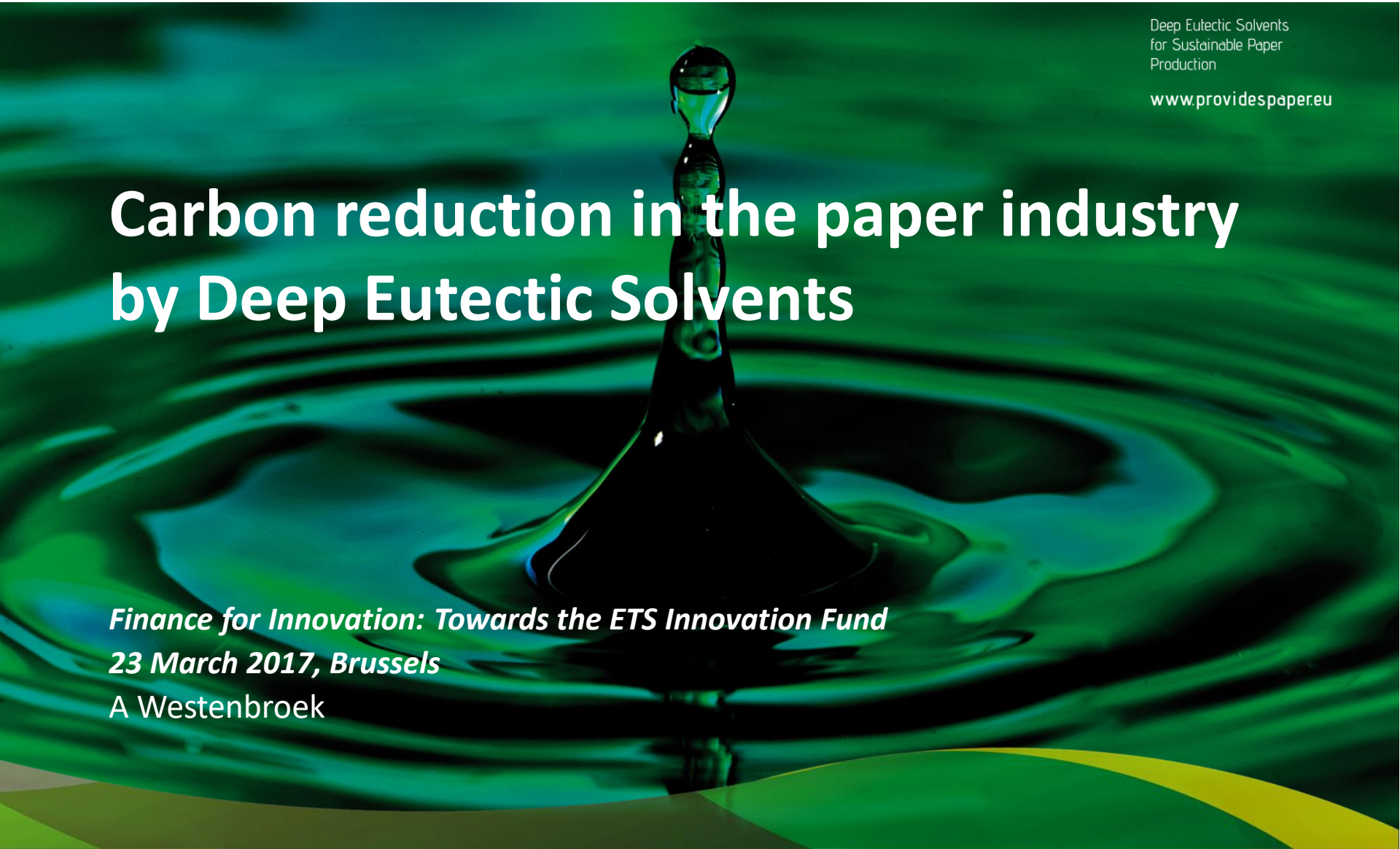
Provides

Deep Eutectic Solvents for Sustainable Paper Production

www.providespaper.eu



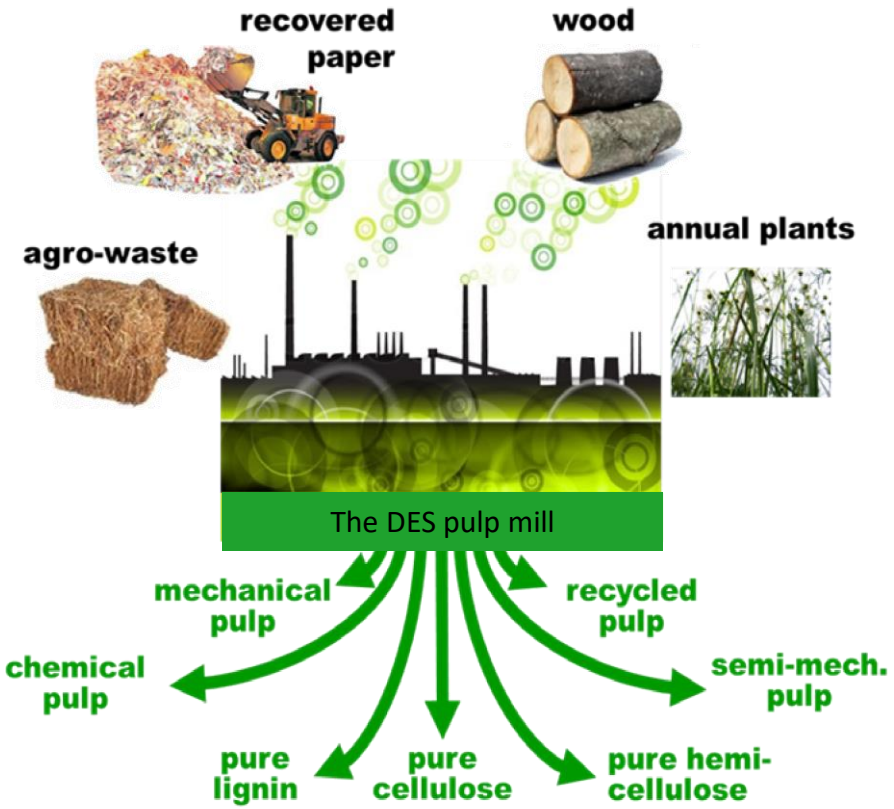
Carbon reduction in the paper industry by Deep Eutectic Solvents

Finance for Innovation: Towards the ETS Innovation Fund

23 March 2017, Brussels

