

The future is  
**BIOREFINING**





# Stepping up to **THE CHALLENGE**

If we want a more sustainable future, we need to make better use of renewable biomass residues. Advanced technology from Chempolis makes it possible to do just that. Now.

**TODAY'S PLANET** is home to over 6 billion people, and by 2050 this figure is estimated to grow by around another 2 billion. As we're already using more natural resources than is really sustainable, the pressure on raw materials will only grow in the future.

Which is why we need to start doing something today – if we want to ensure that future generations have the food, fresh water, and clean air they need.

Making more of agricultural by-products represents a major opportunity here.



### A HUGE UNTAPPED RESOURCE

The world generates more than 5 billion tonnes of biomass as a by-product of food production, most of which is either burned in the fields or ploughed back into the soil. That's more than 10 times the amount of wood currently used by the paper industry.

These non-wood and non-food residues represent a huge untapped – and highly sustainable – resource for producing ethanol for fuel and fibre for papermaking.

Forest resources, currently the main source of fibre for papermaking, are diminishing all the time, and paper consumption is growing fastest in countries with little forest resources of their own, such as China and India.

*“Chempolis technology does things differently. And by doing so can deliver truly sustainable results.”*

The world's reserves of oil and gas are also being depleted at a rapid rate, and the greenhouse gas emissions they produce are one of the major contributors to global warming.

The increasing use of food crops to produce biofuels is not helping things either, as it will lead to higher food prices and quite possibly higher levels of poverty around the world as well.

### THE BIOREFINING OPPORTUNITY

By using biorefining technology to process agricultural residues and energy crops cultivated on marginal land, non-wood and non-food biomass could replace wood as the basis for papermaking and oil as the basis for liquid transportation fuels.

And Chempolis is the company that can offer that technology.

# Sustainable TECHNOLOGY

We are a global leader in biomass processing and refining technologies.

**OUR MISSION AT CHEMPOLIS** is to develop and deliver technologies capable of refining biomass economically into high-quality products while minimising environmental impacts and maximising social benefits.

Our expertise has already proved its potential in the paper and bio-energy industries, and we are now offering solutions for the chemical, oil & gas, food, and energy industries as well.

By delivering the best possible solutions, we help our customers get more for less: less energy, fewer natural resources, less waste, and lower lifetime operating costs.

And by pioneering technologies that help reduce water, energy, and raw material consumption, and cut emissions and waste, we're not only helping our customers, we're also helping build a more sustainable future for everyone.

## A GLOBAL LEADER

Chempolis is a global leader in the development of biomass processing and biorefining technologies, with a wealth of experience and more than 100 worldwide patents to its name. Our experts design and deliver plants, processes, and equipment worldwide, and provide engineering, project, and support services.

This dedication to creating cleaner and more effective solutions has resulted in technologies that have been rated as the greenest economically viable option available by the International Finance Corporation (IFC), part of the World Bank Group, and the US Energy Department.

## DOING IT LOCALLY

Chempolis technologies enable papermaking fibres, bioethanol, and biochemicals to be produced from a varie-

ty of non-wood and non-food biomass, including straw, bagasse, and reeds.

Our **formicofib™** process is a highly sustainable technology for biorefining non-wood raw materials into fibre for papermaking. While **formicobio™** processes non-food raw materials into bioethanol.

By using residual biomass locally and by distributing end-products locally, we believe that we offer a highly sustainable way forward

## STAYING AT THE FOREFRONT

To maintain our position at the forefront of innovation, we operate our own biorefinery and an in-house R&D centre. We also work closely with universities and institutes and have a network of strategic partners and subcontractors.



**“** We work in close partnership with our customers to identify the most profitable solution for their business and help them stay ahead of the competition.”



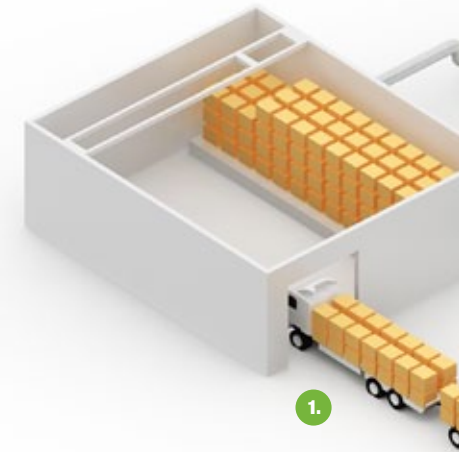
## MULTIPLE ADVANTAGES

Chempolis' **formico**<sup>®</sup> family of technologies:

- Uses residues generated as part of food production, eliminating the need to harvest timber and deplete forest resources
- Is self-sufficient in energy and CO<sub>2</sub>-neutral
- Has a minimal water consumption
- Uses no harmful substances, such as chlorine or sulphur compounds
- Recycles all process chemicals and water
- Produces no effluents, and
- Results in end-products that are recyclable and biodegradable.



