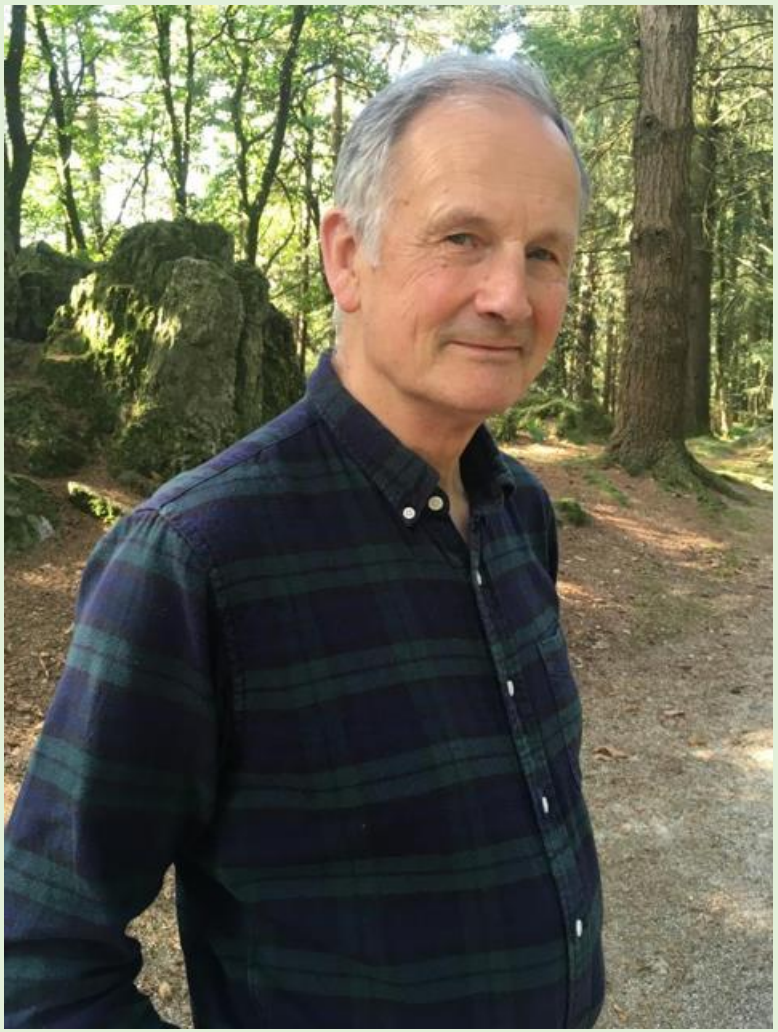
The Story
2005 - 2015

For a Webinar hosted by Brian Cox of the Bioenergy Association of New Zealand on 2nd December 2020



David Collins
MSc FRGS

Former Head of Biogas at the Renewable Energy Association

& founder of the Biofertiliser Certification Scheme at Renewable Energy Assurance Ltd.

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European policy drivers

EU has led push for renewables

- 1997 – Commission White Paper on renewable energy putting forward 12% renewable energy by 2010
- 2001 – EU adopts Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources as part of its commitment under the Kyoto Protocol.
- **EU objectives**
  - Security of supply
  - Jobs and growth
  - Reducing carbon emissions
- 2007 – EU target of 20% renewable energy by 2020
- 2008 – renewable energy directive (RED) agreed
- For UK? = 15% of total energy 30% electricity – 12% heat – 10% transport
- 2018 - 11% of total energy. 31% electricity, 7.3% heat, 6.2%, transport.
- Electricity rose to 37.1% in 2019!

UK landfill biogas production 2004

- UK was 2nd biggest biogas generators in Europe (after Germany) from landfill only!
- 700MWe from landfill in UK
- average capacity 1.5 MWe CHP
- declining 15 – 20 year life
- mandatory targets for diversion of biogenic wastes and no new sites
- most heat is exhausted
- new CHP on landfill gets 0.25 ROC (was 1 ROC)
- will RHI give benefit? nearby heat loads
- AD to replace landfill biogas generation?

