Facilitating Renewable Gas

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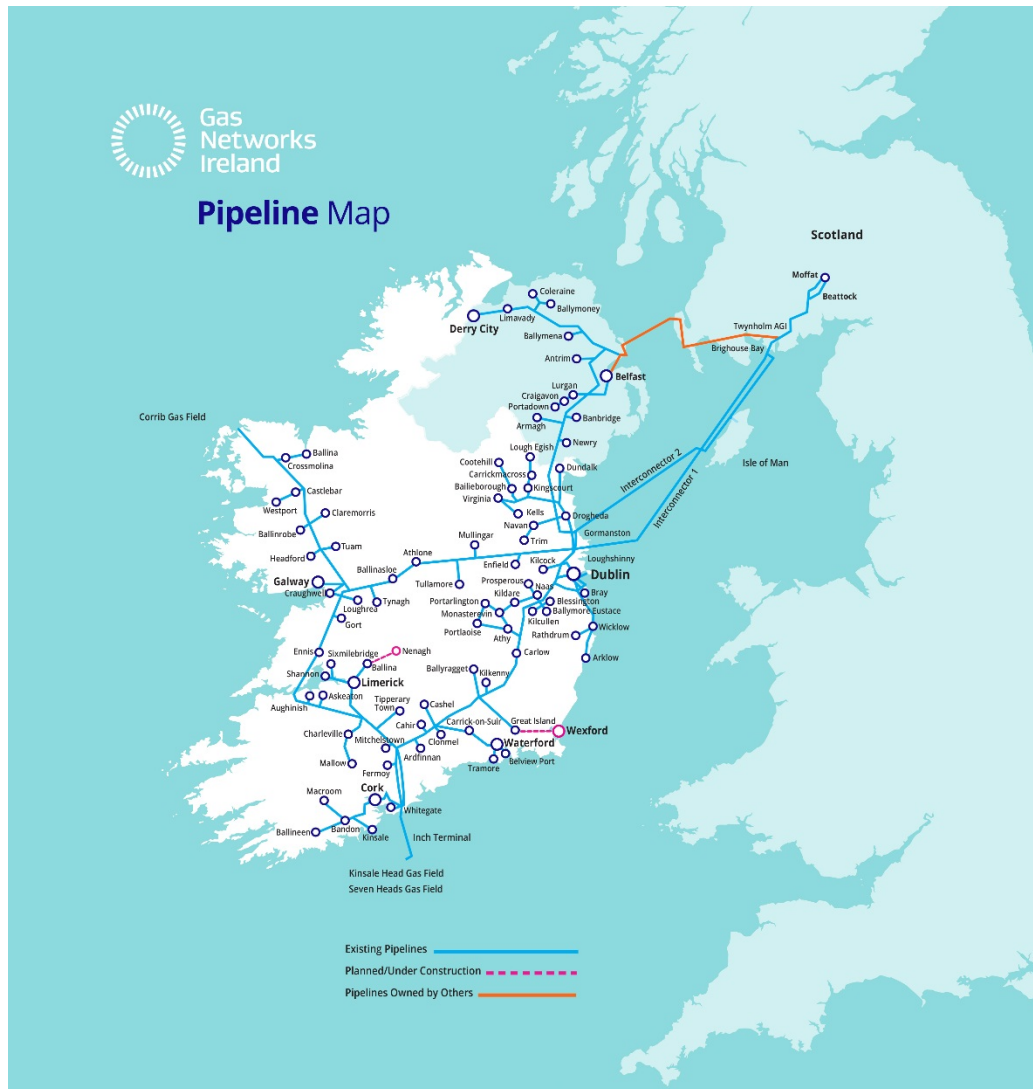
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Contents

Introduction to Gas Networks Ireland

Why Renewable Gas?

