Project ASHES – Projeto CINZAS

„Optimization of thermal processes for the use of residues from bioethanol and sugar production in Brazil “

11th of April

Martin Meiller

Fraunhofer UMSICHT, Institutsteil Sulzbach-Rosenberg

Fraunhofer UMSICHT

The Fraunhofer-Gesellschaft

- Non-profit organization
- Focus on applied sciences
- About 24 000 employees
- 72 institutes and independent research facilities
- International activities
- More than € 2 bn research funds
- Number 15 of German patent applicants[1]
- Spin-Offs are supported

[1] Source: Annual report 2014, Deutsches Patent- und Markenamt
(Number 1: Robert Bosch GmbH, Number 2: Schaeffler Technologies GmbH & Co. KG 3: Siemens AG).

Facts and Figures of Fraunhofer UMSICHT

Oberhausen and Sulzbach-Rosenberg

Director
Prof. Dr.-Ing. Eckhard Weidner

Director Sulzbach-Rosenberg
Prof. Dr. Andreas Hornung

Fraunhofer UMSICHT OBERHAUSEN

Staff	245
Students	182
Laboratories	4,500 m²

Institutsteil SULZBACH-ROSENBERG

Staff	65
Students	60
Laboratories	1,700 m²

Founded: 1990 I Budget: 38,8 Mio. € I Spin-Offs: 12

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Project ASHES overview

Project ASHES

- »Recycling of nutrients from residues of thermo-chemical processing of bagasse/ straw«
- International cooperation project
- Project duration: 01.04.2015 – 31.12.2018
- Funding

Federal Ministry of Education and Research

- 11 Partners
- 4 Brazilian institutes
- 7 German institutes and companies

BAM Bundesanstalt für Materialforschung und -prüfung

CNPEM

CUTEC Informationen Ressourcen Energie

Fraunhofer

JÜLICH FORSCHUNGSZENTRUM

INSTITUTO FEDERAL DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA GOIÁS Câmpus Goiânia

