



“Biomethane Capacity”

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CNG Services Ltd

Low Carbon Innovations

cng services ltd

Over the next 20 years, CSL's projects will contribute towards a CO₂ emissions saving of.....

17,500,000 tonnes

Celebrating over 16 years of innovation in gas

- CNG Services Limited (CSL) provides consultancy, design and build services to the biomethane industry, all focused on reducing Greenhouse Gas (GHG) emissions
- In the past 10 years our efforts have produced a material impact with an estimated 20 year project life reduction in CO₂ emissions of 17,500,000 tonnes through:
 - Biomethane injection into the gas grid
 - Running trucks on Bio-CNG
 - Acting as developer and design and build contractor for the Highlands CNG Project
- Working on a number of Biomethane, H₂ and CCUS innovation projects including:
 - Biomethane from manure with CCS
 - Green H₂ into the NTS
 - Reverse Compression to Create Capacity
- CSL is an ISO 9001, 14001 and 45001 approved company and has also achieved Achilles certification. CSL is GIRS accredited for design and project management and has been certified as a competent design organisation for high pressure UK onshore natural gas works by DNVGL

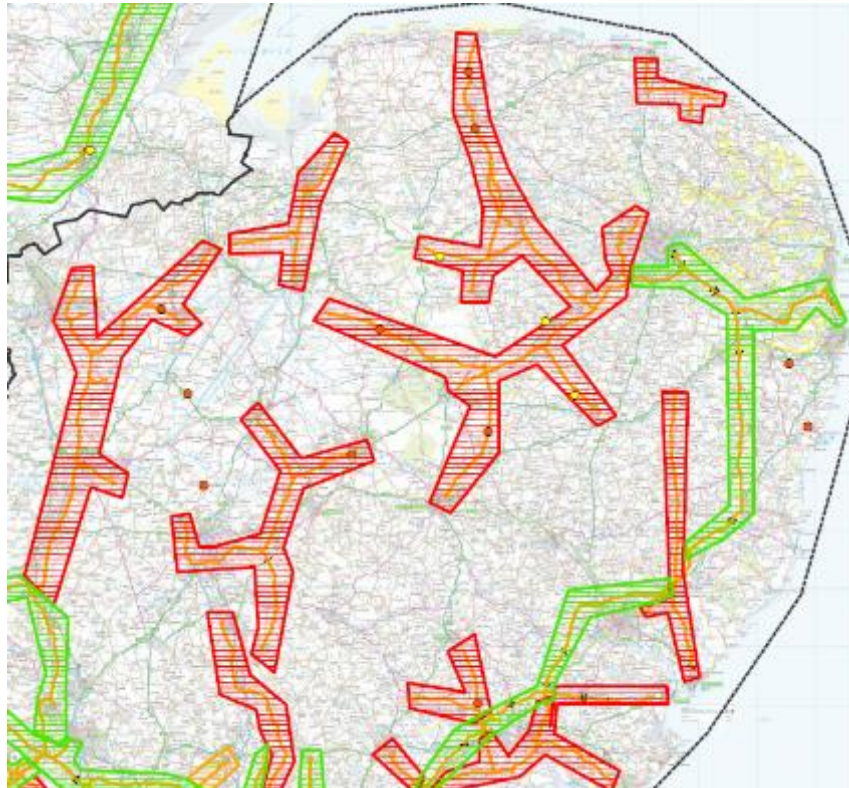


Why Reverse Compression?

Problem: Capacity constraints in the grid means that new projects are unable to get their gas away

CSL is aware of 10 projects in the Cadent area that are ready to go ahead but cannot because of no grid capacity. Total investment of around £200 million held up

