

Air and Waste Management Association

GB biogas market developments

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GB biogas market developments

- CNG Services Ltd
- Renewable Incentives for Biogas
- GB Biomethane Projects
- GB Biomethane issues
- Making Compressed Biomethane (CBM)
- CBM fuelled vehicles
- GB Market Forecast
- Green Gas Certificates
- Biomethane Conclusions

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CNG Services Ltd

- **Cleaning bio-gas and injecting biomethane into the gas grid**
 - Creator of the UU Davyhulme BtG and CBM Project
 - Developing Didcot project for Thames Water, SGN and Centrica
 - Further 20 potential BtG Projects in UK
- **CNG/CBM/LNG projects**
 - CNG Filling Stations
 - Supporting CNG/CBM vehicle development
 - VCNG-LNG virtual pipelines
 - LNG for vehicles/off-grid energy consumers
- **Supporting development of onshore gas and storage projects**
 - Ryedale Onshore Gas Field Project
 - Wingas Saltfleetby Gas Storage Project (depleted gas field)
 - Halite Preesall Gas Storage Project (salt cavity)

We are independent from all makers of plant, vehicles, clean-up, compression....

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BG Group Kazakhstan

- We commissioned in July 2010 the first CNG filling station in Kazakhstan
- 200 buses ordered for Asian games
- CNG is the solution to air quality

(not one CNG bus in UK due to Bus Service Operators Grant (BSOG) which makes CNG uneconomic for buses in UK)



guardian.co.uk

UK given final warning over London air quality

The UK has been issued a written warning by Europe to clean London's air or face fines of up to £300m

John Vidal and Britain's Mail Online
guardian.co.uk, Thursday 2 June 2006 14:40 BST



The Houses of Parliament are shrouded in smog in London. The UK has been given a final warning over London's air quality. Photograph: G. Lewis/Getty Images

Britain has been given a second and final written warning by Europe to clean up London's air or be taken to the European court of justice and face fines of up to €300m.

Most major cities have air quality problems and so make CNG the fuel of choice for buses – it is important that EU Fines London £300 Million for poor air quality.....we should have CNG buses in UK, we have none

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Renewable Incentives for Biogas

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Electricity Feed In Tariff or ROCs

- Biogas that generates electricity can an electricity Feed In Tariff (FIT)
- For plants >500 kWh , FIT worth 9 p/kWh on top of the normal electricity price (which is around 4 p/kWh)
- Or biogas that generates electricity can earn double ROCs (Renewable Obligation Certificates) worth around £45/MWh for 1 ROC

Most existing ADs in UK (they are located at sewage treatment works) earn 1 x ROCs

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Renewable Heat Incentive (RHI)

- 6.7 p/kWh
- This is on top of value of gas – around 2 p/kWh
- Energy that can claim RHI adjusted:
 - First remove propane energy
 - Next, remove energy from external sources used to heat the AD
- Tariff fixed for 20 years, increases each year with inflation
- The RHI gives broadly similar project returns to the electricity option

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Renewable Transport Fuel Certificates (RTFC)

- Compressed Biomethane (CBM) earns 1 X Renewable Transport Fuel Certificates (RTFC)
- 1 x RTFC worth around 10 p per KG of CBM
- Under EU Renewable Energy Directive double RTFCs for transport fuel made from waste
- 20 p/kg still not as good as income from electricity or for grid injection

300 m³/hr gives around 1 MWh of electricity with FIT of around **£600k**
 500,000 therms into grid (30% heating) = 1 million kg = RHI of around **£700k**
 1 million kg of CBM has RTFC worth around **£200k**

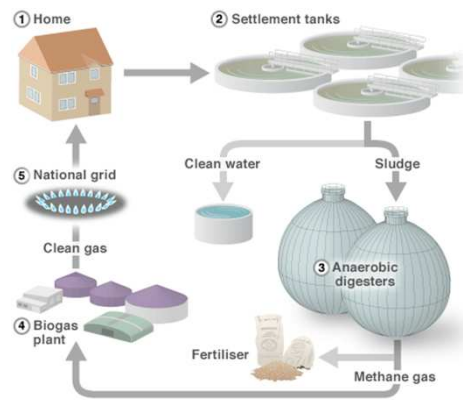
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Biomethane to Grid at Didcot



