



FuturoI™

Your one-way ticket to the
2G world

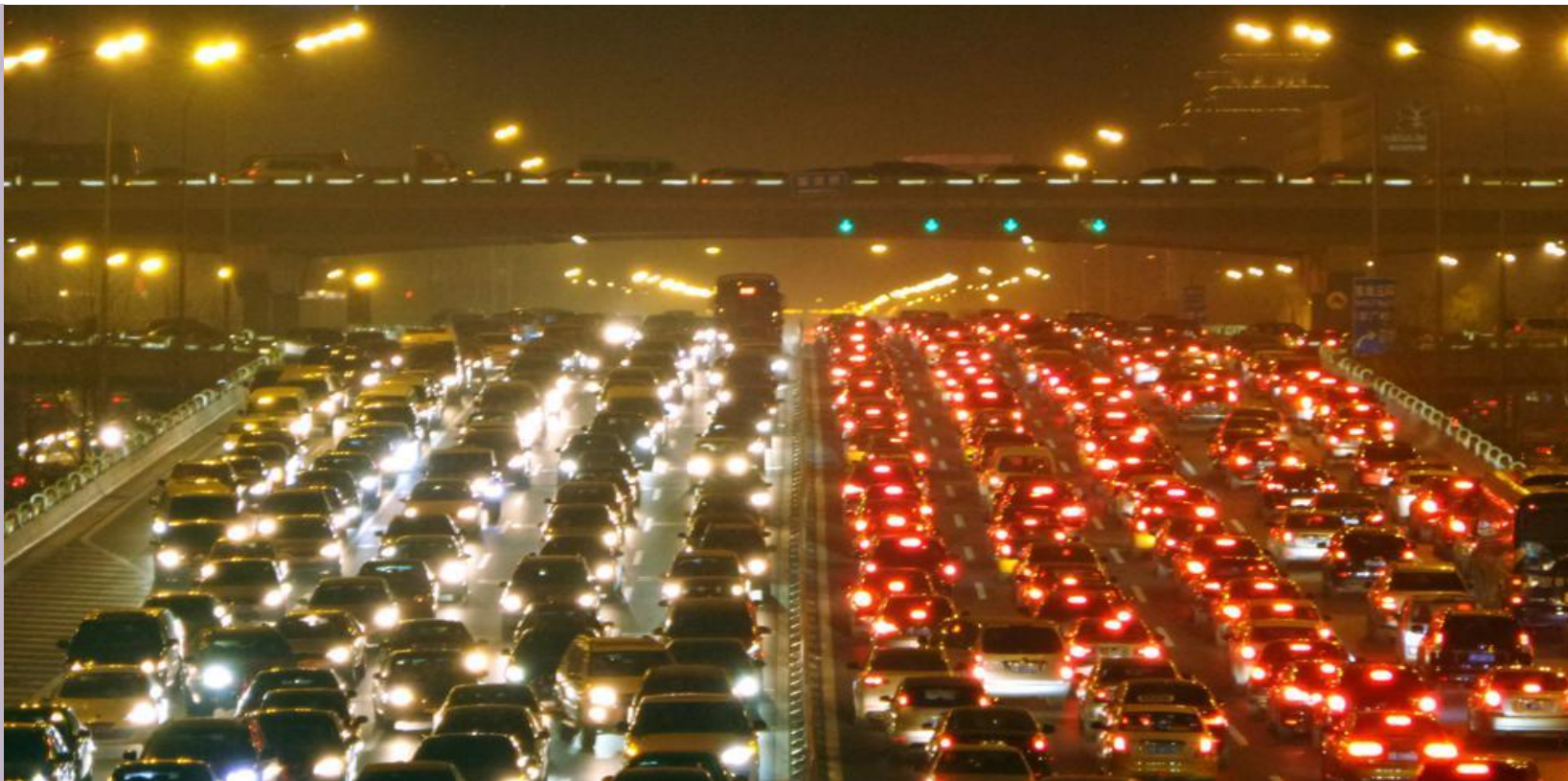
Frédéric BALLIGAND



Axens
SOLUTIONS

A Major Challenge for Humanity

ENVIRONMENTAL CHALLENGES



Our answers to face this challenge