# Doing more **WITH LESS**



Biorefineries based on Chempolis' **formico**<sup>®</sup> technologies deliver sustainability – all the way from high-quality products and excellent profitability to lower CO<sub>2</sub> emissions and reduced natural resource usage.

**CHEMPOLIS'** state-of-the-art **formico**<sup>®</sup> processes have been developed for biorefining non-wood and non-food materials, such as straw, grasses, bagasse, and many other residues. By using a new type of biosolvent, they overcome the challenges typically faced by other technologies.

## **formicofib**<sup>™</sup>

– for producing high-quality fibre for paper and board, packaging, and hygiene products.

The **formicofib**<sup>™</sup> process has been specially developed for non-wood raw materials and offers a more favourable

chemistry than current technologies, requires fewer operations, and consumes less chemicals. As it does not require forest inputs, does not generate net CO<sub>2</sub> emissions, is effluent-free, and consumes minimal amounts of water, **formicofib**<sup>™</sup> represents the most sustainable pulping technology available today.

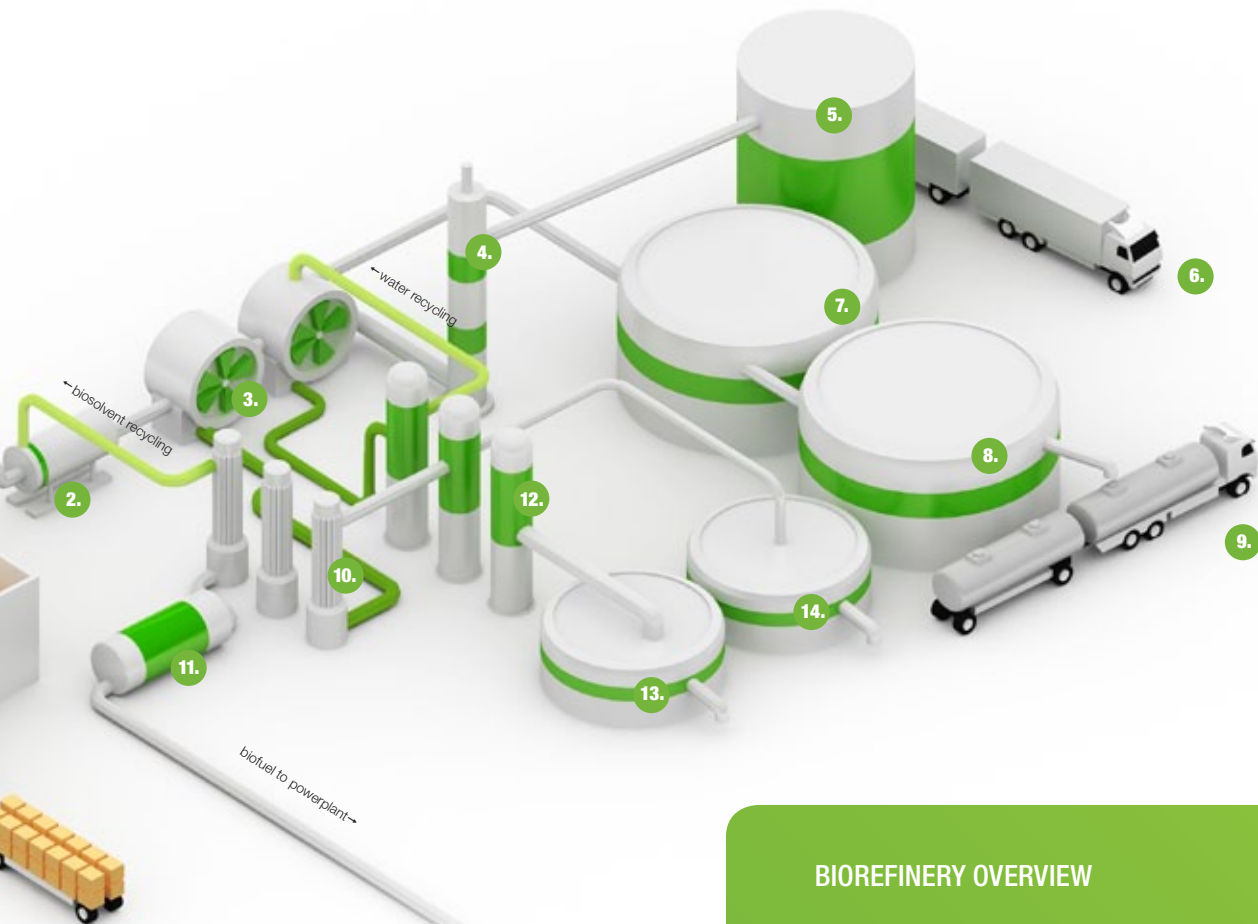
## **formicobio**<sup>™</sup>

– for producing bioethanol for biofuels.

