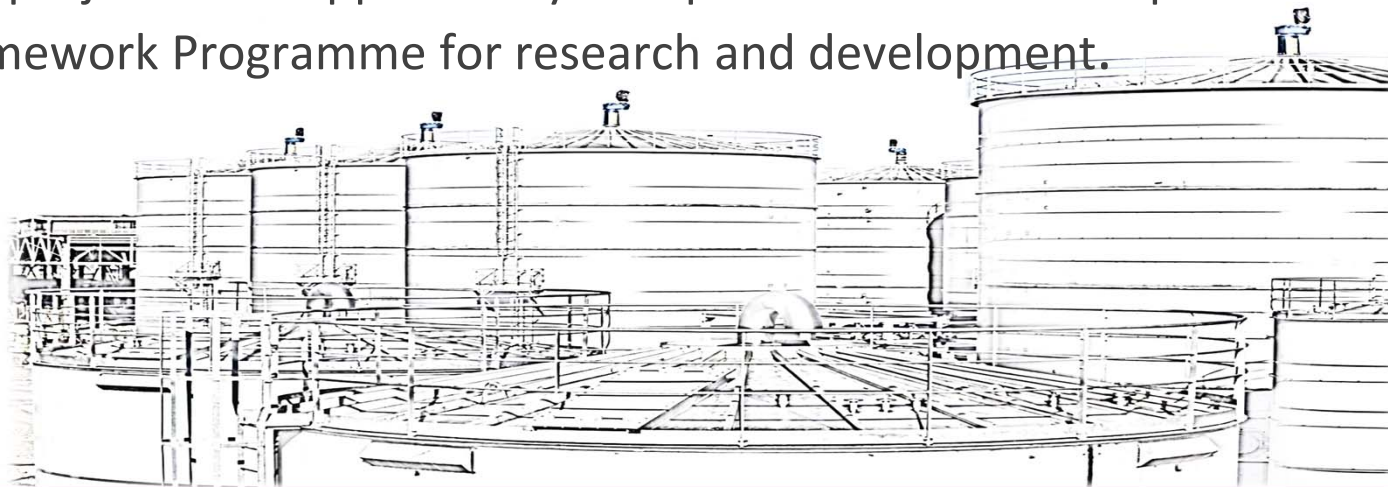
Wednesday, October 9th 2013

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



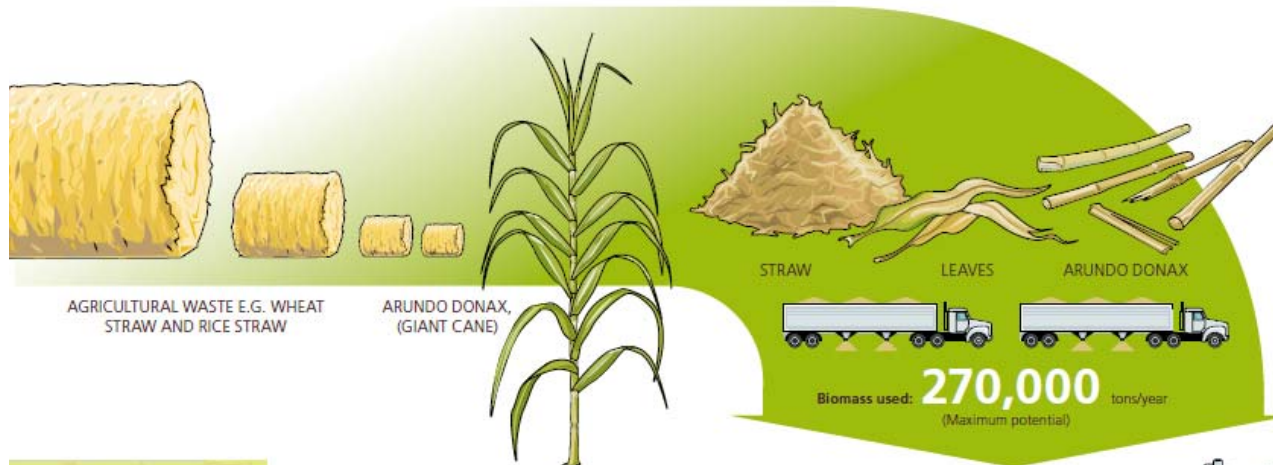
Crescentino

- 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.



