Building the Biomethane Transport Infrastructure.

Grid Operator Perspective

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8th November 2013

BORD GÁIS NETWORKS

Bord Gáis Networks

Introduction

Gas Grid Operator

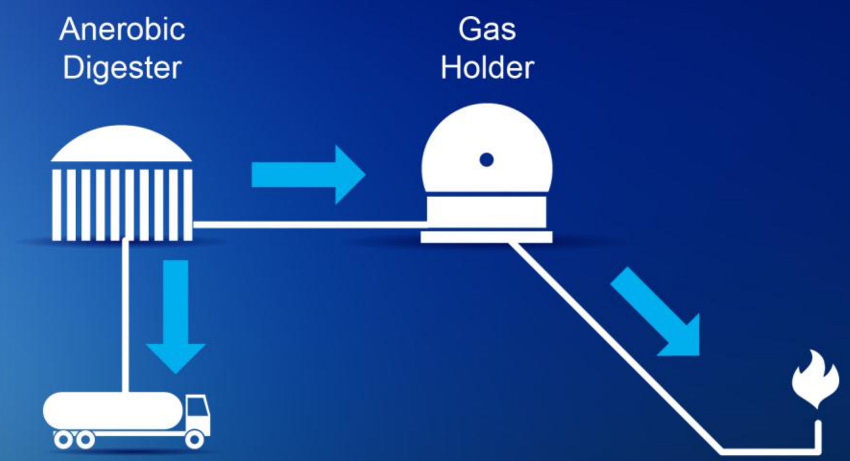
- Own, operate, build and maintain the natural gas network in Ireland and connect all customers to the network on behalf of Gaslink the System Operator.
  - 13,000km of pipelines
  - 650,000 gas consumers

- Provide access to both the High Pressure and Low Pressure gas pipeline system for all Gas Shippers/Suppliers.
  - Code of Operations (rules for gas flow)
  - Retail Market Arrangements
  - New Connections
  - Safety Operations & Oversight
  - Siteworks Services (meter fits, etc.)
  - Metering, inc' PrePay Metering Services
  - 250 Large Industrial Customers
  - 18 Active Shippers/Suppliers

- Investing in new business areas such as renewable gas (Biogas), natural gas vehicle market, and smart metering.

Biogas Resource – largely unutilised

Typically - biogas is flared at waste treatment sites



Biogas to Bio-Methane
(Upgraded Biogas)

Typical Raw Biogas Composition

55% - 65% Methane CH_4	35% - 40% CO_2	0.1%-0.5% O_2
0.5% N_2	200 – 2,000 ppm H_2S	Other compounds specific to feedstock – e.g. Siloxanes in Sewage

- **Conditioning**

  A) Cleaning & filtering (typically @ 7 bar) technologies include;
    - Pressurised Water Scrubbing (PWS)
    - Pressure Swing Absorption (PSA)
    - Chemical Washing
    - Membrane Technology
    - Cryogenics
    - Catalytic Processing

  B) Upgrading where necessary (typically at 3 bar)
    - Addition of propane to achieve minimum CV and NG comparable Wobbe index

  C) Odorised

  D) Gas Quality (Chromat) testing and control (Grid acceptance or recycle/flare)
    - Remote telemetry and valve control

  E) Compression for grid injection or road haulage

  F) Metering – converted volume / flow measurement and telemetry

- Output = **Bio-Methane / Bio-CH_4 is >98% methane**

Gas Conditioning
Biogas to Bio-Methane

Mature, Proven and widely available technologies.

Membrane Plant

Chemical Wash Plant

Pressurised Water
Scrubbing Plant

Grid Injection Equipment

Mature and proven technologies – smaller scale to traditional equipment.

