



Cryo Pur

From waste to fuel

TRANSFORMING BIOGAS INTO BIO-LNG AND LIQUID CO₂

Vaasa Gas Exchange

22/03/2018

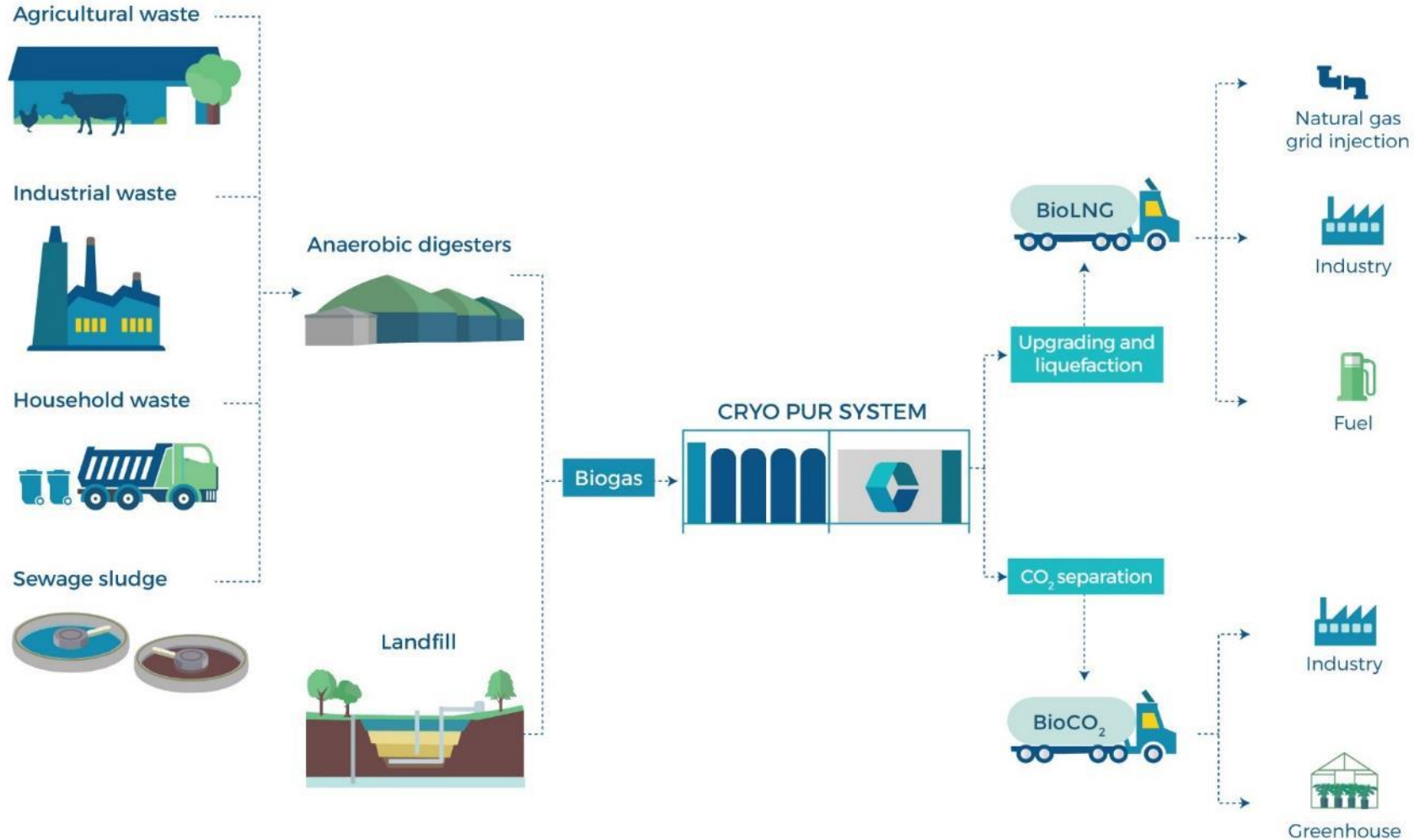
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An integrated system transforming biogas into bio-LNG and liquid CO₂



- **Bio-LNG** is a **sustainable fuel for trucks**, that reduces GHG, NO_x and particle emissions vs. diesel.
- **Bio-LNG** is stored and transported easily, which enables biomethane projects even **when the gas grid is remote or has a limited capacity**.
- **Liquid Bio-CO₂** is an interesting by-product **that can be used in various applications**: greenhouses, refrigeration in transport, chemical industry...