Optimise utilisation of resources

Optimization of Refining & Petrochemical production units



Develop alternative pathways

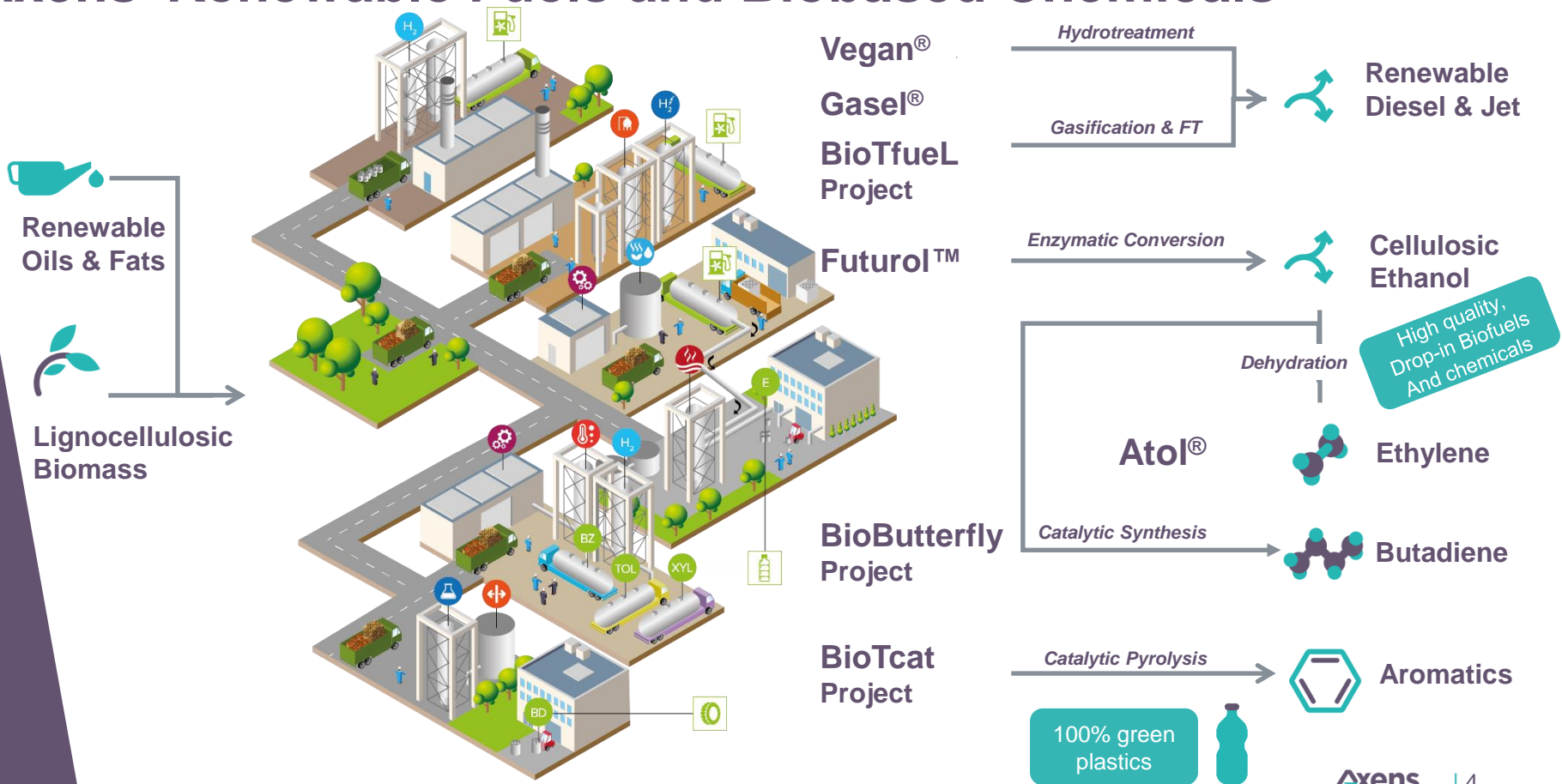
Focus on biotechnology and biobased conversion processes



