

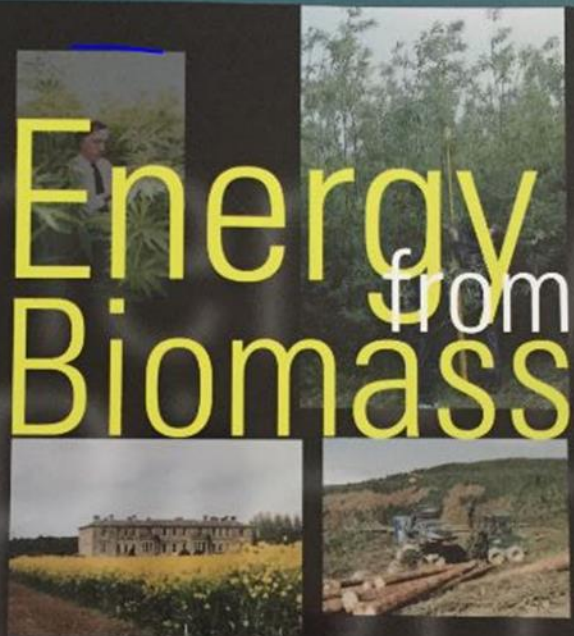
# Overview of the Teagasc Grange Biogas Plant

JJ Lenehan - Teagasc

A stylized, dark teal silhouette of a mountain range is positioned in the bottom right corner of the slide, adding a decorative element to the background.

# Potential for Energy Production from Agricultural and Forest Biomass in Ireland

B. Rice, M. Bulfin, T. Kent, A. Fröhlich, J.J. Lenehan



## 1997 Report Conclusion:

*- Further expansion of energy production from agricultural biomass will require that energy crops begin to play a role*

## **POTENTIAL OF GRASS AS A FEEDSTOCK FOR ANAEROBIC DIGESTION**

**JJ Lenehan**

### **Introduction**

With the advent of the Single Farm Payment Scheme it is envisaged that bovine numbers will drop as the link is broken between premia support and animal numbers. The extent of this reduction is difficult to forecast and may not be immediate as farmers adjust to the new situation over a number of years. However, for this exercise it is assumed that bovine numbers will reduce by 5% or 350,000 head. The equivalent reduction in grassland area required to feed these animals is estimated at 100,000 ha. This grassland will be available for other uses but opportunities will be limited in terms of conventional agriculture. There is potential to utilise this area for production of biomass for energy production. As farmed land in Ireland is predominantly grassland the use of grass as a feedstock for energy production (biogas) in an Anaerobic Digestion system could be considered. Already conventional agricultural crops, e.g. maize, fodder beet and grass, are used as a feedstock in Germany for producing biogas. While the systems depend on favourable energy pricing policy for their success the process does contribute to:

- Reduction in greenhouse gas emissions
- Reduction of dependence on finite fossil fuel resources
- Reduction in fuel imports
- Maintenance of viable rural based enterprise

### **Grass Requirements and Outputs**

*Grass Production:* The annual dry matter output from 1 ha of grassland ranges from 5,000 kg ha<sup>-1</sup> (poor to medium land with minimal fertiliser input) to 18,000 kg ha<sup>-1</sup> with a nitrogen input of 300 kg. For the purposes of this exercise the production from a sward is assumed to be 11,500 kg ha<sup>-1</sup>. The practical sward type used would probably include clover

Meath County Council  
Planning Department  
Abbey Mall  
Abbey Road  
Navan  
Co. Meath  
Phone: 046 909 7000 Fax: 046 909 7001

Planning & Development Act 2000 - 2008  
NOTIFICATION OF FINAL GRANT

TO: Teagasc Grange  
C J Falconer  
St. Patrick's House  
Newtown  
Waterford

Planning Register Number: 1a/900729  
Application Receipt Date: 18/05/2009  
Further Information Received Date: 02/11/2009

In pursuance of the powers conferred upon them by the above-mentioned Act, Meath County Council has by Order dated 25/11/2009 GRANTED PERMISSION to the above named for the development of land in accordance with the documents submitted namely:- the demolition of storage tank and farm shed and the construction of an energy centre comprising of an anaerobic digester and a combined heat and power plant. The facility will comprise of an anaerobic digester (and associated vessels), a generator building, storage building, and all associated site works at Teagasc Grange Research Facilities, Dunsany, Co Meath, subject to the 7 conditions set out in the Schedule attached.