About Cryo Pur

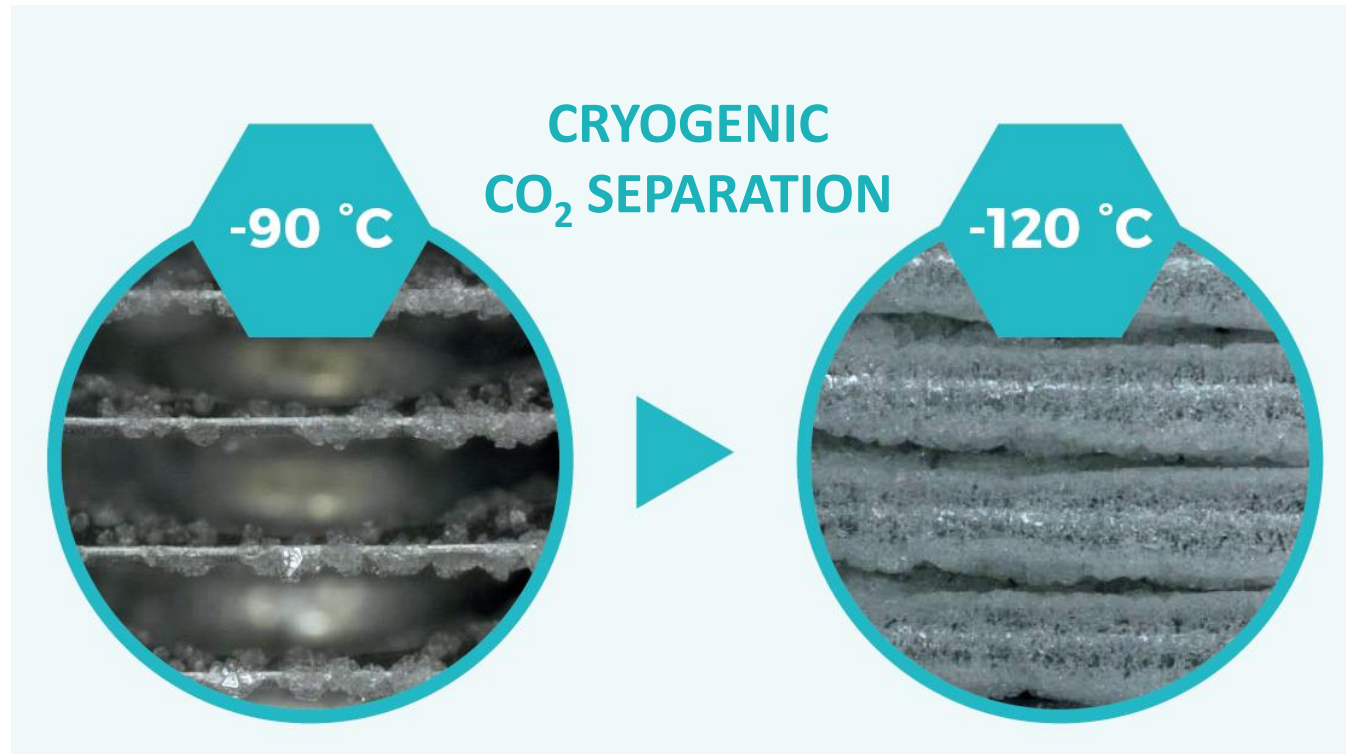
Expert in cryogenic biogas upgrading and liquefaction

- **Activity** : Supply, installation and maintenance of industrial equipment for the production of liquid biomethane (bio-LNG) and liquid CO₂.
- **History:**
 - 15 years R&D in the field of cryogenic CO₂ capture.
 - Pilot and demonstration project at a WWTP in France (2015-2017).
 - First commercial unit commissioned in Northern Ireland (01/2018).
 - 3 tenders won in France and Italy.
- **Intellectual Property** : 7 international patents.
- **Team** : 28 people, including 20 PhD, engineers and technicians.
- **Facilities** : Head Office and workshop in Palaiseau, France (Paris area).
- **Equity raised** : € 3 m in 2015, € 6 m in 2017.