KIT Karlsruhe Institute of Technology

Ministério da Agricultura Pecuária e Abastecimento

BRASIL PAÍS RICO É PAÍS SEM POBREZA

Outotec

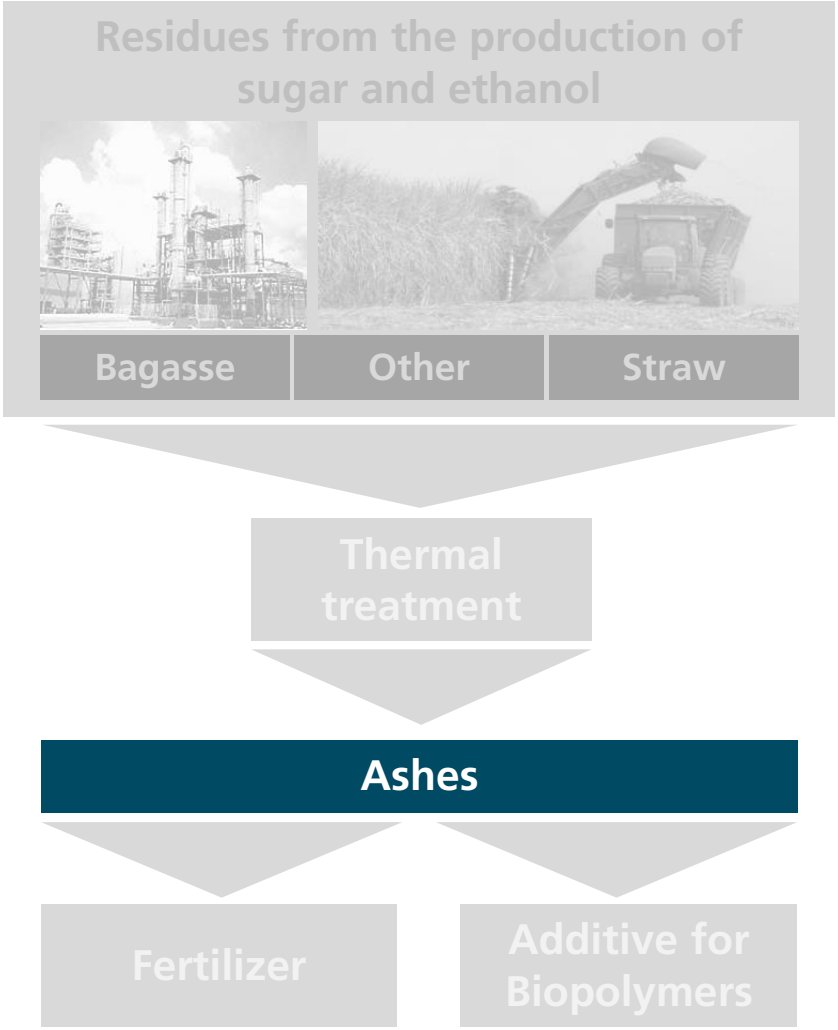
TECNARO The Biopolymer Company inside

UFG UNIVERSIDADE FEDERAL DE GOIÁS

Fraunhofer UMSICHT

Project ASHES overview

Project objectives



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Project ASHES overview

Project objectives

Outotec

CUTEC
Informationen
Ressourcen
Energie

Fraunhofer
UMSICHT

KIT
Karlsruhe Institute of Technology

Optimization of thermal treatment

Design of products

Product testing and evaluation

Residues from the production of sugar and ethanol

Bagasse | Other | Straw

Thermal treatment

Ashes

Fertilizer

Additive for Biopolymers

Project ASHES overview

Project objectives

BAM

CNPEM

Fraunhofer

UFG
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KIT
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Ministério da Agricultura Pecuária e Abastecimento
LANAGRO-GO
GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

INSTITUTO FEDERAL DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA GOIÁS
Câmpus Goiânia

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Residues from the production of sugar and ethanol

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Optimization of combustion

Tested fuels / Additives

Bagasse, Pellets

Bagasse, loose

Sugar cane straw

Sugar cane straw, Pellets

Digestate from cattle manure

Dried chicken manure

Filter cake

Sewage sludge

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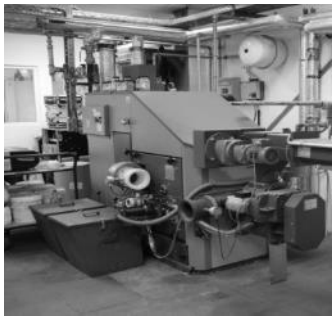
Optimization of combustion

Test equipment

Preliminary test
- Ökotherm Feuerung
- Cooled Brennmulde
- 30 kW
- Automated ash removal
- Wood, biogenic residues



Fuel tests
- HDG Bavaria C 100
- Reciprocating grate
- 100 kW
- Wood chips, wood pellets

Ash production
- Mawera 440 kW
- Horizontal, reciprocating grate
- Automated ash removal
- Dry and wet ash removal possible
- 50 h test runs

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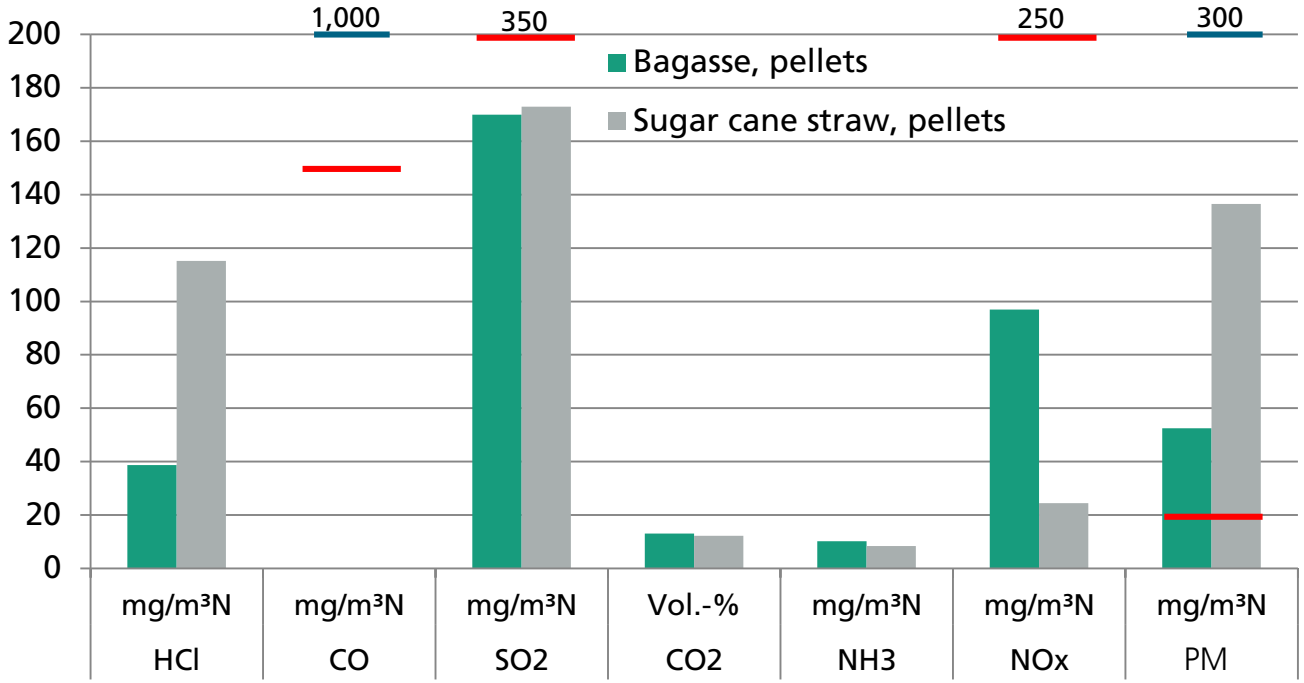
Optimization of combustion

