

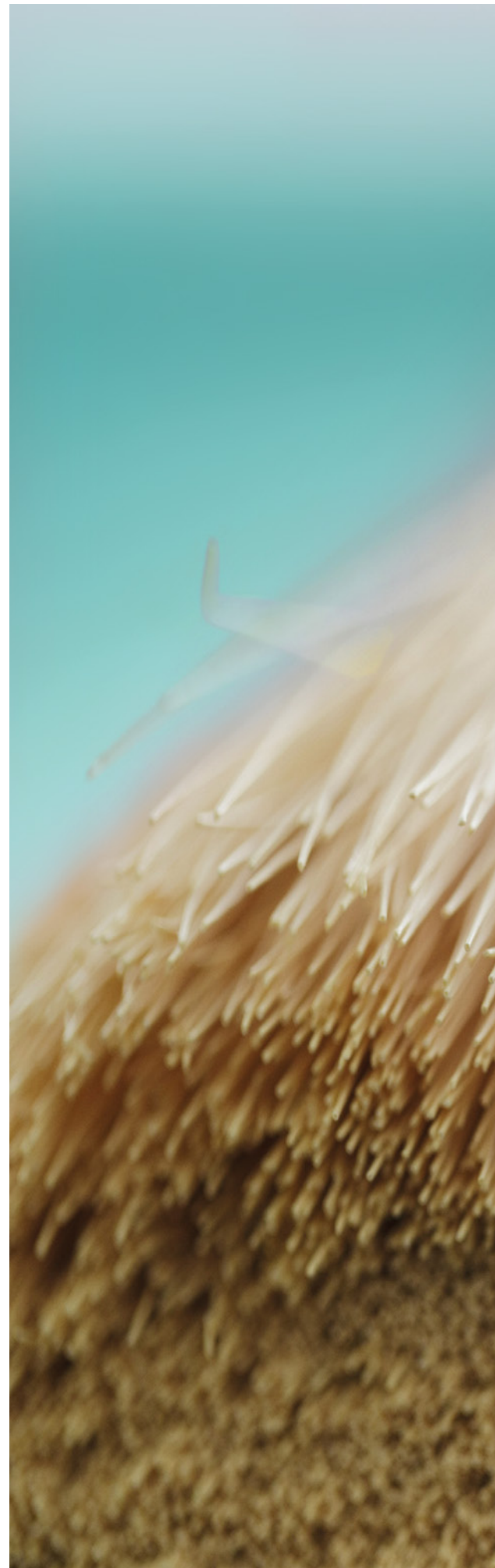



## **SEPURAN® Green**

Membrane technology for  
efficient biogas upgrading

# CONTENT

3	<b>Foreword</b>
4	<b>Don't waste the waste</b>
6	<b>Waste to fuel</b> Efficient biogas upgrading
8	<b>How does the membrane work?</b>
9	<b>The SEPURAN® Green Cartridge</b> Product Overview Upgrading Process Patent
10	<b>References worldwide</b>





EVONIK, THE CREATIVE INDUSTRIAL GROUP FROM GERMANY, IS ONE OF THE WORLD LEADERS IN SPECIALTY CHEMICALS, OPERATING IN THE NUTRITION & CARE, RESOURCE EFFICIENCY AND PERFORMANCE MATERIALS SEGMENTS.

The Resource Efficiency segment supplies high performance materials for environmentally friendly as well as energy-efficient system solutions ensuring sustainability – for business as well as everyday life.