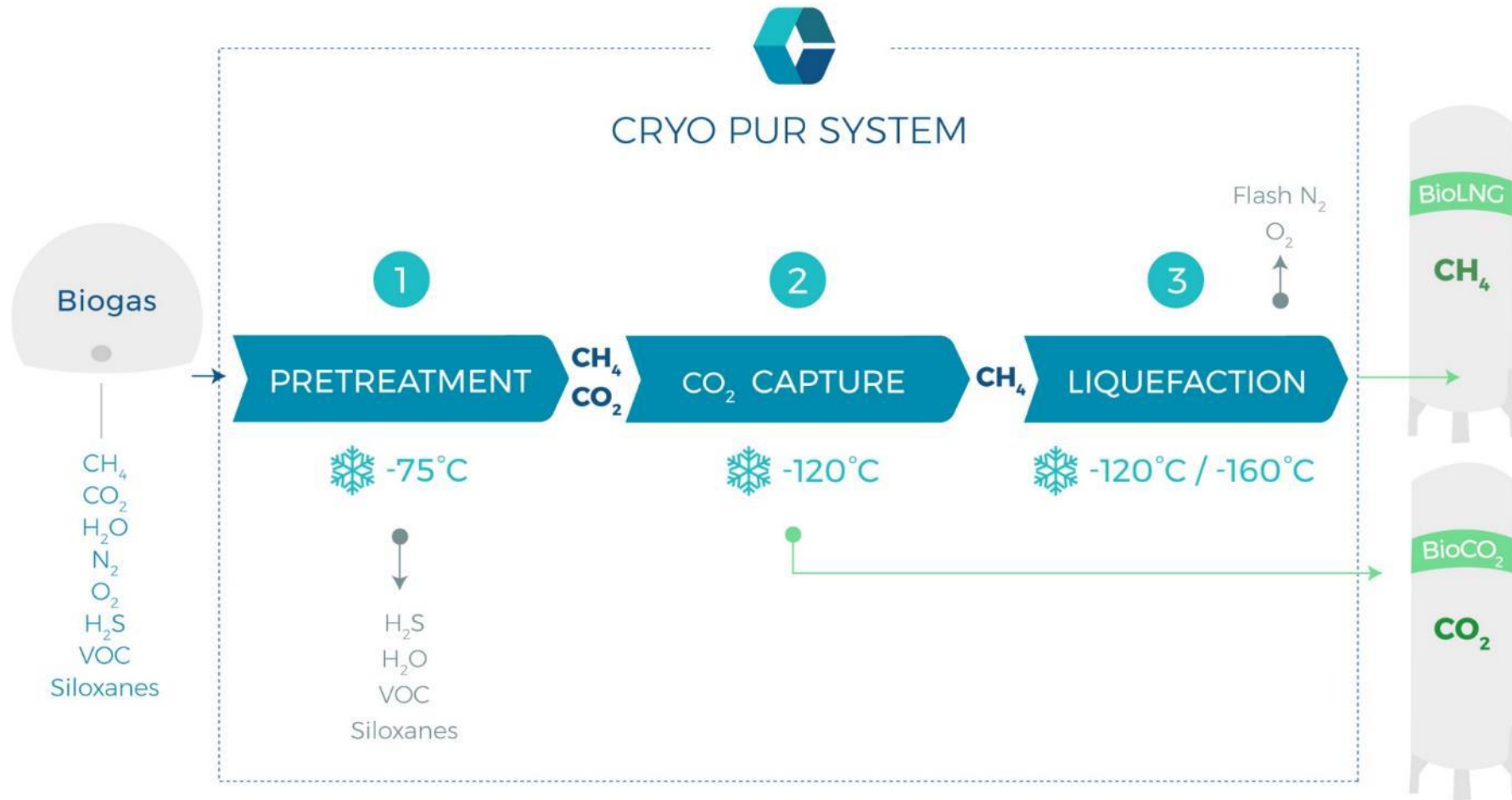


Cryo Pur Process (1 | 3)



