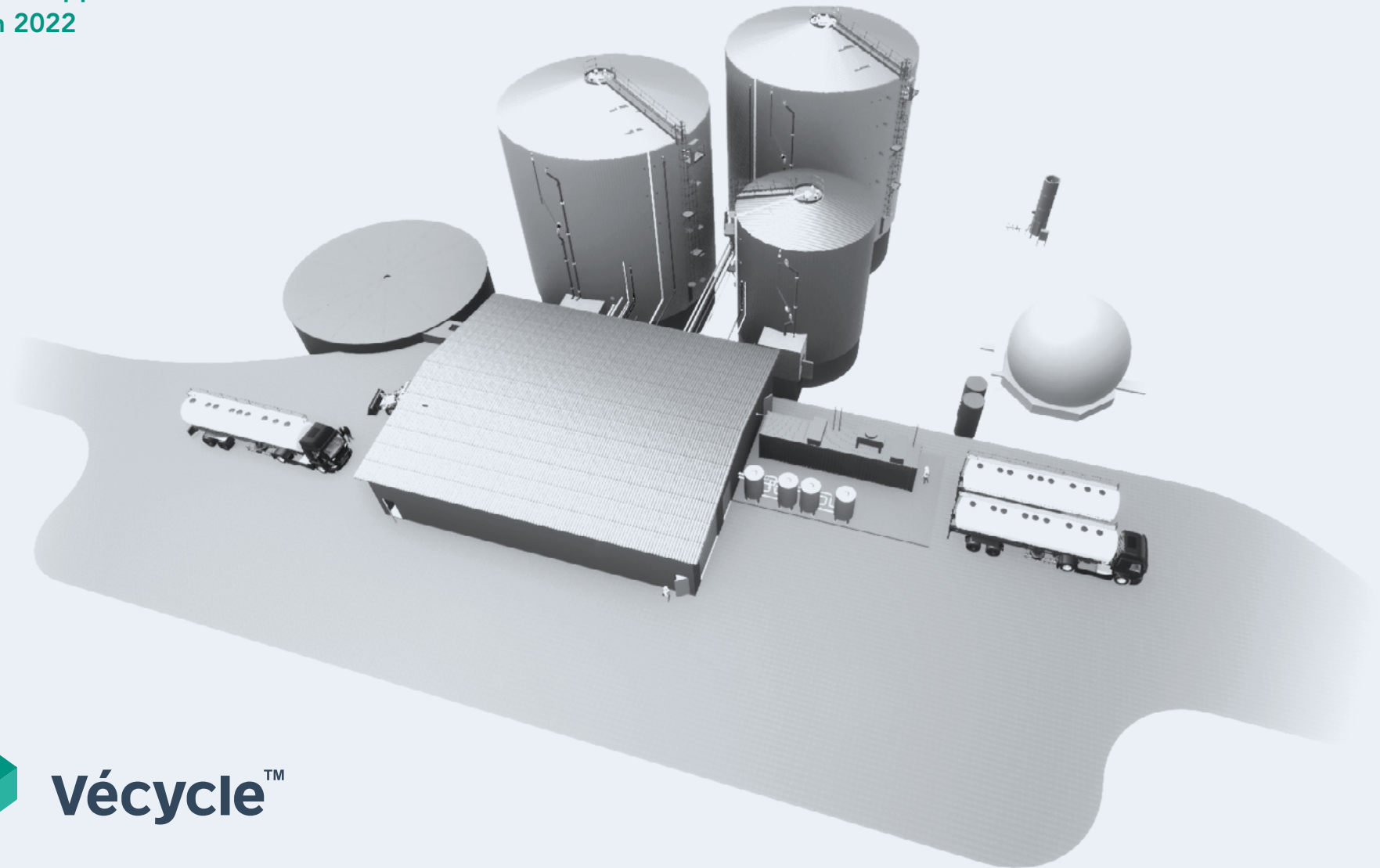


The Vécycle™ Biogas Plant

Technical appendix,
March 2022



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The value of on farm biogas production

Biogas as add-on to farm operations

Biogas is a mix of combustible gases that consists mainly of methane (CH₄) and carbon dioxide (CO₂) and is formed by organic substances during anaerobic decomposition.

