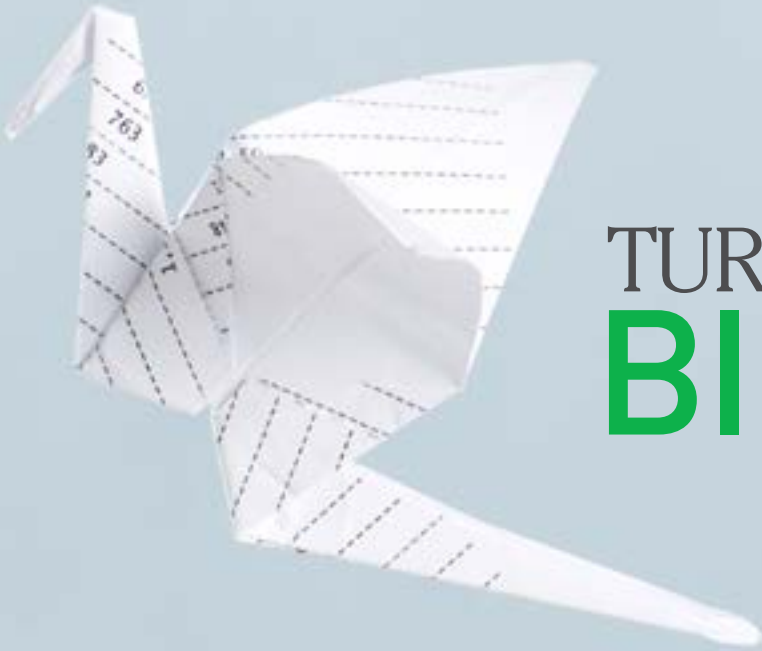


A photograph of a forest with sunlight streaming through the trees, creating a bright, hazy atmosphere. The sun is positioned in the upper left, casting long rays of light across the scene. The trees are tall and thin, with their trunks visible in the foreground and background. The ground is covered in green moss and ferns.

SEKAB CELLUAPP™

Leading **Biorefinery Technology** from idea to business

SEKAB



TURNING BIOMASS INTO ENERGY AND PROFIT



You don't have to throw away your ideas on how to use cellulosic co-products. We can help you turn your biomass into profit.

Many companies across timber industry, agriculture, the food industry and manufacturing have one thing in common: they generate cellulose-based biomass as a by-product, a resource that traditionally has been simply viewed as waste.

SEKAB, the Swedish-based chemicals company disagree. Our CelluAPP™ process mean it is possible to turn almost any form of biomass into environmentally-friendly, high quality, profitable chemicals, biogas and lignin.

SEKAB CELLUAPP™ was developed in Örnsköldsvik, Sweden, where cellulose research dates back 100 years. In our biorefinery cluster,

intensive research and continuous testing of a pilot plant have resulted in the refinement of a technology that realizes the latent value of residues from forestry and agriculture.

Our goal is to make chemicals and fuels that do not require fossil resources or arable land and which meet future requirements regarding environmental benefits and sustainability.

Today we are at the forefront of international research. We have a number of patents covering everything from pretreatment of raw material to downstream processing and system optimization. We are making this happen.

FROM CELLULOSE TO COMMERCIALY VIABLE BUSINESS

The CelluAPP™ technology platform incorporates our technologies for thermochemical pre-treatment, enzymatic hydrolysis and fermentation. It is broad and flexible and can handle many different raw materials such as wood, straw, corn residues and bagasse.



Internationally, many players are attempting to develop the production of ethanol and chemicals from cellulose into commercially viable business. Some players have come a long way - Det norske veritas has determined that SEKAB's process is among the top four in the world.

CelluAPP™

AN OVERVIEW OF OUR TECHNOLOGY PLATFORM

CelluTREAT™

CelluTREAT™ is our patented technology for the pre-treatment of biomass to produce sugars and cellulose suitable for further refinement. The technology can be adapted to the specific requirements of a range of raw materials.

CelluSUGAR™

Technology to produce a sugar solution from lignocellulose. The raw material is pre-treated in the CelluTREAT™ process, releasing sugar and breaking down the crystalline structure of the cellulose. Additional sugar is released through enzymatic hydrolysis. Sugar solution can be used in the production of many different types of chemicals.

CelluFUEL™

A powerful technology for converting lignocellulose to ethanol. Using CelluTREAT™ the cellulosic raw material is pre-treated and additional sugars are released by enzymatic hydrolysis. Yeast converts the sugar into ethanol. The lignin generated in CelluFUEL™ can be used as fuel to produce electricity and steam.

CelluGAS™

CelluGAS™ technology combines CelluTREAT™ technology with anaerobic digestion to produce biogas through a pre-treatment process which increases the efficiency of conversion into biogas. The technology can be used to increase production in existing digestion chambers.

LIGNIN

Lignin is an important building block of biomass such as agricultural residues and forest produce. It has a high calorific value and can be used as fuel in a combustion process. Lignin is also useful in other applications such as concrete aggregates and the production of other chemicals.



CELLUCASE™

If you have biomass, CelluCASE™ will help you make the most of it. It's a proven methodology extending from pre-studies through technical evaluation to full-scale testing.

RAW MATERIAL ANALYSIS (FEEDSTOCK ASSESSMENT)

The evaluation of potential raw material, potentially including trials extending from laboratory to demonstration scale. SEKAB E-Technology adopts a holistic approach to the study from planning, implementation, evaluation and recommendations.

