

What is the FARM250 AD System ?

Quite simply : a Pollution Control, Biogas Energy and materials recycling system. Converting compostable products into energy using Anaerobic Digestion techniques. The resulting Biogas can be either be converted into Electricity through a generator or be used to power boilers as an alternative to natural gas.

This new generation of anaerobic digester has been designed for smaller, family sized farms and will enable them to be sustainable whilst reducing costs and minimising environmental impact.

Most digesters tend to be larger Single Stage systems, from 200 kW to over 1MW electrical output, to be economic and require tens of thousands of tonnes feedstocks per year such as whole crop cereals and maize. The Farm250 is rated at 30 to 50kW if the main energy output is electricity.

The Farm250 is ideal for organic arable with crop rotation, a 100 to 200 cow dairy, 300 sow piggery, vegetable and/or protected cropping.

There are financial benefits in producing electricity and heat. Plus a reduction of fertiliser costs and diesel fuel used in slurry spreading by absorbing slurry into a smaller amount of digested solids to spread, with its slow release natural fertiliser. The nutrients retained are those that would normally be washed or evaporated away.

Biogas can be upgraded to bio-methane (CNG) for use in heating, cooking, tractors and other road vehicles.

The Farm250 is complimentary to other renewable energy sources, such as wind, solar and micro-hydro. With this new generation of digesters, the farm and local community could meet all its energy and fertiliser needs.

The patented three stage digestion process naturally controls odours, diseases, parasites and weed-seeds.

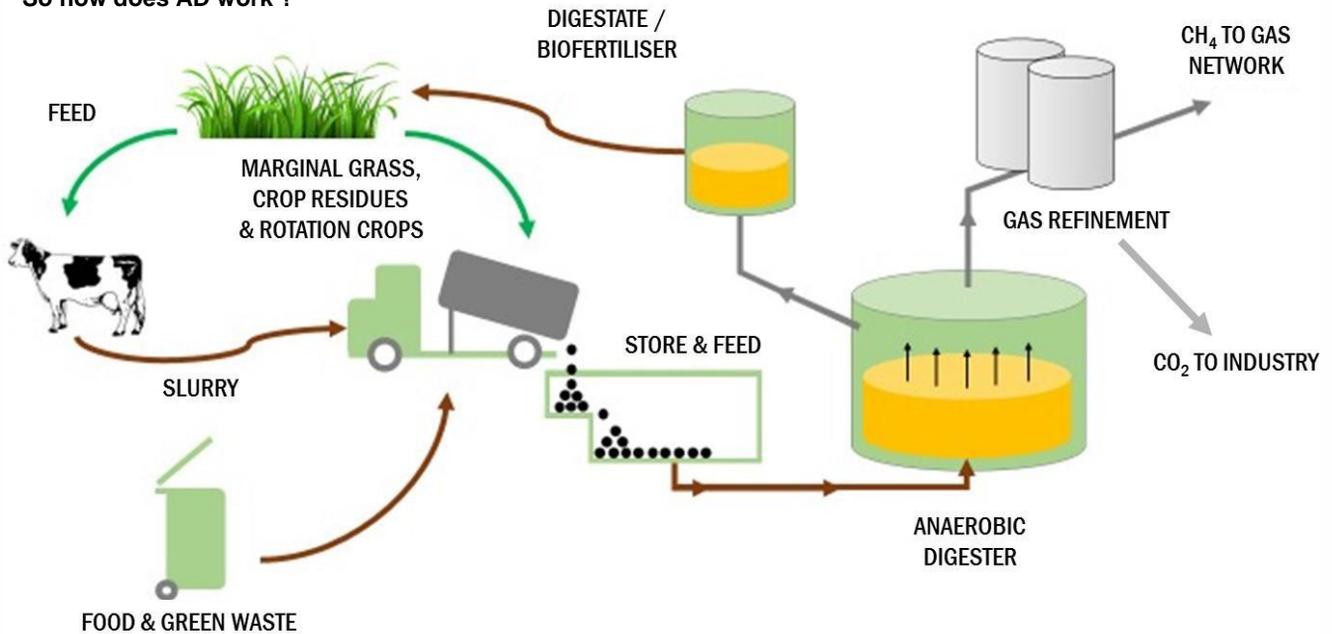
Naturally turning your food, farming, horse stable and garden waste into :-

- Clean Energy
- Slow Release Fertiliser
- Compost

The combined savings made can result in a return on investment in less than 10 Years.