Manure is a perfect organic substrate to use as the basis for a biogas plant, as it is uniform in composition, easy to pump and handle. The methane yield depends on:

- The quality of the feedstock.
- The appropriate processing.
- The efficient upgrade of the biogas.

Based on combined experience, Green Island Vecycle will guarantee that the

processes designed by us will yield a predictable amount of gas

The Vécycle farm based plant will run on manure with addition of surplus organics like silage, deep bedding, straw, dairy waste products etc. If economic considerations make advantageous to include off farm manure/organics, Green Island Vécycle will assist with recalibrating the plant to optimize whatever makes most economic sense.

Greening the Pipe

By upgrading the produced gas to 99% methane it can be sold as Renewable Natural Gas(also known as biomethane) across North America through existing pipelines, directly displacing natural gas. ►

On-Farm Energy Production

Converting manure and surplus organics as part of farm operations:

- Significantly reduces carbon footprint of the farm.
- Diversifies energy sources, that can be sold or secure on-farm energy self-sufficiency.
- Steady and significant income generation.

Enhanced Nutrient Value

The biogas process enhances the value of manure:

- An almost odorless manure.
- Increase in plant available nutrients of the slurry and plant availability of those nutrients offsetting use on carbon based fertilizers.
- A slurry suitable for dragline distribution.

Key figures

Vécycle standard plant

Capacity

~100 tons/day – 38.000 tons/year.

Add on possibility: additional 100 tons/day.

Feedstock presumptions (per 100 tons/day capacity module)

- 35.000 tons of liquid cow manure per year.
- 3.000 tons of organics (Corn or Grass silage) per year.

Use of product

All surplus biogas is upgraded to RNG, pipeline quality.

Minimum Production Guarantee

1.100.000 nM³ raw biogas per year. (100 ton/day capacity)

2.200.000 nM³ raw biogas per year. (200 ton/day capacity)

Plant overview

Step-by-step process from feedstock to RNG

1. Injection of manure and organics

Pumping regime from barns planned to ensure short retention time and uniformity of the manure as it is injected into digester.

Biomass to be manually loaded into container every 2-3 days. If more biomass available, larger intake will produce more gas (see page 6).

2. Digesters and agitation system

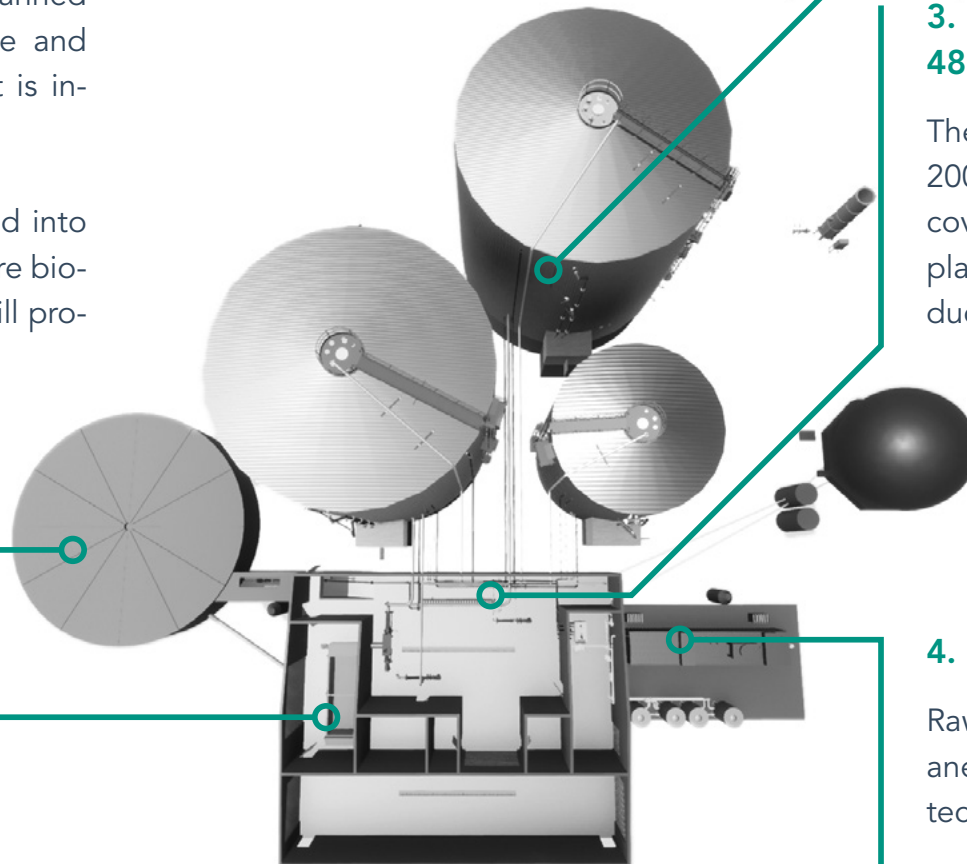
An advanced stirring system secures optimal biochemical processes, providing the correct agitation (see page 7-8).

