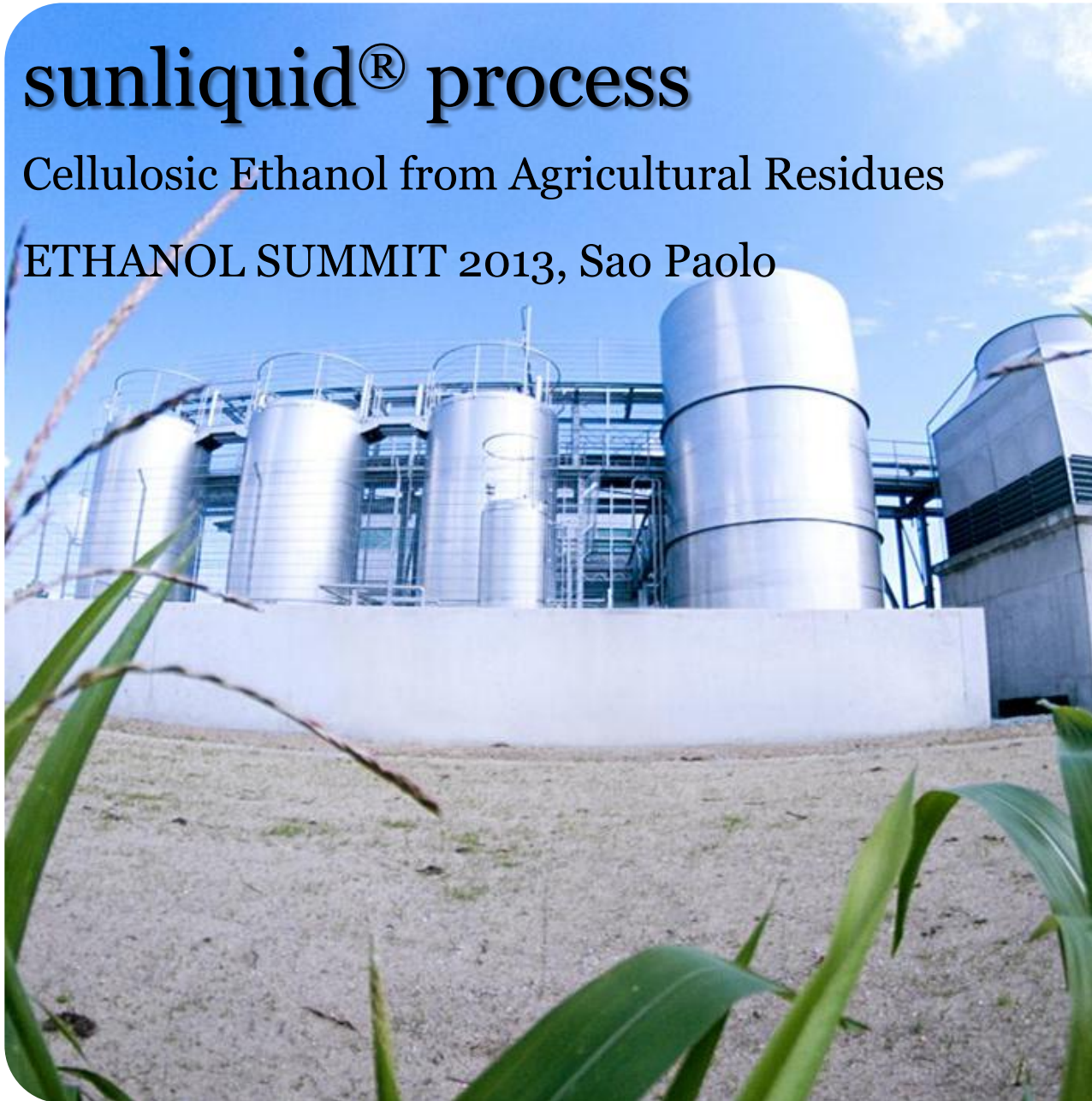


# sunliquid<sup>®</sup> process

Cellulosic Ethanol from Agricultural Residues

ETHANOL SUMMIT 2013, Sao Paolo



**CLARIANT** 

Public

Markus Rarbach  
BRC/BFD  
21.06.2013

what is precious to you?