So how does AD work ?



Why use the FARM250 System ?

The FARM250 system is a Patented 3 Stage Digester system. Each unique stage is separated into it's own Process vessel. The advantages of this system are :-

1. Grit removal: Separation of heavy fragments and grit

Most materials treated by an anaerobic digester (AD) contains grits, sand, gravel and other heavy particles, which has caused many expensive digester failures in the UK since 1980.

Grit and other inorganic heavy materials are either brought in with the feedstock or are formed within the digester vessels. With our patented process, with the retention time of 2 - 3 days in the first stage, the heavy particles separate and precipitate to the bottom of the vessel and removed periodically.

The removal of the heavy residues from the first stage is very easy, because the tank can be emptied every two to three days and be open for ventilation. No interruption of the digestion process is required.

2. Patented High Rate Process.

In the first two process steps of the biogas production – hydrolysis and acidification – low pH values prevail. This has the biological acids which dissolve the molecular structures of celluloses and other such materials found in grass, straw and similar high fibre feedstock's.

These are used by bacteria in the later process later to produce biogas. This is difficult in the higher pH values of 7 – 8 as one finds in conventional digesters.

3. Advanced Process Control.

Unlike the traditional one-stage biogas plants whose performance is variable, our process can control the biogas production down to a 30 minute period. This unique feature, developed for the use of bought in energy crops, can optimise energy production whilst preventing the waste of feedstock and biogas.

4. Solid materials as input material for the biogas plant

Horse stable, weeds and farm yard manure (FYM) was one of the first input materials to be used in the our AD plants. Solid manure is rarely used in conventional digesters as it causes problems regarding mixing, grit/sand/stones accumulation and solid layers within.

Higher front end temperatures ensure pathogen, parasite, weed seed and odour control.

The use of high solids materials can lead to little or no excess liquid to deal with - a major advantage.

The process can deal with solid feedstock only, it is not dependent on farm animal slurry.

5. Digestate

The digested materials (digestate) can be separated into solids and liquor. The liquor can be used to replace water when adding to “dry” feedstock’s and any surplus applied to farmland as a liquid fertiliser.

The solid fraction can be composted to produce a natural fertiliser rich compost or with the removal of nutrients from the fibre, a solid fuel similar in calorific value as turf or soft wood. The fuel can be used directly in a wood chip burner, made into briquettes/logs and into pellets.

Replacing slurry spreading with compost spreading is a significant cost saving.



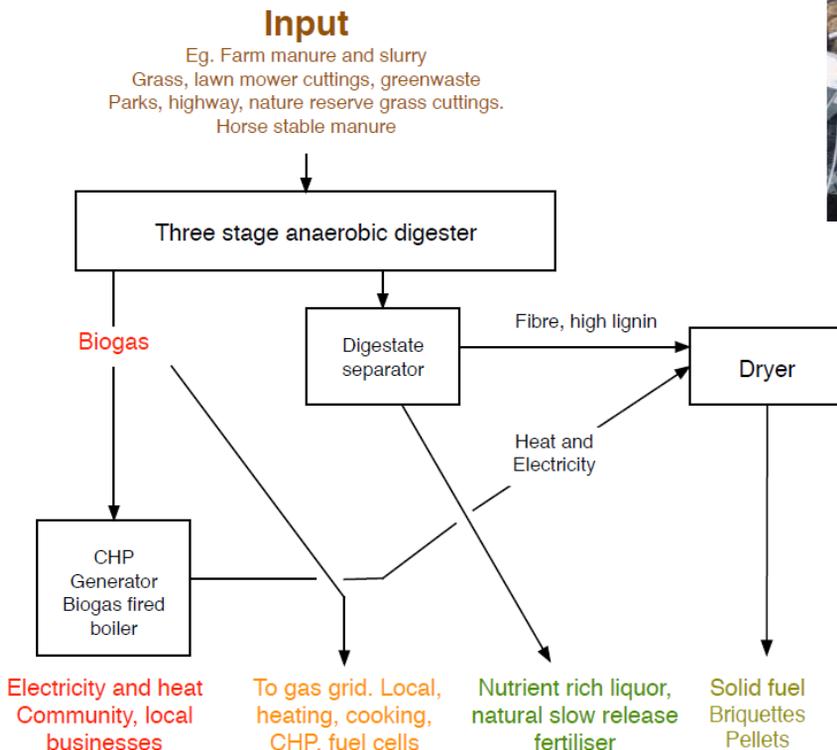
6. Changes in Feedstock

The type of feedstock can be changed daily.