Demand for Renewable Gas

Sources of Renewable Gas

Small scale gas to grid options

GNI projects and the Renewable Gas Forum

Gas
Networks
Ireland

Gas Networks Ireland

- 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
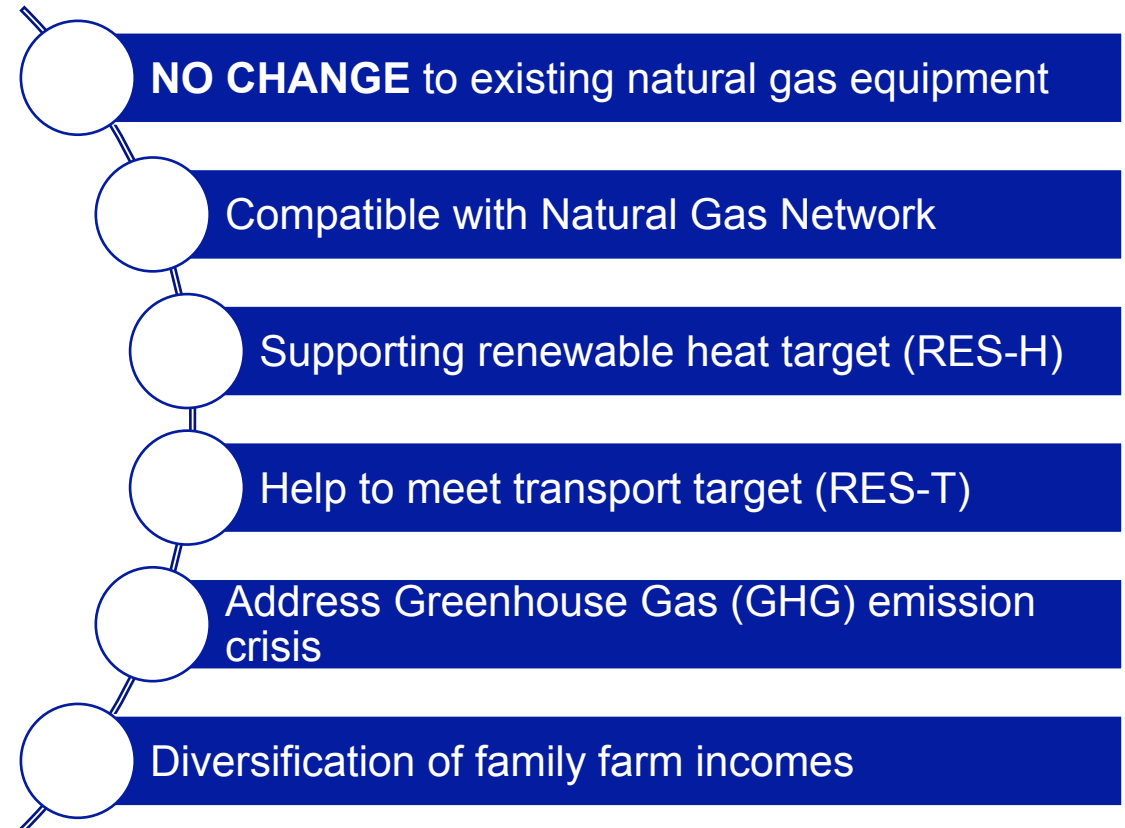
Network potential for large industry sector
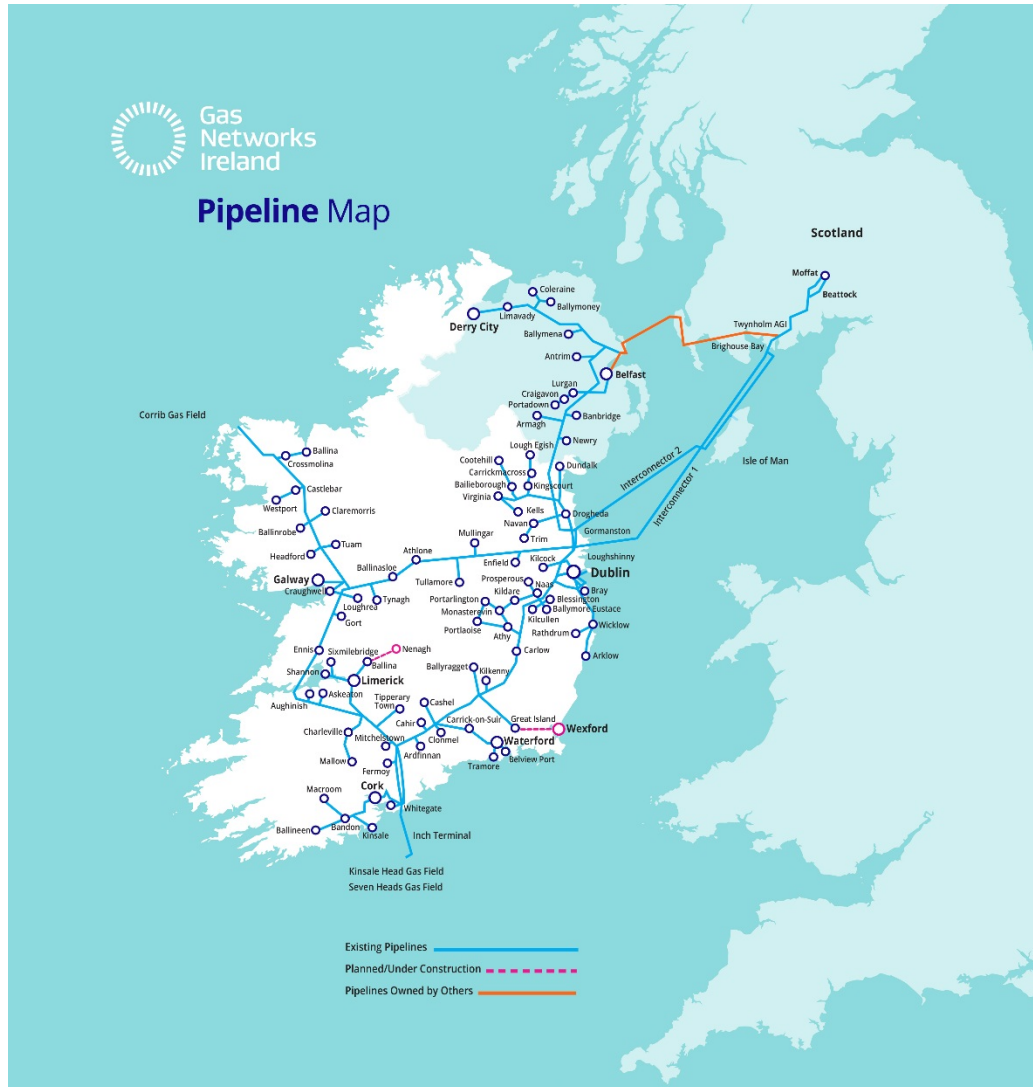
- Network with Abundant Capacity

- 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

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Demand for Renewable Gas - Industry Commitments