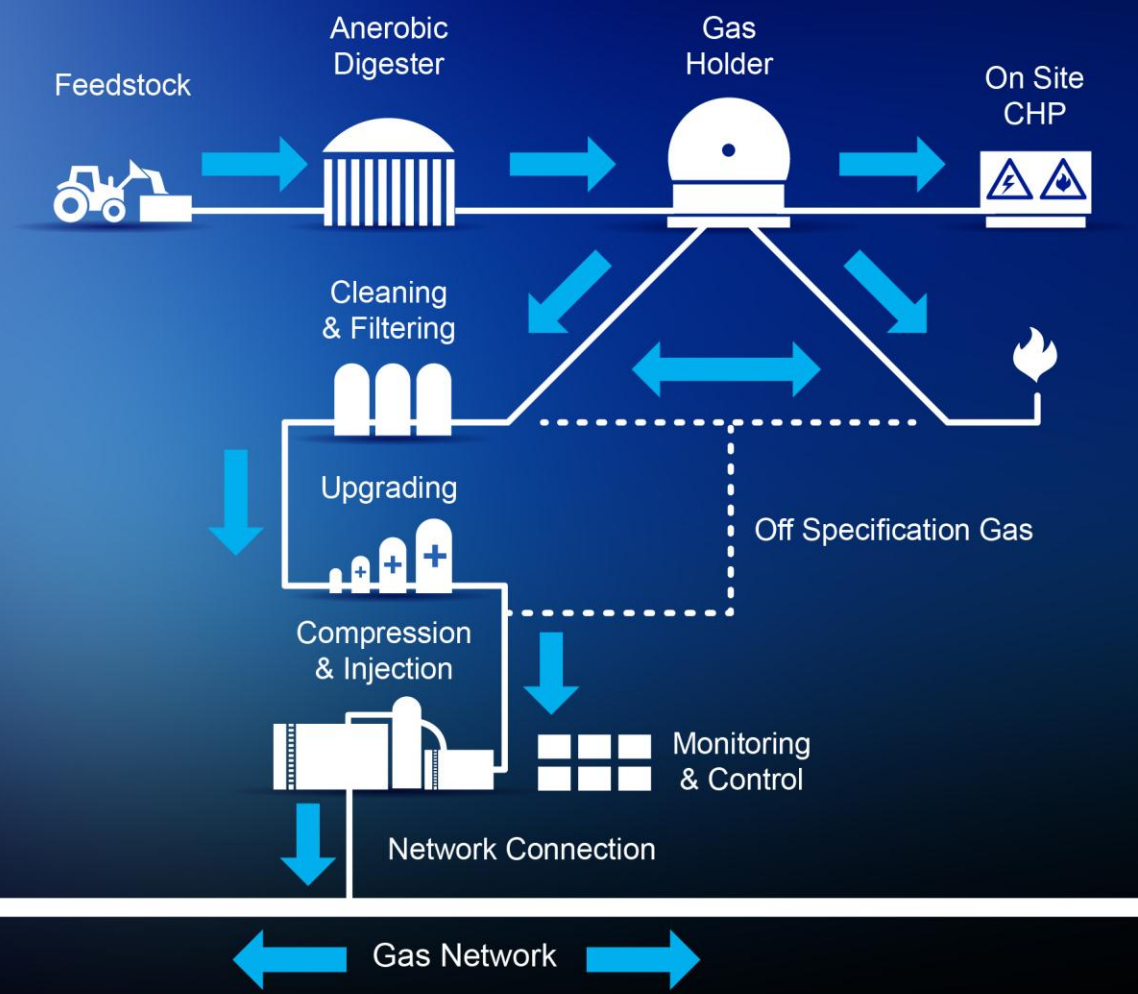
Chromat & Quality Measurement

Odorant injection

Pressure control & metering

Biogas Production

Biogas to Grid Plant



Proven & Sustainable – Sweden

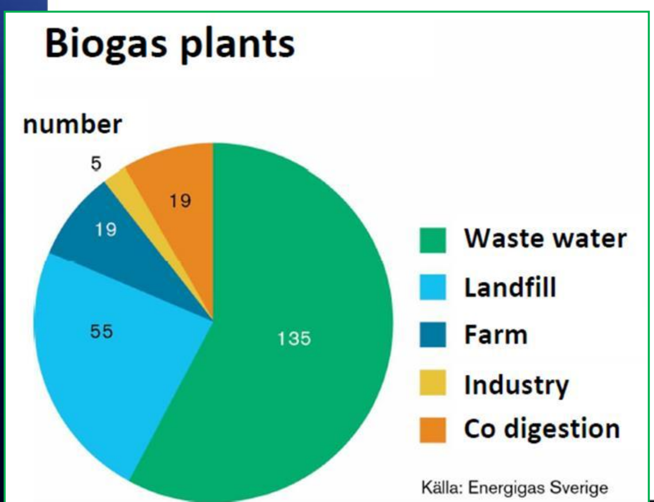
http://www.youtube.com/watch?v=8UHxXqalVNQ

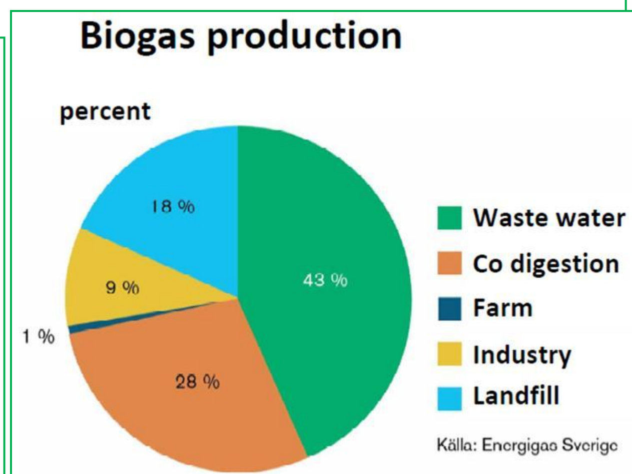
BIOGAS SYD

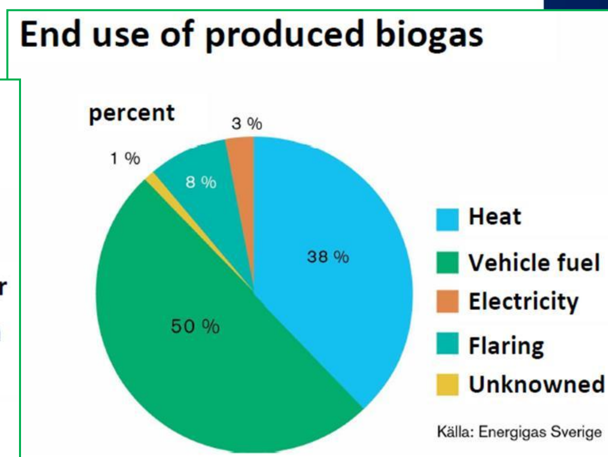
- "Local waste replaces imported energy"

- **Biogas from waste supplies 12% gas demand –**
  - 233 operational biogas production plants (and growing)
  - 5 Aggregator sites for grid injection
  - 50% used as transport fuel (primary growth area).