Changing input material is slow with one-stage biogas plants, the adjustment of input material over several weeks or even months is normal.

Hydrolysis bacteria are very sturdy and tolerate disturbances of the process, such as a sudden change in the feedstock. This allows the biogas plant to react flexibly to the supply of available feedstock’s. For example, single batches of weeds, grass and/or straw can be used at short notice.

- At least a 20% increase in biogas production can be expected
- Greater range of feedstock’s including grass silage and straw
- Separation of heavy fragments, with reduced grit build up in the digester.
- Faster throughput, lower retention times = smaller AD plant
- The type of feedstock can be changed every day
- Pathogen, parasite, weed seed and odour control



7. Methane Quality

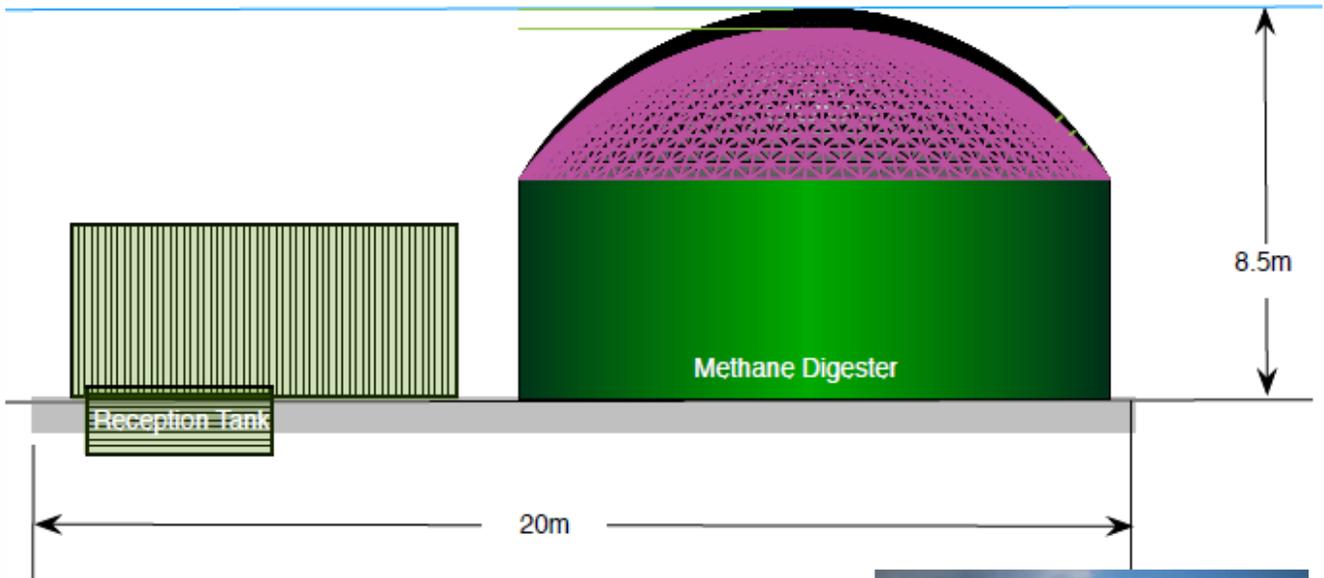
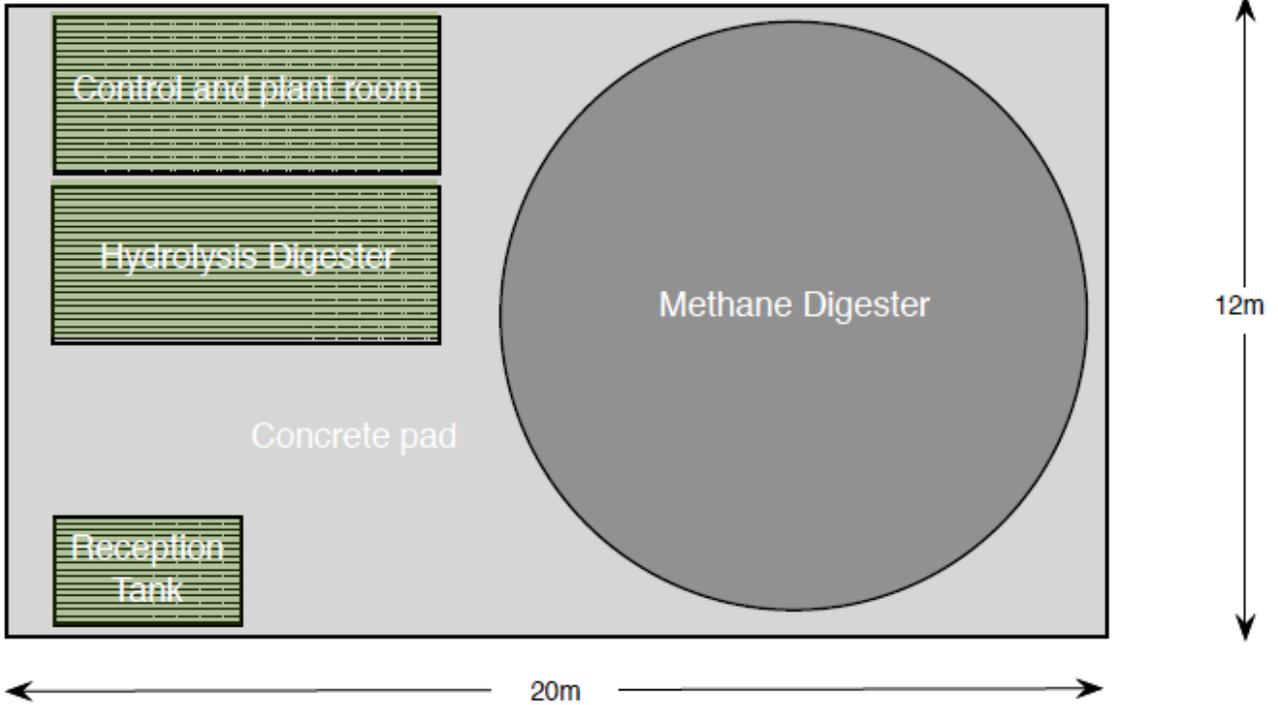
The BioPlex patented 3-Stage FARM250 Digester provides Biogas with ~ 70% methane.*