Crescentino Fast Facts

The world's first commercial scale cellulosic ethanol plant is up and running. With a cost of € 150 million it will pave the way for one of the most sustainable alternatives to gasoline. Fuel made from agricultural waste is now a reality.



100% waste and energy crops
The Crescentino plant is a multi-feedstock cellulosic ethanol plant. It can handle agricultural waste from a broad variety of crops e.g. wheat straw and rice straw.

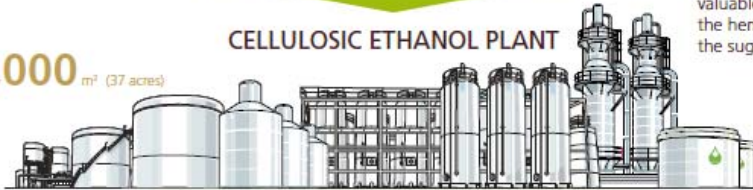
The plant also use energy crops like arundo donax (known as giant cane) as feedstock. The arundo donax is a high yield energy crop that can grow on marginal lands, providing an extra income to the farmers for many years.

Biomass to ethanol
The biomass consists of cellulose, hemicellulose and lignin. With a unique combination of the leading production technology and the most efficient enzymes, we are able to release the valuable sugars from the cellulose and the hemicellulose. In the fermentation the sugars are converted into ethanol.



Biomass supply radius: **70** km radius

Plant area: **150,000** m² (37 acres)

