



Biogas Upgrading Solutions for the agriculture sector

Greenlane™ **Cascade MS** product line delivers farm-friendly solutions to turn agricultural waste into clean, low-carbon renewable natural gas.



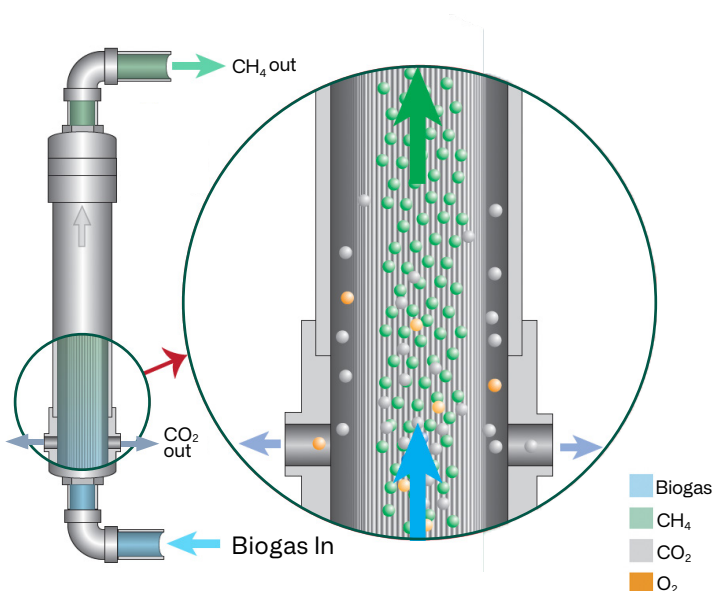
Creating new opportunities for farmers and rural communities

Greenlane™ Cascade MS products deliver end-to-end biogas upgrading solutions, designed with ease of installation and operation in mind.

Manure and other agricultural residues are an excellent renewable energy source. Under anaerobic conditions, these valuable waste resources generate biogas. Biogas upgrading systems cleanse the impurities in biogas and separate the carbon dioxide from the methane to create a clean, high-purity low carbon fuel: biomethane, or renewable natural gas (RNG).

