

BIO-BASED INDUSTRY



DSEC, your Partner for Bio-based Projects

An aerial photograph of a large industrial complex, likely a chemical or biotech plant, featuring several large white buildings with blue roofs. In the foreground, a worker wearing a white hard hat and a high-visibility yellow vest with the 'De Smet' logo is looking towards the facility. The background shows a green, hilly landscape. The image is overlaid with a teal geometric design consisting of several overlapping triangles.

Bio-based chemical plants & bio-commodities production

Implementing External Technologies and beyond

- * Capability to develop full projects **from feed-stock handling to product conditioning**, including **offsites and construction works**
- * Full **understanding of Technology Providers' downstream requirement** through DSEC's large experience in the agro industry (filtration, evaporation, separation, drying, chromatography, ion exchanges...)
- * Experience in **assessing and validating all stages of process development** and products definition so as to reach a comprehensive concept before effective project start (Pilot ► Demo ► Industrial)
- * In-house specialists in **glucose, fructose, protein, inulin, betaine, amino and organic acids**.

Industrial Biotechnology: a large range of processes that DSEC can develop

- * **Catalytic reaction** (polyols)
- * **Aerobic fermentation** (hydrocarbons, polyols, organic and amino acids, yeasts...)
- * **Anaerobic fermentation** (sugar, starch and cellulose based ethanol, sugar and starch based alcohol...)
- * **Cross-sectional, interdisciplinary bio-refinery approach** through valorisation of food processing **side/waste streams** by the biochemical/biofuels industry for the **economical and environmental benefit** of both activities.

Reliability through experience



2nd Generation Ethanol production plants

PARTICULAR FOCUS ON TECHNOLOGY PROVIDER'S DEVELOPMENT IN THE 2G FERMENTABLE SUGAR PRODUCTION

- * Biomass pre-treatment (wood, straw, bagasse, agroindustry wastes, energy crops...)
- * Enzymatic hydrolysis
- * Lignin processing

Green field implementation or add-on to existing 1G facilities

Biomolecules (betaine, inulin,...) extraction plants

LARGE EXPERIENCE IN THE DESIGN AND IMPLEMENTATION OF BIOMOLECULES PRODUCTION PLANTS

- * Integrated inulin production facilities from chicory and Jerusalem artichoke
- * Betaine extraction unit from beet

PROJECT ACTIVITIES: DSEC is your partner for...

Project definition

- * PDP development based on technical process description from supplier & client
- * Technical & technological assessments
- * Selection of appropriate technology & unitary operation
- * Integration of an add-on into & existing facility
- * Utilities engineering & interfaces design
- * CAPEX & OPEX development

Project implementation

- * Overall Project Management including cost control, scheduling & HSSE
- * Detailed Design of all activities (CW, steel structure, piping, E&I...)
- * Procurement of equipments & materials
- * Workshop quality control & FAT
- * Expediting services
- * Integration of all related project activities
- * Plant automation standardization
- * Site activities management including implementation of site HSSE best practices
- * Plant commissioning & start-up assistance