- **2020 Target: 33%**
  - Scale equiv' to 8% of current demand in Ireland





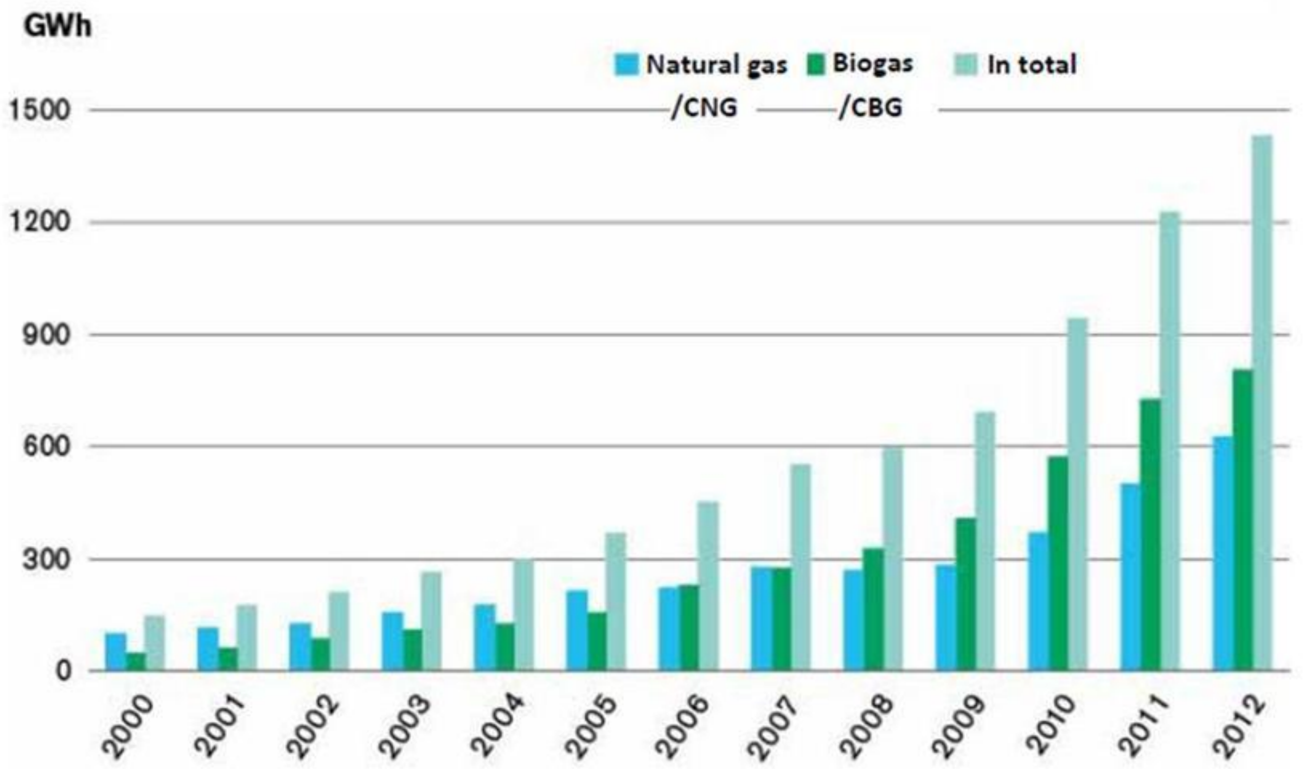


Growth of CNG/CBG Transport in Sweden

→

1-13 litre engine volume

68-460 bhp engine power



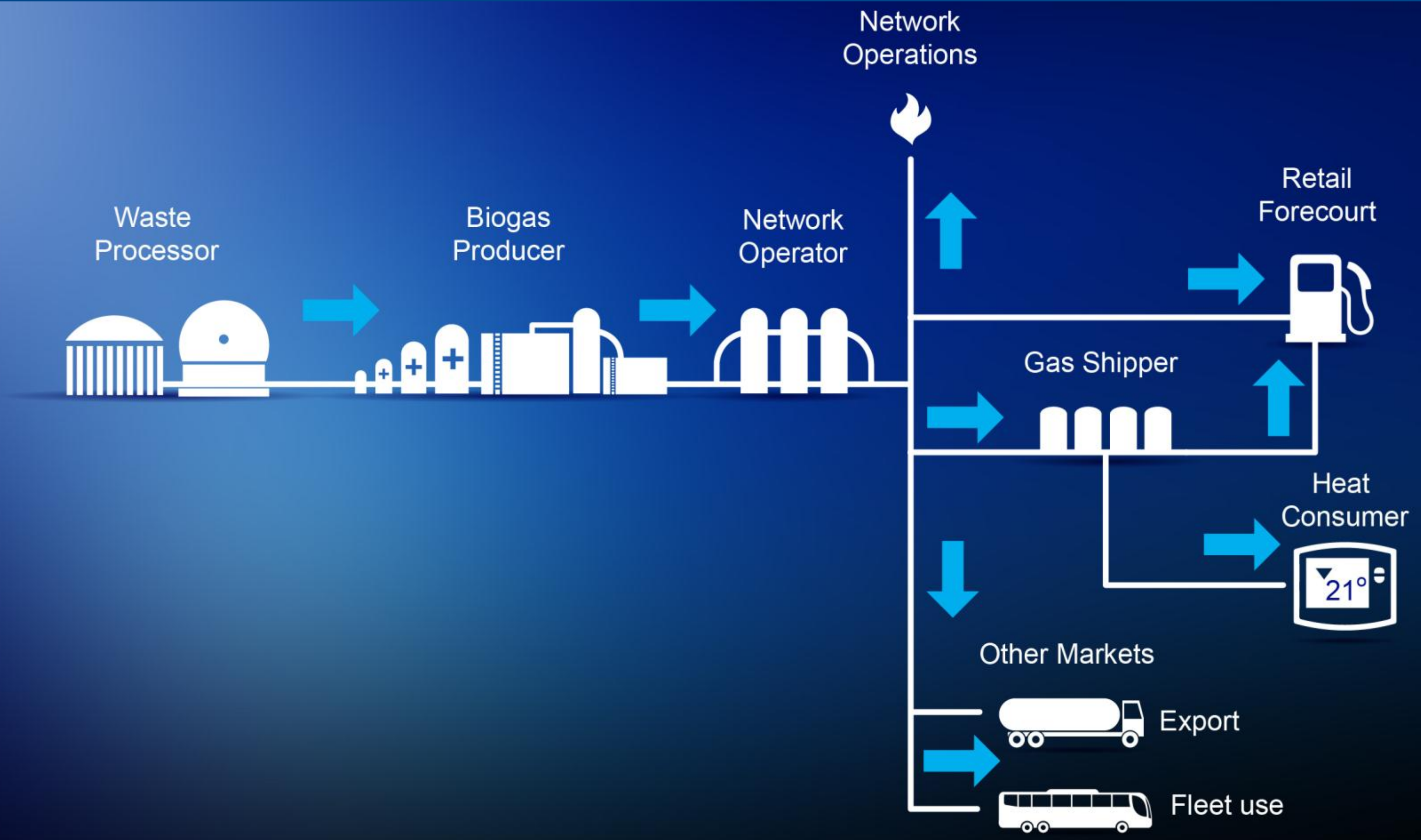
Proven & Sustainable – Gasum Finland