Conventional systems are only providing 50 to 55% methane.

* The calculation is proven based upon the feedstock chemistry on page 5.



FARM250 Plant Layout.



The FARM250 Digester system is built on a compact concrete base, occupying just 240m² less than the size of a tennis court.

The 3 Stages are easily identifiable and can be maintained independently from one another.

The stages are joined using standard Agricultural pipe work, obtainable anywhere internationally, and the layout can adjusted to suit the location.

The overall height can be reduced to under 5m, by partially installing the Methane Digester below ground level. This enables the plant to comply with planning or conservation requirements.



FARM250 AD Calculation.

120 - 130 Cow Dairy

Feedstock: Slurry, FYM, pasture toppings, waste vegetation, waste silage.

Input data for feedstock, quantity, total and volatile solids: AD Calc 120 cow dairy slurry + FYM 19th April 2018

Feedstock	Tonnes per annum	Tonnes per day	Total Solids	Volatile Solids	Total Solids	Volatile Solids	Biogas per tonne FM
	tpa	tpd		(% of TS)			
	t	t	%	%	kg/d	kg/d	m ³ /t
Cattle slurry	1,500	4.11	8	80	328.77	263.01	25
FYM	750	2.05	30	80	616.44	493.15	120
Maize Silage	0	0.00	32	90	0.00	0.00	210
Rye Silage	0	0.00	37	90	0.00	0.00	200
Whole Crop	0	0.00	28	85	0.00	0.00	150
Fodder Beet	0	0.00	25	85	0.00	0.00	150
Total	2,250	6.16			945.21	756.16	

Note: TS, VS and biogas per tonne FM from SAEI, own results and NNFC.