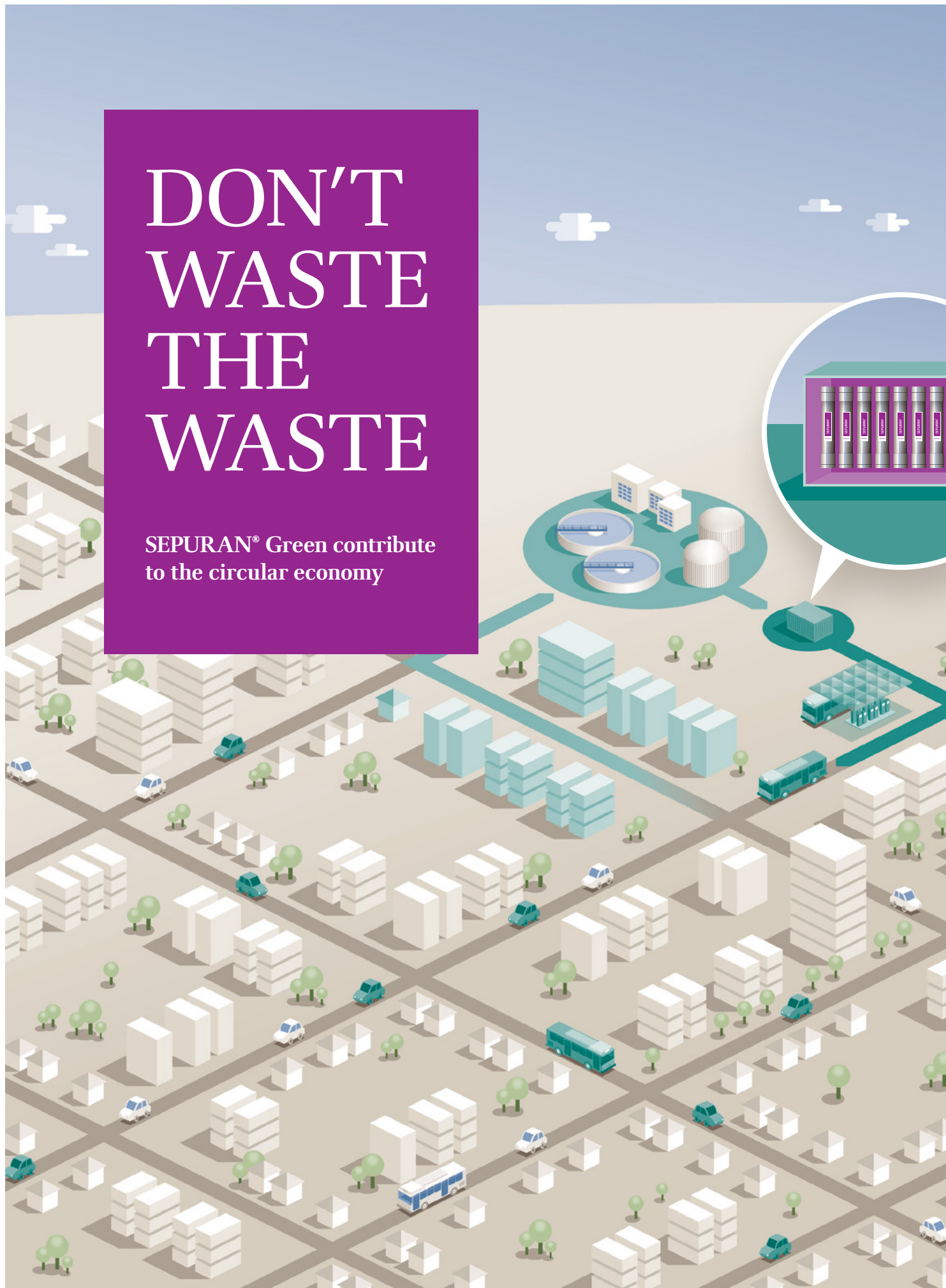
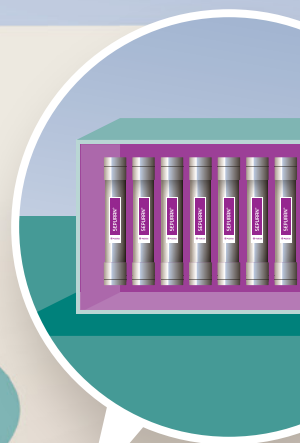
SEPURAN® stands for customized hollow fiber membranes for efficient gas separation. The first product of the membrane family is SEPURAN® Green for biogas upgrading. Our aim is to support turning organic waste into green energy source like biofuel simply and sustainably.

Evonik. Power to create.




# DON'T WASTE THE WASTE

SEPURAN® Green contribute  
to the circular economy







**Evonik makes it possible to turn organic waste into green energy.**

Using the innovative membrane technology from Evonik, biogas which is released during the wastewater treatment process or for example the anaerobic digestion process of household waste can be upgraded simply and efficiently to pure biomethane and fed directly into the natural gas grid or used as biofuel.



# WASTE TO FUEL

## Efficient biogas upgrading

Evonik, the creative industrial group from Germany, is a technology leader in high-performance polymers.

We offer hollow-fiber membranes for efficient and energy-saving gas separation.