http://www.youtube.com/user/Gasum1

- 2020 Target: 28%

Potential Markets for Upgraded Biogas

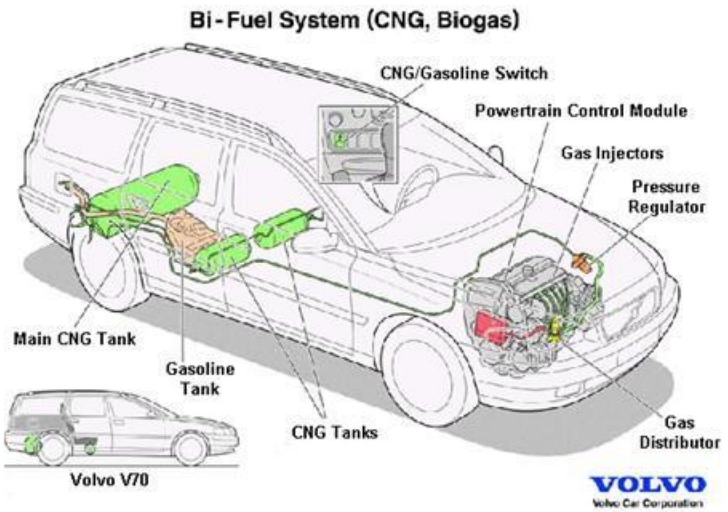
Economic Scale



Biogas use in Transport

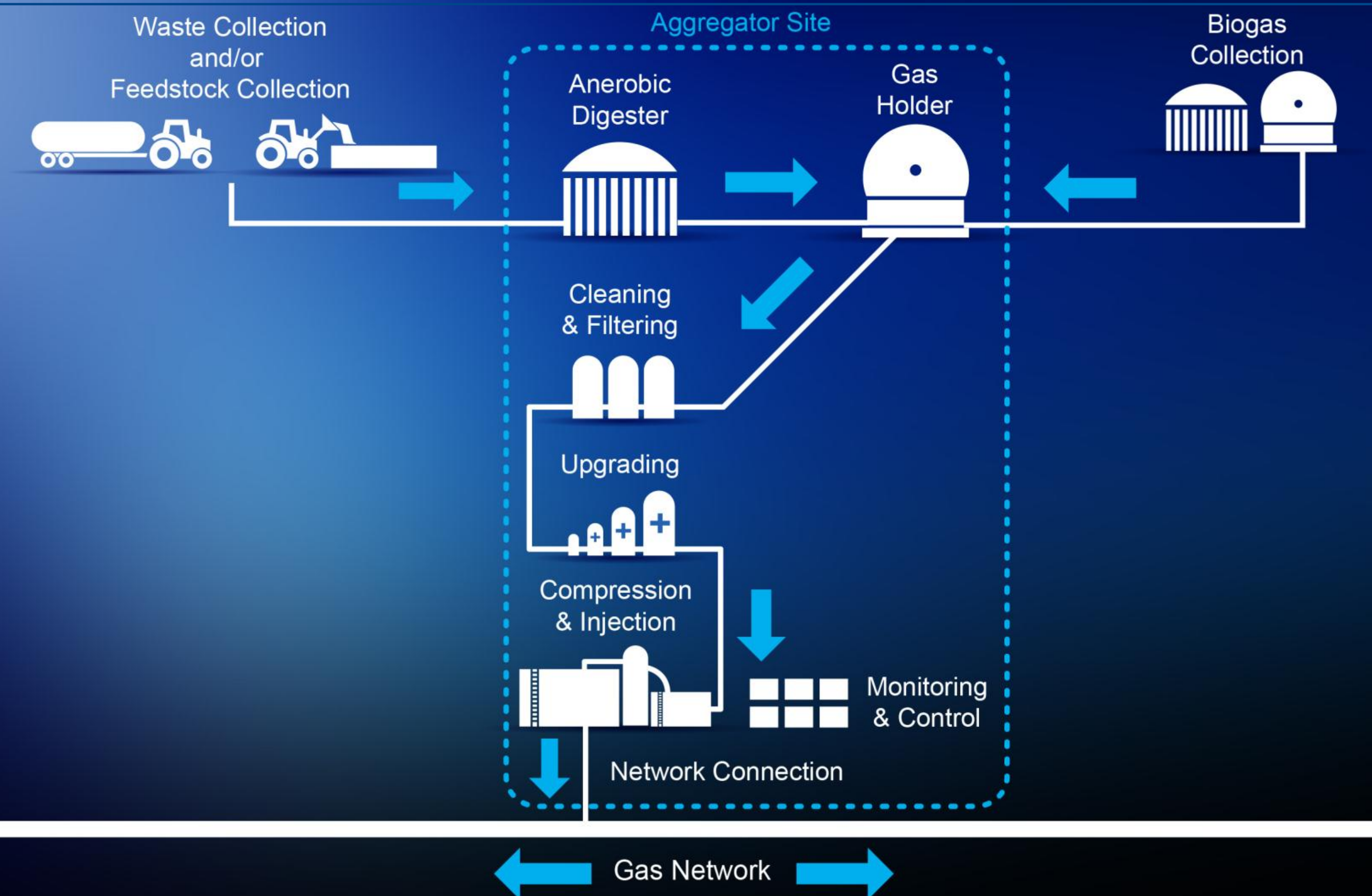
Reasons for focus as an alternative Transport Fuel

- **Value proposition for the consumer & economic viability**
  - Value as a transport fuel exceeds value derived from Heat or CHP,
  - Less complicated business model & easier route to market,
  - Cleaner & cheaper fuel
- **National RES-T Targets**
  - Indigenous & Sustainable
  - Offsets imports & helps security of supply.