Ireland's Commitments

Ireland's Progression Path to RES-H Renewable Contribution to Heat
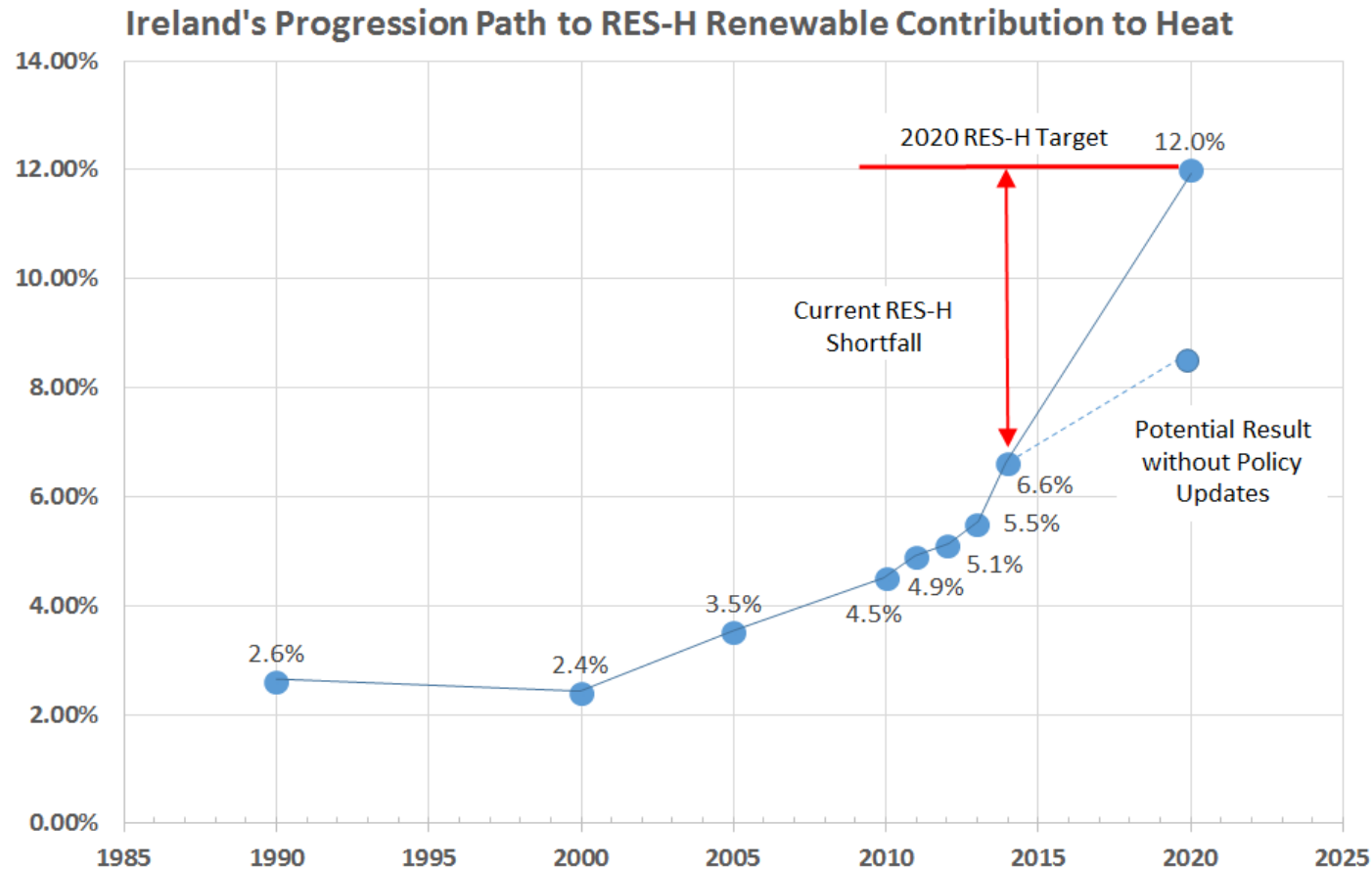
- Challenge for Energy Managers in Industry

  – Security of Supply
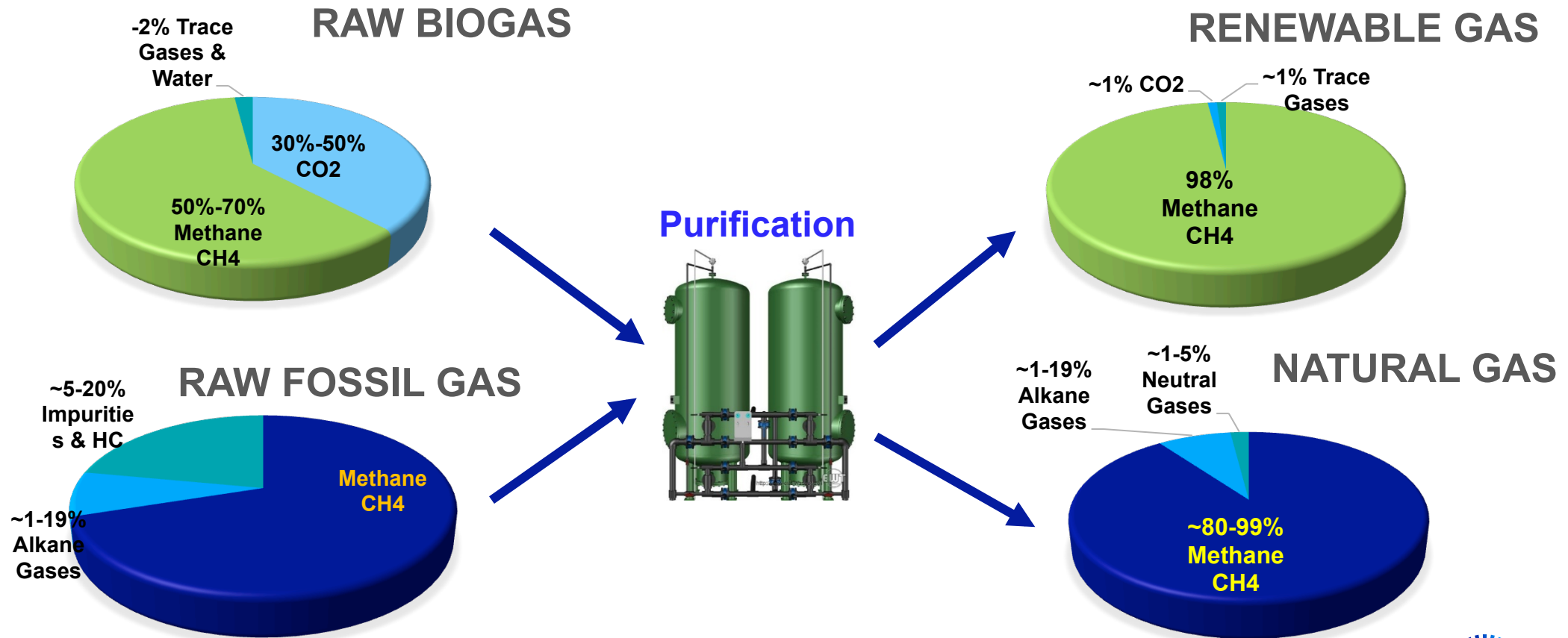 – Reliability
  – Efficiency
  – Operating Costs
  – Infrastructure Investment
  – Cost competitiveness
  – Competitiveness with EU sister facilities
  – Risk
  – Air Quality
  – Scale