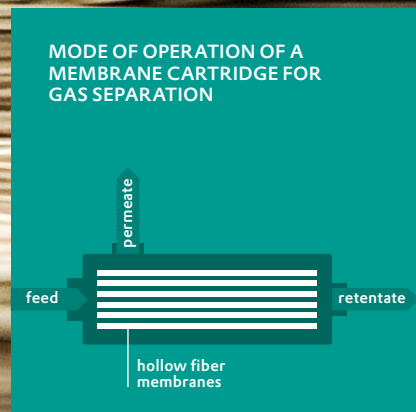
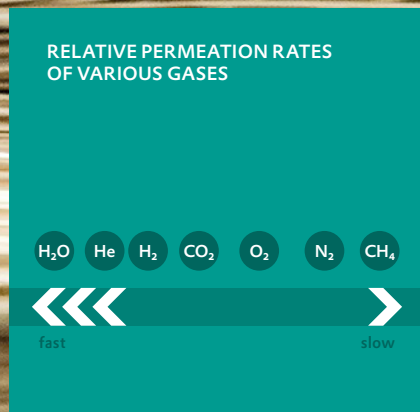


### Benefits

- Lower energy consumption
- No auxiliary materials such as water or sorbents required
- No emissions into the environment
- Separation at ambient temperature
- Low space requirements
- Continuous separation process
- Simple, modular setup
- Flexible and easily expanded
- Very high selectivity
- High yields
- High purity

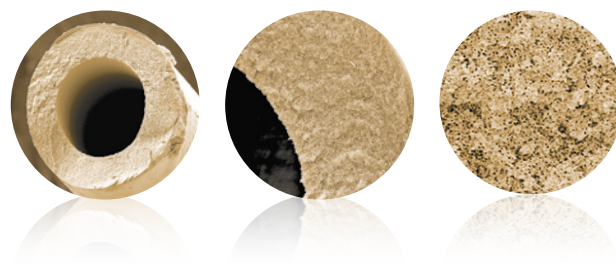
### Applications

- Extraction of methane
- Enrichment of CO<sub>2</sub>



# HOW DOES THE MEMBRANE WORK?

Gas separation membranes work on the principle of selective permeation through a membrane surface. The driving force for permeation of the gas through the membrane is the difference between the partial pressures of the gas on the retentate side (the interior of the hollow fiber) and the permeate side (the exterior of the hollow fiber).



The greater this difference, the higher the proportion of the gas that permeates through the membrane. In a separation, such as between carbon dioxide and methane, permeation of carbon dioxide through the membrane is much faster while methane is retained within.

The permeation rate of each gas depends on its solubility in the membrane material and on the diffusion rate. Gases that have higher solubility and smaller molecular size

permeate the membrane faster than larger, less soluble gases. The ratio of the transport speeds of two gases is called selectivity.

The higher the selectivity, the higher the energy efficiency of the resulting membrane process. Different membrane materials have different separation properties. The driving force required for the separation is obtained through a partial pressure gradient.



### 3-STEP MEMBRANE-BASED GAS SEPARATION PROCESS



## THE SEPURAN® GREEN CARTRIDGE

The SEPURAN® Green membrane cartridge consists of several thousand hollow fibers manufactured from high-performance polymers and wrapped with a stainless steel casing. The ends are embedded in a resin. The membrane cartridge is contained in a stainless steel pressure vessel. The cartridge and housing together comprise the SEPURAN® Green membrane module.

The membrane module can now withstand a gas mixture under pressure in which multiple modules can be piped together,

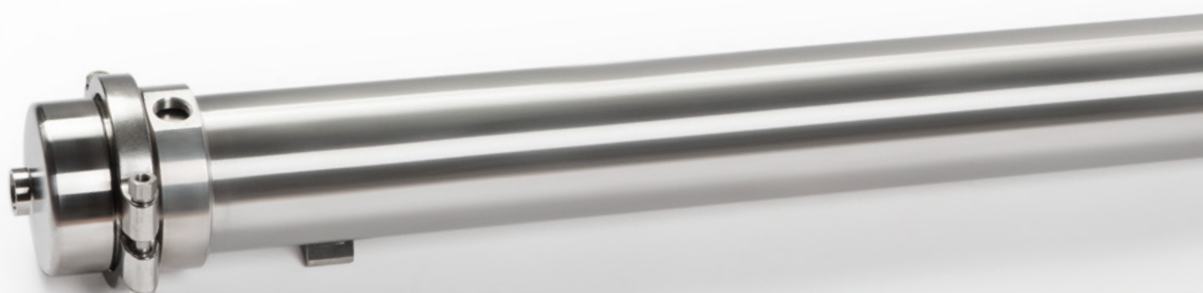
depending on the application and the size of the system. The simple, easy-to-handle set-up results in a compact upgrading plant.

At present, the stainless steel housings manufactured for the SEPURAN® Green cartridges are made to conform to the respective country-specific regulations. This allows plant construction companies to adapt flexibly to local pressurized equipment regulations. Housings for pressures of up to 20 bara and to 40 bara are available.