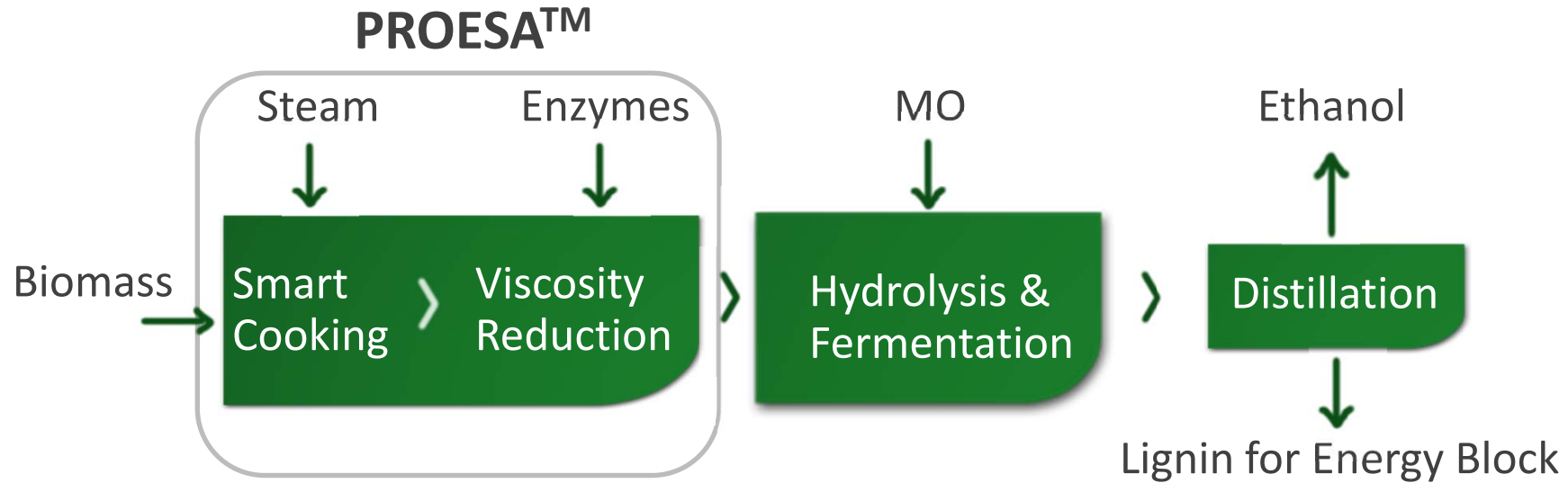


Max. production: **75.000.000** Liters of ethanol/year



- 100%** Water recycling
The industrial production carried out in the plant creates no reflux.
- 13 MW** Electricity production
13 MW, produced entirely from lignin. The plant is entirely self-sufficient in its energy consumption.
- 90%** Green house gas reduction
Cellulosic ethanol can reduce the CO₂ emissions by up to 90% compared with petroleum-based fuel.

Proesa™ - The Technology



Proesa™ Technology benefits:



Feedstock flexibility



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



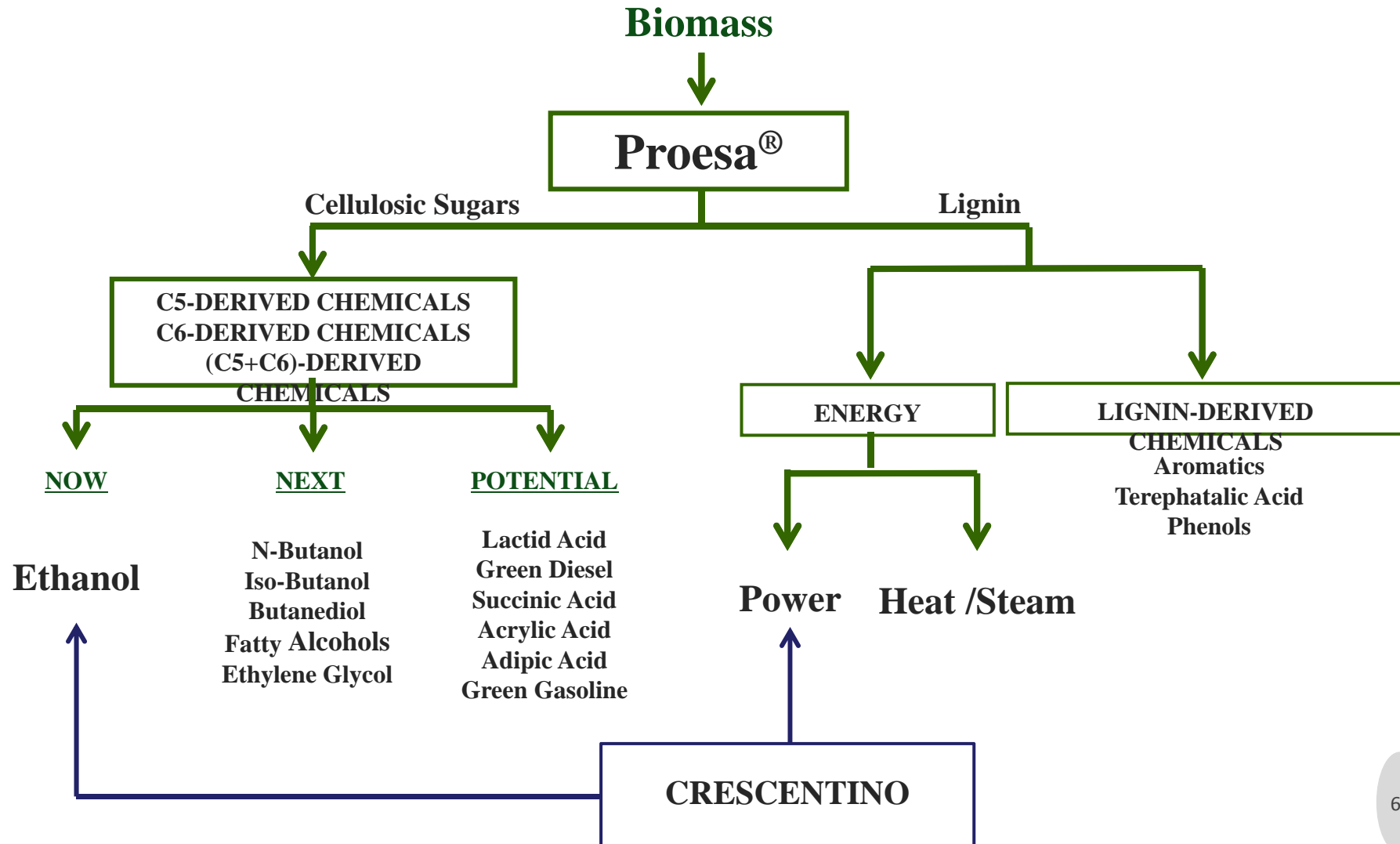
Fully integrated process design
using continuous equipment
to enable large scale plants



