



develop
design
build

BDI is a full-range supplier

of innovative upcycling solutions.

Since the company's founding in 1996, BDI-BioEnergy International has been developing resource-saving technologies for upgrading industrial residual and waste streams. BDI designs projects of all sizes and builds plants to

produce the purest biofuels and valuable by-products.

INNOVATION is a top priority – the benchmark process technologies are realized in the company's technical center.

BDI

- » develops technologies
- » designs processes
- » builds industrial plants

KPIs:

- » 70 international references
- » More than 300 filed patents
- » 15% of the staff engaged in R&D
- » > 90% export rate

1996

Foundation of BDI-Anlagenbau GmbH

2001

Construction of the first European multi-feedstock biodiesel plant in Malchin (DE)

2006

Implementation of a turnkey project at the Danube port in Vienna (AT)

2013

First plant to process trap grease in Hong Kong (HK)

2015

Successful construction and operation of the first malt spent grains fermentation plant worldwide for Heineken in Göss (AT)

2018

Implementation of the first industrial algae cultivation plant at Ökopark Hartberg (AT)

2021

EFSA approves RepCAT technology for safe disposal of high-risk fat material

1998

Construction of the first multi-feedstock biodiesel plant in Kentucky (USA)

2005

First facility to process animal high-risk fats (category 1) in the UK

2007

Implementation of the first industrial plant with RepCAT technology in Carinthia (AT)

2014

Successful construction and operation of the first biomass-to-liquid pilot plant at the OMV refinery Schwechat/Vienna (AT)

2017

Major contract to gain biodiesel from trap grease using BDI RepCAT technology in California (USA)

2020

Start of construction of the largest RepCAT plant in Belgium for Cargill (BE)

2022

Start-up and commissioning of three biodiesel plants with patented RepCAT technology for Envien (HU), Crimson (USA) and Cargill (BE)

Mission statement

BDI's mission statement is based on many years of expertise in international plant construction as well as on know-how in plant design.

develop

- specific know-how in the development of new technologies
- in-house lab and testing facilities

design

- overall planning of international plant construction projects
- projects of all scales

build

- worldwide active for more than 25 years
- more than 70 industrial references
- greenfield and retrofit projects

Value chain

BDI offers services along the entire value chain:

» Consulting

project development support, including feasibility studies and plant concepts

» Research & development

at BDI's testing facilities and laboratories as well as in cooperation with renowned research institutes

» Engineering

starting from authority submission documents to 3D CAD animation of the entire plant

» Construction & commissioning

of customized turnkey plants through a global network of selected suppliers and assembly companies

» Customer service

includes efficient maintenance management (including spare parts), support and servicing as well as 24/7 operational support

BioDiesel

The market leader's multi-feedstock technology

The biodiesel product quality exceeds the most stringent international quality standards

BDI's customized biodiesel plants operate with the multi-feedstock process developed in-house. This enables a wide variety of raw materials – from fresh vegetable oils to waste oils and fats – to be converted into high-quality biodiesel. The company's long-term experience in the design and construction of biodiesel plants and the detailed

knowledge of market conditions are of great benefit in further exploiting the enormous potential of untapped feedstock. The unsurpassed flexibility in the use of raw materials, the maximum yield, the low operating and maintenance costs and the well-known reliability of the plants guarantee the highest possible economic efficiency. In all cases, the biodiesel product quality exceeds the most stringent international quality standards such as EN14214 and ASTM D6751.

RepCAT technology

With the RepCAT process, BDI has developed a technology for processing raw materials with up to 100 percent free fatty acids (FFA). Specifically developed for this purpose, the system allows the catalyst deployed to be reused

within the process, thereby significantly reducing operating costs. Another advantage compared to conventional industrial processes is the recovery of salt-free glycerin in distilled quality as a by-product.

Customer benefits

- » **Maximum raw material flexibility – no restriction on free fatty acid (FFA) content in the raw material**
- » **Maximum technical yield of biodiesel**
- » **No waste to be disposed of from the process but rather reusable by-products**
- » **Obtaining an absolutely salt-free glycerin quality (min. 95%)**
- » **Exceeding all globally applicable biodiesel quality standards**
- » **Approval of the use of risk fats by the European authority EFSA**
- » **Many years of global experience with large-scale industrial implementation**

RetroFit

The technology leader's plant optimization

Every biodiesel plant is unique. Standard solutions for improving individual parameters such as yield, product quality or feedstock flexibility are therefore not effective. To achieve optimum results, it is necessary to develop an individual overall concept for each plant and

to implement the most suitable technical solutions. For that reason, no other company is more qualified than BDI: thanks to the experience gained from more than 70 biodiesel plants realized with its own technologies, BDI has the ability to identify and optimize the right

individual elements. The result is sustainable improvement in plant performance. The range of services offered by the BDI RetroFit program includes all necessary steps for a successful plant optimization.

