

ECHI-T

Large bio-ethanol project from Sweet Sorghum in China & Italy

Eng. Norbert Vasen



**ETA Renewable Energies
Florence, Italy
Piazza Savonarola 10, I-50132
Tel. +39 055 5002174
Fax +39 055 573425
www.etaflorence.it
eta.fi@etaflorence.it**



**BIO-ENERGY
ENLARGED PERSPECTIVES**

Budapest ,16-17 October 2003

Outline

- **Project partners**
- **Project objectives**
- **Considered areas**
- **The sweet sorghum complex**
- **Configuration and schemes**
- **Amount of products**
- **Conclusions**

Project partners

- **ETA (Italy)**
- **COTEI (Italy)**
- **SIEMENS (Germany)**
- **WIP (Germany)**
- **BAFF (Sweden)**
- **DeltaT (US)**
- **ISCI (Italy)**
- **Sorghal (Belgium)**
- **EUBIA (Belgium)**
- **Energidalen (Sweden)**
- **Berwin Leighton Paisner (Belgium)**
- **C.A.R.E.I. (P.R. China)**
- **Beijing E&E Biomass Development L.t.d. (P.R. China)**

Italy
Germany
Sweden
Belgium
US
China



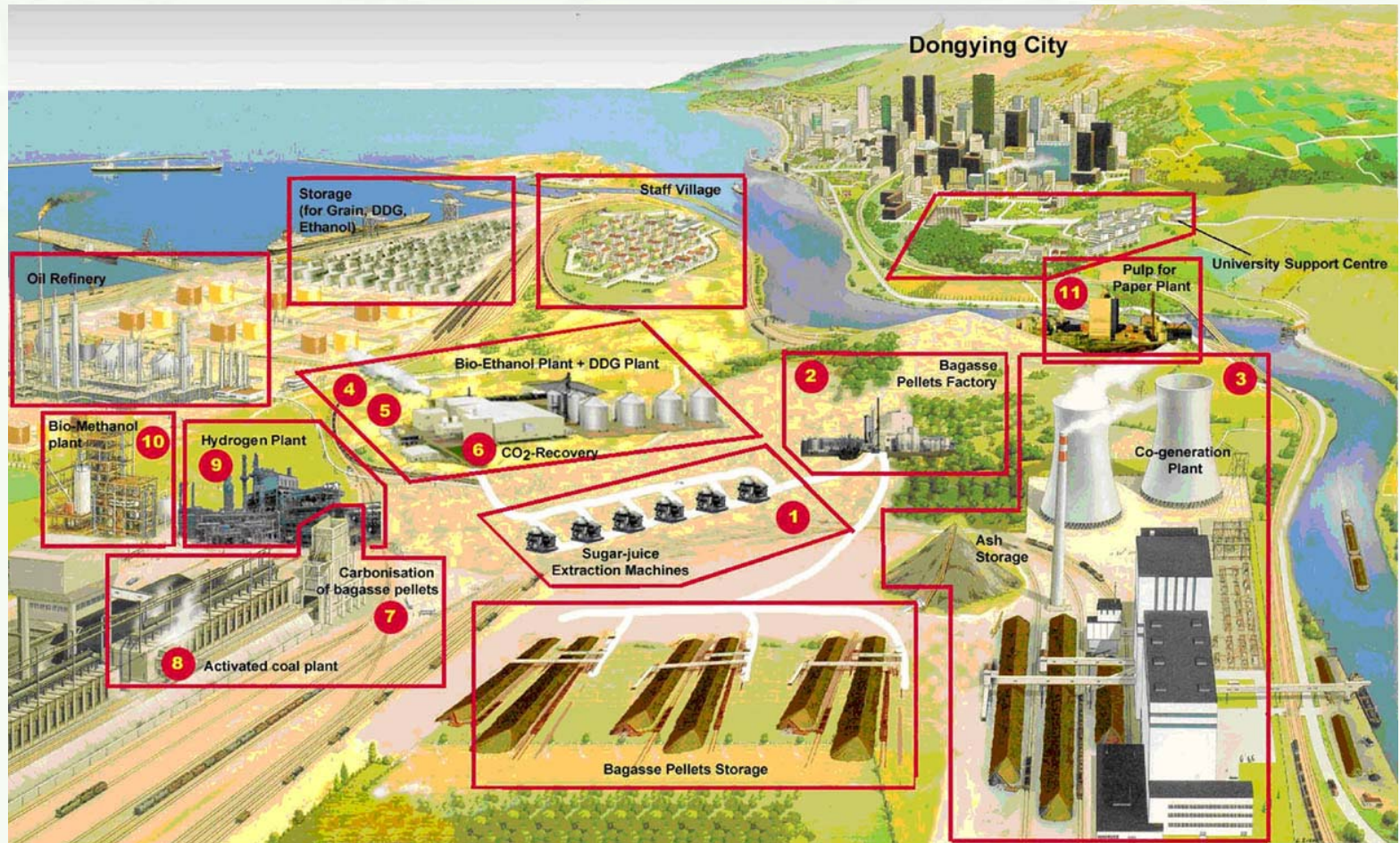
Main objectives of the project

- **Sweet Sorghum variety selections, and evaluation of productivity**
- **Possible configuration (lay-out) and preliminary characteristics of the three complexes**
- **Available commercial technologies**
- **Prelim. main characteristics and dimensions**
- **Prelim. investment costs**
- **Logistics needed by the integrated complexes**
- **Costs associated to the Sweet Sorghum production**
- **Co-product values**
- **Techno-economic assessment in China and Italy**

Considered areas



The sweet sorghum integrated complex



Dongying: Kenli refinery



Present capacity

- 500,000 t/y crude oil
- Diesel: 37% of prod.
- Gasoline: 17% of prod.

