

Developing Opportunities in Bio-Energy

Alternative Uses Working Group



Beatrice Smyth, QUB

Tel: 028 9097 4318; Email: beatrice.smyth@qub.ac.uk

Alternative Uses Working Group

- Remit:
 - Facts and figures for alternative uses of biogas
- Alternative uses defined as ‘uses other than on-site electricity or CHP generation’

Group members:

Leader	Thomas Cromie	AgriAD
Support	Beatrice Smyth	QUB
Members	David Rooney	QUB
	Peter Watters	Peter Watters
	Stephen Glover	QUB
	Simon Murray	Questor
	Angela Orozco	Questor
	Christine Irvine	SWC
	James Browne	AFBI

Focus of working group

Alternative
uses of biogas

Agriculture

Residential

Existing gas-
fired
electricity

Transport



Residential sector

Headline figures

- Responsible for 19% of GHGs in N Ireland
- Target: 10% renewable heat by 2020
- Currently only 1.7% of heat from renewable sources
- 15% households have mains gas

Meeting the 10% target

- To meet the target, 16% of housing stock would need to switch to renewable energy
 - 11,800 homes per year
 - 1.6% of housing stock per year
- Currently 7% of boilers replaced annually

Energy use and GHG emissions in N Ireland residential sector in 2010

Use	Energy use (TWh)	GHG emissions (ktCO ₂ e)
Electricity	3.24	1660
Fossil fuel	14.21	4133 70%
Non-energy	-	123
Total	17.45	5916

Potential of biogas/biomethane

- 15% of heat demand could be met by biogas from waste and grass...
- ...which is approximately equal to the target

Residential – barriers and drivers

- ✓ Biomethane is mixable and interchangeable with natural gas
- ✓ Can use existing infrastructure and appliances in homes
- ✓ Only new billing system required
- ✓ Fuel poverty – indigenous biomethane could provide a buffer from volatile price changes on global energy markets
- X No legislation to allow injection of biomethane to the grid, but...
 - this is required under EU Directive 2009/73/EC
 - CER recently held a consultation on biogas injection into natural gas grid
- ✓ 271 upgrading plants worldwide
 - ✓ 159 plants injecting into gas grid worldwide, and 4 in UK

Biogas in the residential sector in action

Farm-based AD plant and upgrading unit, Pucking, Austria



Farm-based AD plant



Containerised upgrading unit



Apartments on local distribution grid

CAD plant and membrane upgrading unit, Bruck an der Leitha, Austria



Centralised AD plant



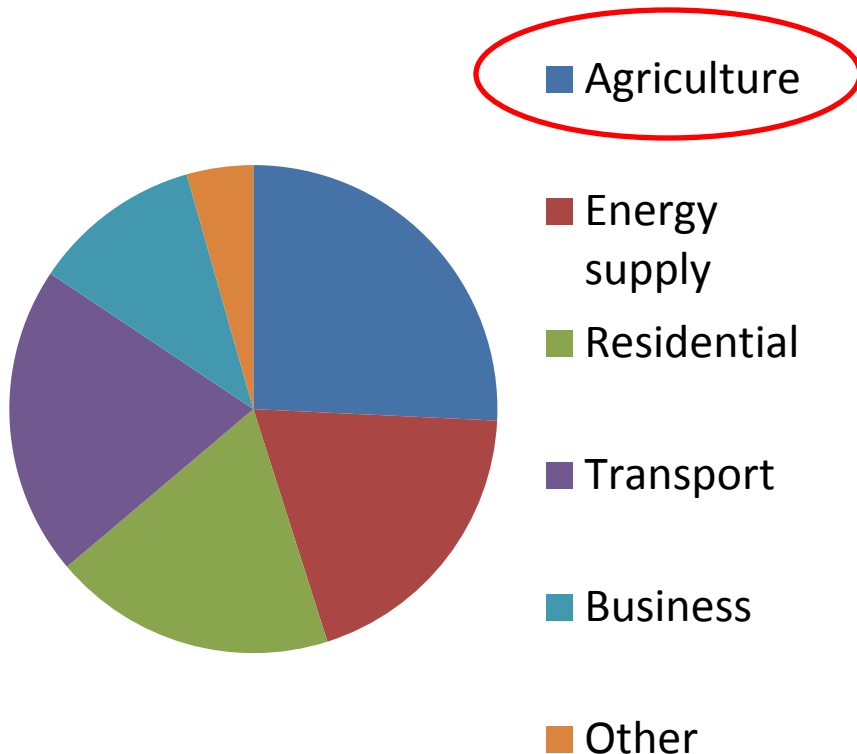
Containerised upgrading unit (membrane)