A one-stop-shop

1. Status evaluation

- Determination of customer requirements
- Technological evaluation of the existing plant
- Preparation of preliminary concepts and rough cost estimate
- Summary of results and recommendations

2. Pre-engineering

- Preparation of concepts and planning of layout
- Integration into existing process – interface management
- Preparation of mass and energy balances

3. Offer preparation

- Definition of scope of supply
- Project and implementation plan
- Binding offer with detailed costing structure

4. Authorization procedure

- Preparation of data required by the authorities
- Assistance throughout the authorization process
- Preparation of risk analyses (e.g. HAZOP studies)

5. Engineering and delivery

- Basic and detailed engineering
- Supplier management

6. Implementation

- Technical on-site support during construction phase
- Shortest possible downtimes due to efficient process planning during installation phase

7. Commissioning

- Functional plant testing and start-up
- Optimization of plant parameters and stabilization of processes
- Training of plant personnel
- Sustainable realization of guaranteed values and plant handover

8. Customer service

- Regular maintenance support
- Spare part supply and service
- 24-hour technical service hotline
- Further training and workshops

Customer benefits

- » **On-site evaluation by BDI technicians**
- » **Developing customized improvement concepts**
- » **Efficient project sequence with short downtimes**
- » **Everything from one source**

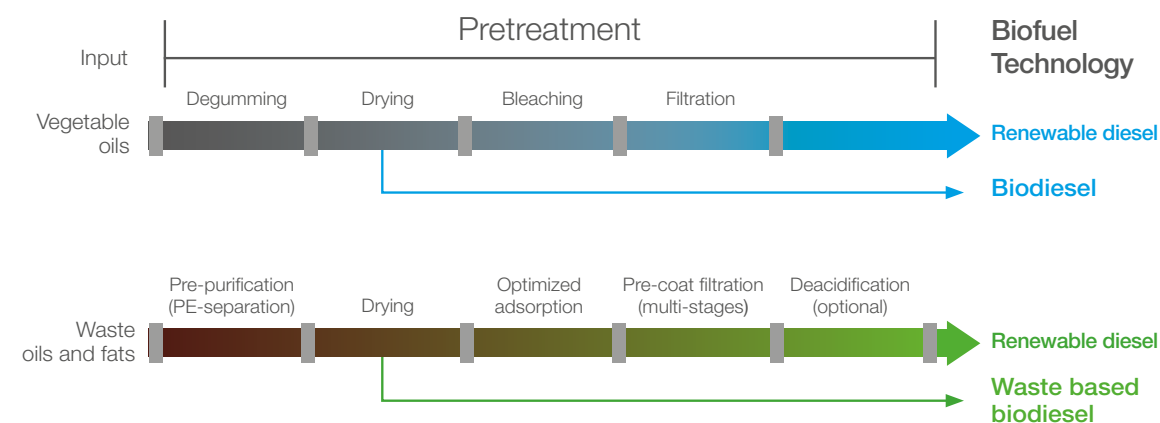
Advanced PreTreatment

The unique feedstock pretreatment process

Renewable diesel and sustainable aviation fuel in the form of hydrogenated oils and fats (HVO and HEFA) are becoming increasingly important as biofuels. Strict requirements are imposed on the oils and fats used regarding the contained impurities to avoid negative impact on the subsequent process steps. Therefore, pretreatment is a crucial step for an efficient and economical production of hydrogenated biofuels, especially when processing waste raw materials.

The advanced pretreatment process is modular so that it can be adapted to the requirements on raw material based on the core modules of pre-purification, drying and adsorption. This includes additional modules such as polyethylene separation with a special process patented by BDI, or the separation or conversion of free fatty acids from raw material.

With many years of experience in handling a wide variety of oils and fats, BDI assists from project start-up, beginning with raw material analyses to operational support.



Customer benefits

- » Unique, patented system to remove polyethylene from the raw material **without filtration**
- » Robust and efficient tricanter-based pre-cleaning unit to reduce oil losses, which is not possible with conventional degumming
- » Modular system offers a choice of process units – tailor-made for the particular impurities in raw material

Smart Operations

Process optimization using an advanced process control system

The performance of a biodiesel production is highly dependent on the control of the plant, which primarily correlates with the experience level and the technical qualification of the plant operator. Even one process step beyond the ideal range can significantly reduce the overall production capacity and product quality and consequently jeopardize profitability.

From the very beginning, BDI has been working on optimizing automated process control. By incorporating state-of-the-art software tools based on artificial intelligence, BDI is breaking new ground in process automation with smart operations – envisioning a fully automated, self-learning production plant.

The most powerful tool for process optimization in biodiesel production is the **advanced process control system (APCS)** from BDI's Smart Operations product range. Data analysis is used to create mathematical algorithms that map and iteratively optimize the individual production steps.

As a higher level control system, APCS provides the optimum setpoints for the individual process steps in real time, compensates for raw material deviations, avoids process disturbances and enables precise planning of maintenance intervals. Like cruise control, APCS ensures optimal biodiesel production at all times.