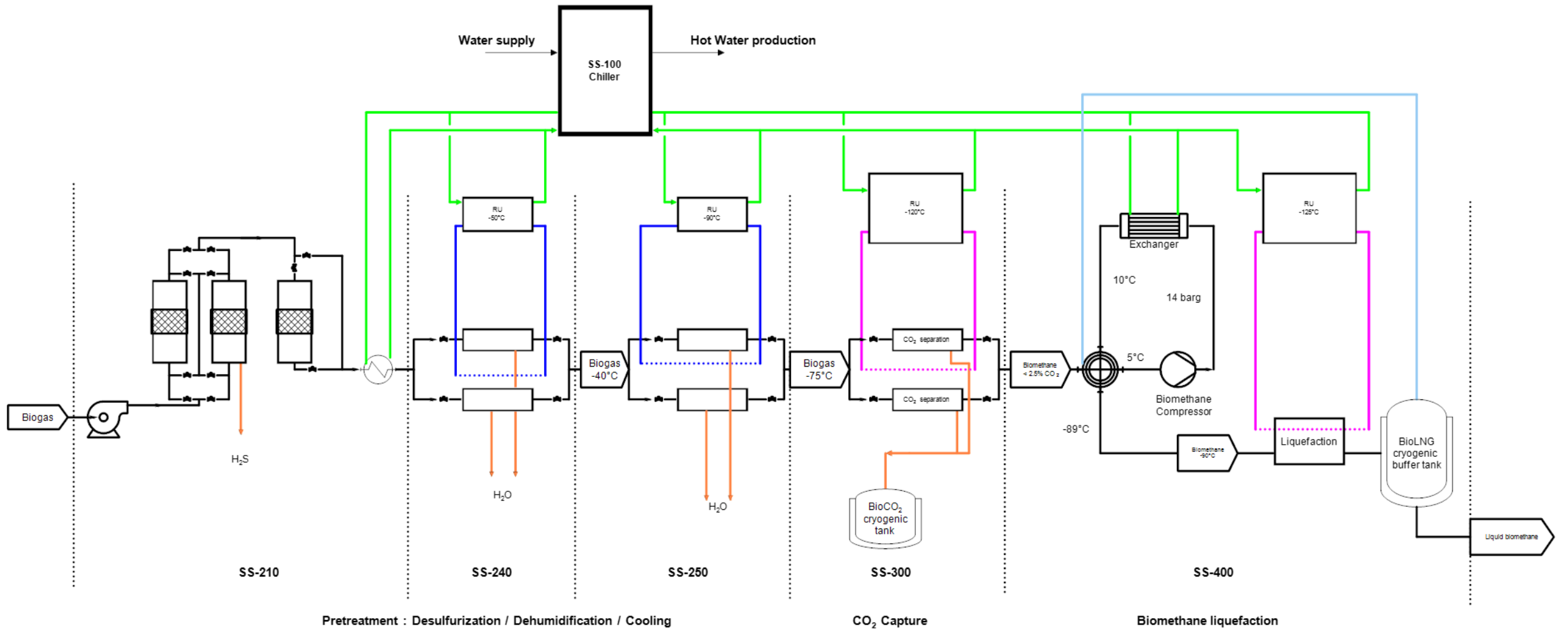


Cryo Pur Process (2|3)





Cryo Pur Process (3 | 3)