A Westenbroek

The dream



Any lignocellulosic raw material

from any source

with a very low energy and environmental impact

Can be converted to

Fibers

Lignin

Chemicals

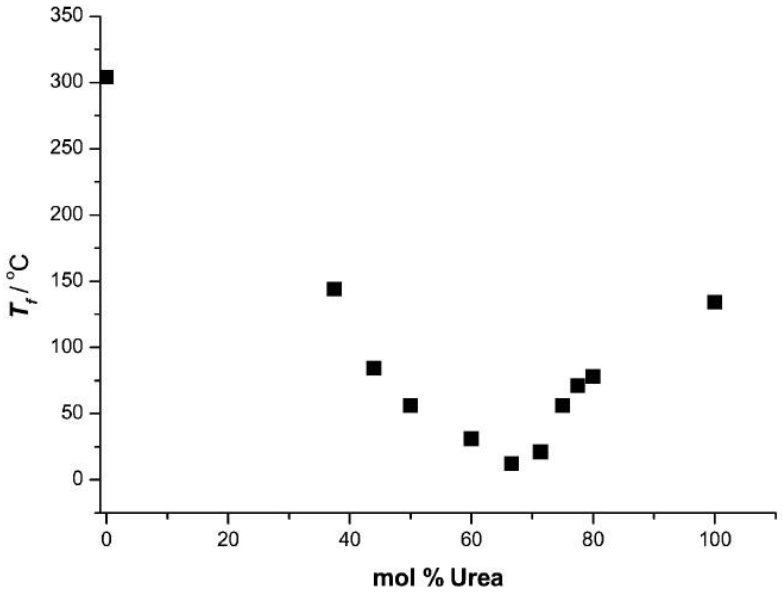
Ambition

Approaching 80% CO_2 emission reduction by the application of Deep Eutectic Solvents (DESs)