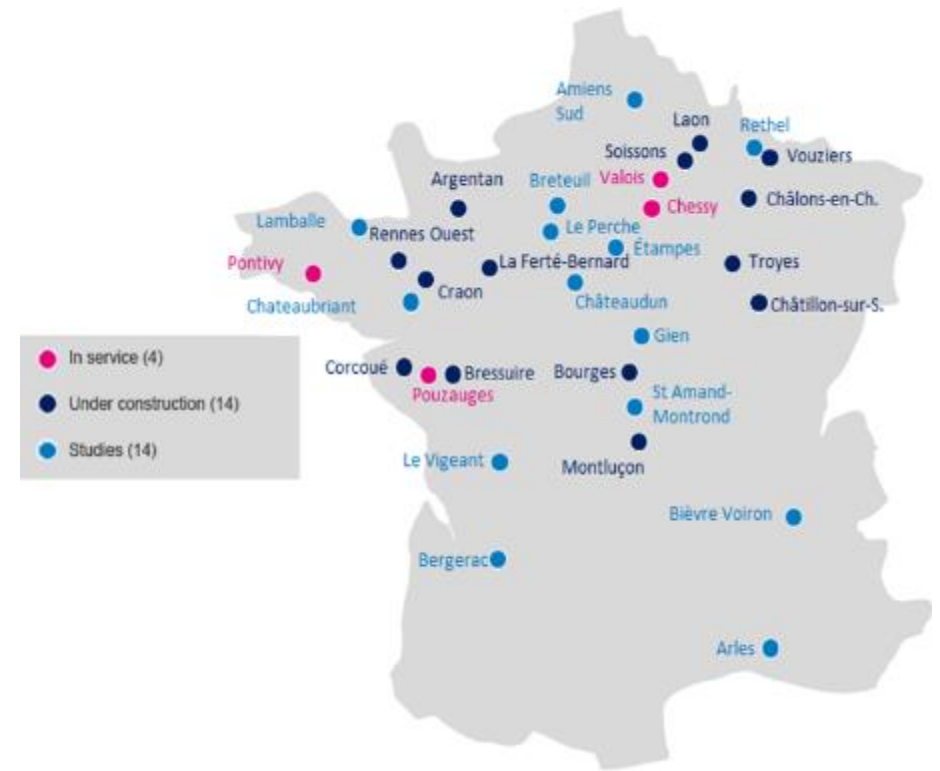
Solution: Move the gas to a place where there is capacity



Time	Estimated Average Monthly Flow Rates (scm/h)
January	1,300
February	
March	
April	
May	0 - 1,300
June	
July	
August	
September	1,300
October	
November	
December	

What is Reverse Compression?

- For capacity, best option is smart pressure control but this only helps 10% of projects
- Installation of a compressor where a lower pressure tier meets a higher pressure tier gas pipeline
- At times when the lower tier pipeline reaches its maximum pressure:
 - Compressor operates injecting gas from the lower pressure tier to the higher pressure tier pipeline
 - Operates on pressures ensuring that there is not circular flow
 - Only operates as required – saving OPEX as not having to inject into a higher pressure tier pipeline all the time. This should be a few hours every night, mainly summer
- Removes capacity constraints in the lower pressure tier pipeline
- Common practice in France, Denmark, Netherlands, Germany
 - Series of “Reverse Compressors” installed across the network
 - Allows new projects to inject green gas into the network
 - Reduces risk of flaring



Options for Reverse Compression?