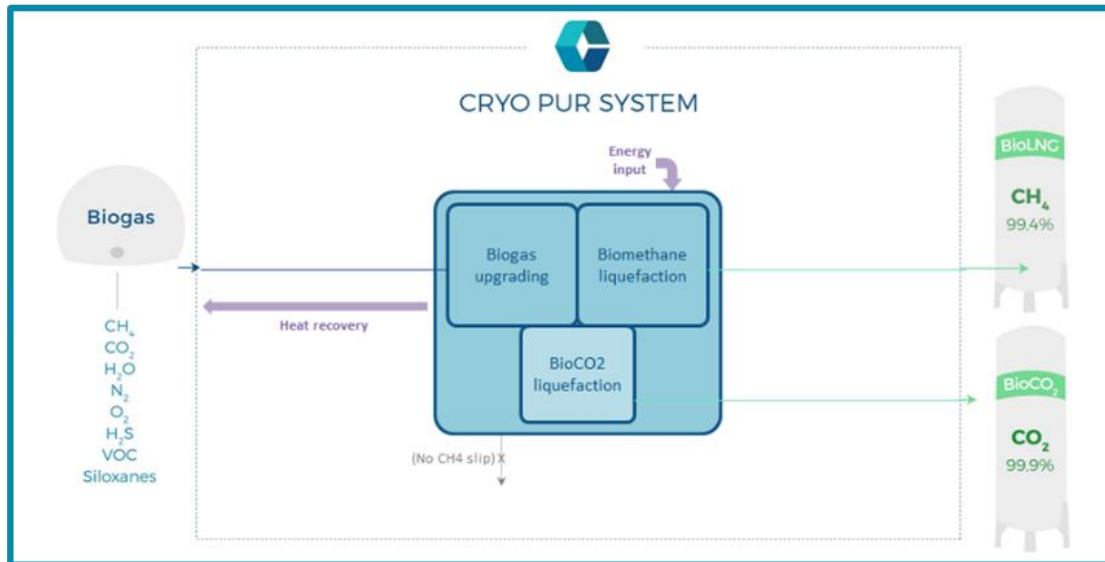
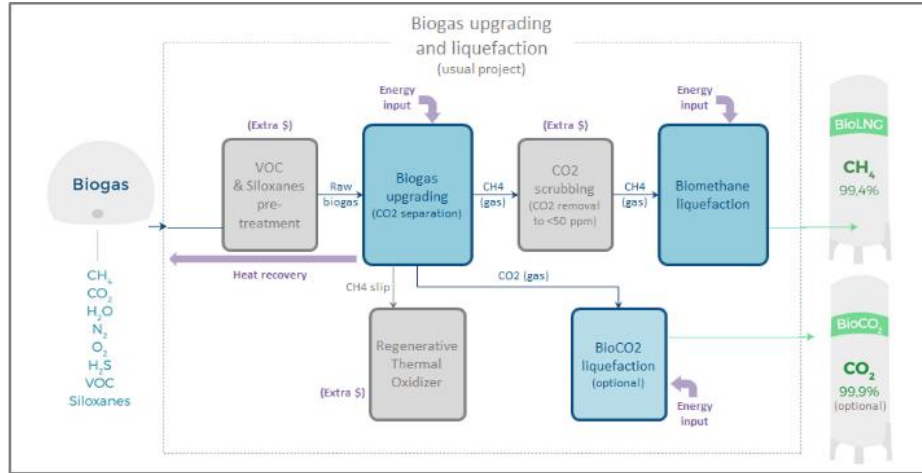


Cryo Pur technology benefits (1 | 2)

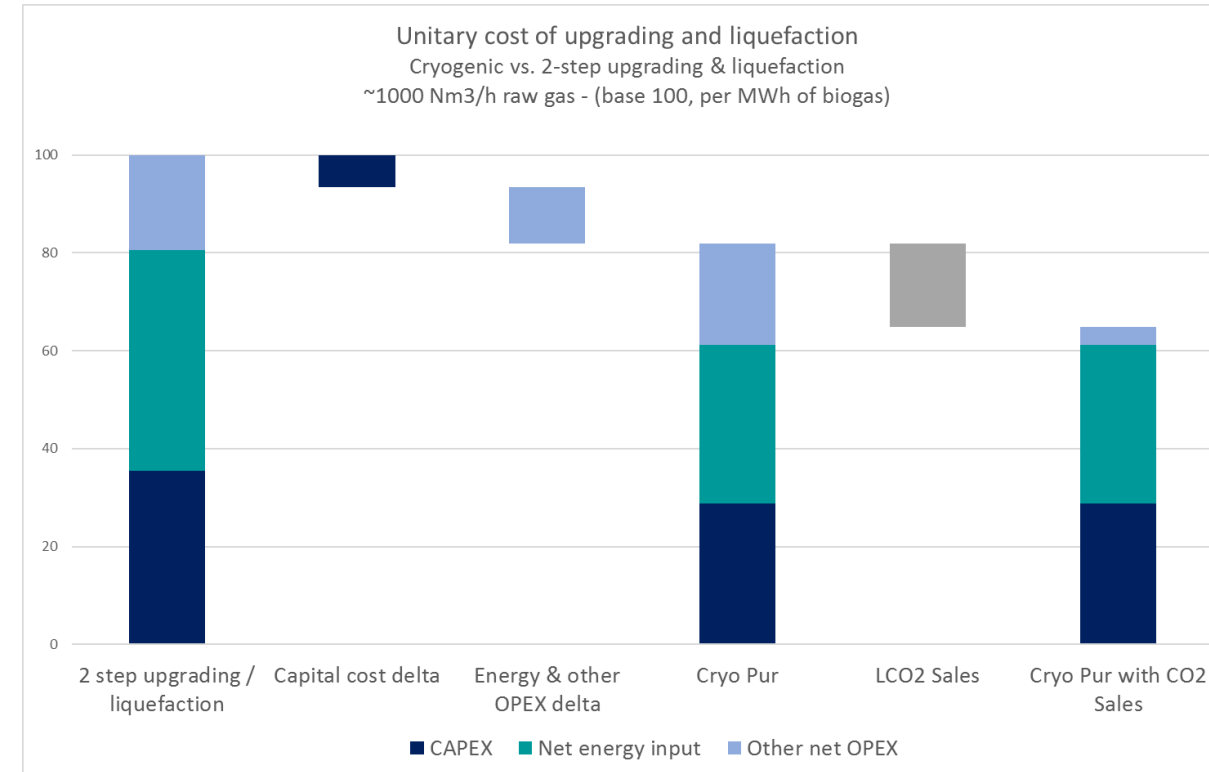
- **Integrated technology** for biogas upgrading, bioCO₂ liquefaction and biomethane liquefaction
 - Cost efficiency
 - Simplified integration and management of interfaces
 - Performance guarantees
 - Large product range
 - Liquid CO₂ as by-product
- **Low electric energy consumption** :
 - 0.6 kWh/Nm³ raw biogas for both upgrading and liquefaction: 14 barg/-120°C
 - 0.7 kWh/Nm³ raw biogas for both upgrading and liquefaction: 1 barg/-160°C
- **Heat recovery** on refrigeration systems covering up to 100% AD heating needs
- **No methane slip** or minimum methane slip for landfill biogas
- **High flexibility** of the system: from 50% to 120% of the nominal biogas flowrate
- Physical separation, **no consumables** except activated carbon