CNG Services is designer and project manager

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UK's first BtG Project



Flow of biogas is 100 m3/hr
First gas to grid on 3rd Oct 2010

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Adnams Brewery – BioGroup – the UK's first BtG Food Waste Project



100 m3/hr biogas, cryogenic CO2 removal

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GB Specific Biomethane Issues

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BtG Injection Equipment Gas quality – energy – odorant - telemetry



Costs £600k today, CSL believes should cost <£200k (Netherlands)

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Propane Enrichment



Propane Storage tanks



Propane Mixing Vessel

- The Gross Calorific Value (GCV) in the GB gas grid is around 39 MJ/M3
- The typical biomethane GCV is 37 MJ/M3
- Propane has to be added to bring the CV up to 39 MJ/M3
- This is because of billing for natural gas

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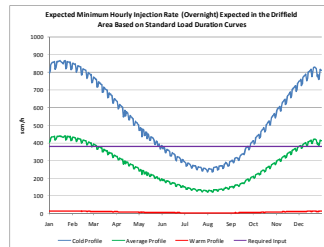
Getting Connected – Key Issues

- Location of grid compared to Anaerobic Digestion Plant?
- Does the grid have capacity?
 - See next slide
- What grid pressure?
- Will the gas meet the grid specification
 - Key issue is Oxygen, everything else can be sorted without any difficulty
- Network Entry Agreement
 - Sets gas quality, capacity, ownership
- Design and Build Agreement
 - Defines the gas quality monitoring system, odorant

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Capacity in the Grid

- Often the gas grid cannot accept the biomethane on a 365 day basis
 - CSL believes an issue around 30-40% of the time
 - Below is taken from an NGN Study

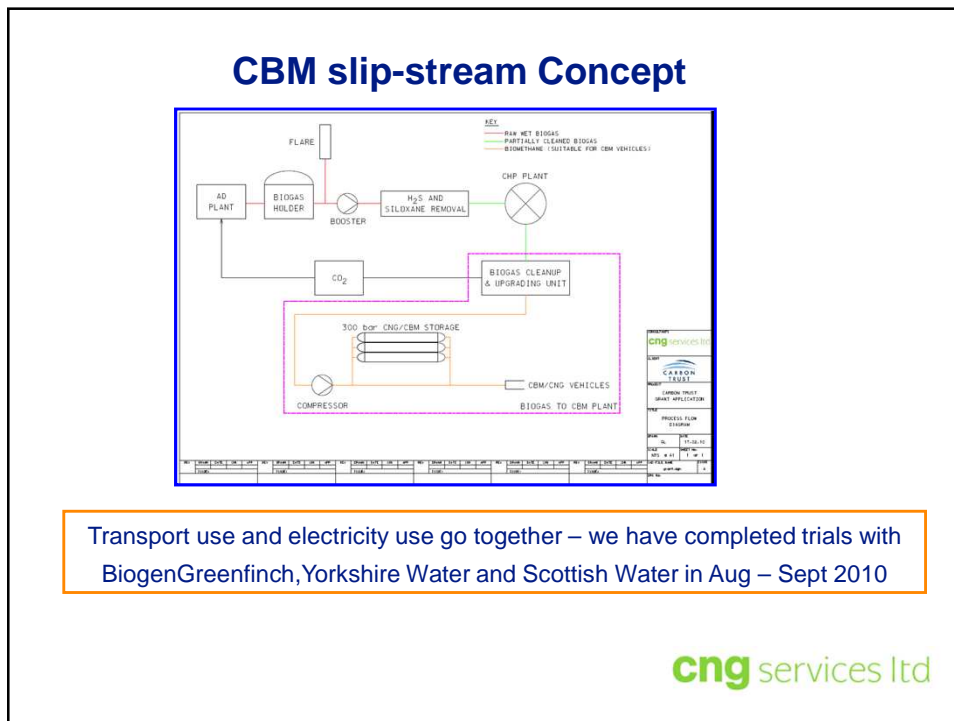
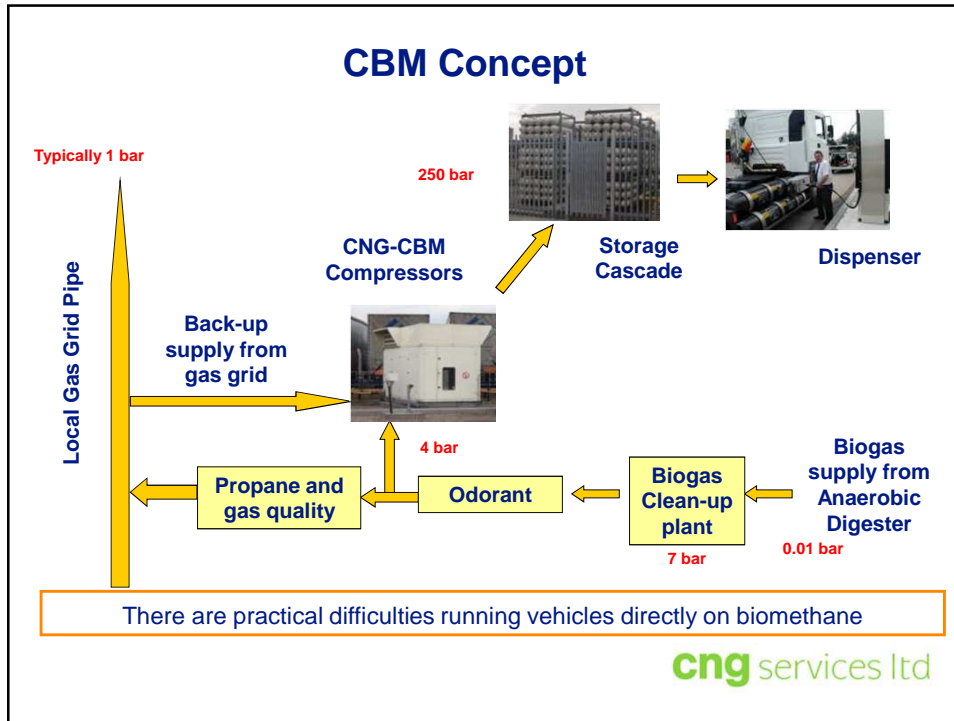