Signed on behalf of Meath County Council

  
Administrative Officer

DATE: 30/12/2009

Planning permission 2009

# Standard Connection Agreement\*

General Conditions for Connection of Industrial and Commercial Customers and Generators to the Distribution System also apply.

## TEAGASC

Grange, Teagasc Grange, Dunsany, Co. Meath

Connection Agreement Number: 6002491432


## Customer Copy – Important

Please retain this for future reference.

### \*Applying to:

- Customer Connections at Low and Medium Voltage of Maximum Import Capacities 100 kVA and greater (Classes A2, A3, A4)
- Customer Connections at High Voltage (Class B1)
- Embedded Generating Plant (Classes A1, A2, A3, A4, A5, B2, B3 and B4)


# Teagasc Research – Padraig O’Kiely

- How best should grass and silage samples be prepared for in vitro anaerobic digestion tests?
  - Do different tests produce similar estimates of methane production?
  - Do grass species or growth stage at harvest impact on the methane yields achieved?
  - Will treating grass with fibrolytic enzymes at ensiling improve methane production?
  - Will grass silage or cattle slurry produce the most methane, and will co-digestion of these feedstocks produce pro-rata yields with those achieved by mono-digestion?
  - What are optimal organic loading rates during mono- or co-digestion of grass silage and cattle slurry?
  - Will finer chopping of silage or use of rumen fluid as an inoculum improve subsequent methane yields?
  - Will fortifying the digestion medium with added trace elements improve the longevity of the digestion process?
  - What scale of impact might anaerobic digestion of grass silage and cattle slurry make in Ireland?
- 
- A stylized, layered mountain range graphic in shades of teal and blue, located in the bottom right corner of the slide.


# Renewable Energy Commitments 2020

- ◆ EU 20% by 2020 – Ireland 16%

## Categories of Energy

- ◆ *Electricity 40%*
  - ◆ *Heat 12%*
  - ◆ *Transport 10%*
- 
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# Renewable Energy Targets

- ◆ Teagasc policy to exceed national targets for renewable energy in terms of its energy use
  - ◆ Choose range of “land” based energy types
  - ◆ Opportunity for farmers
  - ◆ R&D opportunities
- 
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## Smart Grid Dashboard: All Island

Last updated: 1 December 2016, 14:45



DASHBOARD



SYSTEM  
DEMAND



SYSTEM  
GENERATION



WIND  
GENERATION



INTERCONNECTION



FREQUENCY



MARKET PRICE



CO<sub>2</sub>

### System Demand & Wind Generation



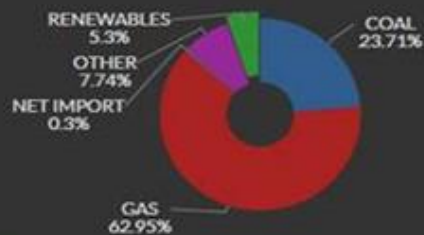
SYSTEM DEMAND

5,204MW >

WIND GENERATION

72MW >

### Fuel Mix



### Frequency



# Teagasc Projects

## **Completed Projects**

- ◆ Oak Park House Boiler
- ◆ Oak Park (other Boilers)
- ◆ Athenry Boiler
- ◆ Johnstown Castle Boiler
- ◆ Westport Boiler
- ◆ Mohill Boiler

*8% replacement by renewables*

## **Project Underway**

- ◆ Grange Biogas

*5% replacement by renewables*


## **Other Projects at feasibility study or planning permission stage**

Moorepark, Ballyhaise, AFRC, Kildalton, JCastle wind


# Anaerobic Digestion

- Anaerobic Digestion is a biological process in which micro-organisms break down biodegradable material in the absence of oxygen to produce Biogas (a mixture of predominantly Methane and Carbon Dioxide)
- While slurry can be used as a feedstock a much greater output of biogas comes from a high grade feedstock like grass silage
- Biogas can be used in a Combined Heat & Power Plant to produce Electricity & Heat
- Grange Plant will produce biogas to power a 150kWe capacity CHP plant using 12t of silage & 12t of slurry each day (varies Summer vs Winter)
- Digestate (i.e. feedstock after digestion) is utilised as a fertiliser
- Biogas can be upgraded to Bio-methane which is the same as Natural Gas