Volumes of digestion vessels using results from Sheet 1

Soup of the Day	Make up Liquid	Total Active Digester Volume	Reception Tank	Hydrolysis Digester	Methane Digester
t/d	t/d	m ³	m ³	m ³	m ³
7.85	1.68	252	12	20	232

Biogas yield, heat required and outputs

Biogas yield	Heat required	Heat input	Biogas per hour	CHP kWe	CHP kWt	Boiler kWt	Fibre
m ³ /d	kWh/d (max)	kW (max)	m ³ /h				
102.74	274.58	13.73	14.55	29.11	36.39	58.22	472.60
246.58							
349.32							

Feedstock	Tonnes per annum (tpa)	Tonnes per day (tpd)	Nitrogen	Phosphorus	Potassium	N	P	K
			N ₂ (kg t ⁻¹)	P ₂ O ₅ (kg t ⁻¹)	K ₂ O (kg t ⁻¹)	tpa	tpa	tpa
Cattle slurry	1,500	4.11	4.00	1.50	6.00	6.00	2.25	9.00
FYM	750	2.05	6.00	3.20	8.80	4.50	2.40	6.60
Maize Silage	0	0.00	6.00	3.00	8.00	0.00	0.00	0.00
Rye Silage	0	0.00	5.50	1.00	7.00	0.00	0.00	0.00
Whole Crop	0	0.00	4.60	1.90	5.50	0.00	0.00	0.00
Fodder Beet	0	0.00	5.10	1.60	10.00	0.00	0.00	0.00
	2,250	6.16				10.50	4.65	15.60

WINDOVER FARM - INPUTS & OUTPUTS.**At 100% Capacity:**

Slurry from 375 cows or

Slurry from 120 to 250 cows + FYM, spoilt silage, pasture toppings, vegetation waste or

250 to 500 sow piggery + FYM, vegetation waste etc. or

100 to 300 acres of crop and/crop residues.

Estimated biogas output:

Useable gas created by the system based on operating at 100% capacity

Cows 15 tonnes slurry - 12 m³ biogas per hour - 280m³ biogas per day

Pigs 28 tonnes slurry - 13 m³ biogas per hour - 310m³ biogas per day

Crop 5 tonnes feedstock - 25 m³ biogas per hour - 600m³ biogas per day

Windover Dairy (125 cows) - 16 m³ biogas per hour - 380m³ biogas per day

Estimated energy output:

Operating at 100% capacity.

Cows 15 tonnes slurry only (8% Total Solids) per day 22kWe 30kWt

Pigs 28 tonnes slurry only (4.5% TS) per day 25kWe 30kWt

Crops 5 tonnes grass silage (25% TS) per day 50kWe 60kWt

Windover Dairy (125 cows)

Winter: 5.5 tonnes slurry + 2 tonnes FYM 30kWe 35kWt

Summer: 3 tonnes pasture toppings, old silage, FYM

Off grid 6kWe 50kWt

Fertiliser output:

Recovered by the system, estimate based on operating at 100% capacity

Cows 60 Kg. N₂ / 22 Kg. P₂O₂ / 90 Kg. K₂O per day

Pigs 125 Kg. N₂ / 42 Kg. P₂O₂ / 70 Kg. K₂O per day

Crop 30 Kg. N₂ / 10 Kg. P₂O₂ / 45 Kg. K₂O per day

Windover Dairy 35 Kg. N₂ / 15 Kg. P₂O₂ / 51 Kg. K₂O per day

Sulphur remains in the digester liquor and solids only.

Ammonia concentration decreases through the hybrid process.

