



Innovations to improve the sustainability of Lactic Acid production



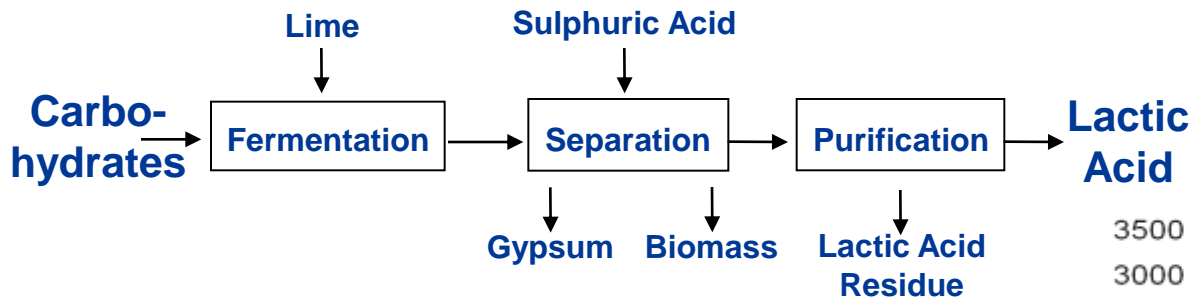
CSM Investor Event
Gorinchem, 27 April 2011
Rop Zoetemeyer
Chief Technology Officer

Agenda

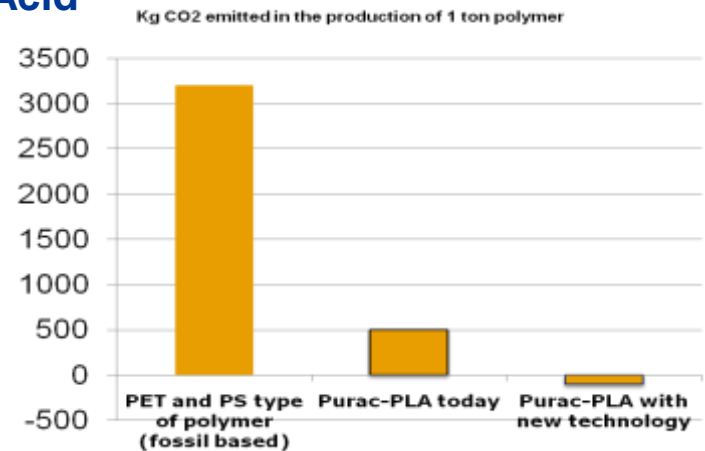
- Review plant tour
- Eco-footprint of Lactic Acid production
- Purac innovation topics
- Alternative substrates for Lactic Acid production
- Bio-refinery concept
- Conclusions



