Facilitating Renewable Gas

How to incorporate small scale AD in gas to grid systems in Ireland

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Gas Networks Ireland owns, operates, develops and maintains the natural gas network in Ireland.

World-class Modern Gas Network

Over 13,500Km:
- 2,422Km Transmission Network
- 11,288Km Distribution Network

More than 675,000 gas consumers
- 650,000 homes
- 25,000 businesses

Over 160 population centres
- 19 counties
Network potential for large industry sector

- Network with Abundant Capacity
- Secure and Reliable
- Potential for over 50 injection points for renewable gas
- Can deliver the same strong clean product, but now it can be Green also.
Why Renewable Gas?

Renewable Gas will enable industry to decarbonise, without the need to re-invest in alternative infrastructure.

Making renewable gas available to large energy users will play a vital role in helping Ireland meet its renewable heat (RES-H) targets of 12% by 2020.

- NO CHANGE to existing natural gas equipment
- Compatible with Natural Gas Network
- Supporting renewable heat target (RES-H)
- Help to meet transport target (RES-T)
- Address Greenhouse Gas (GHG) emission crisis
- Diversification of family farm incomes
Demand for Renewable Gas - Industry Commitments

Tackling climate change is one of America’s greatest economic opportunities of the 21st century (and it’s simply the right thing to do).

RE 100

GO 100%

RENEWABLE ENERGY

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Ireland’s Commitments

- Challenge for Energy Managers in Industry
  - Security of Supply
  - Reliability
  - Efficiency
  - Operating Costs
  - Infrastructure Investment
  - Cost competitiveness
  - Competitiveness with EU sister facilities
  - Risk
  - Air Quality
  - Scale
Renewable Gas Compatibility

RAW BIOGAS

- 30%-50% CO2
- 50%-70% Methane CH4
- ~2% Trace Gases & Water

RAW FOSSIL GAS

- ~5-20% Impurities & HC
- ~1-19% Alkane Gases
- Methane CH4

RENEWABLE GAS

- 98% Methane CH4
- ~1% CO2
- ~1% Trace Gases

NATURAL GAS

- ~80-99% Methane CH4
- ~1-5% Neutral Gases
- ~1-19% Alkane Gases
Sources of Renewable Gas

- Renewable gas can be produced by anaerobic digestion (AD), gasification and power to gas (P2G) technologies

- Available feedstock for anaerobic digestion
  - Organic waste and residues
  - Agricultural slurries
  - Additional grass (in excess of livestock requirements)

- Emerging sources of renewable gas such as
  - Power to gas (H₂ produced from curtailed electricity and catalytic/biological methanation)
  - Gasification of wood biomass with catalytic/biological methanation
  - It is estimated that these resources could add approximately 10,000 GWh/annum of renewable gas
Analysis of Manure Feedstock

- GIS mapping of each electoral divisions in the country (3440 EDs)
- Collectable cattle slurry based on CSO and Teagasc data.
- Wet manure as a feedstock for AD has additional benefits of avoided GHG emissions from the alternative manure management.

Source:
UCC ERI, MaREI, Teagasc. Funded by SFI & GNI
Researchers: Richard O’Shea, Prof Jerry Murphy
Analysis of Grass Feedstock

- In excess of Harvest 2020 fodder demand

- Teagasc study: “How much grassland biomass is available in Ireland in excess of livestock requirements?” by McEniry et al. 2013

- Up to 12.2 million tonnes of dry matter could be achieved even when allowing for “Food Harvest 2020” targets ~ 54,800 GWh/annum renewable gas.
Renewable Gas Supply Chain

- **Feed**
  - Energy Crops
  - Slurry
  - Biowaste

- **Digestion**
  - Digestate - Biofertiliser

- **Collection**
- **Treatment**
- **Network** 
  - Renewable Gas to Network
How small is small?

• What rate of biogas production is suitable for gas to grid?
• Capital costs do not greatly increase with flow rate
• Smaller flow rates incur higher specific costs
• Operating costs dominated by gas conditioning (LPG) and electricity to run compressor
• Injection into low pressure grid (< 4 bar) may lower capex and opex
Gas to grid scenarios

- Direct grid injection – Transmission AGI (> 70 bar)
- Direct grid injection – Distribution (< 4 bar)
- Centralised/ Aggregator injection point – Transmission AGI (> 70 bar)
- Off grid/ mini grid (< 4 bar)

- Best suited to large scale biogas production > 1,000 m³ biogas/ hour
- Potentially viable at 250 m³ biogas/hour limited by flow rate in local network
- Involves mobile purification, compression and transportation to AGI
- Biogas can be piped or road hauled to off grid site or remote mini grid e.g. industrial estate
Small scale options – purification, compression & supply

- **Option A**
  - 3-5 small scale farm digesters
  - Combined biogas production of ca. 150-250 m³ biogas/hr.
  - Mobile trailer unit with gas purification, compressor and gas cylinders
  - Aggregator gas grid injection point
  - Specific costs = 5 - 6 c/kWh depending on distances

- **Option B**
  - On site production and purification ca. 250 m³/hour
  - Connection to low pressure gas distribution grid
  - Specific costs = 4 - 5 c/kWh

- **Option C**
  - On site production, purification and compression into gas cylinders ca. 150-250 m³/hour
  - Delivery to off grid customers (e.g. CHP with heat load)
  - Specific costs = 3 - 4 c/kWh
Initial biomethane GNI Projects

- Project 1 - Direct grid injection – Transmission AGI (> 70 bar)
- Project 2 - Direct grid injection – Distribution (< 4 bar)
- Project 3 – Off grid (< 4 bar)
- Market barriers = Price of gas
- Large gas customer currently pay ca. 3c/kWh
- LCOE of biomethane 6-10 c/kWh
- Who will fill the gap?
Renewable Gas Forum Ireland (RGFI)

Represent the interest of the Industry by Consensus across all sectors.
Irish Gas Market – Secure & Competitive

Gas Producer → Gas Purchase Agreement → Gas Shipper/Supplier → Gas Code of Operations Entry/Exit Arrangements → Consumer

Gas Transporter → Network Entry Agreements → Gas Shipper/Supplier
Irish Gas Market – Secure & Competitive

Renewable Gas Producer

Gas Producer

Gas Purchase Agreement

Gas Shipper/Supplier

Network Entry Agreements

Gas Transporter

Green Certification

Gas Code of Operations Entry/Exit Arrangements

Consumer
Summary

• Ireland has abundant feedstock sources – particularly from agriculture
• Gas grid offers access to ca. 700,000 energy customers
• Large demand from large energy users (Corporate decarbonisation targets)
• Gas Networks Ireland are actively engaged in developing gas to grid projects
• Biomethane struggles to compete with Natural Gas at current wholesale prices
• Biomethane needs government support similar to UK RHI to remove market barriers