Plan for extension

- Increase to 1,500,000 t/y
- 100,000 t/y ETOH



Dongying: cogen plant



Present capacity

- 6 MWeI
- Coal
 - 150 t/d
 - 200 RMB/t

Plan for extension to
12 MWeI

Huhhot: Refinery



Present capacity

- 1,500,000 t/y crude oil
- Gasoline, Diesel, LPG, bitumen

Plans

- 100,000 t/y ETOH



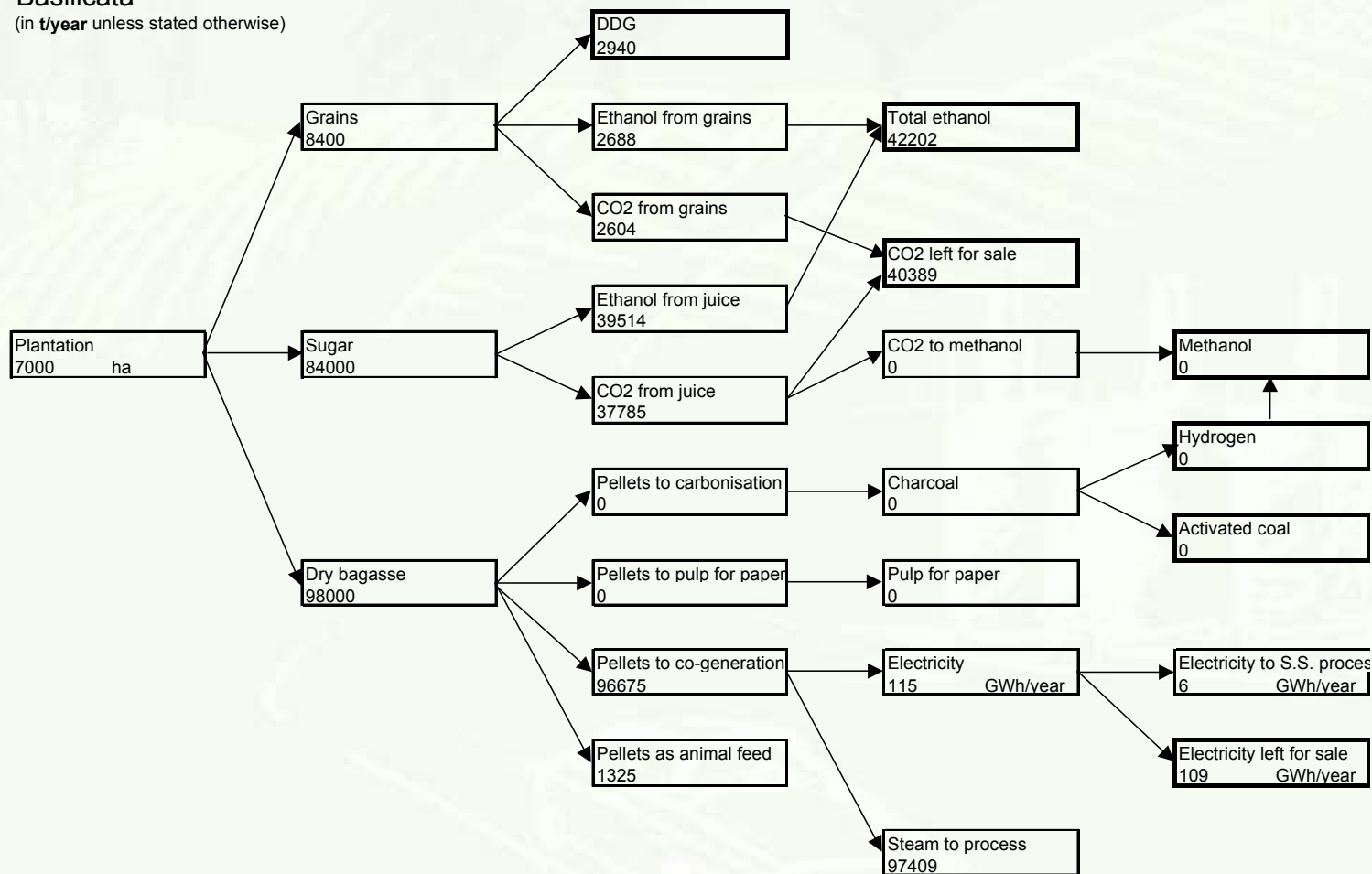
Configurations

Product:	<i>Basilicata</i>	<i>Dongying</i>	<i>Huhot</i>
<i>Grains as animal feed</i>			
<i>DDG</i>	<i>x</i>	<i>x</i>	<i>x</i>
<i>Ethanol from sugar juice/grains</i>	<i>x</i>	<i>x</i>	<i>x</i>
<i>CO2 recovery</i>	<i>x</i>	<i>x</i>	<i>x</i>
<i>Bagasse pellets as animal feed</i>	<i>x</i>	<i>x</i>	<i>x</i>
<i>Electricity</i>	<i>x</i>	<i>x</i>	