Injection to gas grid

Potential for biogas in agriculture

GHGs in 2010



26% of N Ireland's GHG emissions are from agriculture

Energy use in N Ireland agriculture and related greenhouse gas emissions

Use	Energy use (GWh) ^a	% of total agricultural emissions from energy
Fuel for vehicles (off-road machinery)	1798	90
Fuel for heat (stationary combustion)	200	10
Electricity ^b	198	-

^a Energy use statistics are for 2010.

^b Emissions from electricity are categorised under 'energy supply' rather than under 'agriculture'.

Biomethane in agricultural vehicles

Valtra

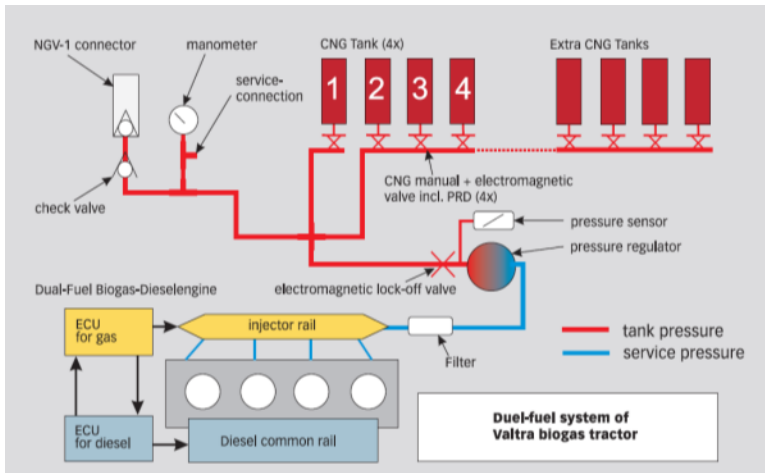
- Dual fuel diesel/CNG tractor
- Enough gas for 3-4 hours' work
- 70-80% power generated by gas
- Serial production of tractors began in 2013



Source: <http://www1.steyr-traktoren.com/Pages/en/Aktuelles-Veranstaltungen/Aktuelles/Pressedetail.aspx?Guid=b67da90c-f5dc-45fd-b849-4221962680ee>

Steyr

- Dual fuel diesel/CNG reduces diesel costs by about 40% and emissions by 20%
- Dedicated CNG – market launch in 2015



Biomethane for transport

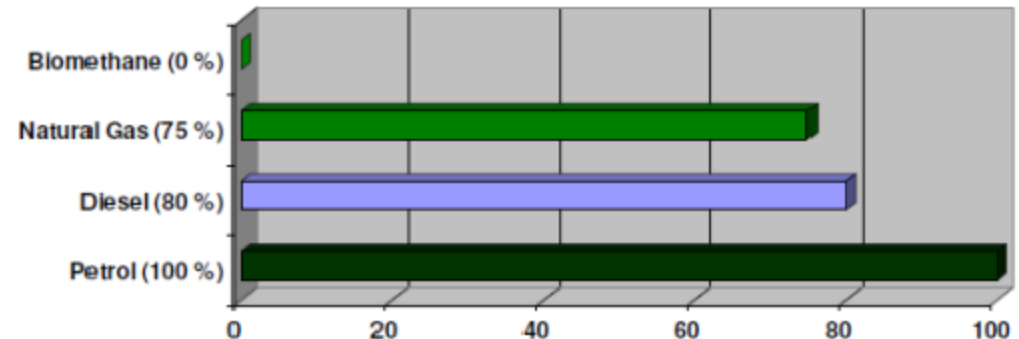
Headline figures

- Transport accounts for ~20% of GHGs in N Ireland
- In 2012-13...
 - 1,060,328 vehicles in NI
 - 764,756 tonnes of diesel and petrol sold
- Target: 10% renewable transport by 2020