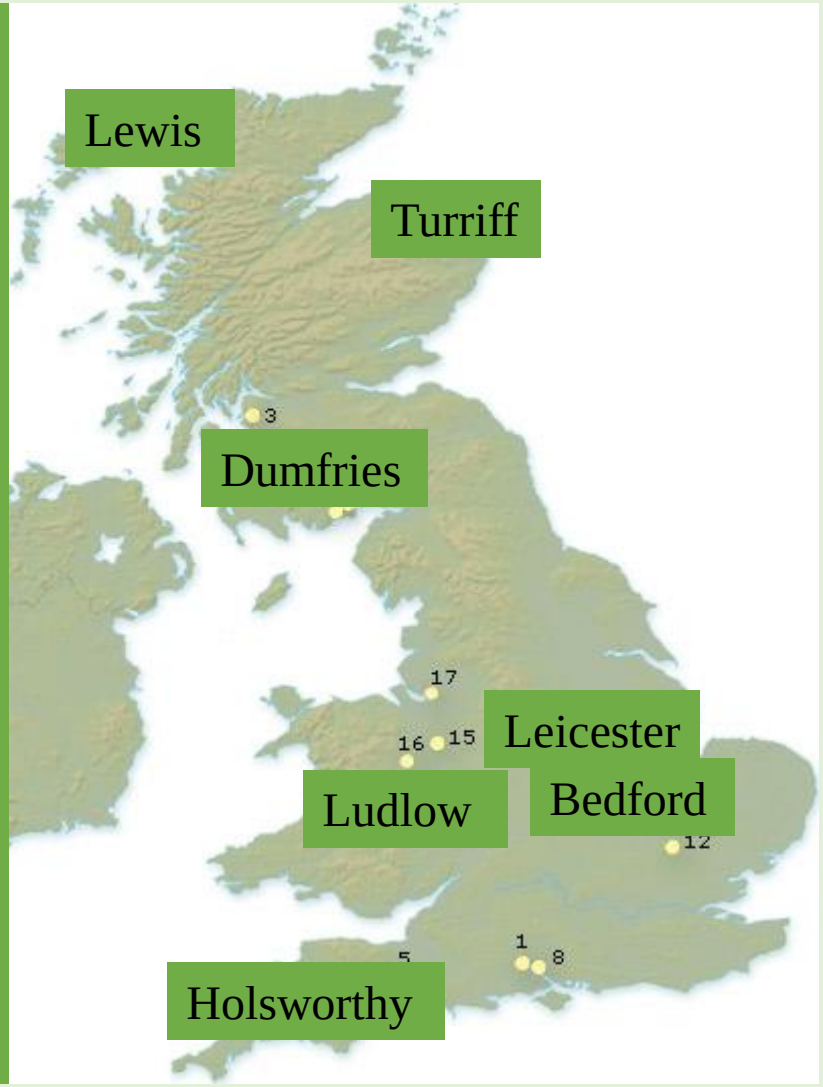
7 Food AD Plants 2005

Food Waste

- Lewis (12kt)
- Biogask, Turriff (12kt)
- Dumfries 7 x Farm
- Greenfinch, Ludlow (6kt)
- Biogen, Bedford (40kt)
- Summerleaze, Holsworthy (135kt)
- Biffa, Leicester (40kt)

