

Innovation Made in Switzerland

Sugar Based Chemistry for Bio-Plastics

NRP 66 "Resource Wood"

15 April 2016

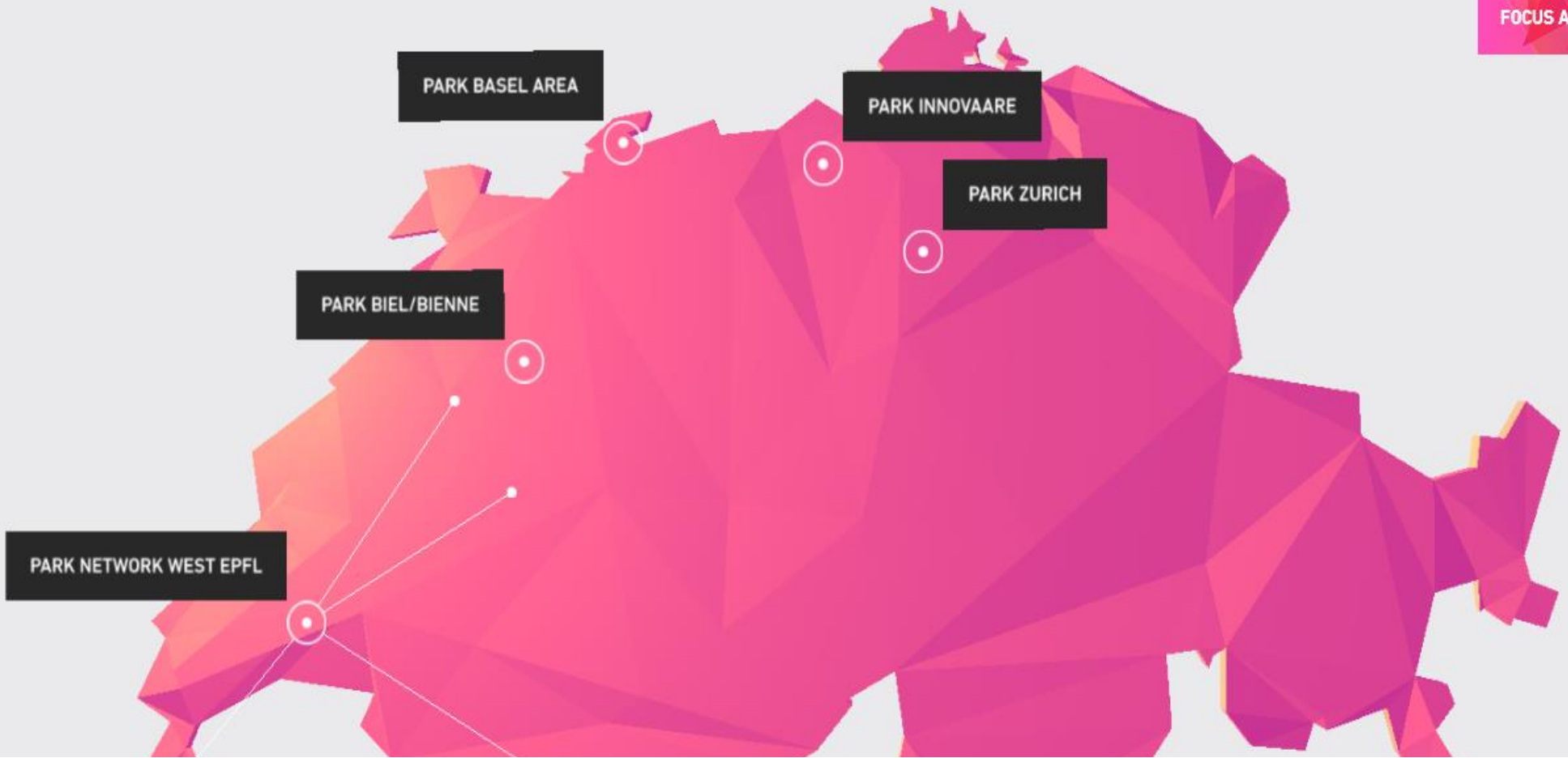


INNOVATION



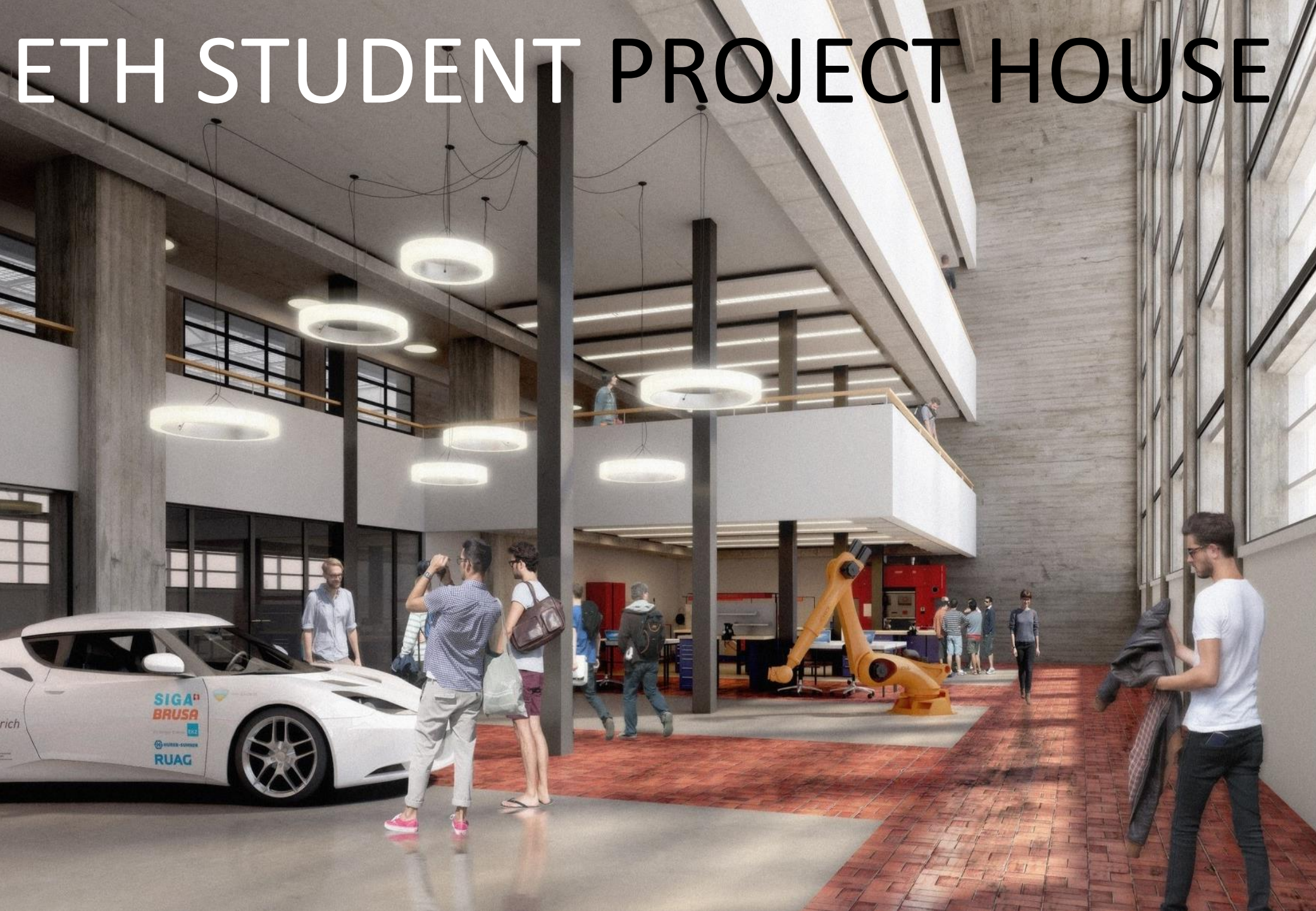
37'000

aus der Schweiz heraus wurden 2010 mehr als 37'000 Patentanmeldungen eingereicht. Dies entspricht im Durchschnitt der vergangenen Jahre rund 8000 verschiedenen Erfindungen, die häufig in mehreren Ländern oder Regionen angemeldet wurden. Die Schweiz ist damit Europameisterin und weltweit absolute Spitze



SWITZERLAND INNOVATION PARK

ETH STUDENT PROJECT HOUSE





Sulzer is closing down its last factory

Sulzer gibt den letzten verbliebenen Produktions-standort in der Stadt Winterthur auf. Erneut streicht der Traditionsbetrieb 90 Stellen.