INITIAL CASE ASSESSMENT (ICA)

A tool for the initial evaluation of business opportunities. A technical and economical analysis prior to possible investment in a production plant.

FEASIBILITY STUDY – PROJECT DEVELOPMENT

A feasibility study, adapted to customer requirements, serving as a basis for investment decisions.

- ✓ Feasibility study from raw materials to finished products
- ✓ Appropriate process solution for the specific feasibility study
- ✓ Mass and energy balances for the selected process solution
- ✓ Basis for investment assessment
- ✓ Layout adapted to the customer's site
- ✓ OPEX and CAPEX assessments
- ✓ Financial analysis

CELLUAPP™ – A VERIFIED PROCESS

SEKAB is situated in an industrial cluster that brings together some 60 years of experience of biorefinery, including more than 20 years of research into the degradation of cellulose and second-generation ethanol. SEKAB E-Technology leverages the expertise of a strong network of energy companies, cellulose industry, manufacturing companies and ethanol producers.

CelluAPP™ technology is developed and verified in an industrial test environment through extensive continuous around-the-clock operation of a demonstration plant.

The demonstration plant is located in close proximity to SEKAB's production facility in Örnsköldsvik and has been in operation since 2004. The development of the CelluAPP™ technology has encompassed everything from raw materials, chemical and biological processes, control and regulation technology to integration with other production.

The result is a technology with great potential for businesses to generate biomass as a by or waste product. It enables you to take advantage of an untapped resource while making a significant contribution to the environment and our climate.

IPR

SEKAB follows an active IPR strategy that was established in 2007. In addition to our own patents and know-how, it allows access to key patents and knowledge through partnerships and licensing agreements. SEKAB monitors the patent situation closely and draws up confidentiality agreements in all partnerships to protect the results and knowledge.

DEVELOPED IN AN INDUSTRIAL TEST ENVIRONMENT

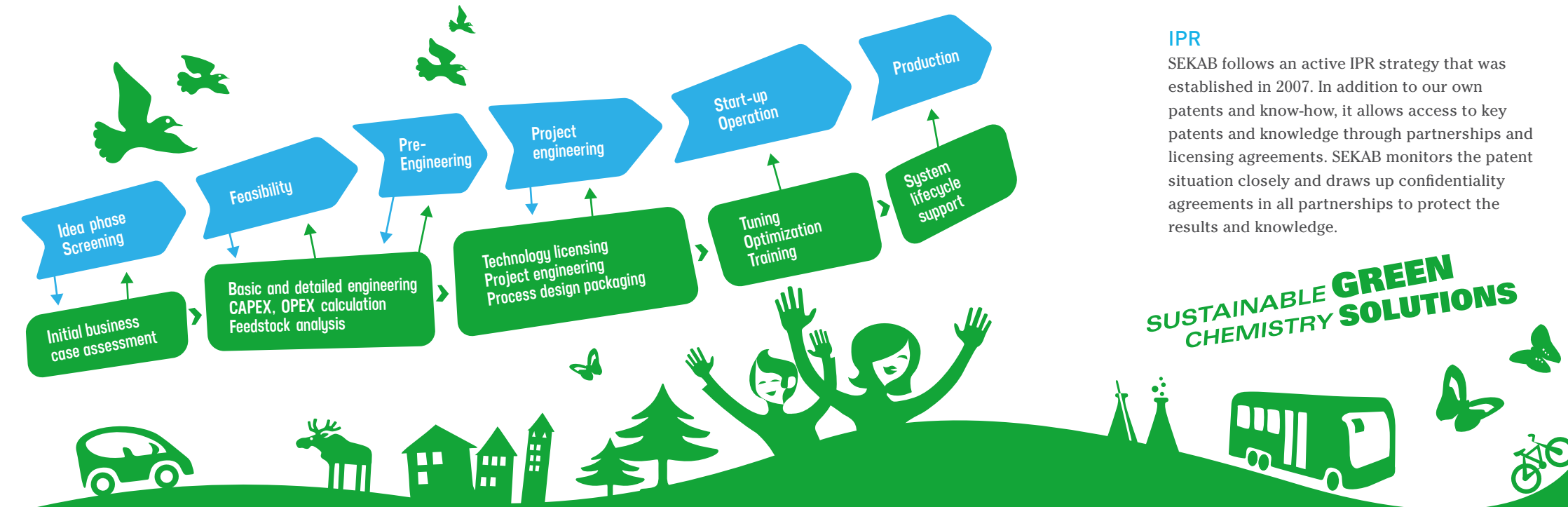


The Ethanol Pilot, SEKAB E-technology's demo plant, was inaugurated in 2004 and is adjacent to SEKAB's Domsjö plant in Örnsköldsvik. Advanced research and development work has verified all the process steps required to commercialise the technology. The development work has comprised everything from raw materials, chemical and biological processes, and command and control technology to the integration of these processes with other production.

SEKAB now has 28,000 hours of operations and experience in the demo plant. Creating unique insights, methodology and knowledge which does not exist anywhere else in the industry.

The Demo plant is not owned by SEKAB, but can be booked through SEKAB.

SUSTAINABLE GREEN CHEMISTRY SOLUTIONS



www.sekab.com/celluapp