Biogas Production

Aggregator and Co-op Models for waste or feedstock collection



Business / Market Development

- **Commission for Energy Regulation - Consultation Process**
  - CER/13/209 Biogas injection into the Natural Gas Grid
  - Market Development and Connections Policy Development
- **Government Policy**
  - National RES Targets
  - New Strategy due for RES-T & RES-H
- **Industry Technical Expert Group**
  - Support for irbea proposal
  - National Policies and Commercial Framework
  - Proven effective in other States – means to overcome barriers
- **Aggregator Model**
  - Economy of Scale

Research & Development Collaboration

BGN's current and planned collaboration partners

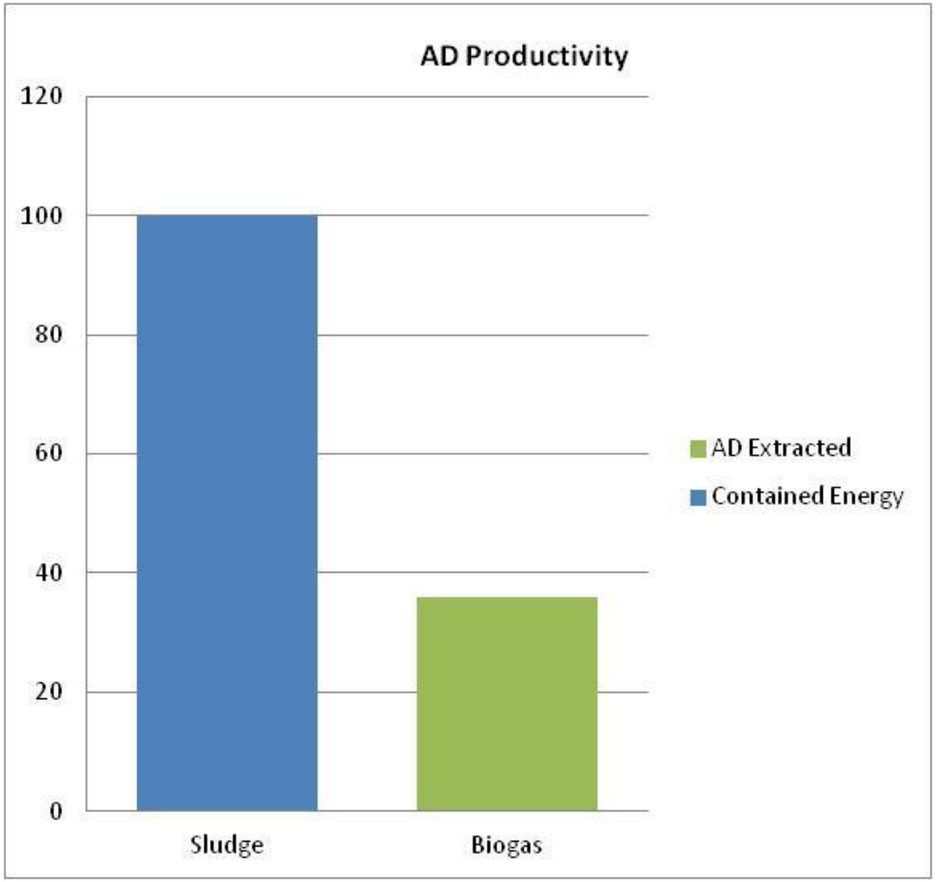
- Dr. Jerry Murphy, Environmental Research Institute, University College Cork.
- Bart Bonsall, Technology Centre for Bio-energy and Bio-refining.
- Questor Centre, Queens University Belfast.
  - EC Framework-7: ATBEST project. EC funding of €3.98 Million.
    - 12 Phd Researchers & 2 Experienced Researchers
    - 4 Year Programme