3 options in GB for Reverse Compression

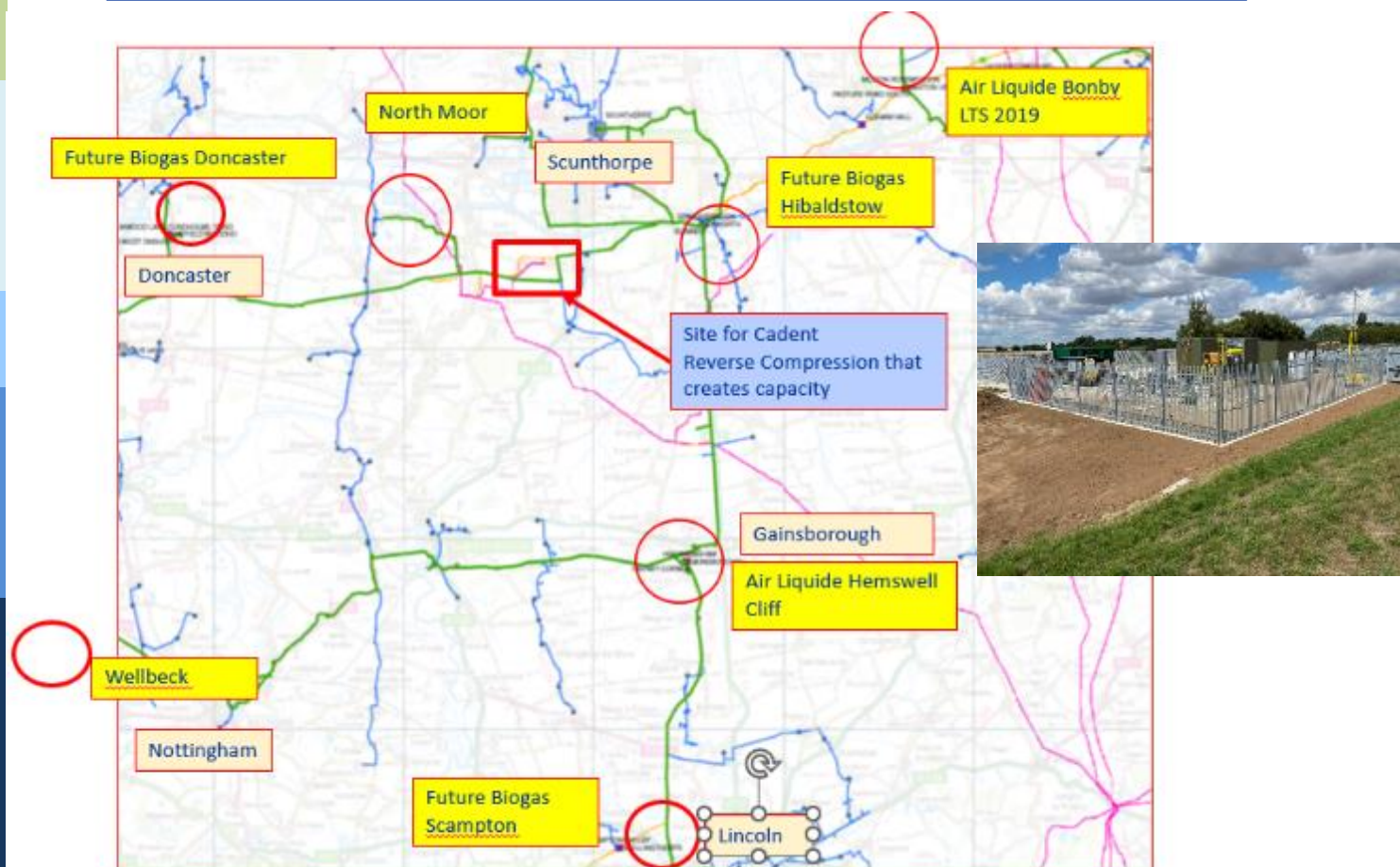
1. GDN installs, owns and operates
 2. 3rd party install, GDN adopts and then owns and operates
 3. 3rd party “Reverse Compressor iGT” installs, owns and operates
- Each option will operate in similar way (pressure control)
 - Oil free compressors
 - 20 GB biomethane plants already injecting into higher pressure grids with identical compressors as per photos
 - Technically straightforward



Option 1 and 2

Designed, installed, owned and operated by GDN or GDN adopted

- Cadent Innovation Project East of Doncaster
- IP injecting into LTS provides 5,000m³/hr extra capacity
- Good option where multiple biomethane sites require capacity – see below
- The compressor can run for 5 hours overnight and create a lot of capacity



Option 1 and Option 2

Compressor is owned operated and maintained by the GDN and forms part of the network

Comprises an Exit to the lower pressure grid (2 bar or 7 bar) and an Entry into the high pressure grid (7 bar or 19/40/70 bar LTS)

Exit meter from low pressure grid for management information

No charges as gas does not leave network

Funding may be from the biomethane producer in the form of up front CAPEX or GDN funded and a tariff

Ongoing charge for maintenance and compression levied by the GDN

Compressor design approved by the GDN – common specification across all GDNs

Self-lay makes this Option 2, otherwise identical

Land and planning likely to be arranged by the biomethane producer

Pressure in lower pressure grid reduced in summer months to facilitate compressor operation and ensure there is no circular flow