- Solution is to install compressors within the grid (to export gas from one pressure tier to the higher pressure one that feeds it)
 - NGN/NG progressing as R&D Project

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Making Compressed Biomethane and the Vehicles that can run on it

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Passat TSI EcoFuel

- engine 1.4 TSI CNG
- performance 110 kW / 150 PS
0 – 60 mph in 9.5 seconds
- maximum speed 210 km/h
- fuel consumption 5.1 kg / 100 km
- CO2-emissions 119 g/km = **ZERO on CBM**
- Range CNG/biomethane 420 km
3-underfloor gas tanks, steel
135 Liter (22 kg)
gasoline 400 km, 31 Liter



820 km total operating range – Electric Vehicles have a target to aim for
This vehicle is NOT available in the UK

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VW Caddy Eco-fuel

- Best selling CNG van in Germany, launched mid 2006
 - Built to run on CNG rather than a petrol conversion
 - Right hand drive is type approved for sale in UK
 - Also available at Caddy Maxi Car – 7 seats
 - Good financial savings, good eco outcome
 - New version November 2010



EEV emissions – very low NOX and particulates.
Carbon neutral on CBM – this will become the van that Water Companies want to have

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MB Sprinter NGT

- Mercedes Benz
 - First time MB have designed a CNG Sprinter from 'first principles' (rather than petrol conversion):
 - Very low emissions
 - 25% less CO₂ than petrol on grid gas
 - Carbon neutral on CBM
 - Also has petrol tank
 - Total range of 1,100 km
 - Ideal for supermarket home delivery, quiet, clean, long range, fast refuelling



Carbon neutral on biomethane – the big white van for inner city and home delivery

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MB Econic - Tractor

- Distribution logistics
 - EEV emissions and 20% lower CO₂ than diesel
 - Drive at night into cities as very quiet
 - On bio-methane, carbon neutral
- MB bringing to UK in right hand drive form
 - In UK in Q2 2011
- What a great idea for supermarkets



Ideal for inner city deliveries and loads of <36 tonne
This truck loves biomethane

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Econic Refuse truck

- Refuse Trucks
 - MB Econic (see below in Malmo, running on bio-methane)
 - Now Sheffield – Veolia!