Reliability through Experience



DSEC's Assets for the Bio-based Industry



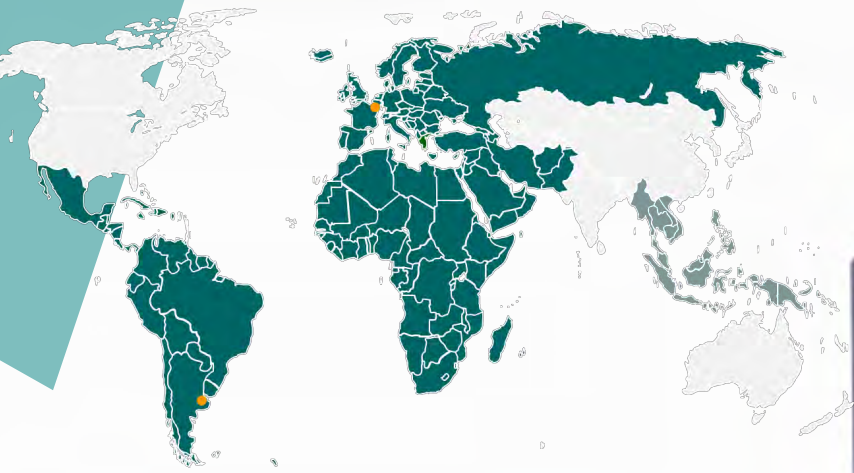
- * Efficient Integration of new developments and flexibility in dealing with changing environments
- * Strong track record accumulated for more than 30 years, working in 65 countries and completing more than 50 Large Scale Projects (which major bio-based projects referenced are listed opposite)
- * Integrated, robust, validated process and final product definition, before transfer of technology (Pilot ► Demo ► Industrial)
- * Repeated experience with key industry players, Client IP protection
- * In-house specialists in glucose, fructose, protein, inulin, betaine, amino and organic acids, ...
- * Focus on efficiency and energy saving
- * Full independence from equipment suppliers allowing optimization of projects' Global Sourcing Strategy
- * Execution of all downstream process units applicable for the Bio-Industry such as: filtration, evaporation, separation, drying, chromatography, ion exchange, ...
- * Familiar with all types of raw material: seeds, grain, molasses, beet, chicory, bagasse, wood, straw, ...

MEETING OUR CUSTOMER'S NEEDS through flexible contractual set-up



Industrial References in the Bio-based Chemicals & Commodities Production

PRODUCT	CUSTOMER	COUNTRY	CONTRACT	YEAR
POLYDEXTROSE from sugar	Cargill	Germany	EPCM Brownfield project	2019 > 2021
PECTIN from apple & lemon peels	Cargill	France	EPCM Brownfield project	2019 > 2020
PROTEIN from sugars/oilseeds	Several Undisclosed Customers	E.U.	Several Pre-FEED and FEED studies	2018 > 2020
(MYCO-) PROTEIN from sugars/grains	3FBIO	E.U.	FEED	2019 > 2020
PROPANEDIOL, BUTYRIC ACID from (raw) glycerol	Metabolic Explorer (METEX)	France	FEED followed by EPCM Greenfield project	2017 > 2020
2G SUGARS, LIGNIN from woody biomass	Graanul Biotech	Estonia	FEED, EPCM Greenfield project	2018 > 2020
2G SUGARS, BIO-CHEMICALS from woody biomass, wheat straw, sugarcane bagasse	Several Undisclosed Customers	E.U. / Brazil	Several Pre-FEED and FEED studies	2016 > 2020
AMINO ACID from sugars	Ajinomoto-Eurolysine	France	Several EPCM Brownfield units	2015 > 2018
2G BIOFUELS from woody biomass, wheat straw, sugarcane bagasse, cane straw	Several undisclosed customers	E.U. / Brazil / Australia	Audit, Pre-FEED, FEED studies, Cost estimates, Engineering services	2015 > 2020
2G BIOFUEL from miscanthus/wheat straw	INA	Croatia	Basic Engineering OSBL	2019 > 2020
WET MILLING PRODUCTS / STARCH / SYRUPS from corn, wheat, cassava, sorghum	CropEnergies (Südzucker) / Promaiz / ACA / Undisclosed	E.U. / Argentina / Africa	Pre-FEED and FEED studies, EPC	2006 > 2019
INULINE (FRUCTOSE) from chicory	Orafti-Beneo (Südzucker) / Cosucra (Groupe Warcoing) / EastAgro Don Ltd	Belgium / Chile / Russia	Several EPCM Brownfield projects and 2 EPC Greenfield projects, Engineering services	2000 > 2020
BIOETHANOL from wheat, corn, sugar cane	Biowanze (Südzucker) / Alco Bio Fuel / ACA / Addax	Belgium / Argentina / Sierra Leone	EPC / EPCM for 4 Greenfield projects	2007 > 2015
POTABLE ETHANOL (ENA)	NCP (Alcogroup)	South Africa	FEED followed by EPC Brownfield project	2016 > 2021
LACTIC ACID from sugar	Galactic	Belgium	Engineering services	2013 > 2018
BETAÏNE from sugar beet	Danisco	France	EPC Greenfield plant	2010 > 2012



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