Cryo Pur technology benefits (2 | 2)



=> Better economics for large-scale bio-LNG projects :



=> Enables small-scale bio-LNG projects.



Reference #1 : BioGNVal Project (1|3)

First integrated small-scale bio-LNG demo plant in the world



Site location: Valenton WWTP,
France (Paris Area).

Biogas source: Sewage sludge

Operation: 10/2015-04/2017

Capacity:

- Raw biogas flow: 100 Nm³/h biogas
- Bio-LNG prod.: 1 tpd
- Liquid CO₂ prod.: 1.6 tpd



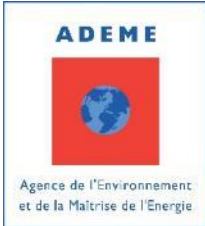
Click here to watch the presentation video





Reference #1 : BioGNVal Project (2|3)

Partners



Finance
Technical expertise



Design, manufacturing, operation
of the demonstration plant for
bio-LNG and bio-CO₂ production



Owner of Valenton WWTP



LNG/bio-LNG fueling
station provider



Operator of Valenton
WWTP and Project coordinator



LNG/bio-LNG truck
provider



Liquid CO₂ refrigeration
system provider



Reference #1 : BioGNVal Project (3|3)

Key achievements

Bio-LNG transfer to the mobile transport station



Use as vehicle fuel



Use as industrial fuel





Reference #2 : Greenville Bio-LNG plant (1|5)

First farm-based bio-LNG plant in the world





Reference #2 : Greenville Bio-LNG plant (2|5)

Plant profile



Site location: Omagh,
Northern Ireland (UK)

Biogas source: Animal waste and
food waste

Operation: Since January 2018

Capacity:

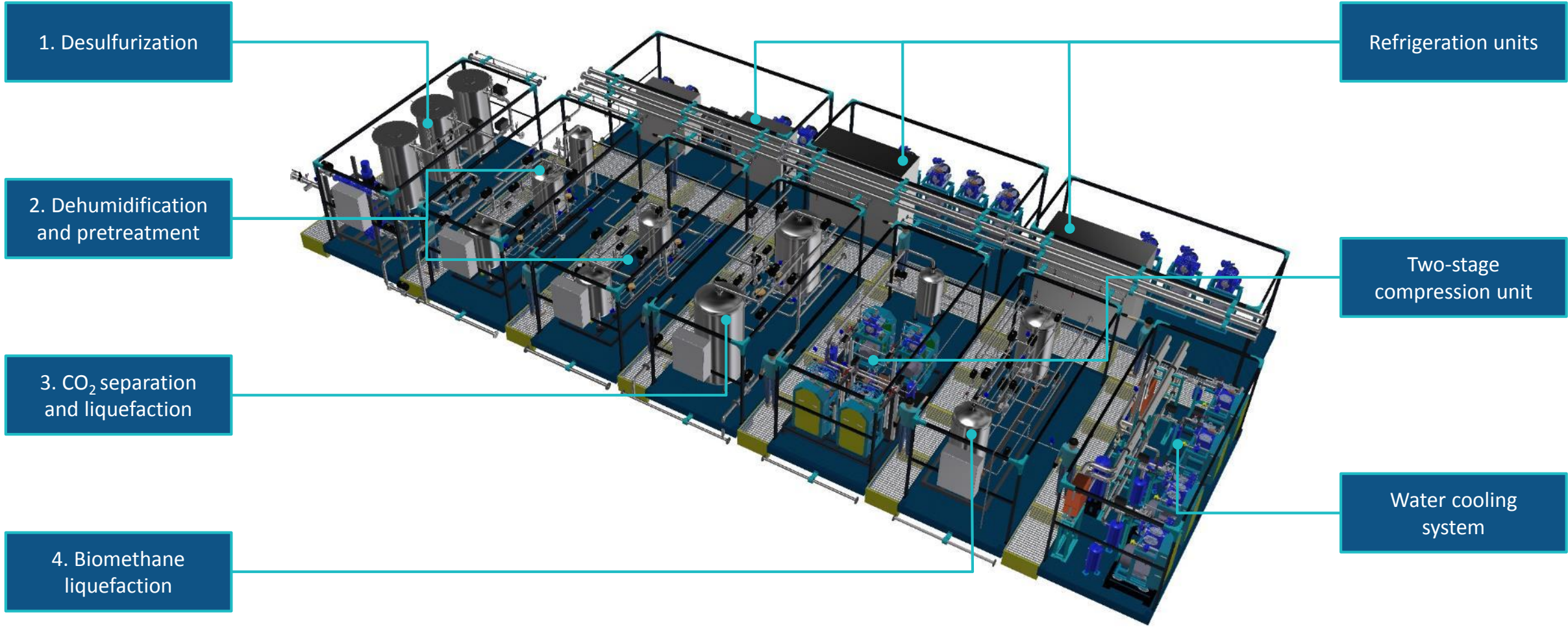
- Raw biogas flow: 340 Nm³/h biogas
- Bio-LNG prod.: 3.3 tpd
- Liquid CO₂ prod.: 6 tpd





Reference #2 : Greenville Bio-LNG plant (3|5)

Upgrading and liquefaction plant layout





Reference #2 : Greenville Bio-LNG plant (4|5)

Delivering Bio-LNG

From the
production
site...



*Mobile LNG container
loading operation*

...to the
customer
site.



*LNG satellite station design
/ LNG container unloading*





Reference #2 : Greenville Bio-LNG plant (5|5)

Pictures





Reference #2 : Greenville Bio-LNG plant (5|5)

