State-of-the-art R&D and Pilot Facilities

- State-of-the-art lab space and offices
- Open access and shared facilities
- Umbrella permits
- Shared services
- Unique testing facilities for pre-treatment, fermentation and downstream processing

Biotechnopolis Multitenant Building

Bioprocess Pilot Facility
Some facts on the Bioprocess Pilot Facility

- **BPF as a company was established May 2012 (B.V.)**
- **Location** Biotech Campus Delft, the Netherlands
- **BPF is investing** €37 mln in modernizing existing assets, and in pretreatment and food grade pilot plant facilities
- **Number of employees**: +/- 30 (Management, technology experts, operators, administration)
- **Longstanding experience** in fermentation and downstream processing
- **Open access**
The Innovation Valley(s) of Death...

- No capital
- No process technology
- No pilot test facilities

Basic research
New ideas
Inventions
Applied research
Knowledge

Product Development
Implementation
Market
Scale-up/piloting in bio-processing: why?

- **Reduce risks** for up-scaling from lab-scale to factory
  - proof of concept on semi-industrial scale
  - collecting reliable input-data for engineering & safety studies

- **Produce product** (100s kilograms) to run pre-marketing/application tests or pre-clinical/tox trials

- Test/validate new technical designs

- **Enhance** the bio-processing **competence** in your team/organization (both down- and up-scaling know-how)
**BPF’s Defined Strategy**

**Ambition:** “Be the leading, open-access, state-of-the-art pilot facility for scale-up research and development, education and training of new generation bioprocesses and products.

**Customer groups and segments:**
- Open access
- Corporates, start ups, CRO’s and equipment builders.
- Bio-chemicals, Food and to a lesser extend on biofuels, reactive approach towards pharmaceuticals
- Focus on Europe and North America

**Service offering:**
- Provide scale-up services;
  - Pre-treatment, fermentation and down stream processing
  - Trials, pre-trial consulting, education and rental

**Commercial model:**
- Within its trial business, it will use a standard time and materials-based tariff and will NOT use alternative models such as performance based payment in any form.
- Customer IP is fully secure. The BPF will NOT build up own IP on products nor will it do non-trial related consulting.

**The BPF.....a unique venture** with Over 100 year experience in Fermentation and Downstream processing
Decades of proven experience in fermentation/DSP up-scaling in the BPF

Track record in piloting and contract manufacturing of:
- (Bio)chemicals
- Enzymes/proteins
- Food additives
- Pharma intermediates

Efficient - biobased route antibioticum

\begin{itemize}
\item Traditional route:
  \begin{itemize}
  \item Sugar
  \item Traditional fermentation
  \item Penicillin G
  \item 13 Chemical steps
  \end{itemize}

\item New route:
  \begin{itemize}
  \item Sugar
  \item Penicillium chrysogenum
  \item metabolic Engineering
  \item 2 Enzymatic steps
  \end{itemize}
\end{itemize}
BPF Facilities – Plug and Play

Bioprocess Pilot Facility for innovations in Sustainable Bioprocesses

The Bioprocess Pilot facility B.V. (BPF), situated at the Biotech Campus Delft, the Netherlands, is a unique open access facility where companies and knowledge institutions can develop new sustainable production processes. These processes serve many purposes, such as converting bio-based residues into useful chemicals or fuels. The facility has been specifically designed to enable the transition from laboratory to industrial scale. BPF allows users to construct complex operations by linking separate process modules like Pretreatment, Hydrolysis, Fermentation, and/or Downstream Processing.

**Experienced Crew**

The facility has a skilled crew, working in a continuous mode, with a long track record in the scale-up and scale-down of bioprocesses. Operations are performed using a CIPF mind-set.

**Fermentation**

In the fermentation module, bioconversions are executed by means of microorganisms (bacteria, yeasts, or fungi) or enzymes to obtain the desired product.

**Food**

Processes and products requiring a food-grade quality are prepared in a dedicated area.

**Pretreatment and Hydrolysis**

In this module, dry and wet residues can be pretreated, hydrolysed, and prepared for the fermentation phase.