Renewable Gas Compatibility

RAW BIOGAS

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

RAW FOSSIL GAS

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

Purification

RENEWABLE GAS

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

NATURAL GAS

- ~1-19% Alkane Gases
- ~1-5% Neutral Gases
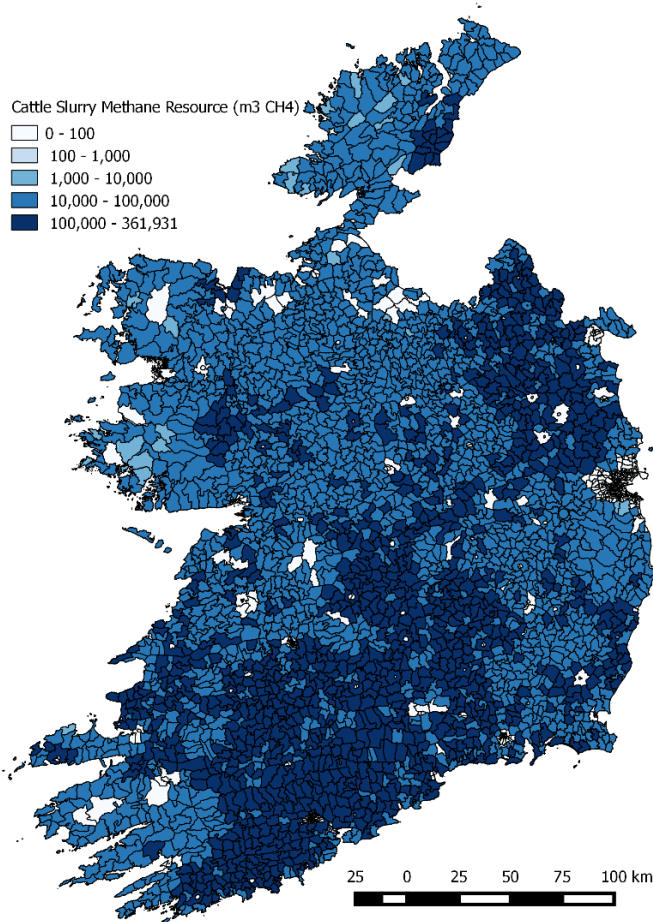- ~80-99% Methane CH4

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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 (H_2 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

Energy (GWh/annum)

Legend:
- Grass
- Agricultural Manure
- Natural Gas demand
- Organic Waste
- Emerging Sources
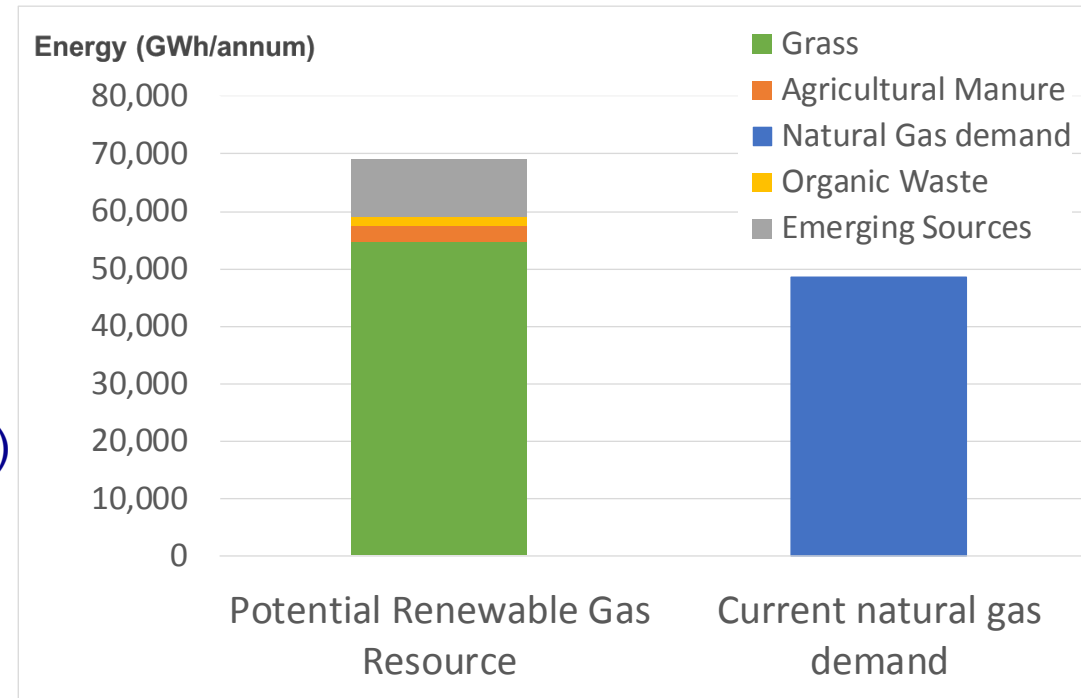
Assessed potential renewable gas sources in Ireland