Just like **formicofib**<sup>™</sup>, **formicobio**<sup>™</sup> also avoids the main problems associated with other technologies devel-

oped for non-food raw materials – and represents a true third-generation technology for producing liquid biofuels.

Both **formicofib**<sup>™</sup> and **formicobio**<sup>™</sup> enable the co-production of biochemicals, such as acetic acid and furfural, which are used as a raw material in the production of paints, adhesives, and plastics, and as a solvent and raw material for resins.



## formico® SYSTEMS

Our **formico**® systems round out our offering – providing the key machinery, piping, instrumentation, and control systems for making the most of our processes.

These systems include **formicodeli**™ for optimising the delignification of non-wood and non-food biomass; **formicopure**™ for purifying biosolvents and biochemicals; and **formicocont**™ for operating **formico**® biorefineries safely and reliably.

By combining comprehensive technology transfer packages with Chempolis’ proprietary systems and tailoring everything to customers’ specific requirements, we can eliminate unnecessary bottlenecks and shutdowns. And provide the most economical solutions for the entire lifetime of a plant.

### BIOREFINERY OVERVIEW

1. Storing and pre-treatment of non-wood and non-food biomass
2. Fractionation and cooking of biomass using **formicodeli**™
3. Separation of biosolvent and lignin
4. Bleaching of non-wood fibres
5. Storage for bleached pulp
6. Transportation of pulp for papermaking
7. Hydrolysis of non-food fibres and fermentation of bioethanol
8. Storage for bioethanol
9. Transportation of bioethanol
10. Recycling of biosolvent using evaporation
11. Production of solid biofuel
12. Recycling and purification of water, biosolvent and biochemicals using **formicopure**™
13. Storage for bioacetic acid
14. Storage for furfural

# Optimal process **SOLUTIONS**

Our approach is based on our extensive R&D experience and our belief that innovation is essential to delivering truly sustainable results.

**“** *Biorefining non-wood and non-food raw materials is a key way of preserving forest resources, reducing CO<sub>2</sub> emissions, and securing sufficient food for the world's growing population. It can also provide a valuable boost for the local economy in rural areas.”*



Wheat straw



Bamboo



Corn stalk



Bagasse

**AS EACH TYPE** of biomass is different, an in-depth understanding of chemistry and process technology is essential for an optimal process solution.

Whatever your input, a Chempolis solution will always offer just that – in terms of raw material usage, low levels of water and energy consumption, and minimal emissions. And do so in the most sustainable way possible – socially, environmentally, and economically.

To achieve this, we make use of advanced evaluation methods and have invested in extensive biomass testing and processing facilities. Only by looking at every aspect of the challenge facing a customer we can find the best solution for delivering the right results.