Gypsum-free Lactic Acid production



Result: simplification and lower environmental impact



Purac to a lower eco-footprint

People - Planet - Profit

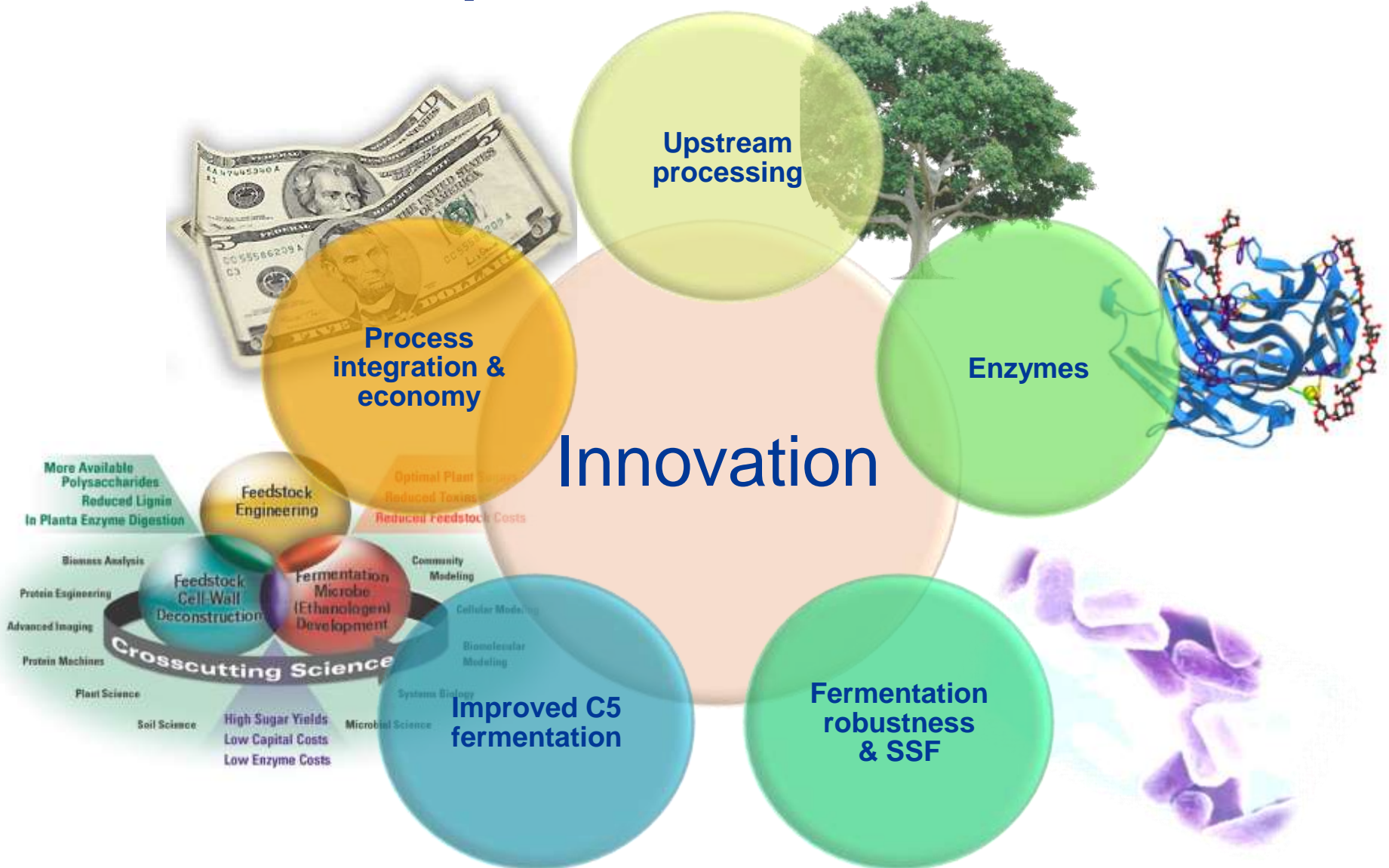
A good eco-footprint is more than only a favorable CO₂ footprint

Eco-footprint item	Purac technology today	Purac technology tomorrow	Remark
Non-renewable energy demand	√	√	
Global warming potential	√	√	
Acidification potential		√	Sulphuric Acid
Eutrophication potential		√	Carbohydrates
Photochemical ozone depletion potential		√	Carbohydrates
Farm land use		√	Carbohydrates
Abiotic (mineral) depletion	√	√	

Projects:

- Gypsum-free process
- Alternative substrates

Innovation topics in alternative substrates



Alternative substrates

Aim: Non-food substrates for non-food applications

Goal: A commercial plant for producing PLA monomers using non-food substrates by 2015

Examples of potential substrates:



Corn stover, corn cobs



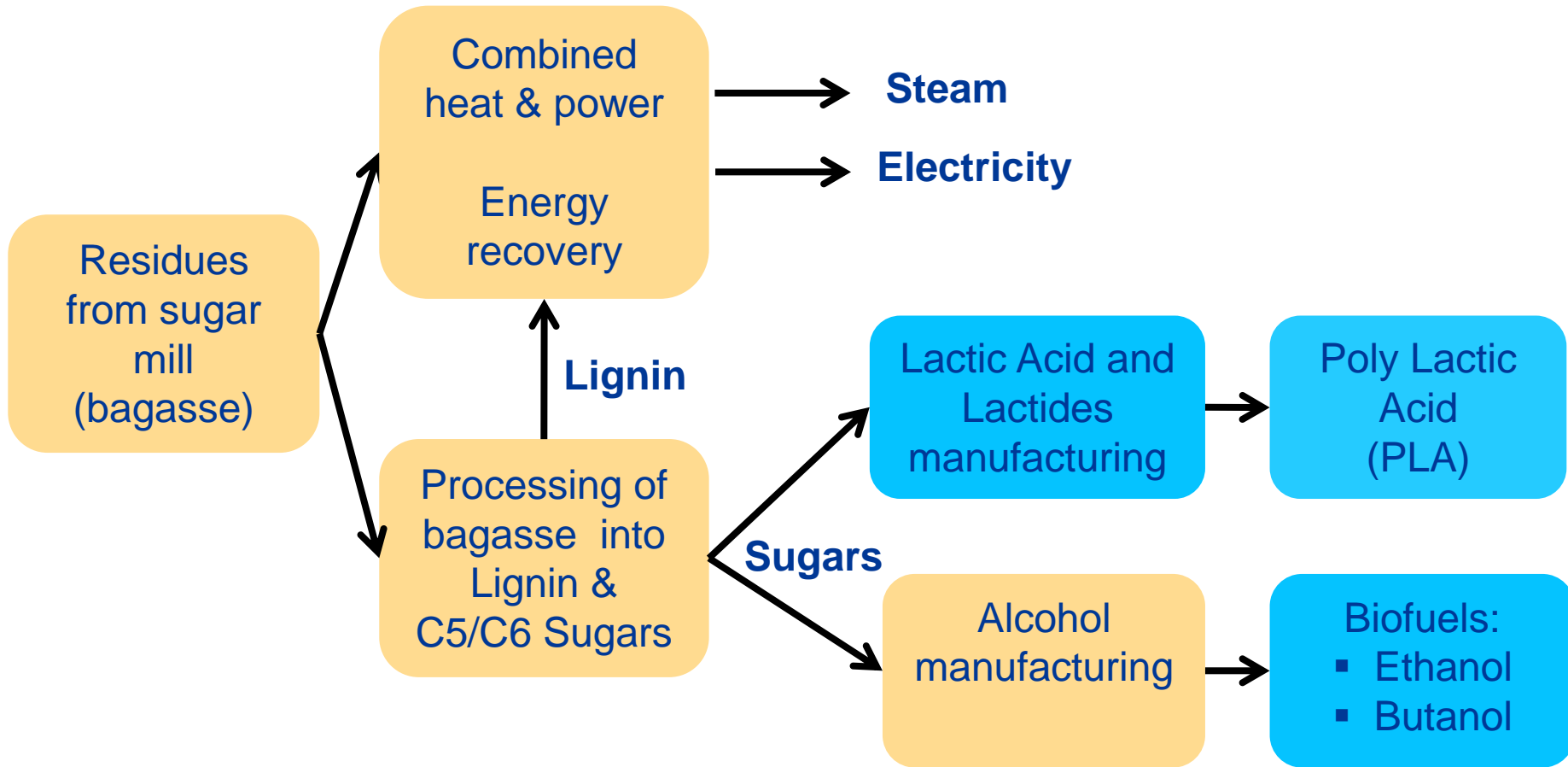
Bagasse



Wood waste, paper waste

Example bio-refinery concept

Converting residue streams into PLA



Long term partnerships in a bio-refinery
Shared facilities & lowest cost

Purac participation in public-private-partnerships

- Purac is investing several million euro in next generation feedstock development with various partners:

- BE-Basic R&D program : EUR 120 million
 - Global industrial, academic & financial partners
 - Purac is a research member
 - Bioprocess pilot facilities

- Kluyver Centre

- SenterNovem

- Bio Based Europe (BBE)

- Dutch Separation Technology Institute (DSTI)



GHENT
BIO-ENERGY
VALLEY



Agentschap NL
Ministerie van Economische Zaken

Science Port Holland



Purac is candidate partner in Dutch Bioprocess Pilot Facility (BPF)

- CSM is investigating the participation of its subsidiary Purac in a multi-purpose Bioprocess Pilot Facility (BPF) in a consortium of a number of industry partners and universities, including DSM and Delft University of Technology
- This Bioprocess Pilot Facility is planned to be built in Delft, The Netherlands and aimed at scale-up research and education for next generation bioprocesses
- In this facility process development research can be facilitated in the field of biomass pre-processing, biomass pre-treatment, fermentation and down stream processing



Funding Bioprocess Pilot Facility (BPF)

- The Bioprocess Pilot Facility is planned to be funded by Delft University of Technology, other universities, companies, the European Union, The Dutch Ministry of Agriculture, Nature & Food Quality and Economic Affairs, the Province of South Holland and the Municipalities of Rotterdam, Delft and The Hague. The proposed grants will comply with European Union competition rules and procedures, in particular the rules on State aid. The public authorities involved will follow all necessary procedures



Founders Bioprocess Pilot Facility (BPF) initiative

Implementing new technologies is becoming reality

Planning gypsum-free project

	2009	2010	2011	2012	2013	2014	2015
Pilot plant	■						
Demo plant		■					
Engin+Construct				■			
Operation					■		

Planning alternative substrates project

	2009	2010	2011	2012	2013	2014	2015
Laboratory work	■						
Pilot plant			■				
Engin+Construct					■		
Operation							■

Conclusions

- Purac is actively innovating for sustainable Lactic Acid production today:
 - Gypsum-free Lactic Acid process
 - Alternative substrates
 - Reduced CO₂ footprint → from CO₂ emission to carbon sink
 - Other eco-footprint improvements



Passion
Partnership
Performance