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Analysis of Manure Feedstock

Cattle Slurry Methane Resource (m3 CH4)
- 0 - 100
- 100 - 1,000
- 1,000 - 10,000
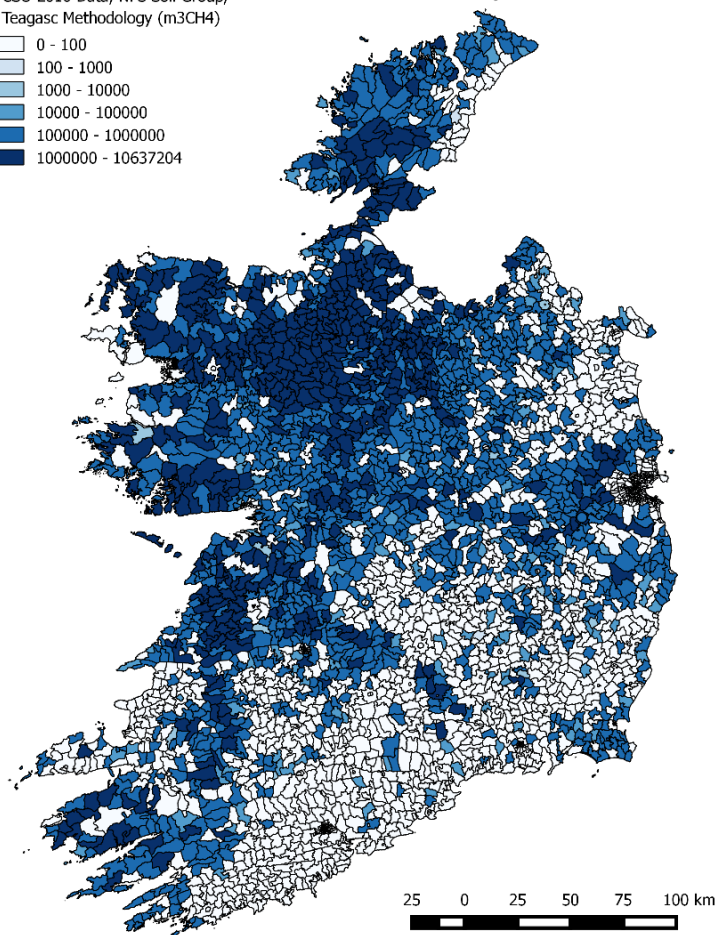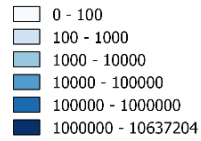- 10,000 - 100,000
- 100,000 - 361,931

Cattle Manure

- 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.

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Analysis of Grass Feedstock

Excess Grass Silage: Low N Application,
CSO 2010 Data, NFS Soil Group,
Teagasc Methodology (m3CH4)
- 0 - 100
- 100 - 1000
- 1000 - 10000
- 10000 - 100000
- 100000 - 1000000
- 1000000 - 10637204

25 0 25 50 75 100 km

- **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.

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Renewable Gas Supply Chain
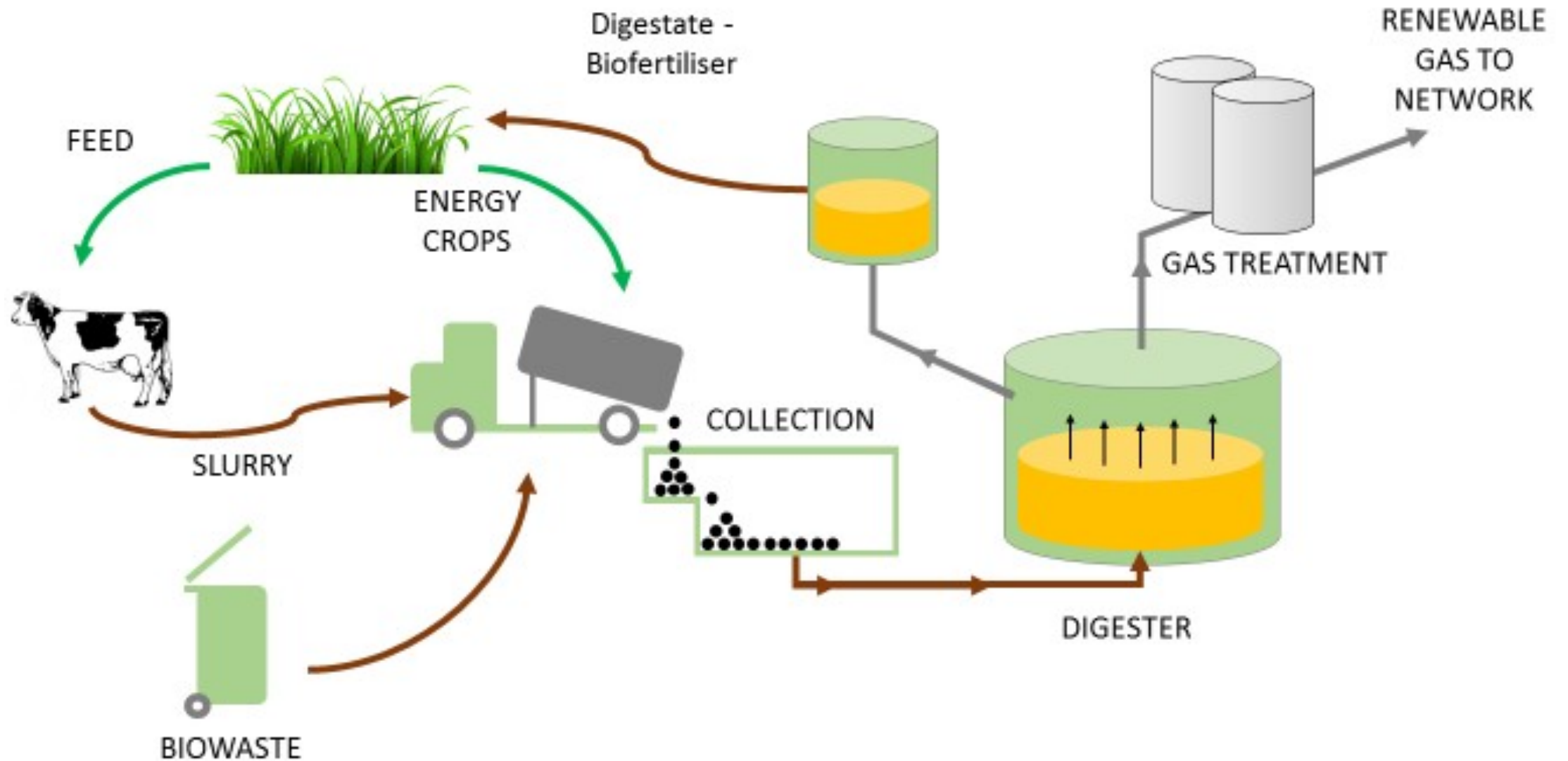
How small is small?