# Biogas

- ◆ Mature technology  
(Germany >9,000 on-farm units)
  - ◆ Grass based – land availability?
  - ◆ Grass based – matches current land use
- 
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# Grange Plant

- ◆ 1500 cubic metre digestion vessel
  - ◆ Pre-mixing of liquid & solid feedstocks
  - ◆ Mechanical mixing of digestion vessel
  - ◆ 150kW<sub>e</sub> CHP plant
  - ◆ Heat used in Bioscience Building
  - ◆ Supplier - Williams Industrial Services
- 
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# Teagasc Grass 10 Campaign

Advisory  
Programme



## Improving grass utilisation

Grass utilised (measured in tonnes DM/ha) can be increased on farms by either increasing the amount of grass grown and/or improving the utilisation rate. How much grass is grown is influenced by soil fertility, sward

composition (ryegrass/clover content of swards) and grassland management decisions (including measurement). The utilisation rate is influenced by grazing infrastructure, grazing management and grassland measurement. The Grass10 campaign will focus on each of these areas.

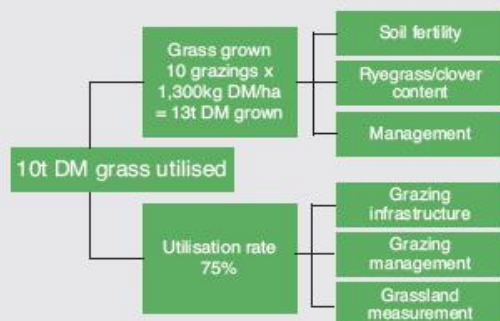


FIGURE 1: Achieving 10t DM/ha grass utilised per year.

## Industry collaboration

Teagasc recognises that the collaboration of a number of organisations in the Irish agri-food industry is required to achieve the Grass10 objectives. We will be seeking strategic industry partners to assist with both the design and delivery of a range of activities under the Grass10 campaign.

For further details, contact Dr Tom O'Dwyer at [tom.odwyer@teagasc.ie](mailto:tom.odwyer@teagasc.ie) or tel: 076-111 2499.

*Increasing grass utilised by 1.0t DM/ha/year would be worth  
€181/ha to dairy farmers and  
€105/ha to drystock farmers.*

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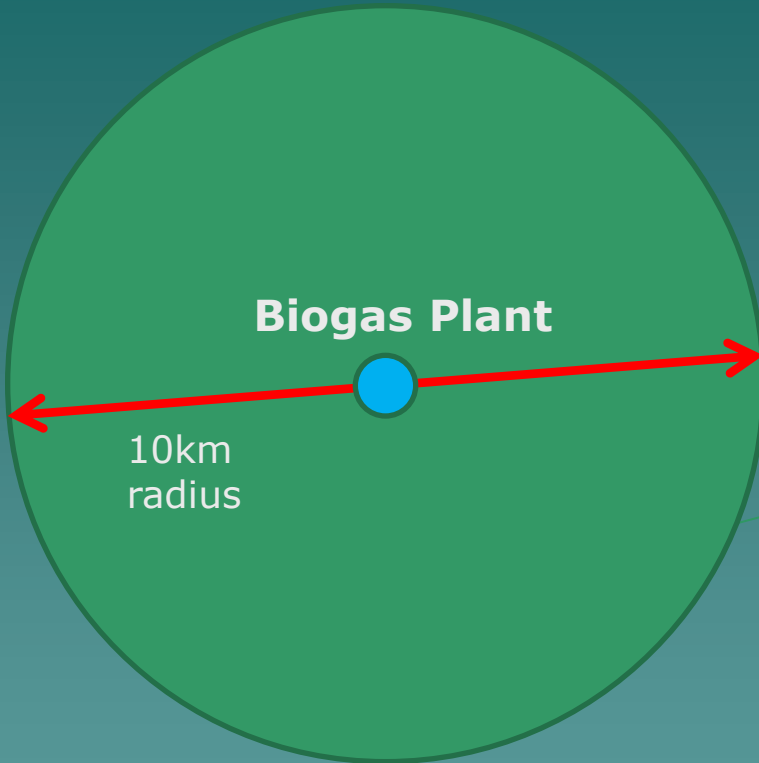
## Grass10