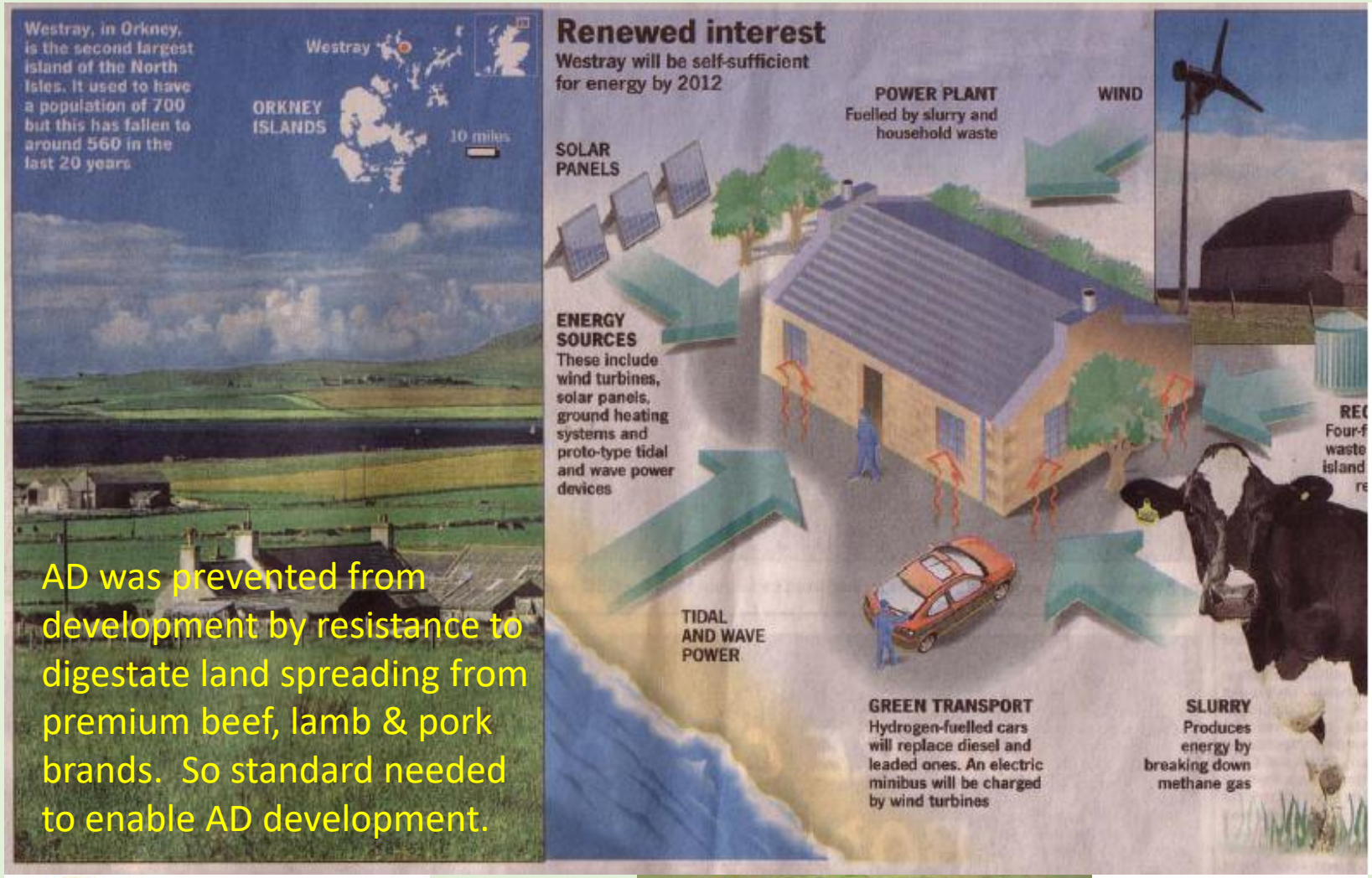
Farm based

- Pilot, demo, testing
  - Organic Power
  - Cambridge
  - Bioplex Ltd



Early Barriers to Food Waste Plant Development

- Planning permission – NIMBYism?
- No Digestate Standard
- Poor financial incentives – Pre ROCS x 2, Fits, RHI
- NVZ Regulations – no recognition of digestate value
- No Food Waste collections – councils choose EfW (incineration)
- Grid connections – local grid capacity barriers
- Waste hierarchy – ranked with composting
- British Retail Consortium – "Yuck" factor
- Investment models – 18% IRR for "risk" – 3-5 year exit
- Food Assurance Schemes - premium bands - defensive
- Global climate catastrophe = new imperative to accept small risks?



RENEWABLE ENERGY FOR EUROPE
Campaign for Take-Off
100 communities for 100% RE

Westray Development Trust

REA Digestate Standard Project Objective

- to help build more biogas plants
- by creating a Standard for the Biogas industry reducing barriers to disposal of digestate to land
- which is acceptable to regulators, farmers, food industry, retailers, food producers, public etc
- and practical & affordable for biogas industry
- and changing digestate from a regulated waste to a de-regulated product

Biogas & Digestate Milestones

- 1970's & 1980's – many on-farm plus water treatment
- 2002 – Renewables Obligation – 1 ROC – a few pioneers in food waste AD
- 2004 – REA Biogas starts - serious political lobbying for industry
- 2005 - Ministerial support, Defra AD Team, 1st AD plan
- 2005 – Grant by Scottish Enterprise to write standard for Scottish Environment Protection Agency. Reading, Southampton Universities
- 2006 – Scottish Digestate Standard accepted by SEPA.
- Renewable Energy Assurance founded – supports Biofertiliser scheme
- David Milliband Environment Secretary supports Standard & Protocol
- 2008 – AD Quality Protocol approved by Environment Agency
- 2008/9 – PAS 110 developed with WRAP support + Cranfield University
- April 2009 – AD classed as "Emerging technology" – 2 ROCs
- Industry expansion – food plants - BCS was in place at the right time
- 2010 Greg Barker Minister for Energy & Climate Change – Defra AD Strategy & Action Plan
- 2011 - Feed in Tariffs and Renewable heat Incentive

Full potential of AD = Energy + Digestate was facilitated from the start!

Renewable Energy Association campaigning with Friends of the Earth & Greenpeace

Caroline Lucas, Leader of the Green Party
& 50 politicians of all parties

Scottish Digestate Standard

- Scottish Enterprise Energy Group & Highlands & Islands Enterprise & Scottish Environment Protection Agency (SEPA)
- REA Project Team,
  - Vicky Heslop – Irish Farmer, AD owner, scientist. David Collins – REA Biogas
  - Reading University – Prof. Stephen Nortcliff. Dr. Becky Arnold
  - Southampton University – Prof. Charles Banks.
  - Scottish Farm Quality Certification – Gary Stoddart
- Many visits to AD plants, sampling, testing, feed-back
- SEPA - approved in November 2006 – Manual - May 2007
- Was a farmer/operator led practical guide as well as standard rules, documentation & code of practice, but outside the BSI "family"
- Used as foundation for BSI PAS110 to join PAS100 (compost)
- Some farmers found BSI documentation completely baffling!

Quality Protocol

for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste.

- Environment Agency defines when waste controls no longer required
- the digestate can be used as a product not a waste
- If it passes PAS 110 in England, Wales and NI
- Additional Scheme rules for Scotland ASRS + PAS110
- protect human, animal, plant health and protect environment
- designated market – agriculture, forestry, soil/field grown horticulture

Rationale

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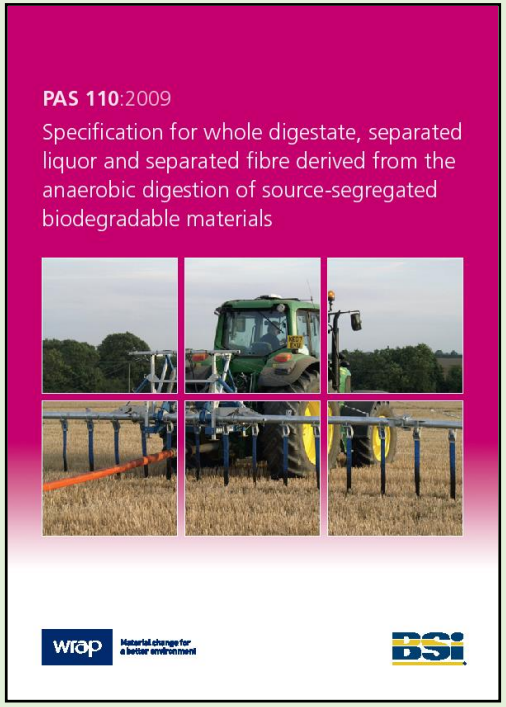
- Risk – there has to be exposure for there to be a risk
- Understand source-pathway-receptor relationships
- Risk assessment informs risk management (the AD Quality Protocol)
- Risk assessment provides evidence base and market confidence for QP
- QP primary instrument for managing risk – by waste type, operational control, post treatment and restrictions on use