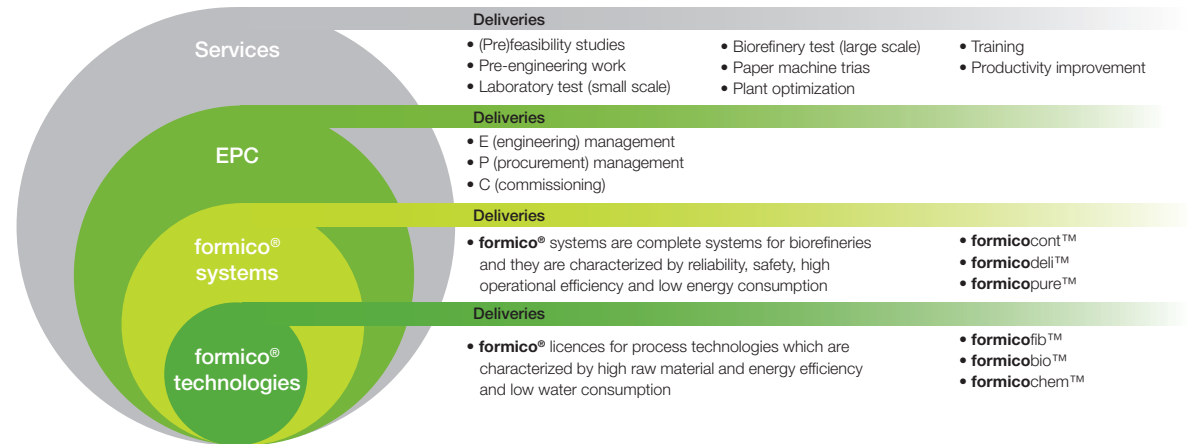
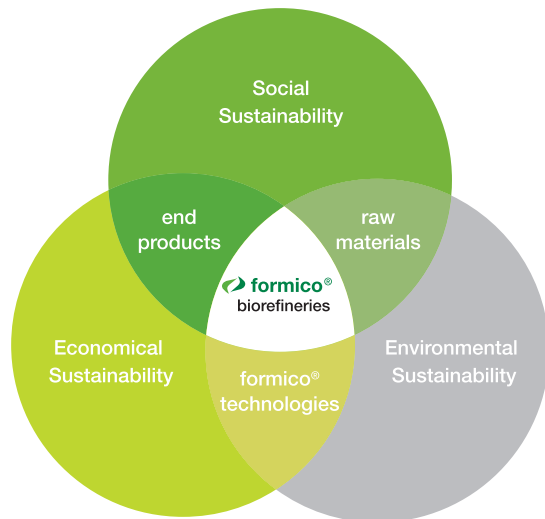
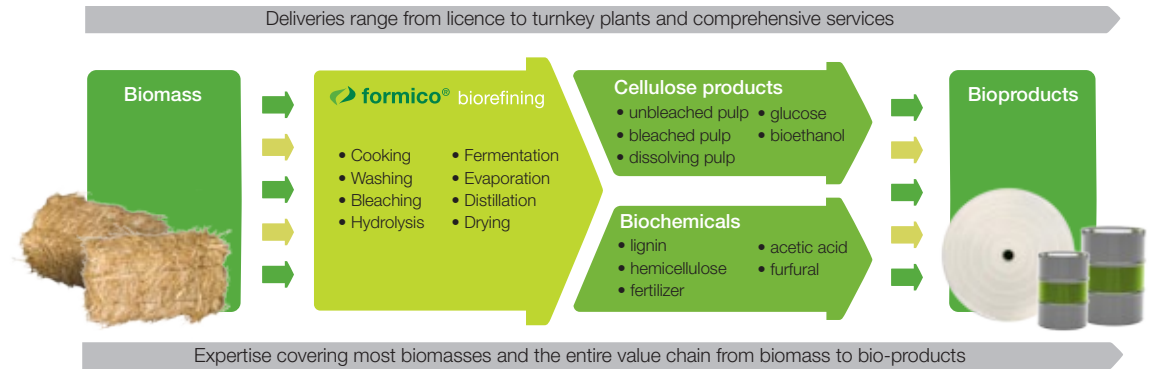
## EXPERTISE THROUGHOUT THE CHAIN

Our expertise across the entire processing chain – from biomass to fibre or other end-product – means that we can deliver results at every stage of a project.

Our involvement doesn't end with the successful development and transfer of new technologies, either. In fact, our role in engineering and project implementation is an equally important part of any investment.

Our expertise covers everything from conceptual engineering, process and plant engineering, to equipment design, supplying proprietary systems, and turnkey plant deliveries.

Supervising installation work, commissioning, and initial operations are also an integral part of Chempolis' skills set. And by relying on us as a one-stop shop technology partner, customers can rest assured that their plants will perform at their best from the very start.