Comparison Bagasse, pelletized – Sugar cane straw



	HCl	CO	SO_2	CO_2	NH_3	NO_x	PM
	mg/m^3_N	mg/m^3_N	mg/m^3_N	Vol.-%	mg/m^3_N	mg/m^3_N	mg/m^3_N
Bagasse, pellets	38.65	<10	169.93	13.08	10.21	96.99	52.5
Sugar cane straw	115.20	<10	172.88	12.23	8.41	24.40	136.49

German Standard (TA Luft)

Brazilian Limits

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Optimization of combustion
Comparsion

- Burnout of solid fuel:

Test: TOC 1.88% - 2.67%
Plant: TOC 8.4% - 38.4%

- Combustion of gaseous components:

Test: CO < 10 mg/Nm³
Plant: CO < 1,000 mg/Nm³ (10 MW)

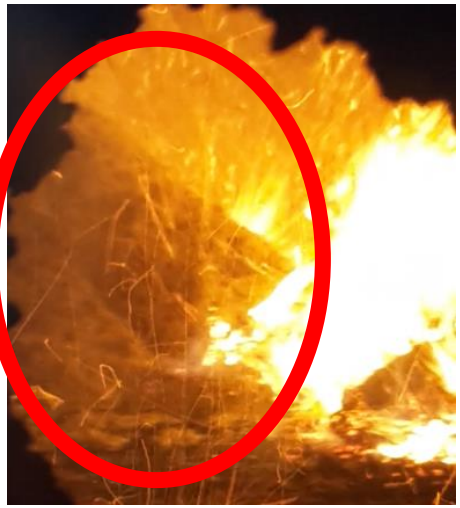
- Particulate matter

Test: Factor 2.5 below limit values (Sugar cane straw)
Factor 6 below limit values (Bagasse)

- High consumption of fresh waster:

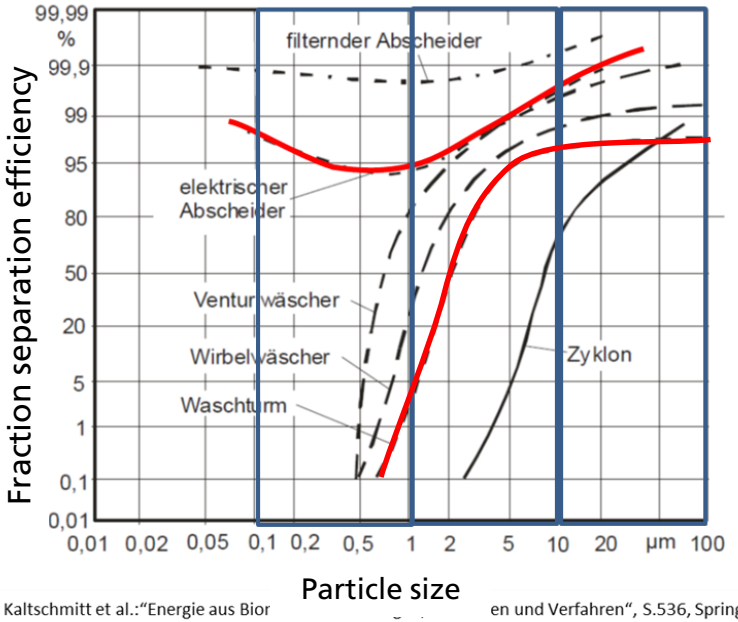
Plant: 500 l / ton of cane for scrubber and ash-removal
Test: dry removal

- Additional costs



Optimization of flue gas treatment

ESP vs. Washer



Kaltschmitt et al.:"Energie aus Bior en und Verfahren", S.536, Springer, 2.Auflage, ISBN 978-3-540-85094-6, Heidelberg, 2009

Fraction separation efficiency

[%]	PM 1	PM 10	>PM 10
Fabric Filter	99,75	99,775	99,97
ESP	96,5	97,25	99,725
Washer Venturi	40	89,7	99,65
Whirling washer	10	59	98,5
Washer Tower	1	49	96
Cyclone	0	32,5	82

- Starting point: Fraction seperation efficiency of different technologies
- Assumption: Existing plants comply with emission limits
- Particle size distribution is used to estimate share of PM1, PM10 and >PM10 (Cleaned gas)
- From the efficiency of the washer the raw gas values are estimated
- With the efficiency of the ESP possible concentrations of PM1, PM 10, >PM10 and TSP are estimated.

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Conclusion

- Pelletized bagasse and sugar cane straw showed very good combustion behavior:
  - Low emissions of particulate matter
  - Low emissions of NO_X
  - Complying with German emissions standard
  - Complete burnout

- Flue gas treatment:
  - Separation efficiency of washers decrease for particles below <1PM
  - Fresh water consumption can be reduced significantly
  - Low pressure drop and low energy consumption

Project Ashes – Projeto Cinzas

Thank you very much for your kind attention!
Muito obrigado

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Ashes

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