PAS110

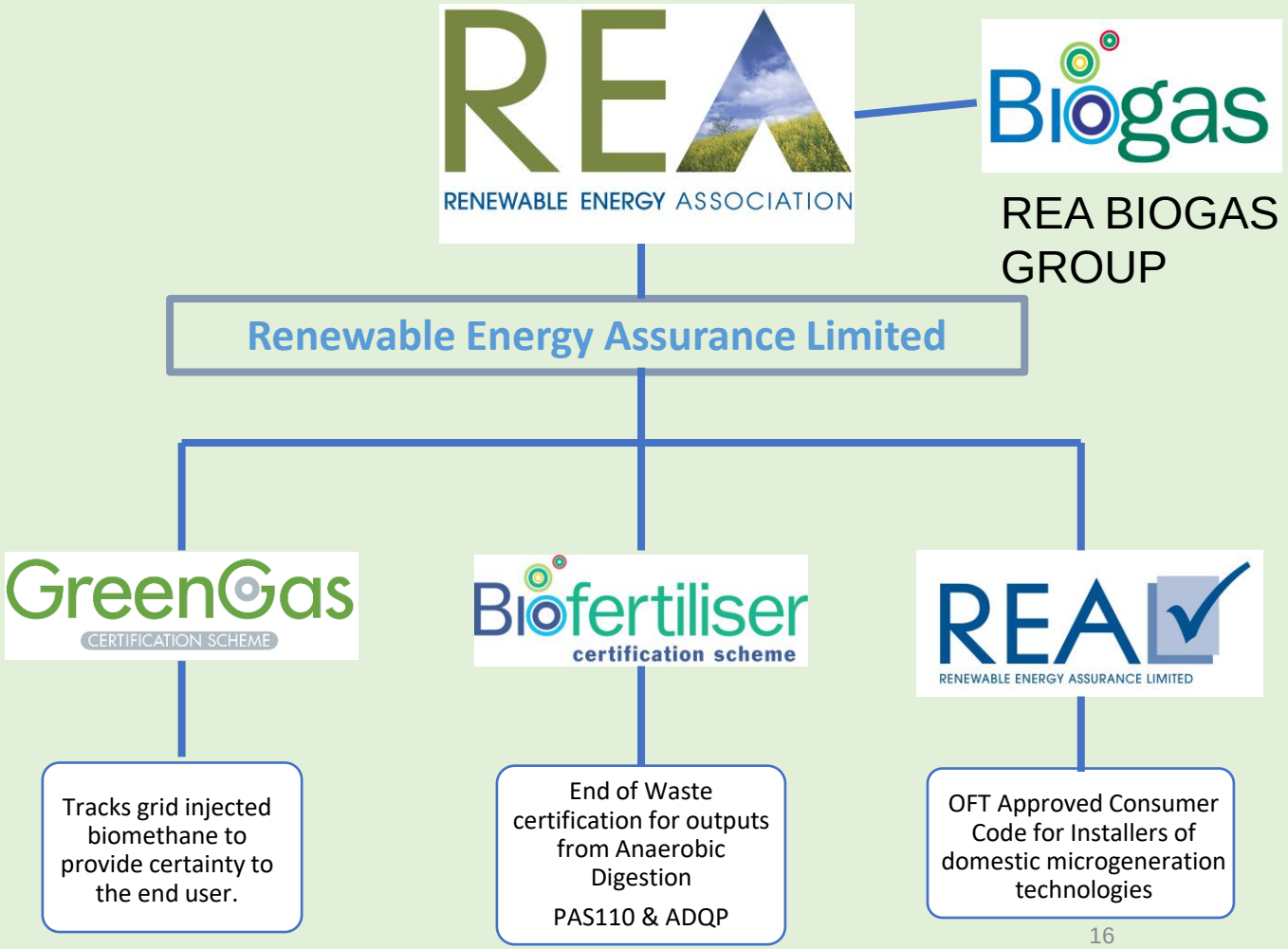
- Quality Management System
- HACCP
- input agreements
- process management/equipment/ monitoring
- sampling & testing
- validation
- after validation



Hazard categorisation

Cranfield UNIVERSITY

- Potentially toxic elements;
- Nutrients – N and P;
- Organic pollutants - e.g. DEHP or PCBs;
- Plant pathogens – e.g. those that may transfer from treated waste food to crops;
- Invasive weeds and exotic species e.g. those that may transfer from gardens to farmland or vice versa;
- Animal pathogens – those that may be transferred between farms via the treatment of manures;
- Human pathogens
- Physical contaminants
- Odours


RENEWABLE ENERGY ASSOCIATION
Biogas
REA BIOGAS GROUP
Renewable Energy Assurance Limited
GreenGas
CERTIFICATION SCHEME
Biofertiliser
certification scheme
RENEWABLE ENERGY ASSURANCE LIMITED
Tracks grid injected biomethane to provide certainty to the end user.
End of Waste certification for outputs from Anaerobic Digestion
PAS110 & ADQP
OFT Approved Consumer Code for Installers of domestic microgeneration technologies

What does the BCS do?