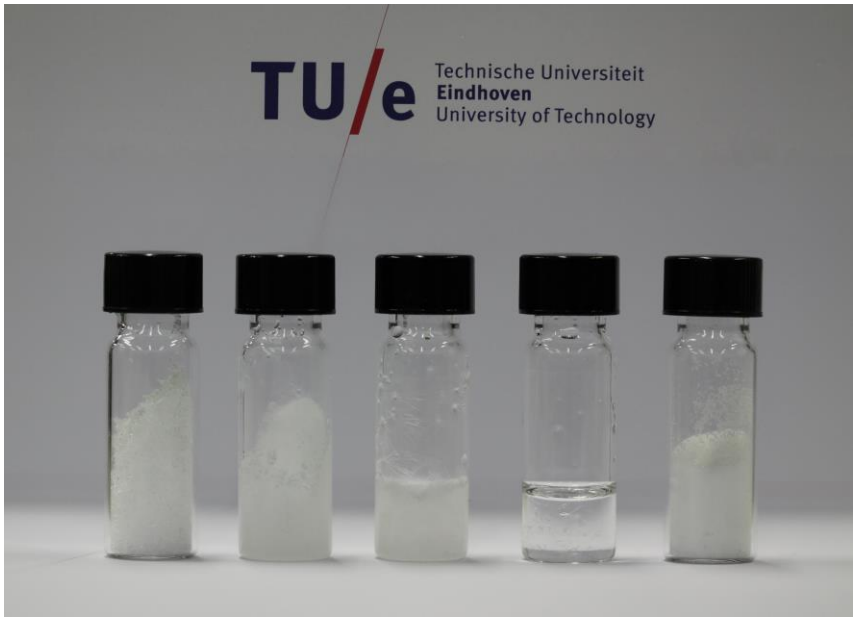
- Common development of the technology
- Europe-wide application

About Deep Eutectic Solvents (DESs)

Deep Eutectic Solvents (DESs) are low transition temperature mixtures (LTTMs) consisting of at least one hydrogen bond donor (HBD) and one hydrogen bond acceptor (HBA) counterparts that result on a liquid mixture showing unusual low freezing point



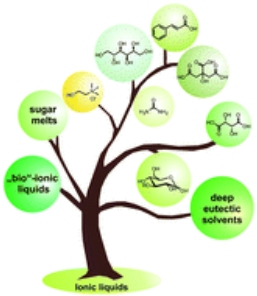
Freezing point of choline chloride / urea mixtures as a function of composition.



Visual representation of choline chloride / urea mixtures as a function of composition.

A.P. Abbott et al. Chem. Comm., 2003, 70-71

Mimicking Nature



Hypothesis:
DESs are used by plants to operate even during drought or frost periods.