Today, Evonik offers SEPURAN® Green membranes/cartridge systems for biogas upgrading in various sizes. Choices of 2", 4", or 6" diameter membranes are available to address plants of all sizes.

### Upgrading process patent – 3 stages design

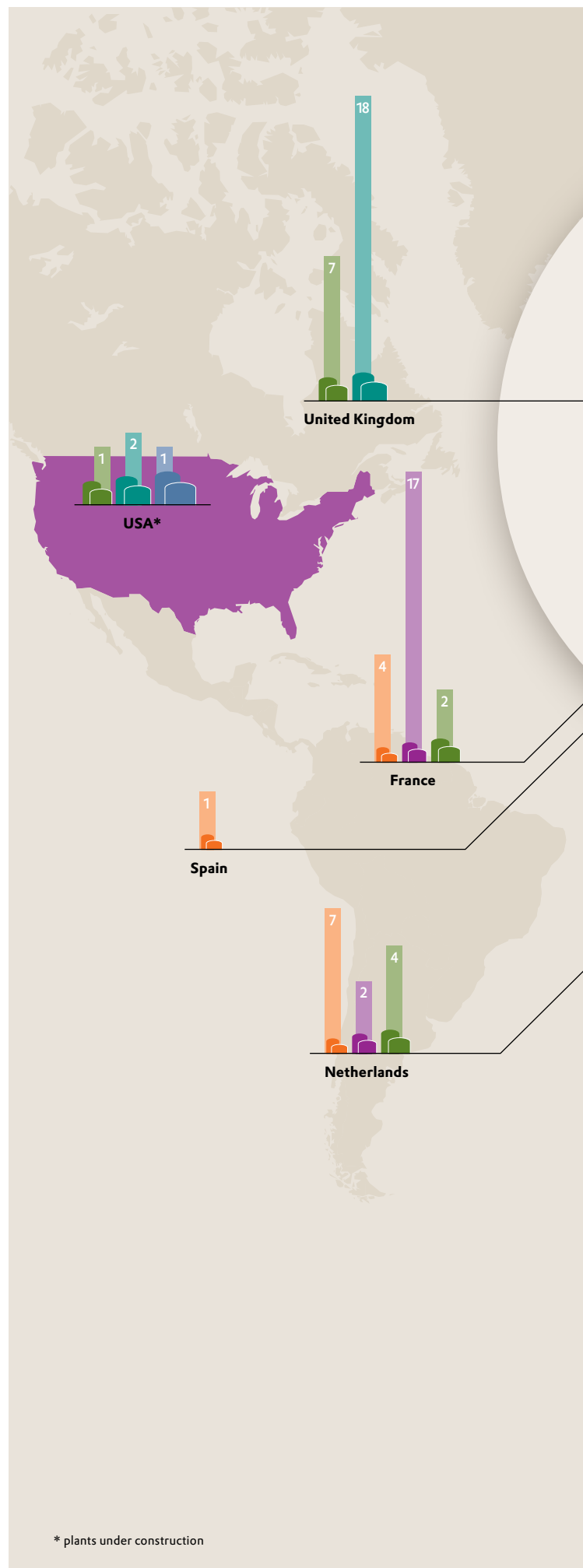
In addition to the SEPURAN® Green membranes, Evonik has also developed a biogas upgrading process patent that makes optimum use of the membranes' separation properties: Through skillful connection of SEPURAN® Green membranes in a 3 stages design, obtaining methane with a purity level of up to 99% from the crude gas with only one compression step is possible. Our patent features a low energy consumption, which allows operating the plant at a very high efficiency.