ABB stops production of gearless mill drives in Switzerland

Innovation Strategy

BIO-BASED CHEMISTRY

Platform Chemical
5-HMF

Bio-based Plastics
Bio-based Polymers
Pharma

PERFORMANCE CARBONS

Powder Activated Carbon
Carbon Black

Adsorption of
Micro Pollutants
CO₂-Reduction

ENERGY & UTILISATION

Sewage Sludge
Biogenic Residues

Energy Efficiency
Phosphorous-
Recovery

RENEWABLE BIOMASS

HYDROTHERMAL PROCESS AS PLATFORM TECHNOLOGY

Sugar Based Chemistry from 5-HMF to FDCA to PEF

THE FUTURE



THE PAST



Performance Advantages of PEF Packaging

Performance	PEF	PET
Gas permeability O ₂	6-10 x better than PET	
Gas permeability CO ₂	2-5 x better than PET	
Moisture resistance H ₂ O	2 x better than PET	
CO ₂ -Footprint	50% better than PET	
Glass transition temperature TG	84-90° C	67-81° C
Melting point T _m	195-265° C (stable up to 325° C)	250-270° C
Density	1.43 g/cm ³	1.36 g/cm ³
Young's modulus E	3.0-3.5 GPa	2.1-3.1 GPa
Field strength	90-100 MPa	50-60 MPa

Bioche-1 Production Plant





**Haupteingang
Rothausstrasse 61**



Facts & Figures

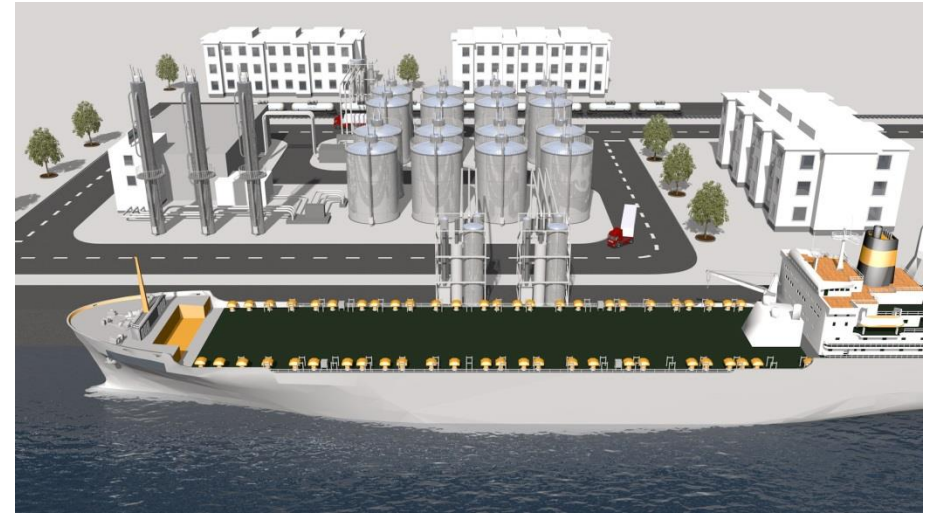
Total Production Capacity:

- 5-HMF Crystalline: 20 t/a
- 5-HMF in water: 300 t/a

Start of Operation: 2014

Industries served: Product Development & Research in various industries

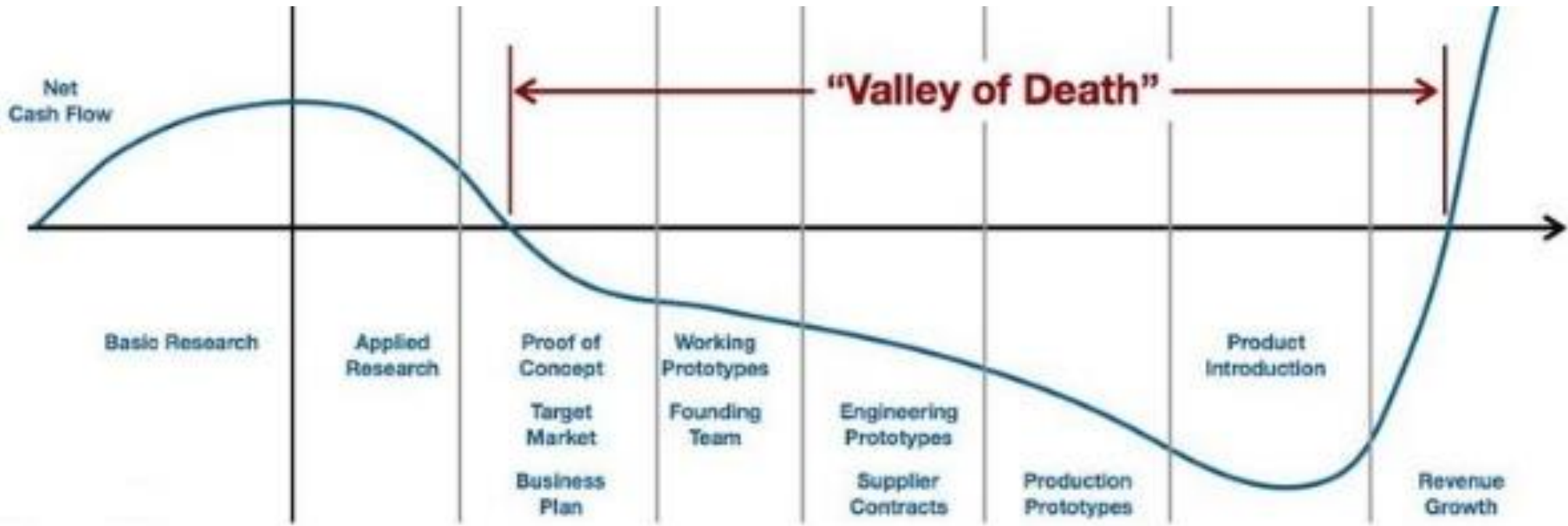
Large Scale Production Plant



Facts & Figures

Total Input:	240'000 (60'000 Phase 1) t/a Fructose
Total Output:	120'000 (30'000 Phase 1) t/a FDCA
	→ 7.5 Billion PEF Bottles
	→ 1.5 Billion = Swiss PET Bottle Market
Start of Operation:	2019
Industries served:	Global FMCG companies