- Develops scheme rules
- Information, templates & Code of Practice
- Appoints certification bodies
- Gives technical advice to applicants
- Web - http://www.biofertiliser.org.uk/
- Appoints/administers the Oversight Panel
- On-going development of the scheme
- Reviews the fees & licenses the logo
- Promotion of the scheme & logo

Renewable Energy Assurance Ltd REAL

Choose CB

Approved Labs

Oversight Panel

Certifying Bodies

UKAS

Appeals Committees

Quality Digestate

YES

Quality Protocol & PAS110

NO

Waste

What was in it for the Farmer?

Advantages

No need for Mobile spreading permit from EA - £750 - 50Ha

No need to notify deployments – 25 working days - £450

Can spread to many farms as a non waste at time of choosing

Perception of public, buyers and farm assurance schemes

Disadvantages

28 days to wait for residual biogas potential test

Pasteurisation, storage – changes to installation

Andigestion Ltd –Spreading Digestate to land

What were the costs per year?

For maximum 50,000 tonnes per annum input
£1,700 for certifying body. £2,250 lab tests (3 sets)
Any savings? £700 for Mobile Permit, plus £760 (low risk) but £990 (high risk area) for each 50Ha block of land

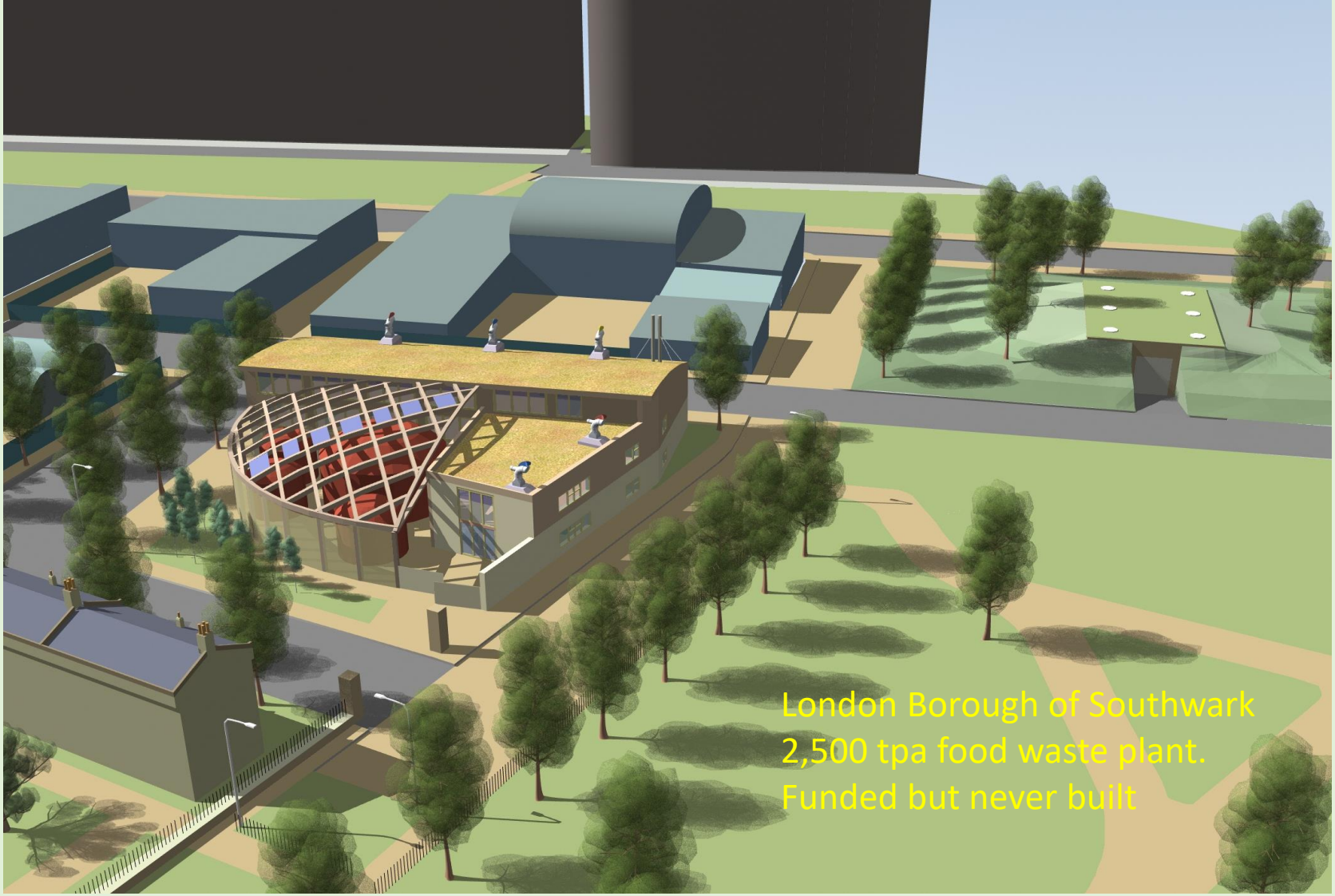
Wales Assembly Government & some English Waste Authorities require PAS to qualify for re-cycling


Biogask, Turriff,
Aberdeenshire
12,000 tonnes


Biogen Ltd – Bedford
42,000 tonnes


Greenfinch Ltd
Farm Digester
Scotland


Greenfinch Ltd
Ludlow,
Shropshire, UK
Sited happily in an industrial estate


London Borough of Southwark
2,500 tpa food waste plant.
Funded but never built

permit to spread digestate

- Non Waste Feedstocks
  - If you produce digestate from manures, slurries or energy crops, (non – wastes) you need no permits to use the digestate
- Waste Feedstocks
  - need environmental permit & provide evidence of agricultural benefit – register an area of land – pay a fee
- Or pass the Digestate 'Standard' PAS 110 & AD Quality Protocol –England, Wales and Northern Ireland
- Scotland – PAS110 & Additional Scheme Rules for Scotland (ASRS)


