Clearfleau™

Renewable Energy
From Liquid Residues

Short Retention Time Digestion

Converting Food Production Residues into Energy

Newcastle – December 2014

www.clearfleau.com

CLEAR*FL*EAU – AN OVERVIEW

On-site Anaerobic Digestion in the Food & Beverage Sector

Target Markets – industrial clients:

- Manufacturing feedstocks - dairy, foods, beverage / distillery & biofuels sectors
- On-site bioenergy plants on industry sites
- UK - plus Ireland and other EU markets

Clients Include Diageo, Nestle, Olleco, First Milk

Commercial Benefits

- On-site green energy supply
- Biogas from COD removal
- Possible grey water re-use
- Revenue with cost reductions
- CSR & environmental benefits

Transforming production residues into valuable renewable energy

Market - Current projects include:

- Milk & Dairy Products
- Confectionery & Food
- Distillers & Brewers
- Biofuels, Fats & Oils

Reference Plants

- BVD Dairy
- Nestle Fawdon
- Diageo Dailuaine
- Diageo Glendullan
- Olleco Liverpool

Awards

B V Dairy

Awards for Excellence in Waste Management
Winner - Innovation in Design of a Waste Management Facility

REA Awards
Runner Up - Project Developer

Diageo, Dailuaine

Scottish Green Energy Awards 2013
Winner – Best Project

VIBES Awards 2013
Runner Up – Environmental and Green Technology Category

Nestle, Fawdon

Sustainability Leaders Awards 2014
Winner – Waste Treatment

UK AD & Biogas Industry Awards 2014
Winner – Best Small Scale AD project

EVOLVING MARKETPLACE

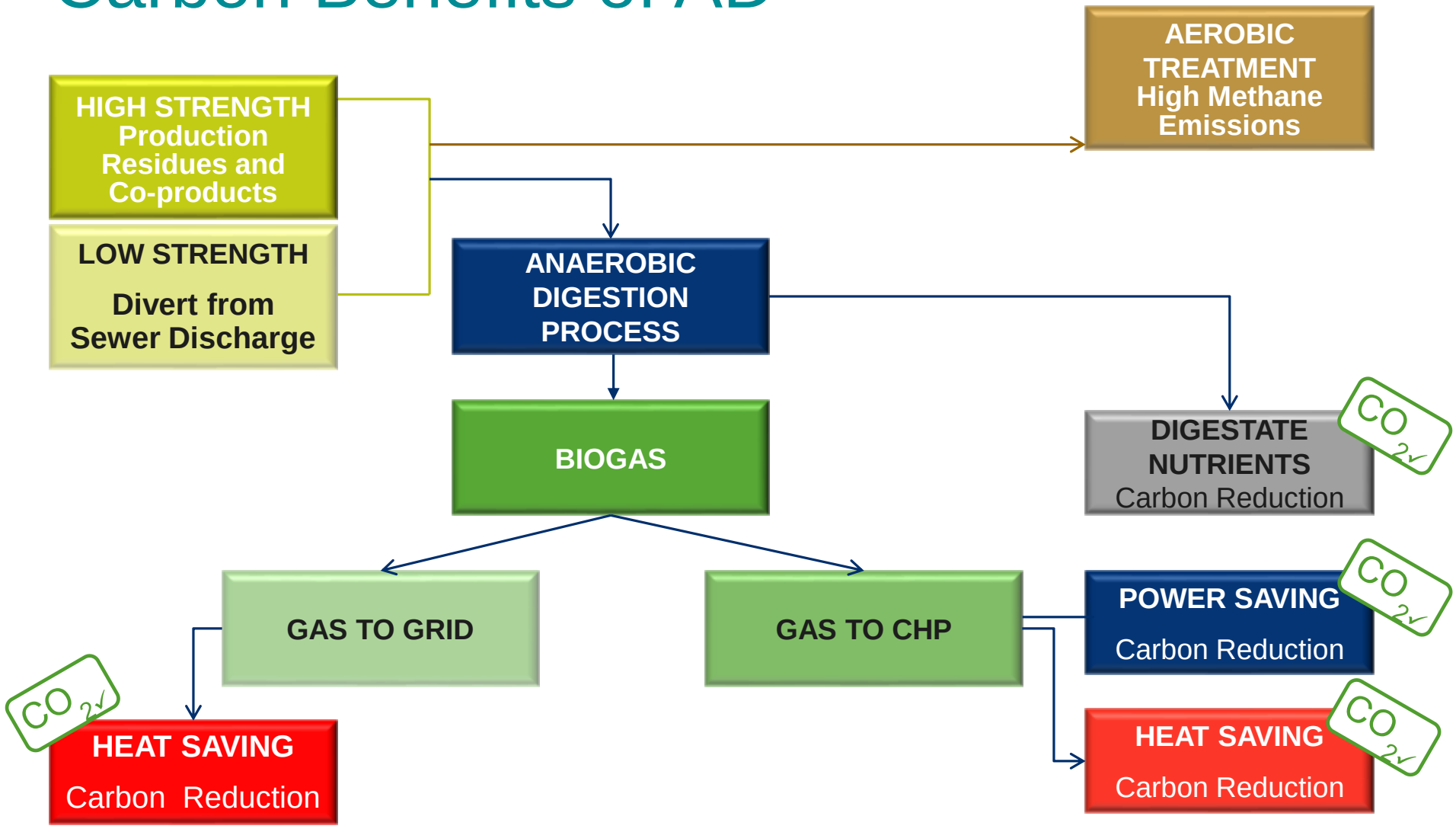
UK AD Market - 3 Core Sectors:

Municipal:	landfill diverted materials diverse feedstocks
Farm:	slurry and crop residues lower cost technology
Industrial:	bio-degradable materials on-site heat & power

Food & Drink Sector Opportunities:

- Escalating energy costs
- Treatment capacity limits
- Effluent discharge consents
- Revenue generation potential
- Scottish ban on landfill disposal

Carbon Benefits of AD



OUR TECHNOLOGY

Liquid waste / wastewaters

- Low dry solids - up to 4%
- COD - 5000mg/l un-concentrated minimum
- Flow - 20m^3 per day min.
- Fats, oils and grease

On-site high-rate treatment

- Pumped to AD plant
- Robust and bio-secure
- Small footprint - closed loop

Plant Deliverables

- On-site electricity / surplus heat
- Energy & carbon saving
- Disposal costs saving

On-Site Digestion for Food Processors

Range of Opportunities:

Lower solids

- Soups and sauces
- Food ingredients
- Fats processors
- Confectionery
- Fruit and jams

Higher solids

- Vegetable growers
- Bakery and starch
- Meat processors
- Ready meals
- Food preparation

Distilling & Brewing

Conversion of Co-products

- Spent grain pressings
- Process residues
- Wash waters

Drivers for Distillery Sites

- Sector expansion
- Energy consumption
- More remote sites

Drivers for Brewers

- Growth of micro brewers
- Energy & carbon
- Confined Industrial sites

Drivers for Bio-fuels

- Energy consumption
- High energy residues
- Environmental impact

CASE STUDY - DAIRY

Client:	BV Dairy
Location:	Shaftesbury, Dorset
Activity:	Independent dairy manufacturer
Build Dates:	Nov 2009 - Sept 2010
Commissioned:	Dec 2010

Key Features:

Material:	200m^3 / day effluent/permeate
Plant:	1,000m^3 digester, external flotation
Energy:	190 kWe combined heat & power
Outputs:	98% COD reduction from 25,400 mg/l 127 Nm^3/hr biogas, 60% methane 20 t/week solid residue (soil improver)
Carbon:	Electricity purchase cut by 60% C0^2 emissions cut by 1,200 t/annum

Material change for a better environment

Awards for Excellence 2011 in recycling and waste management WINNER

CASE STUDY - FOODS

Client:	Nestle
Location:	Fawdon, Newcastle
Activity:	Confectionery
Build dates:	July 2012 - April 2013
Handover:	September 2013

Key Features:

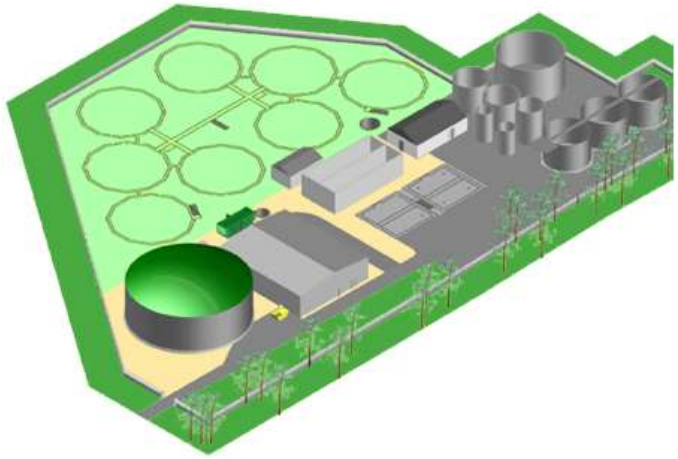
Feedstocks:	275m^3 per day waste water 4t / day solids production residues
Plant:	Solids dissolution, balancing, 1,550m^3 digester, flotation separation
Energy:	305 kWe combined heat & power unit producing 368 kWh surplus heat
Outputs:	95%+ COD reduction from 15,000 mg/l 167 Nm^3/hour, 50% methane 912 kg per day of solids residue

DIAGEO CASE STUDY - DISTILLERY

Client:	Diageo
Location:	Dailuaine, Scotland
Activity:	Distillery & Dark Grains
Build Dates:	Feb 2012 - Oct 2012
Takeover:	February 2013

Key Features:

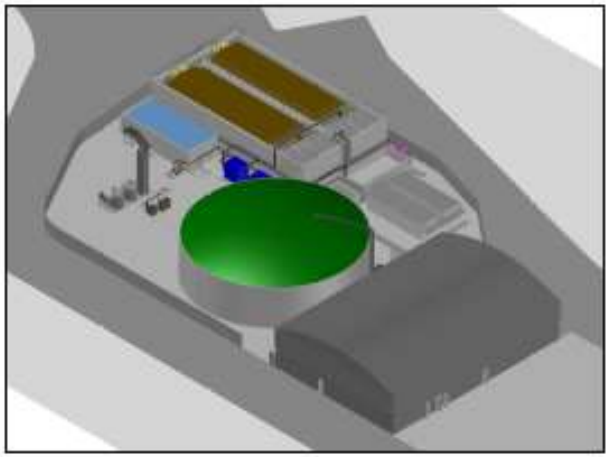
Material:	1,200 m3/day – whisky co-products
Plant:	2,700m3 digester, flotation based solids separation & aerobic treatment (Sequential Batch Reactor)
Energy:	490 kWe combined heat & power
Outputs:	97% COD reduction - river discharge
	270 Nm3/hr biogas, 60% methane
	Solids residue spread to farmland



DIAGEO NEW DISTILLERY PROJECT

Anaerobic Treatment

Location: Dufftown Speyside, Scotland
Activity: Distillery Co-products
Build Dates: Oct 2013 – Dec 2014



DEVELOPING AD IN THE FOOD SECTOR

Technology Profile

- Demonstration sites
- Scale - risk & reward
- Industry awareness

Wider Benefits

- Carbon reduction
- On-site energy
- Water recycling

Future Challenges

- Future of incentives
- Solutions for SMEs
- Scottish technology
- Microbial fuel cells

On site AD – needs FIT/RHI incentives to achieve its potential

ON-SITE TRIALS

Mobile AD Plant Designed for On-site Trials.

Small Scale Production Plant (SSPP)

- Containerised plant
- Feedstock, power & water
- Treats up to 2m³/day
- 9m³ reactor & thickener
- Full process control
- Gas metered & flared off
- Internal lab facilities

Commercial version being developed for smaller sites

Smaller Scale AD Let Down by DECC

FIT Degression Policy Errors

- Stop further FIT degression
- Stop counting un-built plants
- Stop abuse by >500kW plants

FIT Review - DECC Response

- Must support <250kW plants
- New FIT Band for <100kW AD
- Support British companies/jobs

Also RHI degression - ill managed consultation on new Incentive bands for very large (crop fed) gas to grid plants

British AD sector will never reach potential without stable support regime for on-site farm, industry & community plants

Industrial digestion systems need to handle liquid and solid residues, plus by-products, including those containing fats and sugars.

Opportunities for on-site plants in these sectors:

Food and Drink

Dairy

Distilleries

Bio-fuels

On-site AD should combines treatment efficiency with significant cost reduction and carbon savings.

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