Customer benefits

- » Fully automated system control, supported by AI
- » Optimization of operation mode by self-learning process control system
- » Target: higher plant efficiency, better product yield & quality → increase of profitability
- » Enhanced industrial safety by automatization

GreenTech Solutions

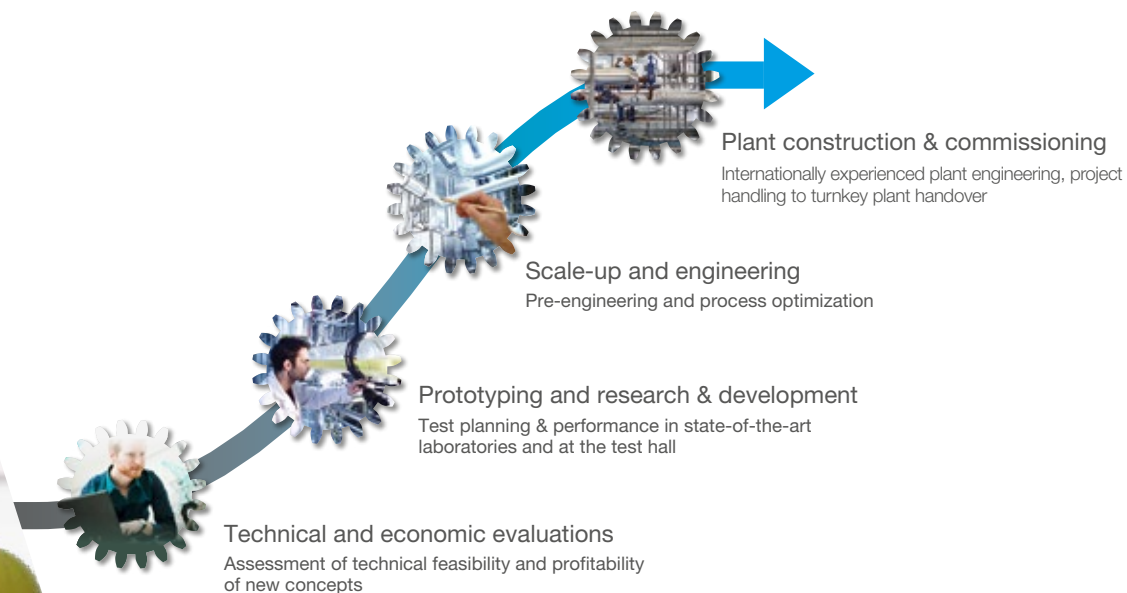
Knowledge center for chemical process engineering

The department of GreenTech Solutions (GTS) functions as knowledge center for chemical process development. This division offers customized services in all phases of technology development – from concept to market maturity.

BDI has long-lasting expertise in the areas of:

- Recycling
- Upcycling
- Green technologies

An interdisciplinary team of experts with high-end engineering capabilities, supported by state-of-the-art testing and laboratory facilities: this unique combination forms the missing industrial link between the customers' idea and the successful implementation.



SynCycle is a joint technology project by BDI and the Next Generation Elements (NGE). In this cooperation, the full performance potential of chemical plastics recycling is used. The result is a highly automated plant which converts non-recyclable plastic waste into new products.

SynCycle: Chemical recycling of plastic

Project management, basic and detail engineering
Cooperation project with Next Generation Elements (NGE)
BDI Technology: Downstream demonstration plant
Capacity: 1,000 kg/h
Raw materials: Waste plastics
Products: Pyrolysis oil

Selected References

BDI milestones for the biodiesel industry

Over the past two decades, BDI has planned, constructed and commissioned more than 70 international large-scale projects on four continents.



Biodiesel plant Crimson Renewable Energy L.P. (Bakersfield, USA)

BDI RepCAT technology for waste oils and fats from California

Customer: Crimson Renewable Energy L.P.
Technology: RepCAT RC100
Commissioning: 2021
Capacity: 40,000 (75,000) tons per year
Raw materials: High-FFA waste oils and fats, UCO, animal fat
Products: Biodiesel ASTM D6751
By-products: Distilled glycerine, bio-heating oil

Biodiesel Plant ASB Biodiesel Ltd. (Hong Kong, HK)

Customer: ASB Biodiesel Ltd.
Technology: Multi-Feedstock MF100+ (incl. high-FFA esterification)
Commissioning: 2013
Capacity: 100,000 tons per year
Raw materials: Animal fat, used cooking oil, trap grease, palm sludge oil
Products: Biodiesel EN14214
By-products: Glycerine, potassium sulfate, bio-heating oil



Retrofit plant Elin Biofuels S.A. (Volos, GR)

Customer: Elin Verd
Retrofit units: Advanced esterification and ECO distillation
Year of execution: 2013
Capacity: 33,000 tons per year
Raw materials: animal fat, used cooking oil
Products: Biodiesel EN14214

Retrofit plant Envien Group (Eastern Europe)

Customer: Envien Group
Retrofit units: By-product line
Year of execution: 2021
Capacity: 48,000 tons per year
Raw materials: glycerin phase, wastewater from a biodiesel plant
Products: Crude glycerin, recycle methanol, fatty acids





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