



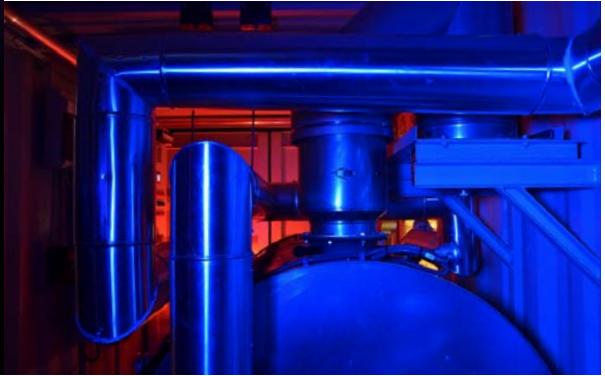


## THE FUTURE OF BIOGAS

The future of biogas lies in the use of lower cost, readily available biomass feedstocks, particularly those which are under-utilised or where energy use is a secondary step, such as solid animal manures.

Driven by economics, the ever present issues around “food v fuel” and government decisions on what to fund with tariffs, novel solutions need to be found for the biogas industry.

One of the key developments required is a technology to access the energy in so called “ligno-cellulosic” feedstocks. In these, nature has worked hard to make the digestible elements difficult to access, and they include cereal straws, hay and landscaping cuttings.



**Before ECONOMIZER SE Treatment**  
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## THE ECONOMIZER STEAM EXPLOSION PROCESS

Ligno-cellulosic structures generally have limited conversion of biomass to biogas. To enable conversion, this kind of biomass needs to be pre-treated before being fed into a biogas plant.

Our pre-treatment:

- removes the protective lignin layer from the cellulose fibres
- breaks apart the cellulose/hemicellulose fibres to increase their surface area, making them available for digestion.

The ECONOMIZER SE achieves these two effects by first cooking and then applying steam explosion. It is a well-understood and well-researched process that has been implemented at industrial scale in the paper industry for over 100 years.

The dry feedstock is mixed with liquids such as fresh or dirty water, separated slurry or separated recycled digestate to adjust the dry matter content of the feedstock to c. 30%. The mixture is then fed into the ECONOMIZER SE system in batches for treatment.

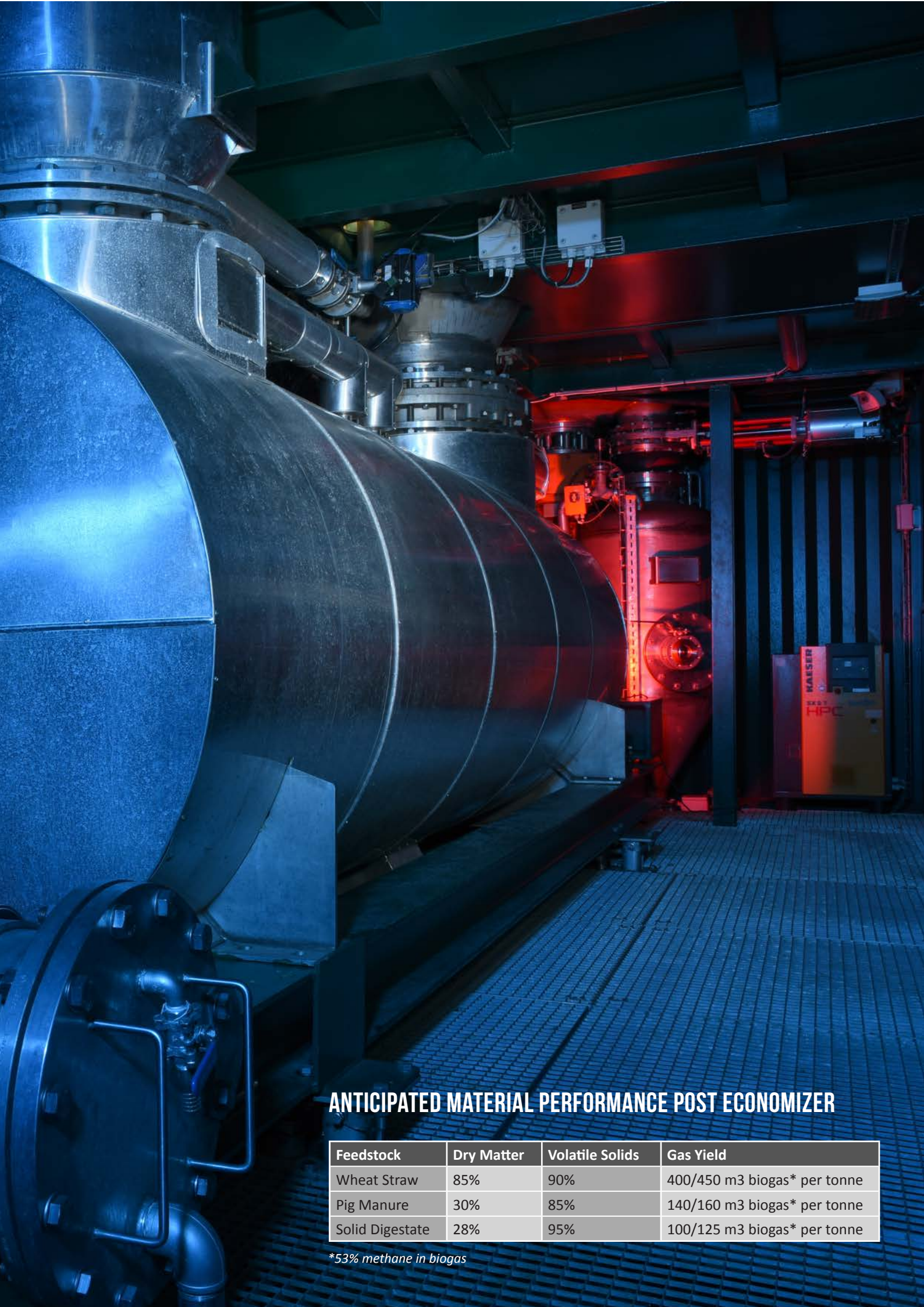
In our process, the ECONOMIZER SE heats the feedstock to temperatures between 150°C and 180°C. At these temperatures, lignin effectively melts and is freed from the cellulose/hemicellulose framework. It can no longer hold the cellulose fibres together and shield the cellulose/hemicellulose from chemical or bacterial digestion.