- 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
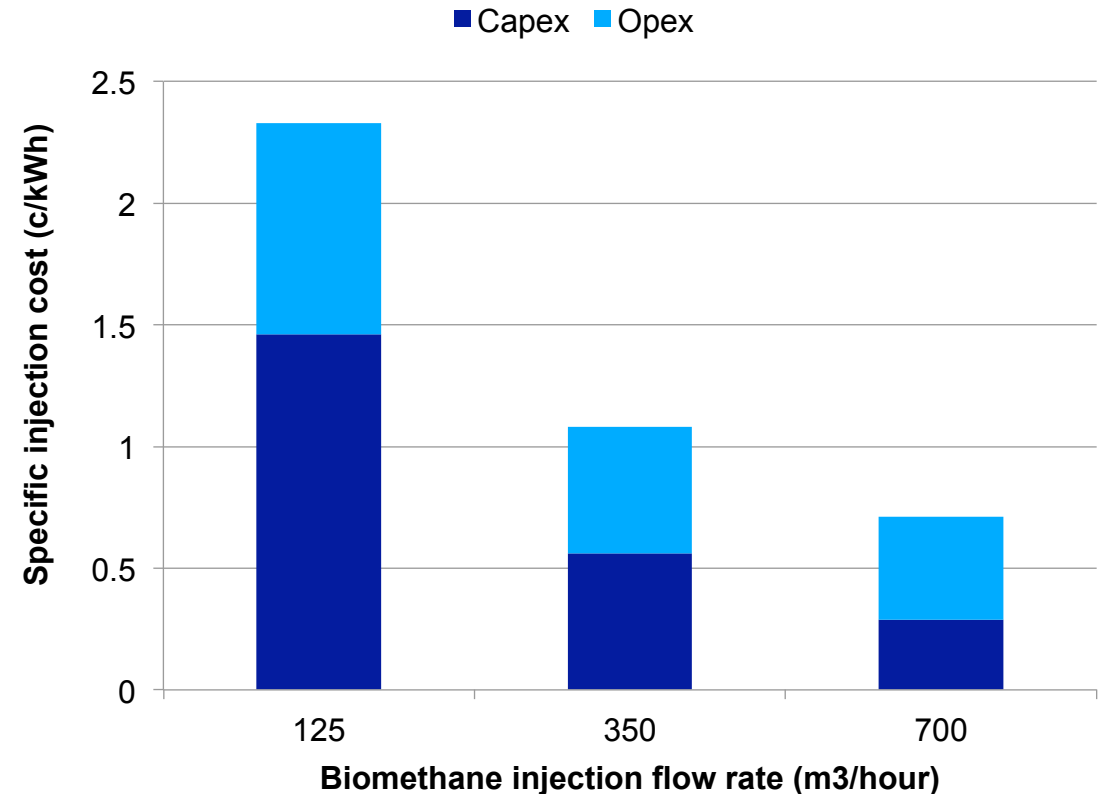
Source: Urban, 2013

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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 m^3 biogas/ hour

✓ Potentially viable at 250 m^3 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