The Innovation Valley of Death



Sometimes the Innovation Valley of Death can feel like the Grand Canyon



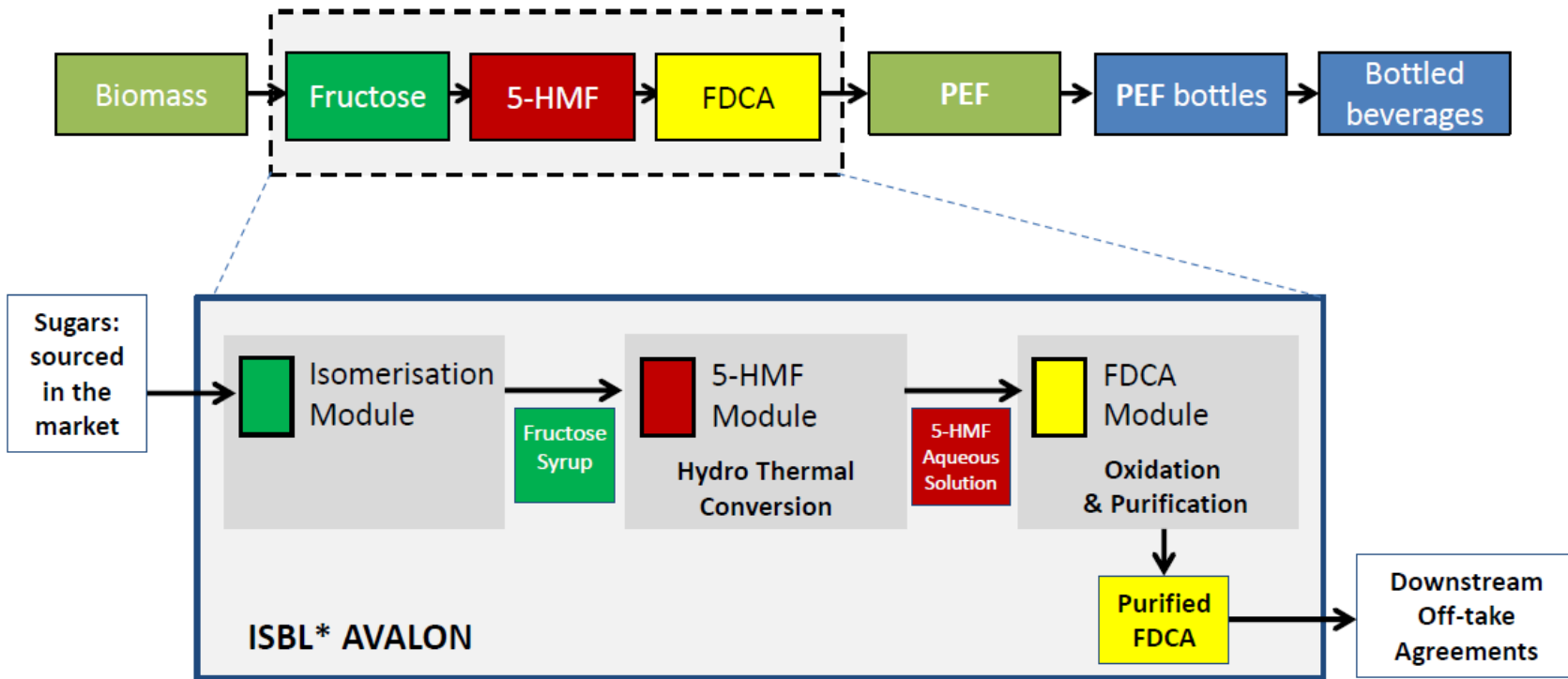
