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 uses energy crops like arundo donax (known as giant cane or 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.

Cellulosic ethanol plant

- Plant area: 150,000 m² (37 acres)
- Biomass used: 270,000 tons/year
- Max. production: 75,000,000 liters of ethanol/year
- Water recycling: The industrial production carried out in the plant ensures no reflux.
- Electricity production: 13 MW, produced entirely from lignin.
- The plant is entirely self-sufficient in its energy consumption.
- Greenhouse gas reduction: Cellulosic ethanol can reduce the CO₂ emissions by up to 90% compared with petroleum-based fuel.
**Proesa™ - The Technology**

**PROESA™**

- Steam
- Enzymes
- MO
- Ethanol
- Viscosity Reduction
- Hydrolysis & Fermentation
- Distillation
- Lignin for Energy Block

**Biomass**

**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
Proesa® in Crescentino

The Biorefinery of the future

Biomass

Cellulosic Sugars

C5-DERIVED CHEMICALS
C6-DERIVED CHEMICALS
(C5+C6)-DERIVED CHEMICALS

Ethanol

NOW

N-Butanol
Iso-Butanol
Butanediol
Fatty Alcohols
Ethylene Glycol

NEXT

POTENTIAL

Lactid Acid
Green Diesel
Succinic Acid
Acrylic Acid
Adipic Acid
Green Gasoline

POWER

Heat /Steam

Lignin

ENERGY

LIGNIN-DERIVED CHEMICALS

Aromatics
Terephthalic Acid
Phenols

CRESCENTINO
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.
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