Grassland excellence  
for Irish livestock 2017-2020

10 grazings per year  
10 tonnes of grass utilised



# Grass Resource?



- Harvest hinterland 10km radius
- Total area 31,400ha
- Agricultural area 20,724ha (66% of total)
- Grass area 19,066ha (92% of Ag area)
- Capture 10% of area 1,906ha
- Improve DM output by 5t/ha (hidden hectares)
- Provides a resource for 10 Grange plants
- No reduction in milk or meat output
- THIS IS THE SCALE OF THE HIDDEN HECTARES

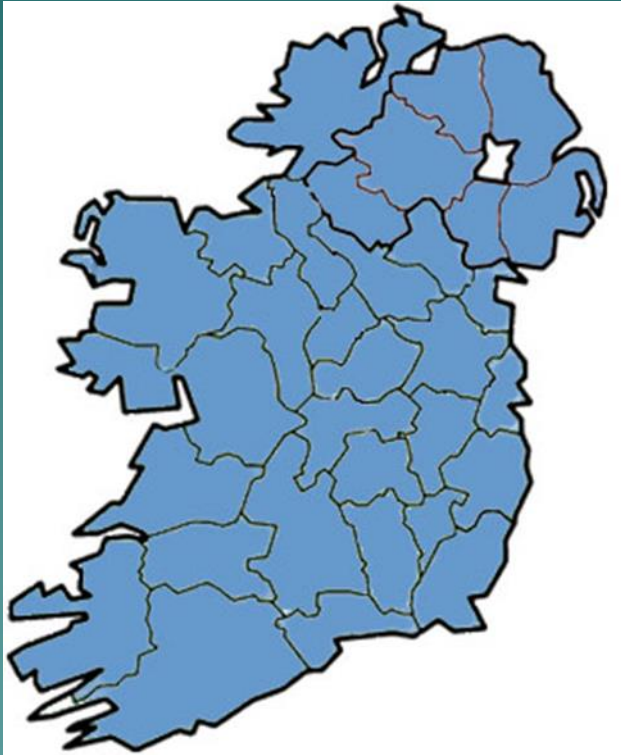
## The Hidden Hectares??

(5t/ha DM output versus potential of 12t/ha)





# Irish Resource




- Targeting 10% of the *hidden hectares*
- Nationally could service 2,240 Grange plants
- Provide 5% of total energy demand with no reduction in milk or meat output
- 20% hidden hectares – 10% of energy demand
- 30% hidden hectares – 15% of energy demand
- Paper by McEniry *et al.* 2013 shows Ireland can provide grass for 11,750 Grange plants while fulfilling targets for milk & meat output.

# Feedstocks For Grange Plant

	Grass Silage t/day	Slurry t/day
Winter	10.4	21.4
Summer	14.2	2.1

# Issues

- ◆ Planning permission \*\*\*\*\*
  - ◆ Grid connection (ESB Networks) \*
  - ◆ DCCAE - REFIT 3 (now closed) \*
  - ◆ DAFM Licencing \*\*\*\*\*
- 
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# Use of GAS from GRASS

## *Biogas –*

- Local CHP with heat recovery
- Direct generation of heat

## *Biomethane (renewable gas) -*

- Injection into grid for use by 750,000 existing gas users
  - Blend with NG for large scale electricity generation
  - Vehicle fuel (commencement of “roll-out” of NG service stations in 2017)

# The Future?

- ◆ Ireland will probably miss 2020 targets for renewables
- ◆ Evolving National Policy
  - (i) Biogas/Biomethane Study (SEAI)
  - (ii) Renewable Heat Incentive (2017)
  - (iii) Renewable Electricity (post REFIT 3)
- ◆ “Renewable Gas”

Natural Gas is methane

Biogas can be upgraded to natural gas standard

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# Energy Use in Ireland

Energy for Electricity (4,365ktoe)  
Energy for Transport (4,522ktoe)  
Energy for Thermal Use (4,300ktoe)

>90% imported!

***There are opportunities for biogas/biomethane***



Thank You