<i>Heat</i>	<i>x</i>	<i>x</i>	<i>x</i>
<i>Charcoal</i>			
<i>Activated coal</i>			
<i>Hydrogen</i>			
<i>Methanol</i>			
<i>Pulp for paper</i>			
<i>Animal feed pellets mixture</i>			

Schedule of quantities produced:

Basilicata

(in t/year unless stated otherwise)



= Products available for sale
that leave the biomass-complex

Sweet Sorghum yields, cultivation areas



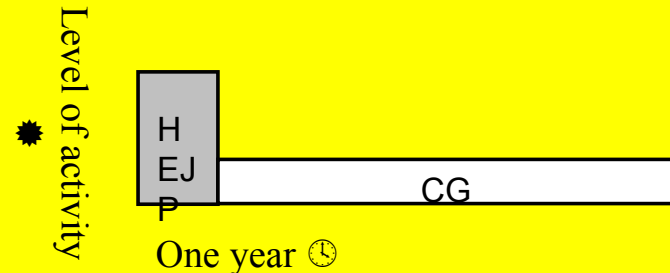
HEJP

**Harveting
Extraction
Juice-to-ethanol-
Pelletisation**

CG

**Cultivation of SS
Grain-to-ethanol**

	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Basilicata												
Dongying												
Huhot harvesting												
Huhot other												