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

Proesa® in Crescentino

The Biorefinery of the future



Crescentino - Location

Crescentino Plant is located in the province of Vercelli

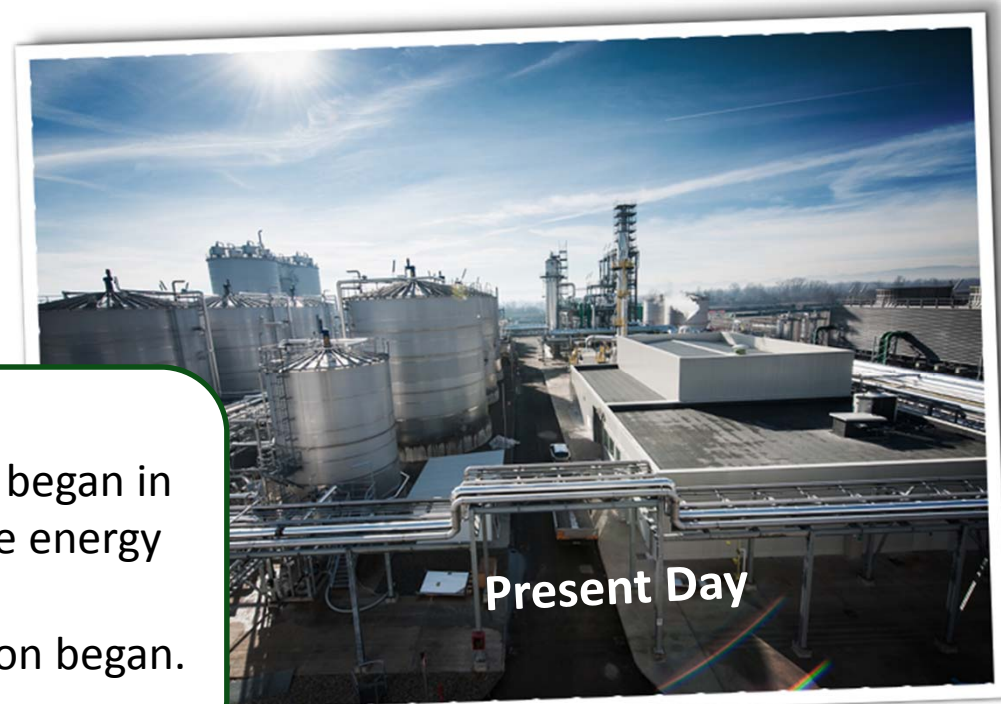
The Bio-refinery stands in an area which previously housed the Teksid foundry (Fiat Group) inoperative for many years



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.



Crescentino - Development Timeline



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.

Crescentino – Vital Data

- Value of investment: € 150 million
- Production: 60,000 tons of bio-ethanol per year
- Area: 150,000 square metres
- Biomass used: 270,000 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 Commercial Plant

- ✓ Commercial-scale
60,000 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



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.





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Thanks