Composed of natural products

- Amides
- Sugars
- Alcohols
- (amino) acids

Chemical characteristics

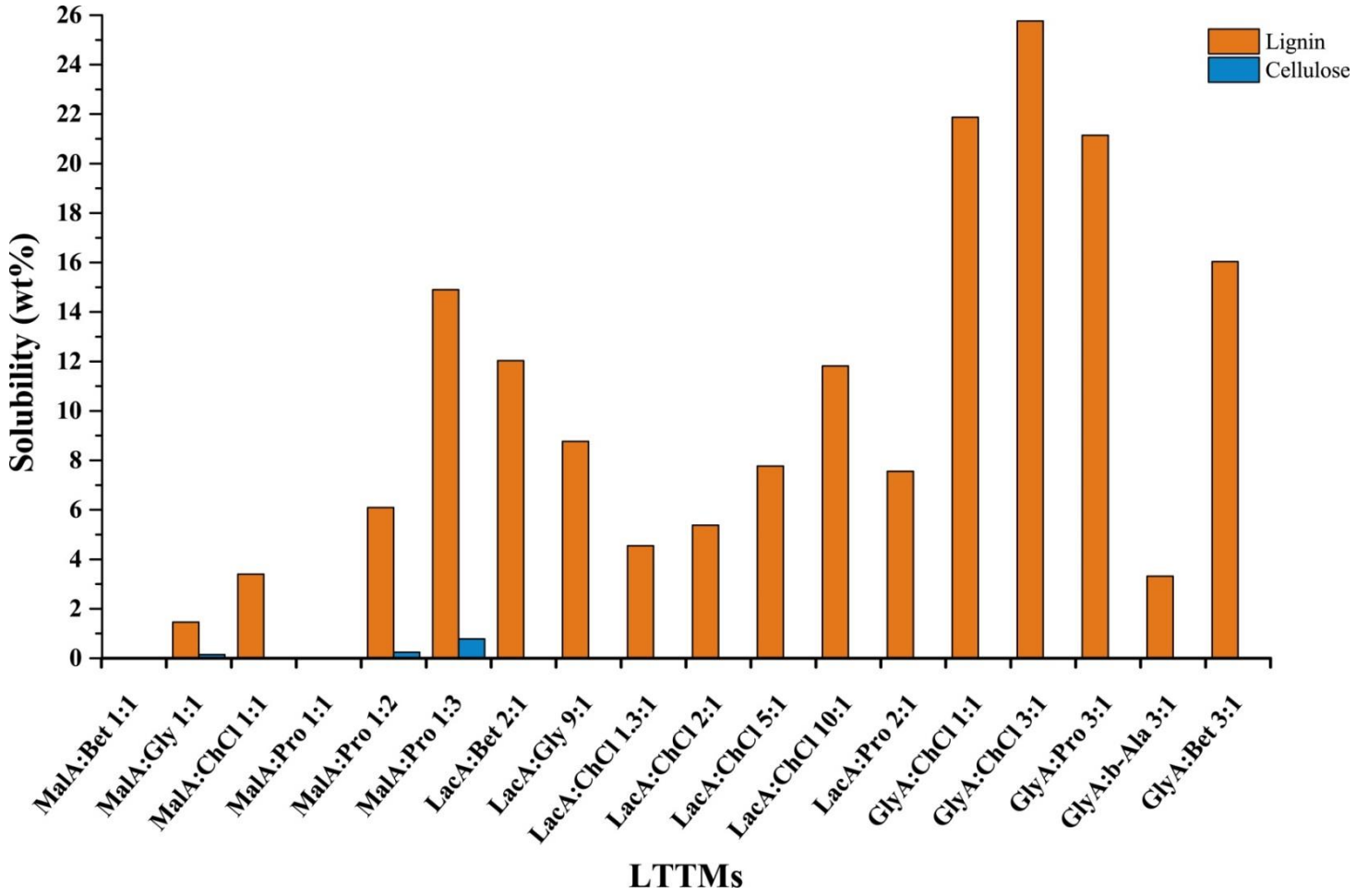
- Biodegradable
- Miscible with H_2O
- Non toxic

Physical characteristics

- Low vapour pressure
- Low flammability
- Non-volatile

DESs are a sustainable and cheap alternative to far more cumbersome solvents used today.

Why for paper industry?



M. Francisco et al., Angewandte. Chem. Int. Ed., 2013

Scope

Dissolving lignin

- Pure cellulose, lignin and hemicellulose
- Low cost
- From different sources (wood, straw)
  → Tailor made fibres depending on DES mixtures

Dissolving cellulose

- Recovery of pure cellulose from papermaking residues
- Low cost
  → Clean dissolved pulp or building block for bio chemicals, materials or fuels

Dissolving ink and other contaminants

Savings

- DES replaces traditional pulping processes.
- DES produces high quality cellulose, hemicellulose and sulphur-free / unchanged lignin.

Energy reduction

CO_2 reduction

The true savings lie outside the mill boundaries:
If lignin replaces aromatics in the chemical industry
→ up to **– 90% overall energy and CO2 savings**

Further added value

- Biomass logistics → – 1 to – 2 Mt CO_2 emissions related to transport
- Lower investment costs → up to – 50%

Participants

Provides

ISPT
altri
sappi
mondi
Buckman
ctp centre technique du papier
TU/e Technische Universiteit Eindhoven University of Technology
CROWN VAN GELDER
DS Smith
Eska Graphic Board
THE NAVIGATOR COMPANY
UPM
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Valmet
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UNIVERSITY OF TWENTE.
universidade de aveiro
OMYA
parenco
Smurfit Kappa
storaenso
VOITH
VanHoutum

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