<i>Site</i>	<i>Basilicata</i>	<i>Dongying</i>	<i>Huhot</i>
<i>Variety</i>	<i>Chinese 1, At623xRoma</i>	<i>M-81E</i>	<i>Tianpin 2</i>
<i>Grain yield (t/ha)</i>	5	5.25	6
<i>Fresh stem yield (t/ha)</i>	70	75	60
<i>Sugar yield (t/ha)</i>	7	7.65	7.2
<i>Brix (%)</i>	16	17	20
<i>Bagasse yield (t dm/ha)</i>	17	15	10.2
<i>Size (ha)</i>	7,000	19,000	20,000
<i>Harvesting</i>	<i>Aug., Sep., 2 months</i>	<i>Sep., Oct., 2 months</i>	<i>Oct., Nov., 2 months</i>

Products

Cultivated area and Feedstock				
	Basilicata	Dongying	Huhot (1x10)	Huhot (10 units)
Plantation (ha)	7,000	19,000	2,000	20,000
Grains (t/y)	8,400	99,750	12,000	120,000
Sugar (t/y)	84,000	145,350	14,400	144,000
Bagasse (t/y)	98,000	285,000	20,400	204,000
Product:	Basilicata	Dongying	Huhot (1x10)	Huhot (10 units)
Grains as animal feed				
DDG	2,940 t/y	34,913 t/y	4,200 t/y	42,000 t/y
Ethanol from sugar juice/grains	42,202 t/y	101,688 t/y	10,614 t/y	106,140 t/y
CO2	40,389 t/y	97,638 t/y	10,197 t/y	101,970 t/y
Bagasse pellets as animal feed	1,325 t/y	101,056 t/y	11,548 t/y	115,480 t/y
Electricity	106 GWh/y 9.5 SS proc 93 for sale	176 GWh/y 90 refin 35 SS proc 73 for sale 22 from grid	- 3.5 GWh/y	- 35 GWh/y
Heat	Process 66-1 t/h	Process 116-16 t/h	Process 10-2 t/h	Process -

Technologies

Technology	Supplier	Capacity per unit	Investment per unit (Euro)
Harvesting	CLAAS Vantor	84 t/h	130,000
Extraction	Brazilian	50 t/h	135,600
Pelletisation	various	7 t/h (in) - 4 t/h (out)	672,000
Ethanol/DDG	Delta-T	<u>Ethanol prod. from juice and grain – t/y</u>	Basilicata: 96,383,800
		Basilicata: 42,202	Dongying: 137,663,000
		Dongying: 101,688	Huhot (1x10): 30,855,500
		Huhot (1x10): 10,614	
		<u>DDG production – t/y</u>	
		Basilicata: 2,940	
		Dongying: 34,913	
		Huhot (1x10): 4,200	
		<u>CO2 prod. from juice and grain – t/y</u>	
		Basilicata: 40,389	
Co-generation	Siemens	Basilicata: 16.6 Mwel,	Basilicata: 30,000,000
		Dongying: 28.2 Mwel	Dongying: 50,000,000
		Huhot (1x10): 10,614 10.26 steam flow t/h	Huhot (1x10): 3-5,000,000

CONCLUSIONS

- **The scheme is technically feasible, based on existing commercial technologies**
- **Integration with other crops to extend bioethanol production time and reduce investments**
- **Integrated juice extraction and pelletisation would be an advantage**
- **Economics are favourable in Basilicata & Dongying**
- **The integrated complex will have significant benefits from the environmental point of view, both production side and end use, and also in terms of local development and economic growth of the interested areas.**

More information

A brochure about ECHI-T is available.

Please contact Gianluca Tondi or Norbert N. Vasen

ETA – Renewable Energies

Piazza Savonarola,10

50132 Florence, ITALY

Tel +39-055-5002174, Fax +39-055-573425

Email: norbert.vasen@etaflorence.it

or eta.fi@etaflorence.it

Web site: www.etaflorence.it