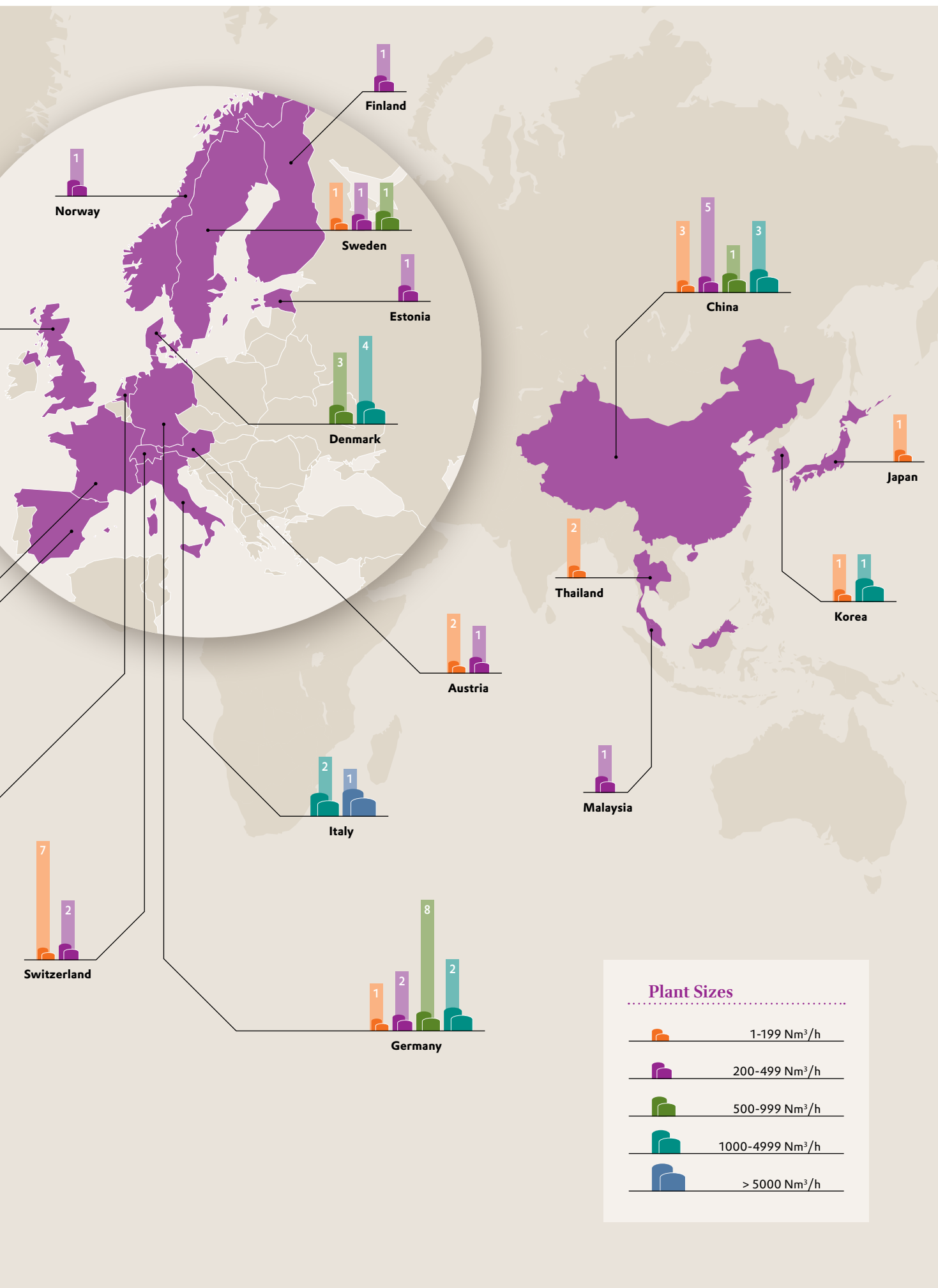


# REFERENCES WORLDWIDE

Quantity of biogas  
facilities with  
SEPURAN® Green

Plant with  
700 Nm<sup>3</sup>/h raw biogas  
Icknield Farm  
Ipsden (Oxfordshire)  
United Kingdom







This information and all technical and other advice are based on Evonik's present knowledge and experience. However, Evonik assumes no liability for such information or advice, including the extent to which such information or advice may relate to third party intellectual property rights. Evonik reserves the right to make any changes to information or advice at any time, without prior or subsequent notice.

EVONIK DISCLAIMS ALL REPRESENTATIONS AND WARRANTIES, WHETHER EXPRESS OR IMPLIED, AND SHALL HAVE NO LIABILITY FOR, MERCHANTABILITY OF THE PRODUCT OR ITS FITNESS FOR A PARTICULAR PURPOSE (EVEN IF EVONIK IS AWARE OF SUCH PURPOSE), OR OTHERWISE. EVONIK SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL, INDIRECT OR INCIDENTAL DAMAGES (INCLUDING LOSS OF PROFITS) OF ANY KIND.

It is the customer's sole responsibility to arrange for inspection and testing of all products by qualified experts. Reference to trade names used by other companies is neither a recommendation nor an endorsement of the corresponding product, and does not imply that similar products could not be used.

\* = registered trademark

#### **Evonik Fibres GmbH**

Gewerbepark 4  
4861 Schörfling  
Austria

PHONE +43 7672 701-2891

FAX +43 7672 96862  
sepuran@evonik.com

[www.sepuran.com](http://www.sepuran.com)  
[www.evonik.com](http://www.evonik.com)

01/hu/1000/en