3. Operating temperature 48-50° C

The heat needed is produced in a 200 Kw furnace. A patented heat recovery system designed for biogas plants, reduces the need for heat production by more than 50%.

4. Gas upgrading to RNG

Raw biogas is upgraded to 99% methane content, using reliable membrane technology (see page 9).



Injection of manure and organics

Injection of manure

Tank holds 2-3 days of intake. The shorter total retention time, the better. Pumping regime from barns planned accordingly. The pumps secure the uniformity of the manure as it is injected into digester.

Organics conveyor system

Terbrackens vario system relies on conveyor/pushbar rails. These ensure a constant and uniform material discharge. During the forward movement of the conveying/ pushbar elements, the

pusher elements fold out and convey the material powerfully in the discharge direction. When conveying/pushbar elements move backwards, the pushers will fold inwards and slide backwards through the material with little resistance, very little material will get pulled back.

All parts inside of the container bottom/floor, which come into contact with the substrate, are made of stainless steel and plastic. This applies to the entire conveyor system.

Vario is equipped with standard motors from Lammers, gear/transmission brand is Comer and the Frequencydrive brand is ABB.

It is possible to extend the Vario with additional equipment at a later date. With the help of this additional equipment, the Vario is capable of conveying difficult, long fibred substrates without any problems.

The Vario dosing container can be used to reliably convey a wide range of substrates to various processes with only a little energy input. The Vario has a very low power input/energy consumption between 0.7 and 1.2 kW/ton depending on substrate). (up to 70% less compared to conventional ladder frame moving floors).

Noise level: The sound/noise emission is maximum 70 dB.



Digester and agitation system

The reactor tank from Assentoft Silo

The tank roof top and the two top wall rings is made from 5 mm S355JR steel with galvanized steel beams.

The lower 10 wall rings are made from Primed steel. Ladders, walkways, wind stiffeners and railings, spools with flanges, fittings for piping and access hatches are hot-dip galvanized.

The tank is designed for an operation pressure of 25 mbar and a test pressure of 28 mbar and a vacuum of 5 mbar. Snow load is calculated with 1 kN/m².

The tank is designed for a temperature of up to: 55° C – termophilic operation and basic wind velocity at: 27 m/s. The tank is designed for stirring by means of GasMix from Landia.



Landia GasMix

Anaerobic Digester Mixing System

1. Landia GasMix Chopper Pump

A key component in the GasMix system is the chopper pump. In addition to providing the correct flow and pressure for the GasMix nozzles its integrated chopping device will chop solids into smaller particles, resulting in improved biogas process and more biogas produced.

2. GasMix Nozzle

The uniqueness of the Landia GasMix lies in the design of the GasMix nozzle. Years of development has gone into this to achieve the most efficient performance. When substrate is pumped through the GasMix nozzle, biogas is sucked from the top of the digester, mixed with the substrate and injected under pressure back into the digester creating not only a horizontal mixing pattern but also a vertical pattern through 3D mixing.

3. Mixing Nozzle lower

The digester content is re-circulated through the lower mixing nozzle in order to create a rotational movement in the lower part of the tank and to avoid settlement at the tank floor.