ATBEST

Advanced Technologies for Biogas Efficiency Sustainability and Transport

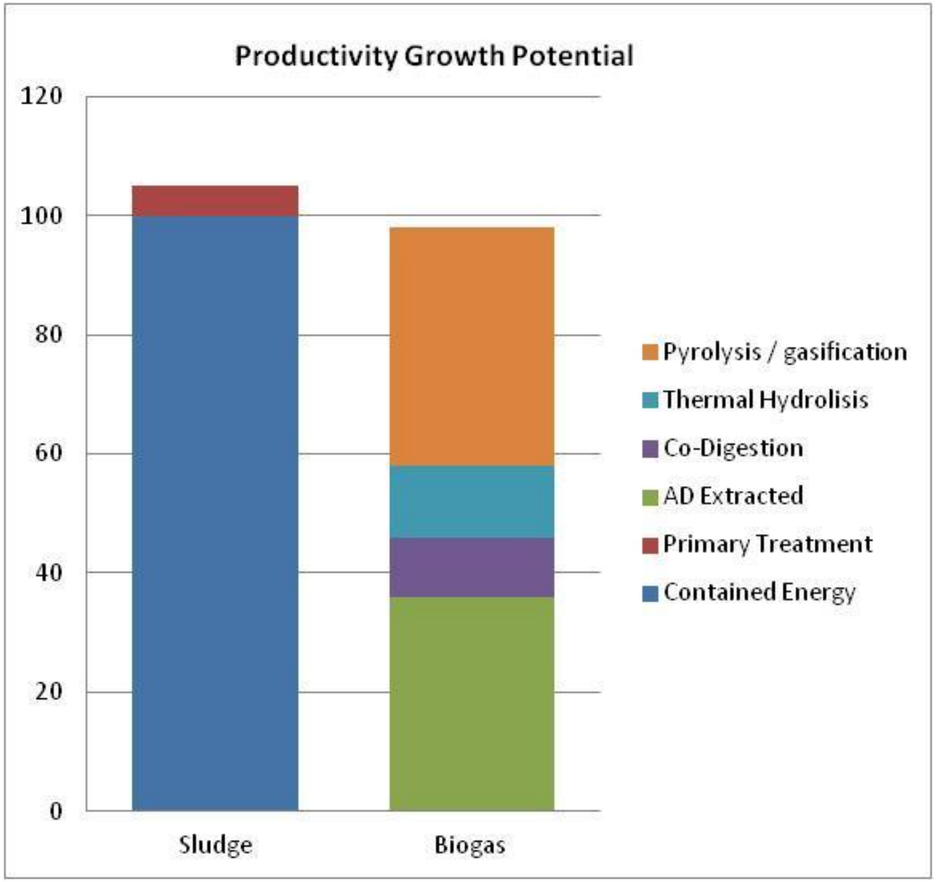
Further Development Potential for Biogas

AD Efficiency



Further Development Potential for Biogas

Maximise Energy Extraction – Minimise Residues



Conclusion

- **Mature & Proven – Technologies**
  - AD, Gas Conditioning, Grid Injection, Use as Transport Fuel.
- **Gas Infrastructure**
  - Significant infrastructure and mature market in place.
- **Significant scale potential in Ireland**
  - Waste & Residues to Energy,
  - Rural Economic Development & Growth,
  - Sustainable / Renewable / Clean,
  - Economic Viability.
- **National benefit**
  - Indigenous energy resource, offsets imports,
  - RES-T & RES-H Targets,
  - Long term sustainability and growth
- **Producer benefits**
  - Higher value proposition, access to broad market,
  - Ongoing growth potential – Feedstocks, AD Efficiencies, Hydrolysis, Pyrolysis, P2G, etc.
- **Commitment**
  - BGN committed to facilitating economic grid connection and market access.

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