# Clariant – Key Facts



- Clariant is a world leader in colors, surface effects, and performance chemicals
- Annual sales of CHF 6.0 billion in 2012
- Headquartered in Muttenz near Basel, Switzerland
- World-wide operations, with more than 100 group companies
- Approximately 21,200 employees
- Products and services of 7 Business Units are based on innovative specialty chemicals
- Clariant acquired Süd-Chemie in 2011 and as of July 2012 Süd-Chemie is officially integrated into Clariant



# The way to competitive cellulosic ethanol



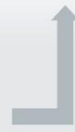
Feedstock

Pre-treatment

Hydrolysis

Fermentation

Cellulosic Ethanol



Integrated enzyme production

- Integrated on-site enzyme production
- Feedstock & process specific enzymes
- C6 & C5 fermentation
- Energy saving ethanol separation

# The integrated enzyme production significantly lowers the enzyme costs per gallon of Ethanol

## Advantages of integrated enzyme production

### Low substrate cost

- Enzymes are produced on lignocellulosic substrate

### No additional utilities

- Enzyme production is process and plant integrated

### No formulation and logistics

- Enzymes are produced directly where needed

### Feedstock and process-specific enzymes

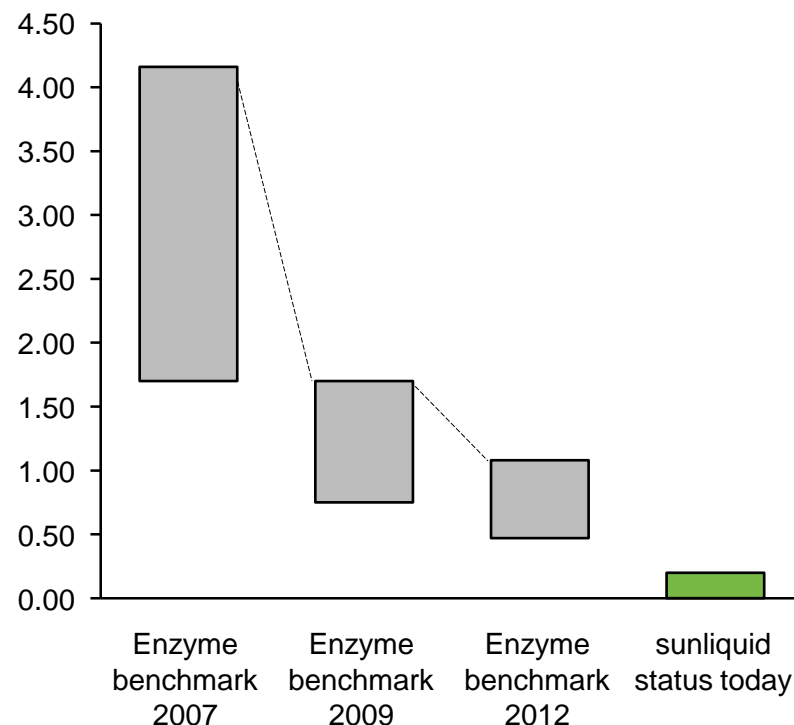
- No 'one-size-fits-all' solution

### Independent from enzyme suppliers

- No additional margins due to pricing strategy

## Enzyme cost comparison

USD/gallon Ethanol





# Demonstration plant is in operation



Feedstock: ~ 4.500 t/a wheat straw,  
corn stover, bagasse

Output: 1.000 t/a (1.2 million litres)

Location: Straubing, Germany

Official Inauguration: July 20<sup>th</sup> 2012





## Conclusion: High technology performance package

- **From one company** a complete integrated process and biotechnology solution
- Process works flexible for **different renewable feedstocks**
- **Integrated production of feedstock specific enzyme** delivers maximum efficiencies
- **High process yield**
- **Production costs** get competitive with 1G ethanol
- **Energy neutral for EtOH production:** no additional fossil energy needed
- **Nearly carbon neutral:** GHG reductions of **about 95%** compared to fossil fuels
- **No “Food for Fuel” competition** and no land use change

THANK YOU!