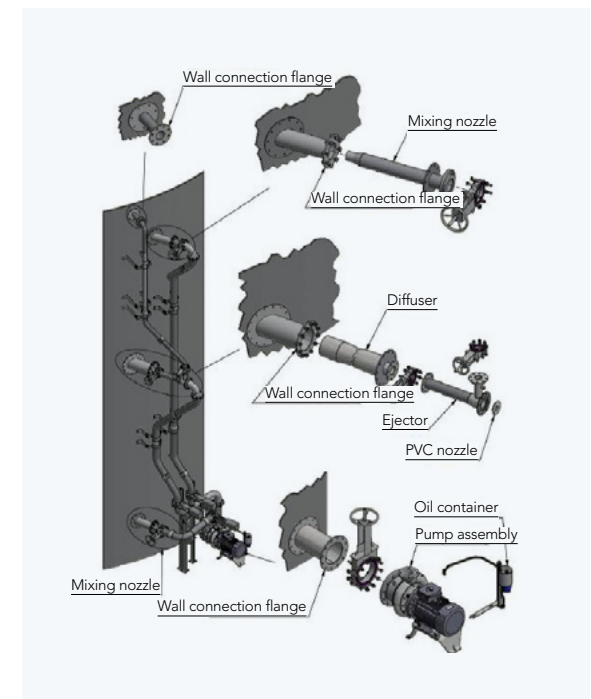
4. »Crust Breaker« Mixing Nozzle – upper

The digester content is re-circulated through the upper mixing nozzle in order to create a rotational movement in the upper part of the digester and to avoid, or break down, crust on the liquid surface.

5. Automated Valves

The Landia GasMix system is a flexible mixing system, and the mixing process is controlled by a number of automated valves – pneumatic or electrical. This

means the operation time of each nozzle is variable depending on the substrate characteristics and can be fine tuned to provide effective mixing.



Gas upgrading system

Upgrading to RNG through reliable membrane technology

Upgrading system

The delivery is offered as a turnkey solution, consisting of gas treatment system and membranebased gas upgrading system. Membranes, control panels and gas compressor are delivered in a special container designed by NISSEN energy.

The scope includes gas treatment to meet gas condition requirements as required by pipeline operators in Canada.

- The scope includes compressor heat recovery.
- The offer includes delivery, supervising and commissioning.

- The scope includes prefabrication and installation of pipes between the delivered equipment.

NISSEN Energy A/S has inhouse plant design and manufacturing in cooperation with the market leading membrane manufacturer EVONIK®.

Gas Storage

Buffer gas storage for 400 M³ gas, certified for -45 to +75 degrees Celsius.

Production Guarantee

Green Island Vécycle guarantees yield – also when markets or feedstock change.



Bringing innovation to complex biogas operations

Green Island Vécycle is based on 30+ years of experience in biogas operations combined with real-time remote monitoring and machine learning, using our digital platform Véhub™

**Green
Island
Group.**



Véhub™

Optimal operations

Véhub™ utilizes machine learning to gather and store data to optimize operations and detect malfunctions.

Operational data is presented in dashboards to farm personnel, service staff, and Véhub specialists ready to crunch any and all operational challenges.

Digital platform for the green economy

Véhub is the result of a strategic partnership between Green Island Group and Trifork aimed at digitizing the implementation and operations of distributed energy resources.

Véhub helps local communities access the solutions needed to develop their green economy. Our project development engine makes it easy for locals to implement ambitious greentech projects. And once a solution is implemented, Véhub offers the cloud-based operational platform hosting OS and operational data from every commissioned solution.



Véhub™



02

YOUR DASHBOARD

Production Goal

Track your production

Remote monitoring

Monitor your system in real-time

System notifications

Get notified on operations and maintenance

Three-Tier Operations

First Tier

On-farm staff make sure to input agreed feedstock types and volumes.

Second Tier

GET Corp service team carry out preventive maintenance and downtime response.

Third Tier

Vehub carries out 24/7 monitoring, troubleshooting operational challenges, and delivery of continuous optimizations of plant operational system.



VéhubTM

Partners & Suppliers

Advising Green Island Group on farm run biogas operations



Suppliers for the Green Island Vécycle™ solution



Partners

Green Island Group.



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