# A true biorefining **EXPERT**

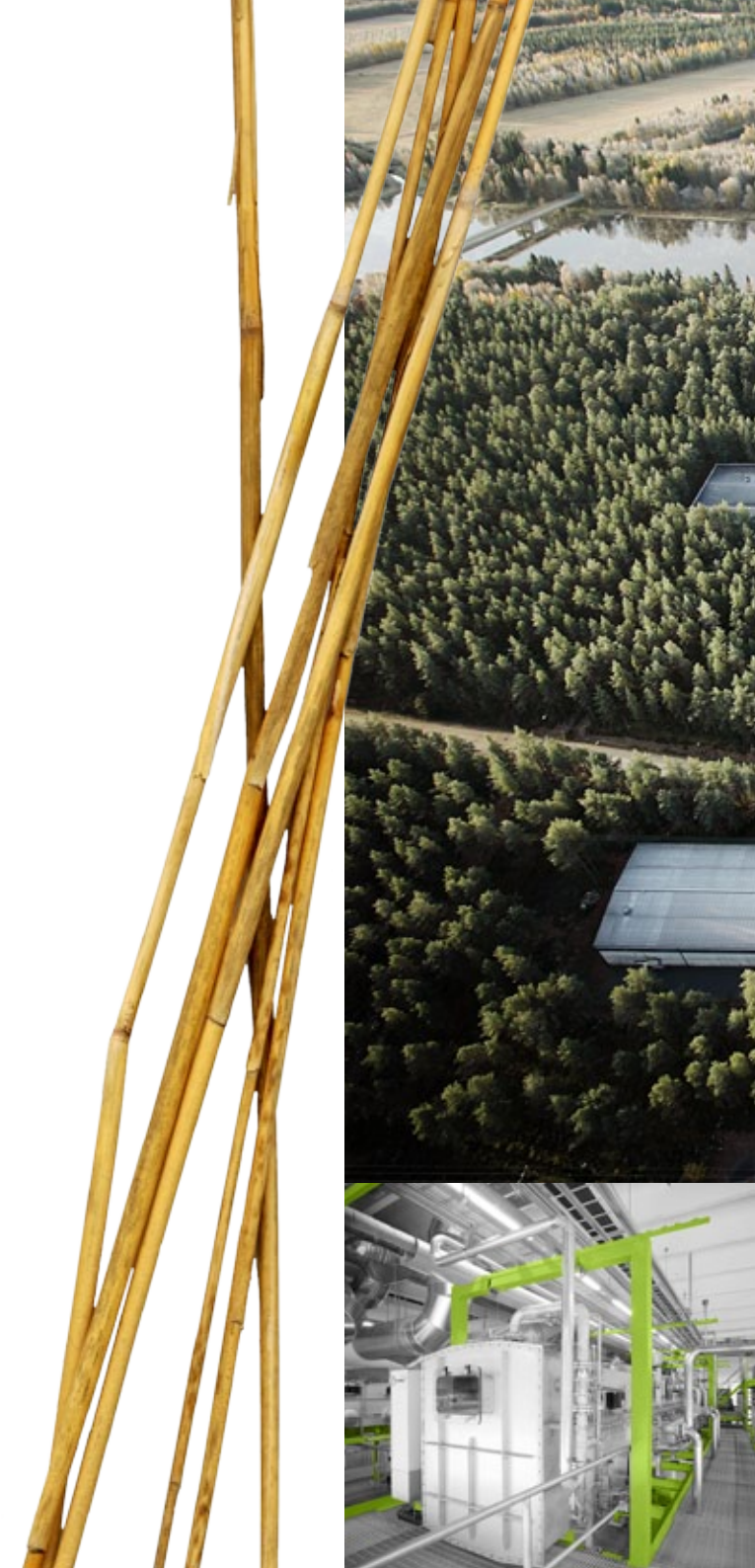
We are committed to ongoing R&D to ensure that our technologies go on delivering. Our in-house biorefinery provides a first-hand look at what our state-of-the-art processes offer.

**BIOREFINERIES BASED** on our **formico**<sup>®</sup> technologies can convert biomass into numerous bio-products very efficiently. And as they are effluent-free and self-sufficient in terms of energy, they offer an excellent tool for mitigating climate change.

While our existing solutions can already deliver a wide range of benefits, we're constantly working to create even better ones that make the best use of biomass resources, while reducing water and energy usage and minimising emissions.

Over the last few years, we have invested around €20 million in R&D. Including the extensive work that we have carried out with our customers and our university partners, the figure is even higher. The result is a large portfolio of patents, which number more than 100 in all today.

Developing sustainable processes and technologies has been our priority for decades. As our solutions are expected to last for decades too, reliability, usability, and safety are important priorities.





## HANDS-ON

Our in-house biorefinery enables us to give our customers a first-hand look at what our technologies can offer and provides us with an optimal facility for piloting R&D work.

We can selectively fractionate customer-sourced biomasses on an industrial scale, test product properties, and generate detailed data for dimensioning the machinery and systems needed for large industrial biorefineries.

## AN ONGOING RELATIONSHIP

Our involvement doesn't stop once a biorefinery has been delivered and is up and running.

As the people who researched, developed, engineered, built, and installed it, we can help keep it running at peak performance and even enhance its long-term performance – through a comprehensive package of simulation, testing, optimisation, and upgrade options.





Chempolis is a technology leader providing innovative and sustainable solutions and services for a wide variety of customers in the biomass and biorefining areas, as well as related process industries.

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