Create strategic alliances with industrials and end-users

Answer to industries' needs, develop synergies and reduce time to market

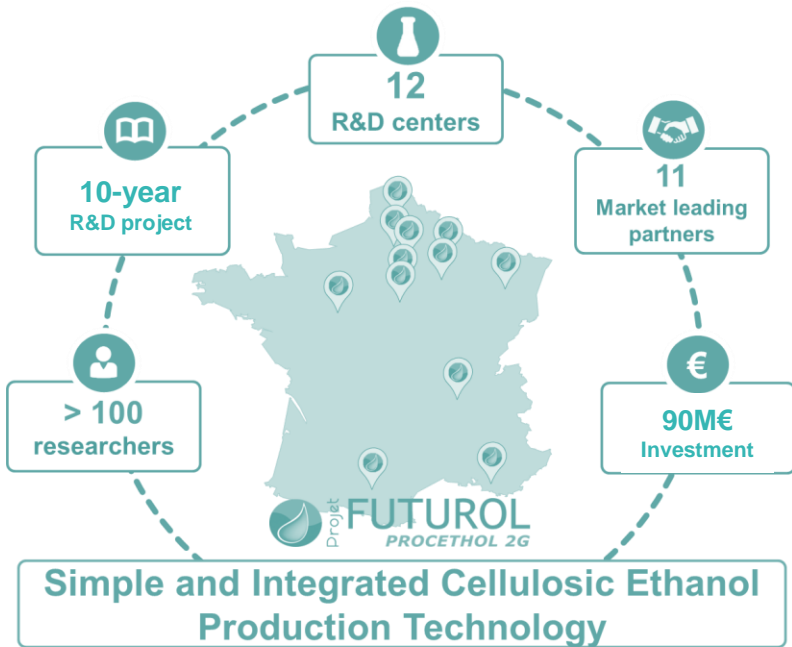
Axens' Renewable Fuels and Biobased Chemicals



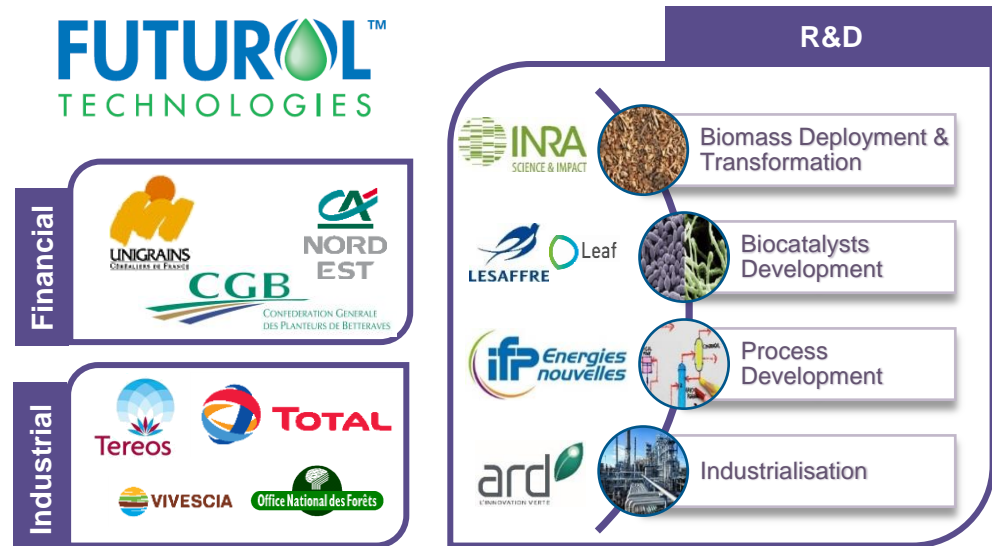


FUTUROL™

Development & Commercialisation of FuturoTM



› Bringing the Best Experts from Each Key Area



A Simple & Efficient Integrated 4-Step Process

1

PRETREATMENT

- ▶ Standardisation step
- ▶ Low moisture
- ▶ High C₅ sugars yield and cellulose digestibility

Lignocellulosic biomass

4

PRODUCTS RECOVERY

- ▶ Energy and process integration:
 - ▶ Steam/power production
 - ▶ Water/stillage direct recycle