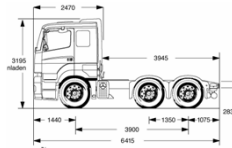
Significant interest in the UK, initially on fossil CNG but migrating to CBM as ADs are developed

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Dual Fuel Tractors – MB



Great news – DfT
 Consulting on allowing extra 2 m length for trucks – this would allow 6 x 2 tractors with 1,000 mile range on CNG

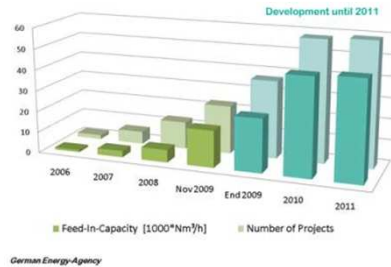


These 4 x 2 vehicles are transformational – benefit of diesel efficiency but with natural gas – 15-20% lower CO₂.....with the world full of abundant shale gas we can now start to shift trucks to dual fuel CNG diesel
 Range is 400 Miles, Substitution is 60%

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GB Market Forecast

- The are 7 sectors:
 - Animal manure
 - Agricultural waste
 - Energy crops
 - Food waste
 - Biodegradable waste (local authority garden/food waste)
 - Sewage sludge
 - Landfill



CNG Services believes it is possible that there will be 40 BtG projects in GB in period to 2014 – the graph above shows market growth in Germany

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Green Gas Certificate Scheme

- Announced on 8 October 2010, system being built, formal launch was on 3rd March 2011 by Renewable Energy Assurance Ltd
- Designed to allow ‘tracking of biomethane from injection point to customer’
 - Integrity - no ‘double counting’
- It is expected that the Green Gas Certificate will be bought by the gas purchaser and not sold separately
- Allows the gas purchaser to work with the producer to market biomethane to customers



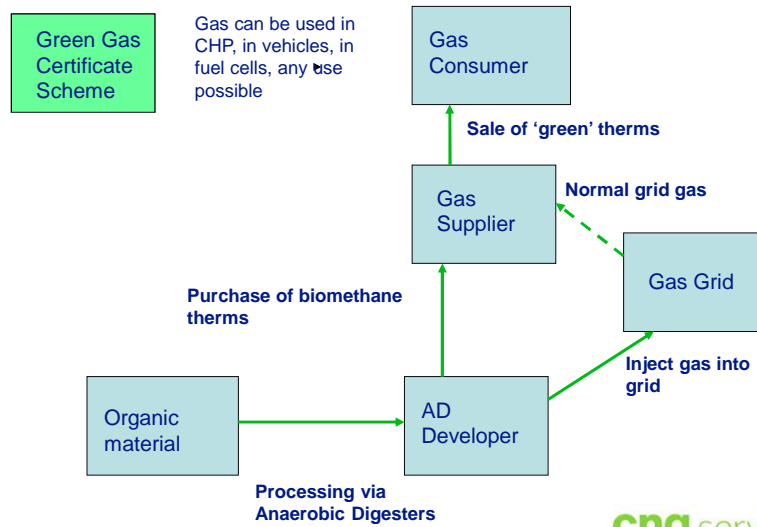
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GGCS Launch Members

- National Grid
- British Gas
- Centrica
- Thames Water (Didcot)
- Adnams Biogroup (Adnams)
- Milton Keynes City Council
- CNG Services Ltd
- System built that will allow the system to operate
- <http://www.greengas.org.uk/>

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AD Developer – Gas Supplier – Gas Grid – Gas Consumer



GB Biomethane Conclusions

- Biogas should only generate electricity when all the heat can be used
- UK has advanced gas grid and the full support of UK gas distribution network owners and energy suppliers
- UK gas production declining, we need to find new gas resources to supply domestic customers and improve security of supply
- Biomethane injection into gas grid is widespread in Europe, no material technical issues
- 10% of domestic customer gas supply by 2020 is a reasonable target
- Green Gas Certificates offer opportunity to keep gas into new homes which has to make a lot of sense and also to fuel dual fuel CNG-diesel trucks

Now that the premium for biomethane injected into gas grid is known, the market for biomethane can start to develop in the UK

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