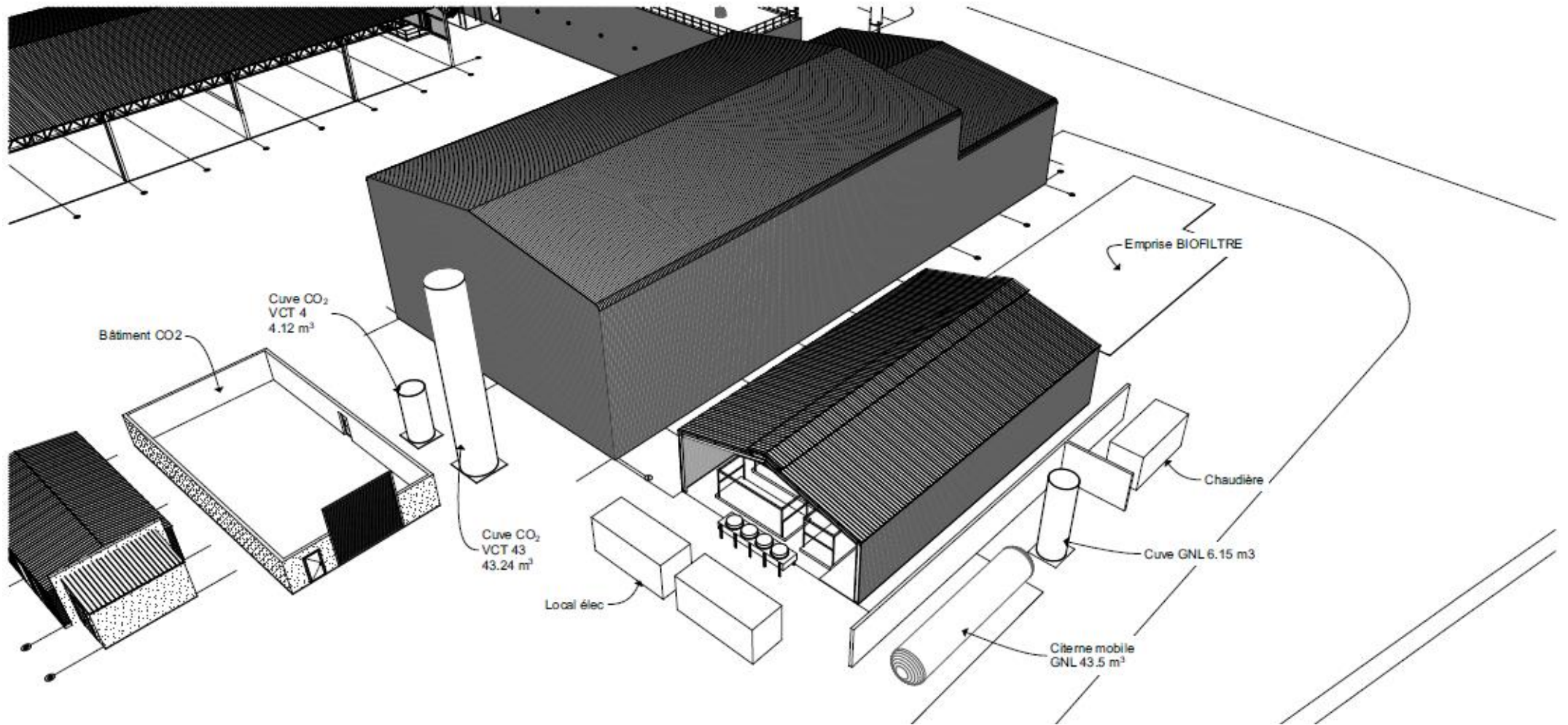
Pictures





Reference #3 : Confidential

France (500 Nm³/h biogas) – 2018





Conclusion

The first integrated system for biogas upgrading, biomethane liquefaction and liquid CO₂ production

- Now commercial.

Cryo Pur solutions :

Cryo Fuel	Production of bio-LNG fuel
Cryo Dist	Production of biomethane from landfill gas
Cryo Haul	Production of liquid biomethane for remote injection
Cryo CO₂	Production of gaseous biomethane and liquid bio-CO ₂

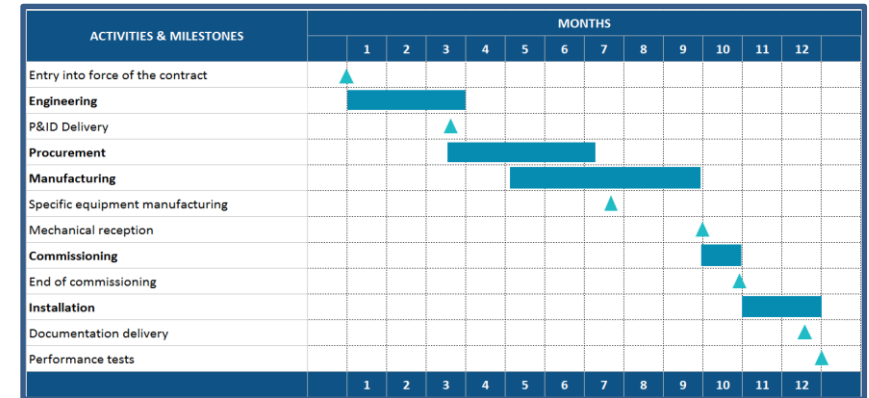
Scope of supply :

- Integrated biogas transformation plant.
- Full service agreement incl. remote monitoring.
- Liquid gas storage / transfer station (option).

Product range :

Product	Nominal biogas flow rate (Nm ³ /h)	Minimum biogas flow rate (Nm ³ /h)	Maximum biogas flow rate (Nm ³ /h)	Nominal bio-LNG production (t/d)	Nominal production of liquid CO ₂ (t/d)
CP 70	70	35	85	0,7	1,3
CP 150	150	75	180	1,4	2,8
CP 250	250	125	300	2,3	4,7
CP 500	500	250	600	4,7	9,5
CP 800	800	400	960	7,5	15,2
CP 1000	1000	500	1200	9,3	19,0
CP 1500	1500	750	1800	14,0	28,4
CP 2000	2000	1000	2400	18,7	37,9

Delivery schedule:





Thank you for your attention!



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