2

BIOCATALYSTS PRODUCTION

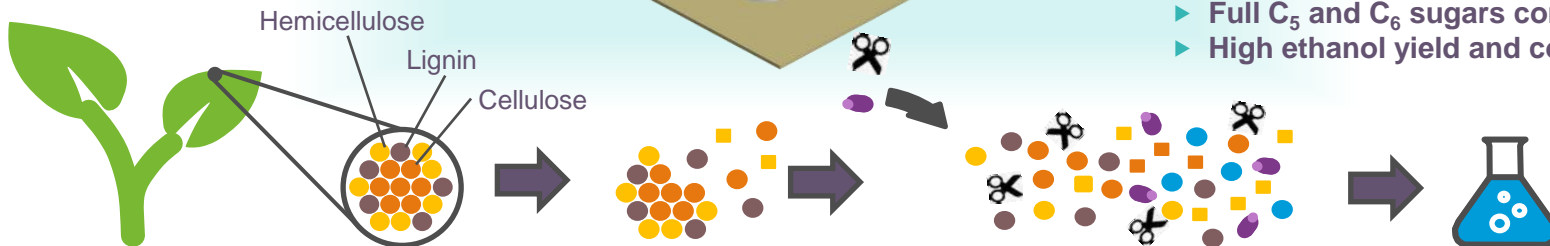
- ▶ On-site production
- ▶ Tailor-made enzymes/yeasts
- ▶ High resistance to inhibitors
- ▶ Fully adapted to substrate

3

HYDROLYSIS & FERMENTATION

- ▶ One-pot process
- ▶ CAPEX and OPEX minimization
- ▶ Full C₅ and C₆ sugars conversion
- ▶ High ethanol yield and content

Ethanol



The Road So Far...



Multi-Feedstock Flexible Process

- › Wide Range of Biomasses thanks to Standardization
- › Seasonal Feedstock: Maximum Time on Stream



High Performance SSCF

- › Economical Optimum in One-Pot Process
- › Full conversion of C5/C6 Sugars
- › High Ethanol Yields



Robust & efficient Biocatalysts

- › Outstanding Resistance to Inhibitors
- › Genetically Improved for Best Performance
- › On-site Production for Cost Minimisation












Simple, Efficient & Integrated Process

- › Proven Biomass Pretreatment
- › Energy self-sufficiency with Coproducts Valorisation
- › Water Recycles & Zero Liquid Discharge

And Now?

■ Biomass Portfolio Expansion

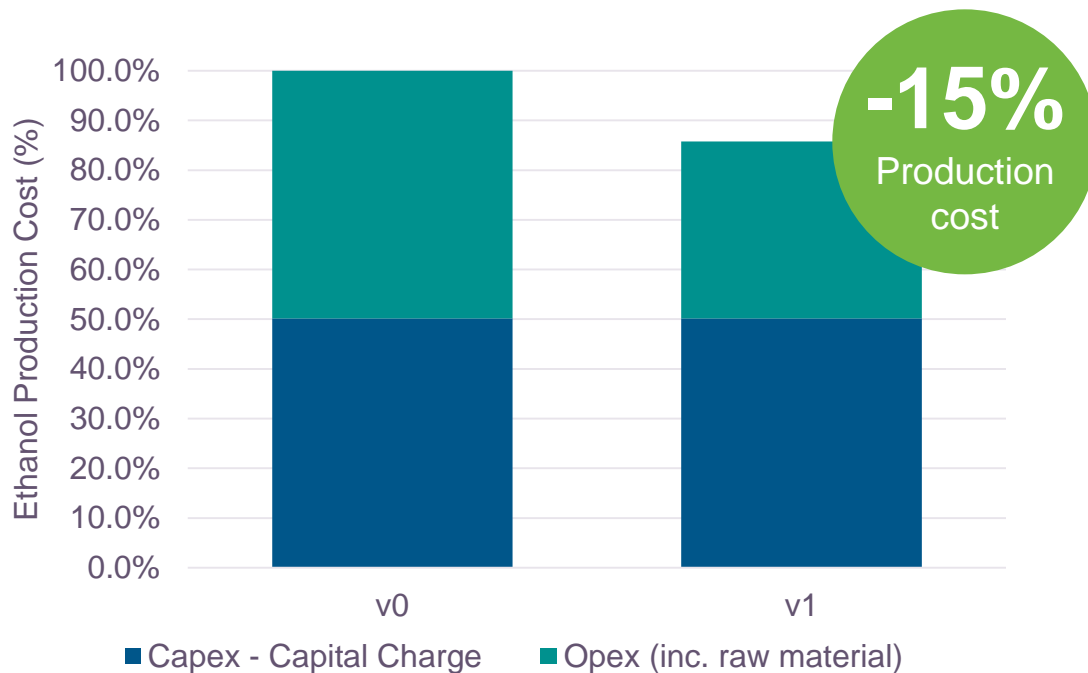
Wheat Straw	Rice Straw	Miscanthus	Sugarcane bagasse & leaves	Bamboo	Resinous wood	Soft wood	Corn cob	Corn stalks & stover
								