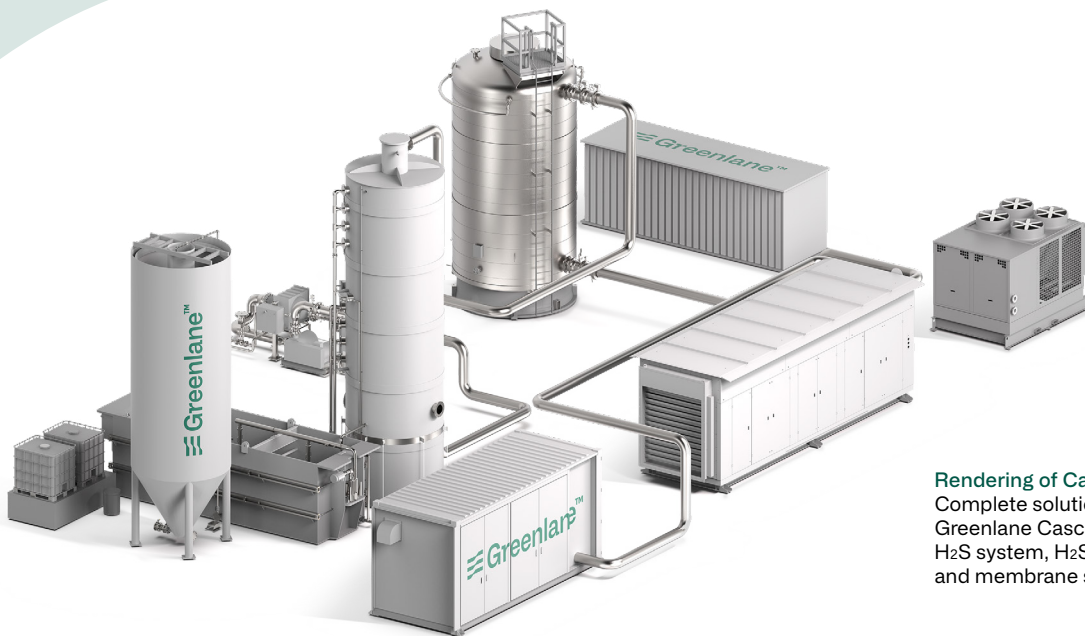
Cascade MS important benefits

- **Creates new economic opportunities while reducing operational costs:**
Building sector resilience in the face of commodity-price fluctuations by helping turn the cost of waste management into new revenue streams.
- **Reduces environmental impact of farming:**
Helping farmers lower greenhouse gas emissions and enabling sustainable agricultural practices.



→ How Cascade MS works

1. biogas is pretreated, compressed, filtered, and conditioned for upgrading
2. biogas flows through multiple stages of membrane cartridges that remove carbon dioxide and some oxygen, resulting in high purity methane product gas
3. some of the processed gas is recycled back to the compressor inlet to maximize methane recovery
4. this entire process results in a continuous stream of high value renewable natural gas



Rendering of Cascade MS:
Complete solution with biogas blower, Greenlane Cascade H₂S regenerative H₂S system, H₂S polisher, compressor and membrane skid

Why membrane technology for agricultural biogas upgrading?

- delivers high biomethane recovery
- integrates with Cascade H₂S for cost effective removal of high H₂S in the biogas along with efficient RNG production
- containerized for easy and effective installation

Types of Feedstock:

Dairy manure, swine manure, chicken litter, agricultural residues

Cascade MS flow range

	Max Flow (Nm ³ /h)*	Max Flow (scmf)*
Cascade MS	750-1000	450-630

*minimum flow is 40% of max flow

¹Higher flows are achieved using multiple units in parallel

Typical gas processing capability for RNG

Parameter	Raw Gas Quality	Product Gas Quality	Cascade MS
Methane (CH ₄)	50-65 %	Meets Pipeline Quality Requirements	Up to 99% guaranteed methane recovery
Carbon Dioxide (CO ₂)	35-50 %		
Nitrogen (N ₂)	0-1 %		
Oxygen (O ₂)	0-0.2 %		
Hydrogen Sulfide (H ₂ S)	up to 3000*		

*contact us for higher H₂S levels

The Cascade MS advantage

- + End-to-end solutions, from digester outlet to pipeline interconnect inlet
- + Cold Weather Packages available
- + Containerized for outdoor applications (indoor configurations available)
- + Cost-effective and fast implementation
- + High methane recovery (up to 99.5%)
- + Low maintenance
- + Suitable for small plants and scalable for larger applications
- + High uptime
- + Low maintenance
- + 24/7/365 on-call technical support

Your trusted biogas upgrading partner



Greenlane Renewables is a leading global provider of integrated biogas upgrading systems, with more than 140 installations worldwide to date. We believe renewable natural gas is the most relevant renewable energy to support the decarbonization of commercial transportation and the natural gas grid.

Greenlane™ **Cascade suite of technologies** and products produce clean, low-carbon and carbon-negative RNG, creating value from organic waste at landfills and water recovery facilities, agricultural, food and organics. With water wash, pressure swing adsorption, membrane separation and proprietary desulfurization products available, Greenlane's commitment is to deliver exactly the right technology and level of service to meet our customers specific biogas upgrading needs and objectives.

Our services:

- 24/7 helpline
- Installation training, consulting, inspection
- Operator training and support
- Commissioning and performance testing
- Service and performance reporting
- Preventative and corrective maintenance
- Performance data analysis
- Options for service/maintenance contract
- Remote monitoring and management

For more information, visit greenlanerenewables.com

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#1

in global
supplied capacity

140+

upgrading
systems deployed

35+

years
experience

19

countries
supplied