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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
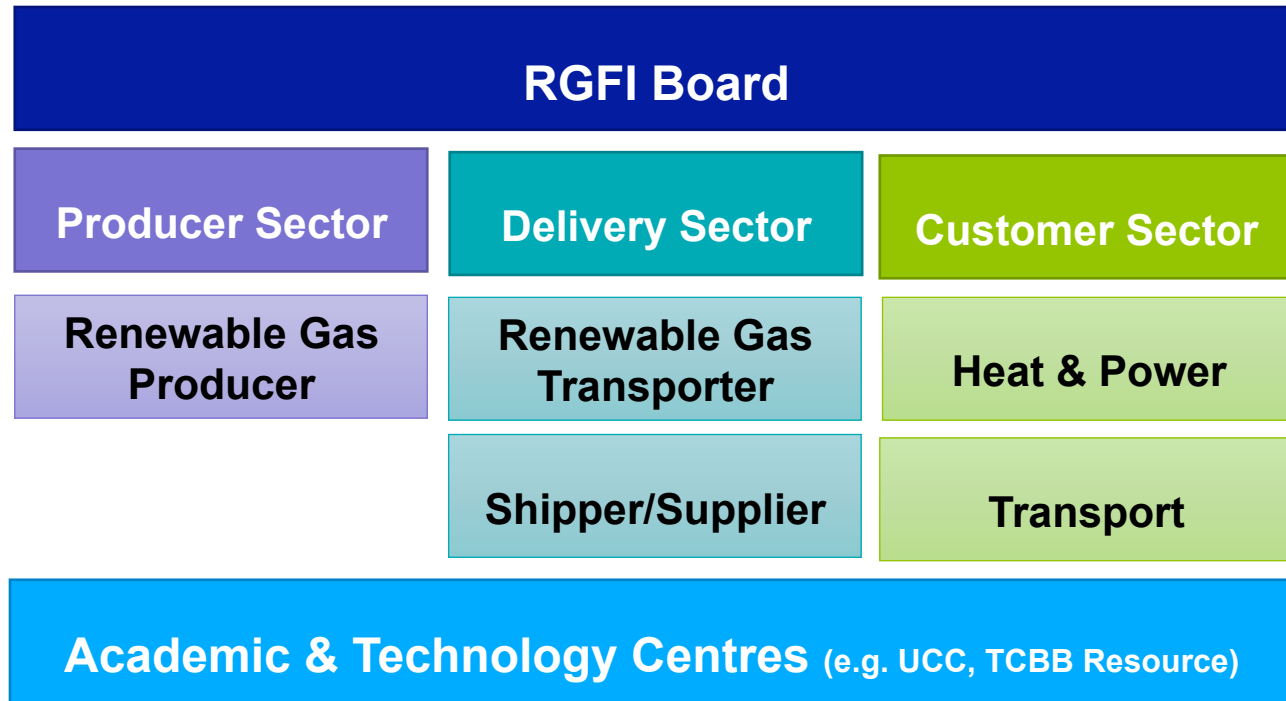
Gas Networks Ireland
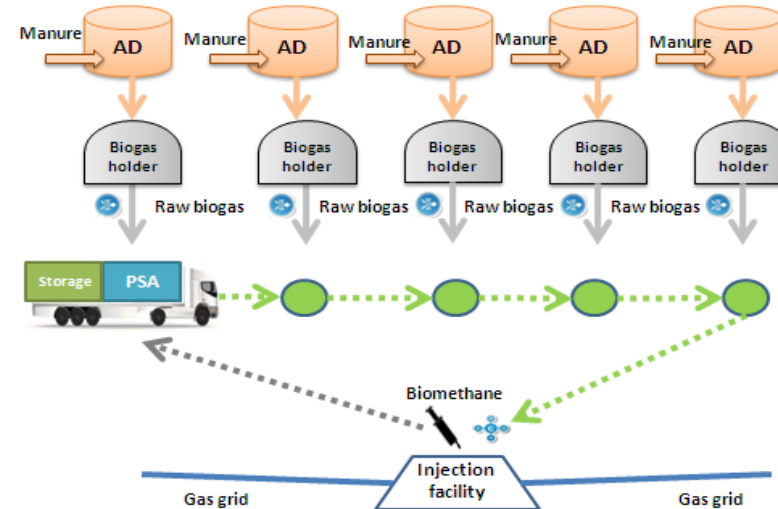
Initial biomethane GNI Projects