THE ROAD TO PEF

COLLABORATE OR DIE

The Value Chain Challenge

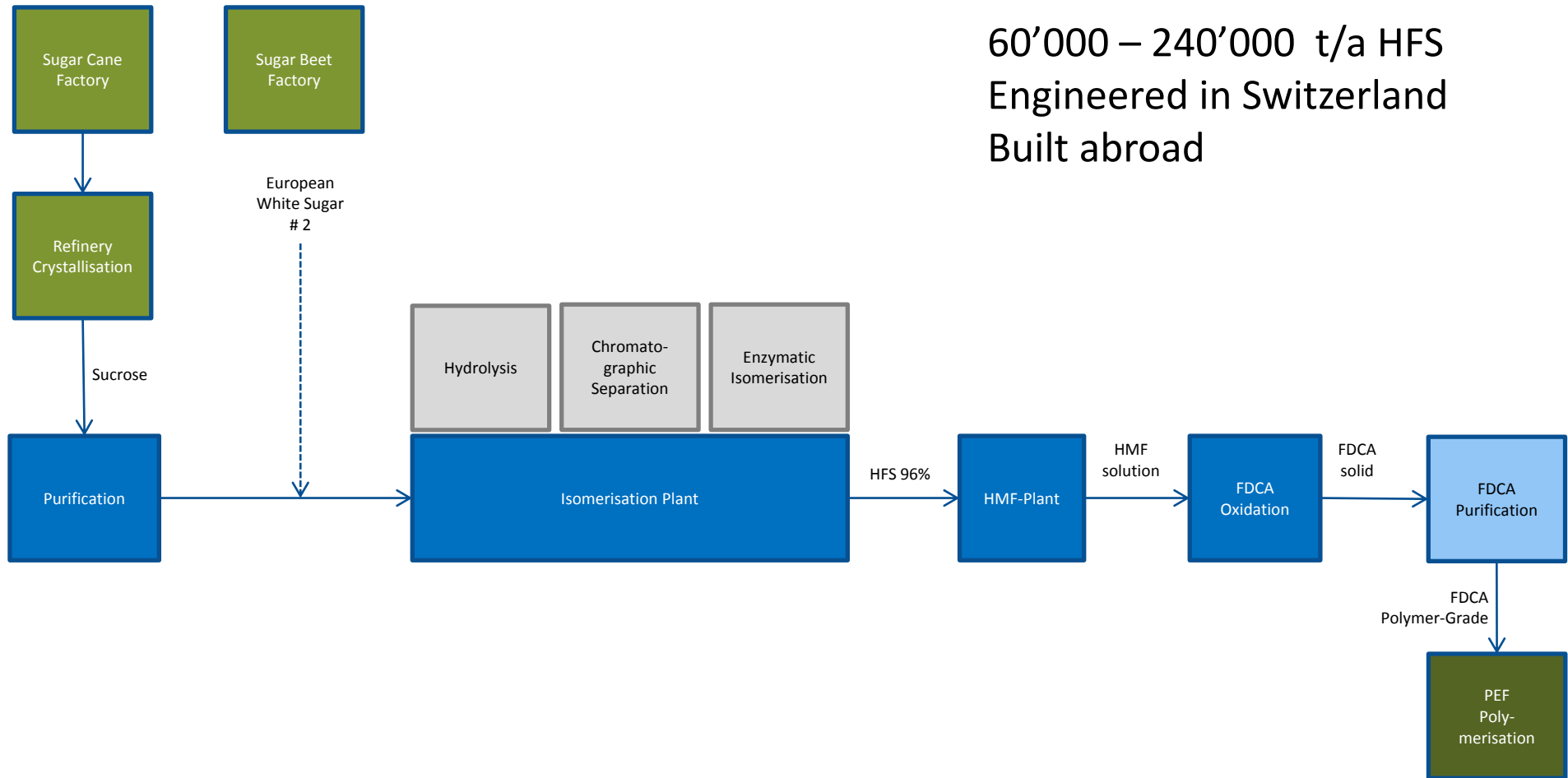
AVALON – Control of the Core Production Steps