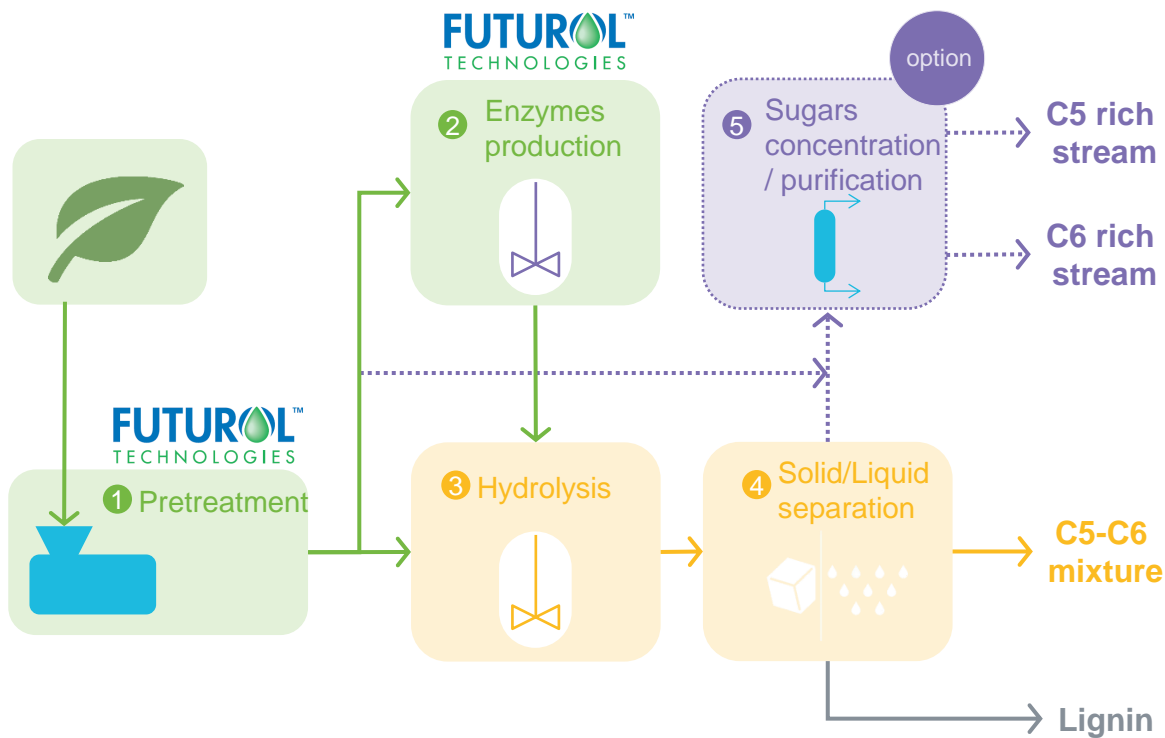
Proven **performance guarantees** on a wide range of biomass

And Now?

■ Process Integration & Enzymatic Cocktail Optimisation



Introducing Axens' 2G Sugars Technology



★ KEY FEATURES

- 1 Industrially proven FuturoL™ pretreatment & Enzyme production
- 2 Same Enzymes as FuturoL™ → benefits from constant strain optimisation
- 3 Hydrolysis optimised on an industrially representative pretreated feedstock
- 4 Optimised based on IFPEN strong knowhow and backed-up by > 10 years of FuturoL development
- 5 Flexible offer with option to separate C5 & C6 streams w/o concentration

Your one-way ticket to the 2G world

- Feedstock-flexible process adapted to campaign operations
- Optimised & Integrated process
- Strong & robust background
- New platform to biobased materials

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www.axens-solutions.net

Thank
you!