CNG/biomethane

- ✓ Proven technology
 - ~18 million NGVs worldwide
 - ~800,000 in Europe
- ✓ Lower emissions of both GHGs and other pollutants (including PM)

Tailpipe emissions compared to petrol and diesel



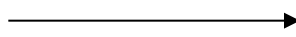
Barriers

- x Policy and incentives
- x Vehicles & filling stations – chicken & egg
- x Additional capital costs

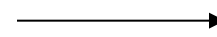
Biomethane as a vehicle fuel in Eugendorf, Austria



harvest silage



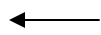
weigh bridge



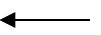
silage storage



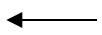
vehicle fuel



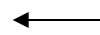
biomethane



biogas



anaerobic digester



macerator



UK case studies: gas and biomethane for transport

Company	Vehicles	Project	Location	Key Findings
Coca-Cola	14 of 26 tonne Iveco Stralis trucks. Fuel: Only Biomethane	The Coca-Cola Enterprises Ltd Biomethane vehicle trial	London	NOx emissions reduced by 85.6% PM emissions reduced by 97.1% GHG emission savings of 50.3% Preferred performance by the drivers Total cost of ownership increased by 15.3%
Sainsbury's	51 of Genesis Edge dual-fuel (Diesel-liquid biomethane (LBM))	Running on Rubbish Trial	Bristol	Reduction of consumption of diesel and carbon emissions Each vehicle saves around 41 tonnes of CO ₂ emissions per year
Tesco	35 Mercedes dual-fuel (Diesel-LBM)	N/A	Daventry	CO ₂ emissions reduced by 15% NOx and PM emissions reduced by 90%
DHL	101 of dual-fuel (Diesel-LNG)	N/A	Bawtry	Reduction of diesel consumption Reduction of CO ₂ emissions by 10-14%

Sources: <http://www.cenex.co.uk/LinkClick.aspx?fileticket=wzFSJX8rAGQ%3D&tabid=916>; www.j-sainsbury.co.uk/media/latest-stories/2013/20130530-sainsburys-takes-to-the-road-to-drive-carbon-reductions/; www.renewableenergyfocus.com/view/32110/tesco-fuels-food-deliveries-with-green-bio-lng-from-gasrec/; <http://www.edie.net/news/6/DHL-expands-duel-fuel-fleet-to-cut-CO2-emissions/>;

Biomethane in existing gas fired electricity generation

All-island fuel mix 2012

Fuel	%
Gas	47.7
Coal	19.9
Renewables	23.7
- Wind	19.5
- Hydro	3.1
- Landfill gas	0.6
- Biomass	0.5
- Biogas, solar, ocean	>0 each
Peat	6.9
Other	1.8

- Target: 40% renewable electricity by 2020
- Nominal base load capacity in N Ireland is 1564 MW, all from gas
- ~95% of gas is imported
- Biomethane could...
 - reduce GHGs
 - increase the penetration of renewables
 - improve energy security

Findings and recommendations

- Large potential for alternative uses of biomethane in N Ireland
 - Residential, agriculture, transport, existing gas-fired electricity
- Gas quality standards required
 - Grid injection
 - Use in vehicles
- Cohesive policy framework needed
- Demonstration projects can be useful in promoting new technologies and public acceptance

Thank you for your attention

Questions?



DO Bioenergy

Alternative Uses Working Group