The bio-based route



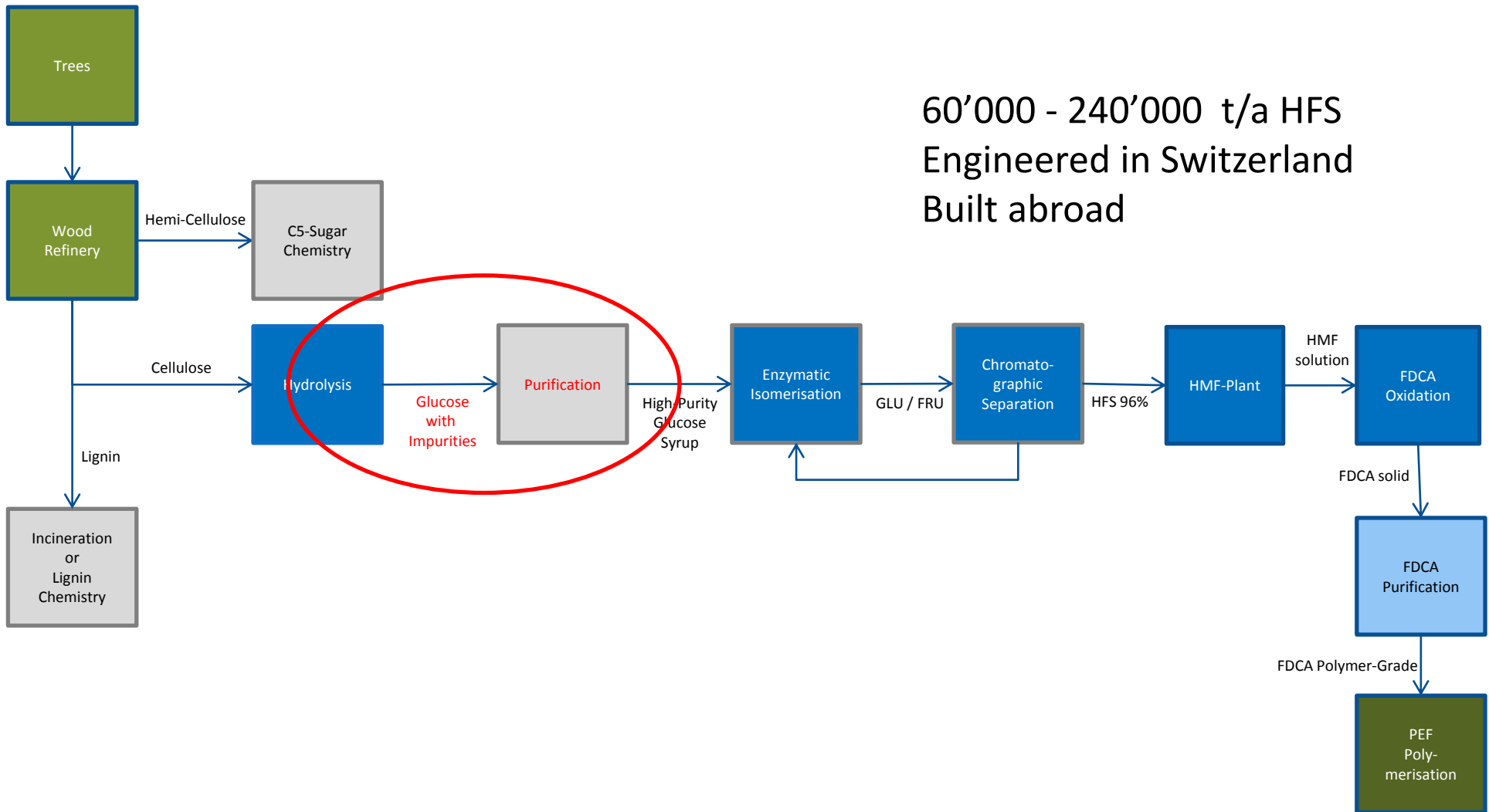
* Inside Battery Limits

Sucrose Based HMF-FDCA Process

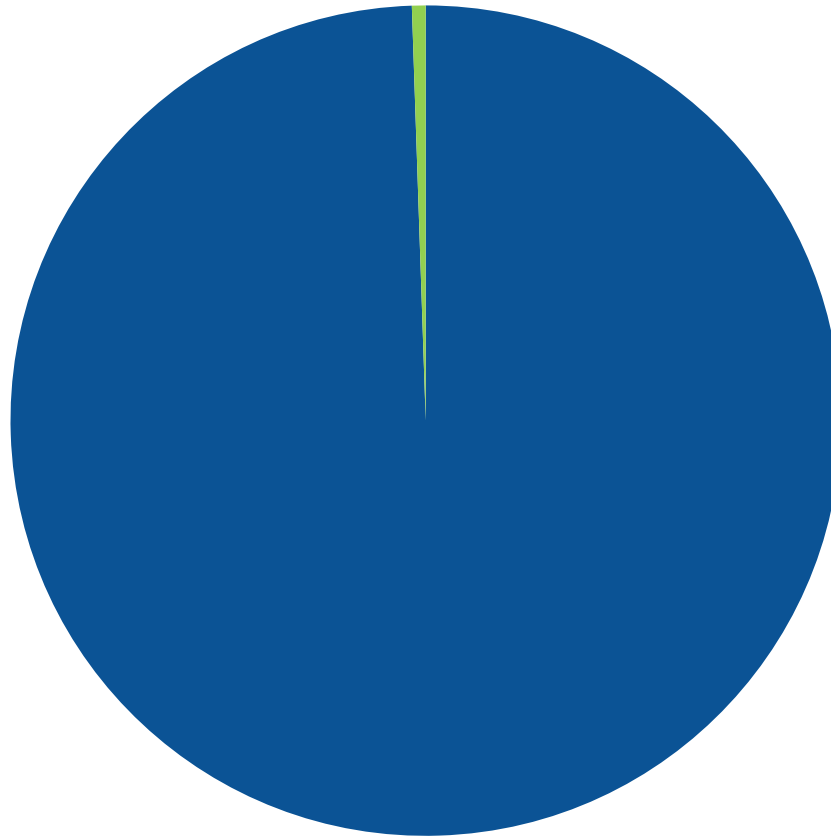


60'000 – 240'000 t/a HFS
 Engineered in Switzerland
 Built abroad

Wood (2nd Generation) Based HMF-FDCA Process



Market Size Bio-Plastics



■ Plastics ■ Bio-Plastics

Plastics: 299 Mio. t/a

Bio-Plastics: 1.6 Mio. t/a

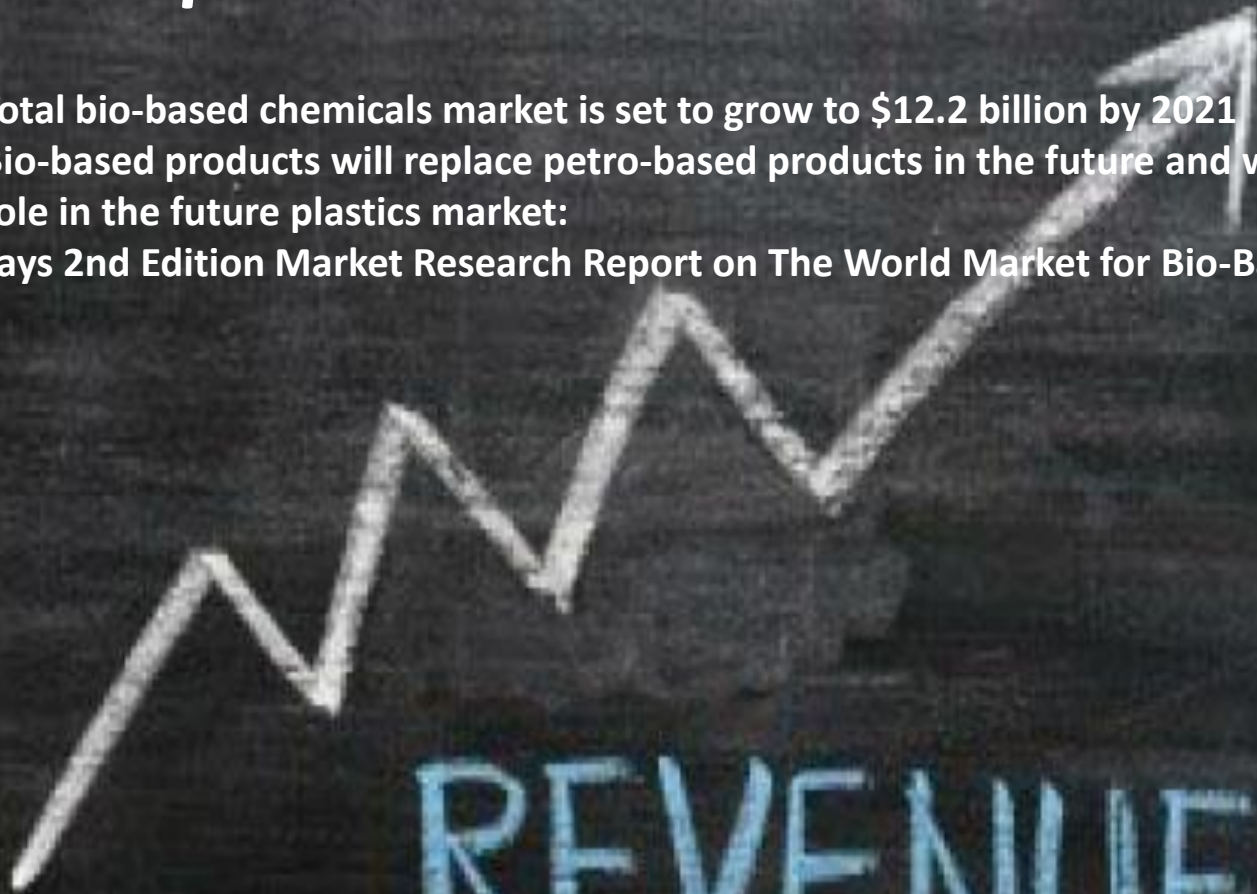
Source: worldwatch institute / european bioplastics (2013)

US\$ 12.2 Billion

Total bio-based chemicals market is set to grow to \$12.2 billion by 2021

Bio-based products will replace petro-based products in the future and will play a dominant role in the future plastics market:

says 2nd Edition Market Research Report on The World Market for Bio-Based Chemicals



REVENUE



THANK YOU

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CMO

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