- 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

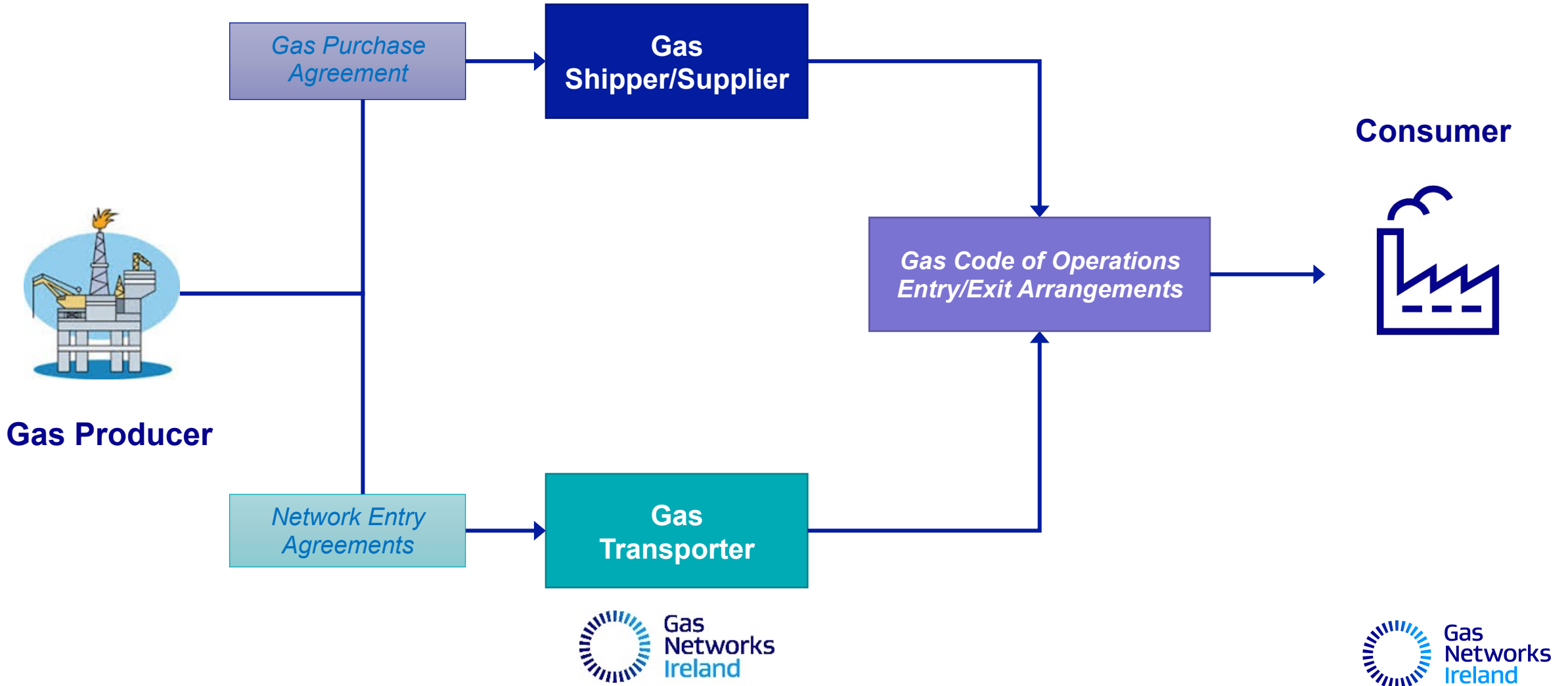- LCOE of biomethane 6-10 c/kWh

- Who will fill the gap?

Gas Networks Ireland

Renewable Gas Forum Ireland (RGFI)

RGFI Board		
Producer Sector	**Delivery Sector**	**Customer Sector**
Renewable Gas Producer	Renewable Gas Transporter	Heat & Power
	Shipper/Supplier	Transport

Academic & Technology Centres (e.g. UCC, TCBB Resource)

ORMONDE Organics

DIAGEO

abp

BOC A Member of The Linde Group

GREEN Generation

Fingleton White

BORD NA MÓNA

irbea

MaREI Centre for Marine and Renewable Energy

CLAREMORRIS & WESTERN DISTRICT ENERGY CO-OP

ERI ENVIRONMENTAL RESEARCH INSTITUTE UNIVERSITY COLLEGE CORK

TCBB Resource

ARUP

Represent the interest of the Industry by Consensus across all sectors.

Gas Networks Ireland

Irish Gas Market – Secure & Competitive

Irish Gas Market – Secure & Competitive
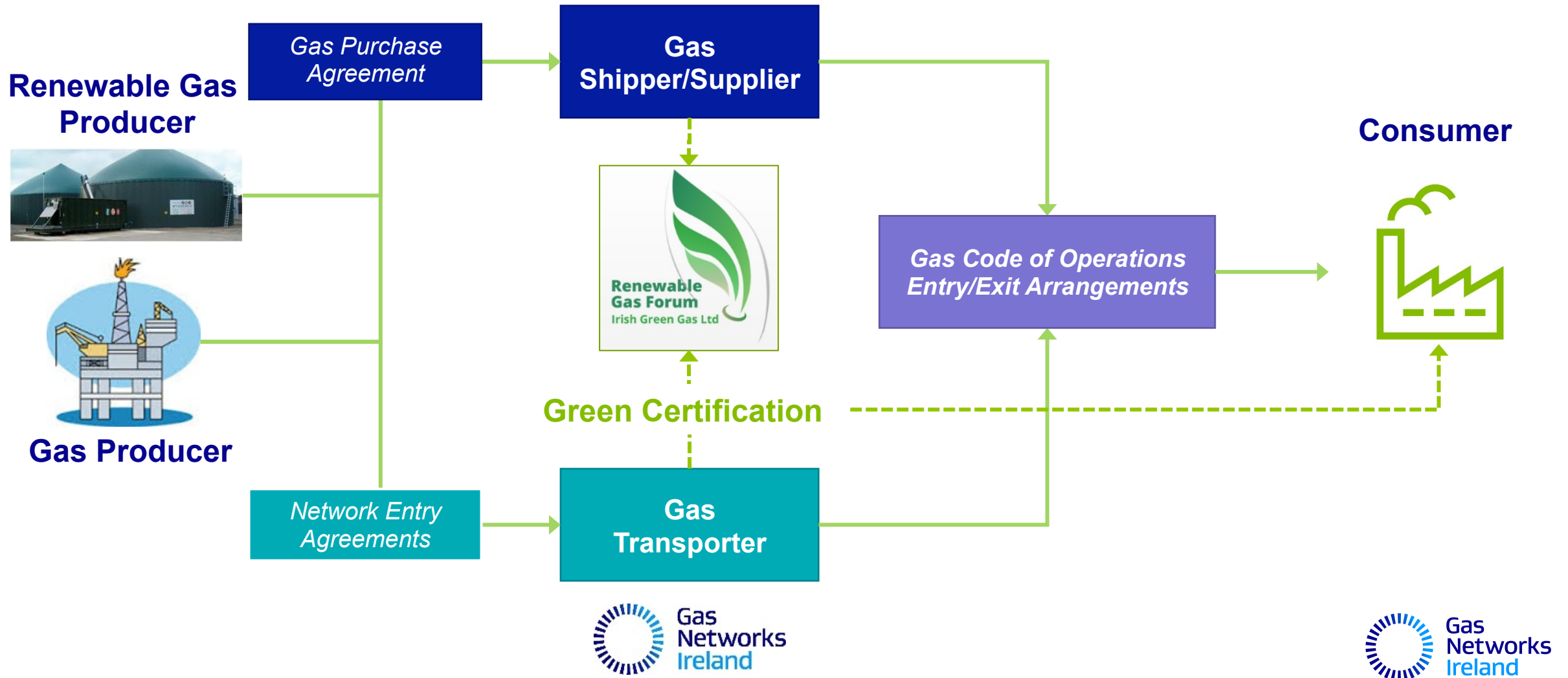
Summary

- 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

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