During the cooking process at high temperature and pressure (between 5 and 8 bar) the feedstock becomes fully saturated with water, filling the spaces between the fibres. After the feedstock heating process has been completed the mixture is released from the system and the pressure is spontaneously reduced from high pressure to atmospheric conditions in a matter of seconds. This causes the water trapped in the fibres to turn into steam with an explosion effect, breaking apart the fibres (see images).



**After ECONOMIZER SE Treatment**  
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## ANTICIPATED MATERIAL PERFORMANCE POST ECONOMIZER

Feedstock	Dry Matter	Volatile Solids	Gas Yield
Wheat Straw	85%	90%	400/450 m3 biogas* per tonne
Pig Manure	30%	85%	140/160 m3 biogas* per tonne
Solid Digestate	28%	95%	100/125 m3 biogas* per tonne

*\*53% methane in biogas*



## QUALITY OF FEEDSTOCK

In principle, any type of dry, ligno-cellulosic plant residues with straw-like appearance are suitable for treatment. The ECONOMIZER SE is not restrictive and can process old or wet bales and still achieve reasonable biogas yields. The system can handle stones, although too many will impact performance, reliability and wear.

*In case of any doubt, Future Biogas Systems must be consulted on the suitability of feedstock.*



## BIOGAS SYSTEMS

Biogas Systems GmbH is a technology developer with a focus on the environmental sector. The Biogas Systems team has completed almost 100 complex water treatment and environmental projects across EMEA. Its administration and engineering is based in Salzburg, while the R&D centre is in Parndorf. This is also where the demonstration ECONOMIZER SE plant is co-located with a 500 kW biogas plant. Visits of the demonstration plant can be arranged on request.

## FUTURE BIOGAS SYSTEMS

Future Biogas Systems Ltd (FBS) is the sole distribution agent of the ECONOMIZER SE in the UK. FBS is a subsidiary of Future Biogas Ltd, a company which has been building and operating AD plants in the UK since 2009. To date, Future Biogas Ltd has built 11 plants and produces in the region of 10,000 m<sup>3</sup> of biogas an hour. It also operates one of the leading install and service teams in the UK. Its plants are predominantly run on energy crops and have generated 1 billion kW of biogas since conception.

Future Biogas Ltd installed the first ECONOMIZER SE in the UK in early 2017 at its latest plant, and is currently adding another unit to operate on its plant, running on various straws and strawed pig muck. Two further units are on order, scheduled for delivery late 2017. Site visits can be arranged.

We offer the complete package, including the design, from the feedhopper for the relevant input material right up to integration of the ECONOMIZER SE system and its output into the biogas plant. We can also fit the necessary heating system to drive the thermal oil system (either gas heat exchangers from a CHP or a simple RHI boiler) and offer full training. From placement of order we anticipate a lead time of 6 to 8 months until the customer has a commissioned ECONOMIZER SE.



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