Holsworthy Food Waste Plant
Devon
Next slides show the practical experience of the land manager/farmer at Holsworthy

Digestate Production

- 2003/4 – 85,000 tonnes/annum digestate
  - Nearly all digestate returned to supplying farmers.
  - Farmers used as if super “cow slurry” but easier to handle
- 2005- Environment Agency “Para 7As”
  - Fees and tighter controls.
  - Improved expertise with new owner
- 2009/10- 50,000 tonnes/annum digestate
  - 100% Food Waste – increased energy output.
  - >40 farms registered to take digestate
  - Digestate treated as a fertiliser with “complications”

Experience of the land manager/farmer at Holsworthy

Market

- Mainly Grassland.
  - Good potential for digestate nitrogen
  - Extended spreading season
- Medium sized farms
  - Frequently with off- ground
- Non- NVZ
  - Nitrogen regulations add complexity.
- Fertiliser Price Awareness
  - 2008 price rises
  - Farms consider sewage sludge/animal manures

Experience of the land manager/farmer at Holsworthy

Digestate Characteristics

- Liquid- bulky and care required on application
- Contains Plant nutrients- mainly crop available N
  - Potential for N losses as ammonia
  - Care needed in application.
  - Nitrogen regulations
- Pasteurised (Animal By-Product Requirement)
  - Grazing ban and on farm records required
  - Pathogen assurance
- "Controlled Waste" Status.
  - EA regulations – bureaucratic and expensive

OR

  - Quality Protocol/PAS110 option

Experience of the land manager/farmer at Holsworthy

Digestate Characteristics (Cont)

- Odour- Digestate does have an odour.
  - AD process reduces odour but does not eliminate it.
  - Depends on AD plant intake materials and process efficiency.
  - Requires management.
- Limited soil improvement qualities for this material.
- Homogenous material- small particle size.
  - Precision possible when applying digestate

Experience of the land manager/farmer at Holsworthy

Shallow Injection into a grazed sward June 2009

Farmer Requirements

- Confidence that digestate use will not harm business
  - What is in the intake material?
  - Farm Assurance type Scheme implications?
  - Plant operator needs to have a local track record
  - Confidence

- Cost effective source of nutrients.
  - Include the cost of spreading

- Predictable response from digestate application
  - Crop response to available N.
  - Cereals especially important
  - Consider potential N losses during storage and application

Experience of the land manager/farmer at Holsworthy

Value of Digestate v Mineral Fertilisers

Fresh Digestate applied 22m3/Ha ***Nitrogen, Phosphate, Potash***	N	P	K	Value
Nutrient requirement for 1st cut silage (kg/ha)	120	40	80	Chemical £165
Supply of plant-available nutrients from Digestate (kg/ha)	120	4	39	Digestate £120
Balance of mineral fertiliser required (kg/ha)	0	36	41	Top up £45
Cost of Fertilisers	% Nutrient			Price per Tonne
Ammonium Nitrate	35			£260 (£340)
Muriate of Potash	60			£280
Phosphate	46			£320

Farmer Requirements (cont)

- Regulatory compliance on farm.
  - Pressure for operator to support farmer
  - Farmers not keeping records correctly becomes a problem for operator
  - Consider differences QP and Standard Permit

- Product Available when required
  - Demand highly seasonal
  - Short spreading windows between crops.
  - Therefore digestate storage requirements high
  - Logistics of delivery to farm
  - Contracting the spreading

Experience of the land manager/farmer at Holsworthy


Digestate
spreading
June 2nd 2008


Grass cover 30th June

Operator Considerations

- AD plant is multi million pound investment
  - Main source of income is from gas produced.
  - Plant reputation as reliable outlet for organics
  - Secure outlet for digestate is essential at least cost.
- Security of local land bank is dependant on goodwill and confidence of farmers.
  - No land owned by operator
  - Transport is very expensive

Experience of the land manager/farmer at Holsworthy


Surplus Digestate Storage Bags

Operator Considerations (cont)

- Regulatory failure on farm may be a threat to operator
    - Compliance with Permitting regs or QP/PAS110
    - Compliance with ABP requirements
    - Environmental failure on farm can lead to loss of goodwill with farmer and local community
- Nutrient makeup of digestate is fixed
    - Crop recommendations need to take this into account
    - Nutrient imbalances can result in poor crops
    - Uninformed negative comment a potential outcome

Experience of the land manager/farmer at Holsworthy

Operator Strategy

- Adopt QP/PAS110
  - Improve confidence in digestate (food chain buy in)
  - Save considerable Permitting costs.
  - More flexibility without EA bureaucratic procedures.
  - Less potential liability than with Standard Permit.
- Provide Farmer Service Package
  - Soils analysed
  - Crop nutrient requirements calculated
  - Digestate quantities assessed at field level
  - Digestate spread (shallow injection)
  - Records confirmed

Experience of the land manager/farmer at Holsworthy

Operator Strategy (cont)

- Conditions of Supply to farmer
  - Quality Protocol compliant
  - All digestate low level application – no spraying
  - Digestate is only spread in fields approved by Operator
  - Application rate agreed with FACTS qualified member of staff.
  - £ payment for digestate.