**Downstream Processing**

In this module, products are extracted, purified, and isolated from the fermentation process stream. The unit operations can be combined at the client’s request to create the desired product.

**Training**

The facility is also a centre of expertise where operators, students, researchers, and technologists can be trained.
The BPF is a truly multi-purpose pilot facility

Bio Pilot Facility
Delft, Netherlands
40 kg/h prehydrolysis reactor system

and

Bench scale facility:
4kg per batch
ATEX

Enzymatic Hydrolysis section, separation of Lignin form C-6 sugar
The BPF is a truly multi-purpose pilot facility

Hydrolysis & Fermentation

**Process:**
- pre-sacc only
- pre-sacc. + SSF
- clean substrate
- contaminated substrate
- physical conditions
- ionic conditions

**Enzymes:**
- natural cocktail
- component cellulases
- enhanced cocktail
- produced in situ
- shipped in plant expressed combinations

**Organism:**
- bacterial
- fungal
- yeast
- GMO
- non-GMO

**Process:**
- pre-sacc only
- SSF
- C₆ only
- C₅ only
- C₅ & C₆
- batch
- continuous

ATEX
The BPF is a truly multi-purpose pilot facility

<table>
<thead>
<tr>
<th>DSP</th>
<th>ATEX</th>
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<tbody>
<tr>
<td><strong>Cell disruption</strong></td>
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<td><strong>Solid-Liquid separation</strong></td>
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<td>- Filter press</td>
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<td>- Centrifuges</td>
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<td>- Membrane filtration</td>
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<td><strong>Bioconversions</strong></td>
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<td>- 60l – 4m³ vessels</td>
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<td><strong>Purification</strong></td>
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<td>- Extraction</td>
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<td>- Membrane filtration</td>
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<td>- Chromatography</td>
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<td><strong>Concentration</strong></td>
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<td>- Evaporation</td>
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<td><strong>Drying</strong></td>
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<td>- Bolz dryer</td>
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<td>- Spraydryer</td>
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<td>- Fluid-bed</td>
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<td>- Double cone</td>
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<td>- Ventilation</td>
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<td>- Vacuum plate</td>
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<td><strong>Formulation</strong></td>
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<td>- Mixing</td>
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<td>- Sieving</td>
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<td>- Milling</td>
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The BPF is a truly multi-purpose pilot facility

**Food grade Pilot**

**Fermentation:**
- 4L
- 40L
- 400L
- 2 x 2000L

**DSP:**
- filtration
- (spray) drying
- fluid bed dryer
- Disk stack centrifuge
- UF/MF filtration
- Fluid bed granulator
- Feed vessels
- Heat shock
- Glass columns
- CIP unit

**Food**
Processes and products requiring a food-grade quality are prepared in a dedicated area.

DSP partly ATEX
BPF expansion ongoing
EU/ Dutch projects

- **Member of:** BIC, C lib2021, IBB Bayern, BE Basic (partner)

- **Horizon2020:**
  - **BIC:** BPF Project in WG-2014, consortium work in progress: BBI R1 - 2014: Efficient pre-treatment of lignocellulosic residues to advanced bio-based chemicals and biomaterials
  - **SPIRE - 2:** BPF partner in a consortium. Objective project: Biorefinery based on 2G feedstock's - production of chemicals like phenol, HMF from lignin

- **Marie Curie:** Reneseng project Kick-off Nov 2013, runs to 2015

- **BE Basic** Is making use of the pilot plant
BPF summary

- A large variety of scales, technologies and unit operations – covering the full supply chain from a large variety of biomasses to end product

- A long-standing historical track record in bio-process piloting (Fermentation and DSP) including kg-production of material for pre-marketing, pre-clinical, tox or application testing

- Hands-on, professional know-how and experience with scaling up and scaling down of bio-processes

- Proven experience with working under GMP- and food quality regimes, resulting in reliable engineering as well as process/product data

- Perfect embedding in a strong (knowledge) infrastructure and perfect fit with regional developments: the Biotech Campus Delft

- Open access, confidentiality & IP remains with client
In Summary ........

...... (im)proving the process of the client