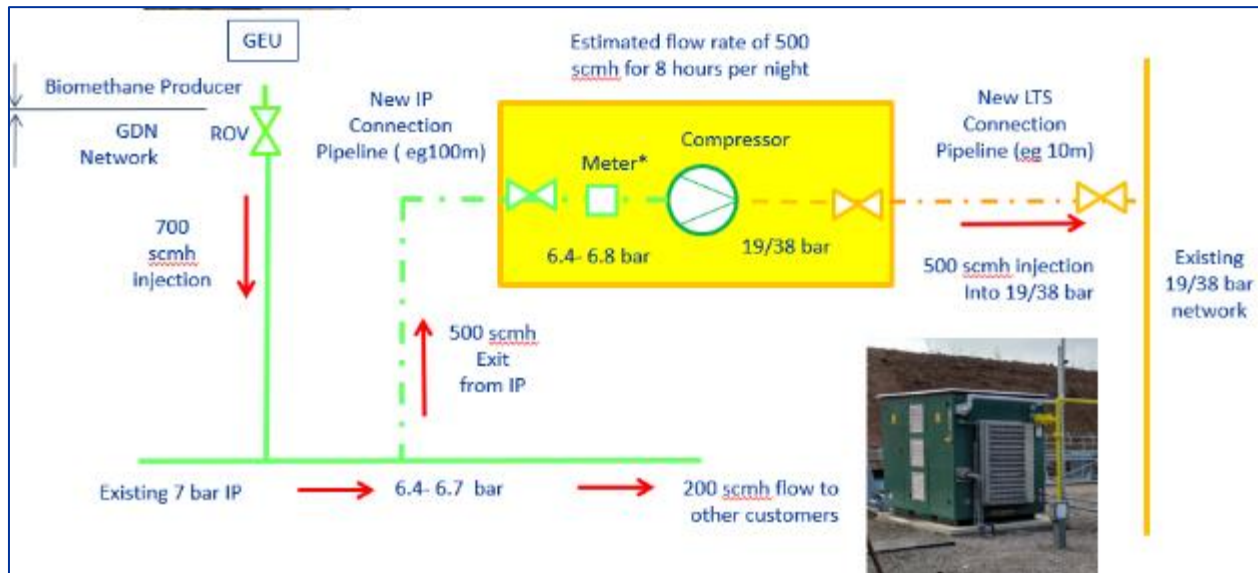
Option 3

GT Licence allows RCiGT party to install, own and operate the RC

- Standard iGT connection with a safety case approved by HSE
- Requires a new Operating Agreement between the DN and the iGT to ensure that the Reverse Compressor will work (ie the GDN sets pressure to facilitate operation)

Compressor Operation

- Compressor would operate when insufficient capacity in IP for biomethane injection
- The GDN is asked to set the IP at 6.5 barg (e.g.) in summer
- When the IP reaches 6.8 barg (e.g.), the compressor starts and runs until the IP pressure falls to 6.5 barg then stops
- This cycle repeats as necessary
- RCiGT owned and operated assets shown in the yellow box



Option 3 – Biomethane Producer Owned

Compressor is owned, operated and maintained by the biomethane producer and does not form part of the network

Comprises an Exit to the lower pressure grid (2 bar or 7 bar) and an Entry into the high pressure grid (7 bar or 19/40/70 bar LTS)

Exit meter for management information

At present the gas shipper would pay an Exit Charge to leave the MP/IP and receive Entry Rebate to enter IP/LTS (the UNC mod aims to exempt from these charges/payments)

Funding from the biomethane producer

Ongoing charge for maintenance and compression paid for by the biomethane producer

Compressor design set by the Biomethane Producer but the GDN can set out specific requirements eg Process Safety and Oil related – common requirements from all GDNs

Responsibility for design, build and maintenance with the biomethane producer

Land and planning to be arranged by the biomethane producer

Pressure in lower pressure grid reduced in summer months to facilitate compressor operation and ensure there is no circular flow

Reverse Compression Conclusions

Reverse compression allows projects previously constrained by capacity to go ahead

There are 3 options available:

1. GDN installs, owns and operates
2. 3rd party installs, GDN adopts, owns and operates
3. 3rd party RCiGT installs, owns and operates

UNC Mod process underway to facilitate Option 3 and aim is to have this implemented before end 2022

CNG Services currently has 10 projects in the Cadent area that need reverse compression for capacity

- 4 may be suitable for Option 1/2 as each RC will support 2 biomethane projects
- 6 of the RC projects only support a single biomethane site and may be more suitable for Option 3

CNG Services' GT Licence application is being processed by Ofgem and expected to be in place in Q1 2023

- Projects can start now as operation not likely to be required by any project before then

Proven process used within Europe and can be installed quickly to help the current situation in the UK stopping biomethane projects going ahead

The Other issue - NTS Exit Meters

- When gas flows from NTS to LDZ the flow is metered
- This meter reading used to allocate gas shrinkage between NTS and LDZ but has negligible customer impact
- Assume an NTS Exit Meter is designed for flow rate 2,000 – 20,000 scmh
- If there is 1,500 scmh biomethane into the LDZ it may be summer night flow is now <2,000 scmh and outside tolerance
- A new meter may cost £1-2 million and take 2-3 years
- GDNs ask the biomethane producer to fund Feasibility/Conceptual Study in relation to new NTS Exit Meter – may be £100k and its unlikely any biomethane producer will pay
- CSL believes such meters are mostly pointless and this should not stop biomethane projects
- At present CSL has 5 biomethane projects with this issue