Reduced risk of losing QP compliance

Experience of the land manager/farmer at Holsworthy

Summary

- Digestate is a valuable source of plant nutrients
  - Notably crop available N. (N price correlated to gas prices)
  - Phosphate recovery important. (Limited world resource)
- Digestate also has potential to harm environment.
  - Expertise required to ensure optimum use.
  - Plastic contamination can require complete soil remediation
  - Micro plastics
- Low unit value due to bulk
  - Transport and spreading costs (including compliance costs)
- Operator digestate policy subject to review.
  - Regulatory change, QP/PAS110 review. Future Research findings

Experience of the land manager/farmer at Holsworthy

Value received by Operator evolves from several variable sources – e.g. the balance alters when government financial incentives change or if source separation became mandatory

- Financial incentives – electricity or biomethane export to grid.
- Electricity and heat – internal cost savings at plant
- Gate fee receipts for organic residues
- Chemical Fertiliser costs reduced
- Soil improvement – testament concerning long term use
- Financial recognition of environmental benefits?
- Venture capital financial returns of 18% IRR not sustainable
- Genuine new green banks – Triodos? Lower interest, longer term.
- Personal green investor tax breaks have ended
- If energy subsidies reduce then local gate fees must compensate?

Update for 2020

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REAL

RENEWABLE ENERGY ASSURANCE LIMITED

Consumer Codes

Certification Schemes

Other Schemes

RECC

RENEWABLE ENERGY CONSUMER CODE

Biofertiliser

certification scheme

EV | ROAM

The UK's EV Chargepoint ID Registration Organisation

EVCC

CONSUMER CODE FOR HOME CHARGEPOINTS

Compost

Certification Scheme

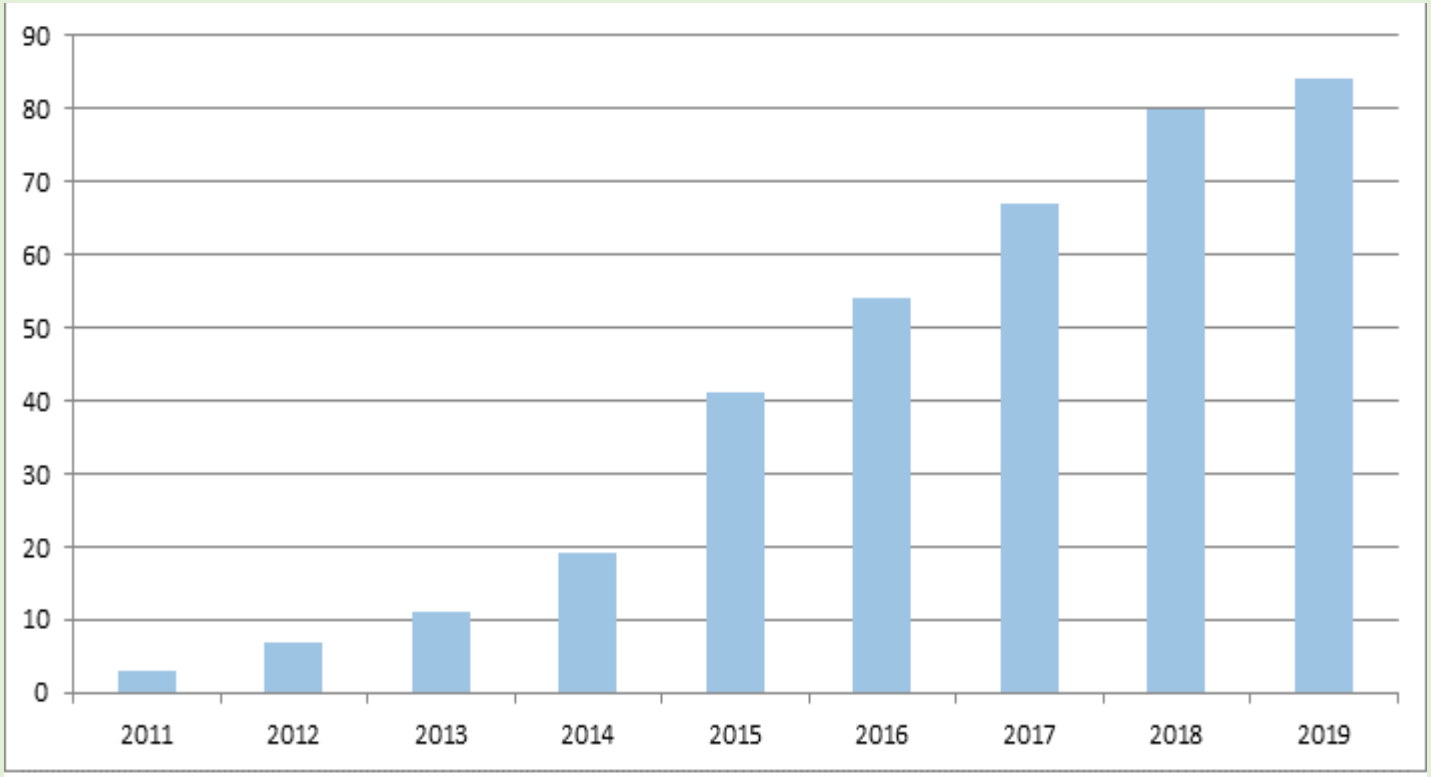
GreenGas

CERTIFICATION SCHEME

Compostable Materials

Certification Scheme

Growth in BCS Certified Plants



Contact: Mollie Rogers - molly@realschemes.org.uk

Certified Plants 2020

- 90 certified AD plants
  - England: 65
  - Scotland:11
  - Wales: 9
  - Northern Ireland: 5
- +/- 4.98 million tonnes p.a. input material
- input materials include: Animal By-Products, Agricultural, Co-products, Commercial, Industrial, Municipal, Non-ABP, Residues and Wastes
  - 11 plants – On Farm
  - 67 - Waste
  - 12 - Mixed

AD Deployment in the UK

Operational:

- 579 in total (466 MWe_{eq})
  - 418 farm-fed
  - 161 waste-fed

In Development:

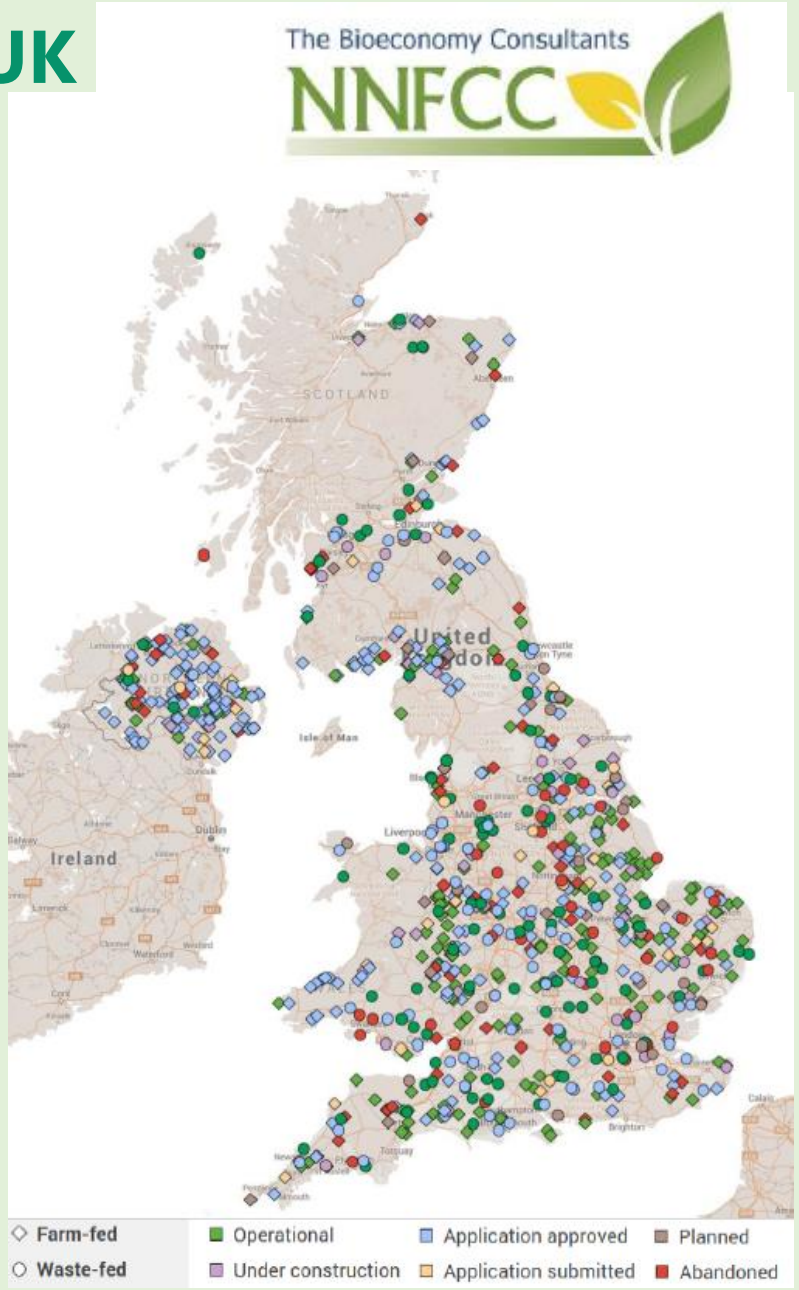
- 331 in total (269 MWe_{eq})
  - 228 farm-fed
  - 103 waste-fed

Biomethane Injection:

88 operational excl. sewage treatment (51,000 Nm^3/hr)

plus 12 in sewage treatment sector

- 52 under development (28,000 $Nm^3/hour$)



NNFCC, April 2020

Biomethane for Transport – Today

- Volumes in the UK are +/- 4TWh/year – supported by the RHI.
- Importing via the grid around 160GWh for transport use (2019 figure).
- Demand increasing to meet expanding fleets using natural gas/biomethane
- Recent announcement of "new RHI" the Green Gas Support Scheme (GGSS) which could bring another 4-5TWh of production on stream.
- Renewable Transport Fuel Obligation (RTFO) support continues to 2034. Increasing ambition in the renewable % of fuel. Target also includes biodiesel, bioethanol etc
- The Climate Change Committee forecasts total of 20TWh of biomethane is possible in the UK – Renewable Energy Association and other bodies have higher long term ambition - 50TWh.
- Far higher demand if there was a major shift to biomethane use by HGVs.
- Important to recognise that many sectors would like to claim the biomethane to help them decarbonise – heating for a start but also shipping which would result in exponential biomethane demand.
- Contact is Jesse Scharf jscharf@greengas.org.uk

Biogas filling station in Kristianstadt