Compost - fibre 25% TS:

Recovered by the system, estimate based on operating at 100% capacity

Cows 2 tonnes per day

Pigs 2 tonnes per day

Crop 3 tonnes per day

Windover Dairy 1 tonne per day

Note - rough estimate based on feedstock TS content

What is included with the FARM250 System

The system comprises 3 packages :-

1. Hydrolysis Digester

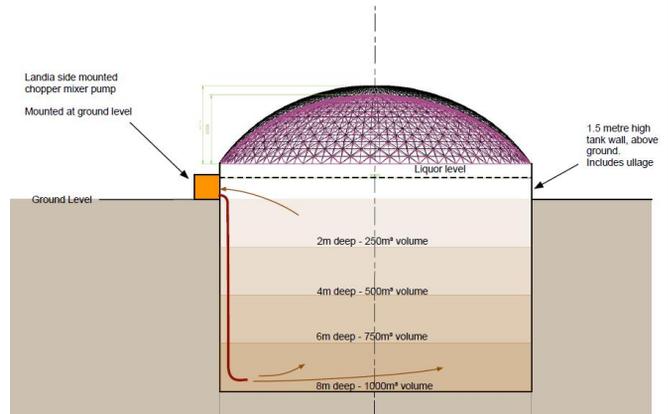
Built using a 20 ft. sized frame. It is fully insulated, lined and contains the heat exchanger as well as the transfer and mixer pumps. The Separator is erected on the roof of the HD unit and removes the digestate from the liquid matter.

2. Methane Digester

The MD unit comprises a modular rugged steel tank which is insulated and lined. The FARM250 comes with a 250m³ Tank .

Larger capacity tanks can be provided by increasing the tank height and erecting below ground level.

The roof to the tank is a Double Layer Inflated PVC Tensile Fabric Membrane. Designed and Engineered to withstand all normal U.K Wind and Snow Load. Site specific engineering is available.



3. Plant Room.

The plant room is built inside a 20 ft. container unit. Plyboard lined with a bulkhead panel. All the Biogas plant controls, wiring, reception tank local control is pre-built into this unit. The unit is earth bonded and supplied with UK test certification. During shipping, the methane digester is flat packed inside the plant room ready for assembly on site.

Engineering Support.

Your FARM250 comes complete with all the support required to get you producing Biogas. An initial Biomethane Test (BMP) will be conducted, system design, project management, system start-up with inoculum and training.

Not Included.

1. Reception Tank – most farms will have one; but we can provide one if required along with a tank mixer, chopper pump and pipework to the digester.
2. Groundwork's, Wiring & Piping – you will need a tennis court sized 25m x 15m concrete pad, site wiring to/from the Biogas Plant, services as well as some fencing and landscaping.
3. Electricity to Grid Connection – required 50kW Biogas CHP generator (with high yield biogas feedstock), grid connection, Biogas boiler, plant for the CHP. These items can be procured and maintained locally to the installation.
4. Off-Grid Energy System – required 12kW Biogas 48v DC generator, 3.2kW Solar Array, 48v Chargers, Invertor Chargers and Battery Bank. These items can be procured and maintained locally to the installation.



Why Biogas ? Why not alternative Energy Sources

Every renewable energy source has it's own distinct advantages and disadvantages. Traditionally we are all conversant with Solar, Wind, and Tidal sources, however these sources are not guaranteed. By this we simply mean, there is no given guarantee that the sun will always shine, there will be sufficient wind or tidal energy.

The one thing in life we can all guarantee is compostable waste :-

- Food Waste
- Green Waste
- Manure

Converting these daily generating wastes into energy can be guaranteed.

By taking these feedstock's and creating energy you can :-

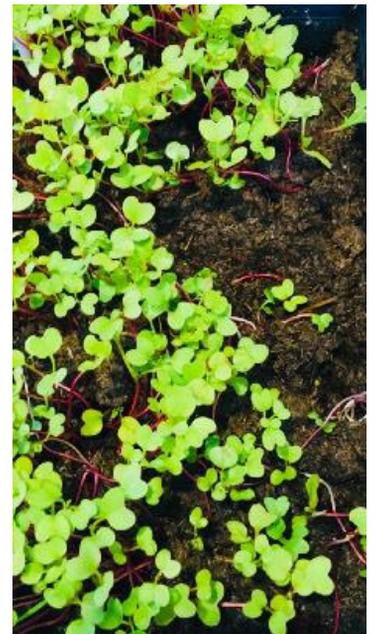
- Reduce your own on site Energy costs
- Reduce waste disposal costs
- Create additional income (from 150 cows typically > £ 40k per annum)
- Become Organic through Closed Loop Farming
- Become diverse



The FARM250 is designed by people who understand and live Agriculture. So many of the components included within the system are Agri-friendly. They can be obtained from local Agricultural dealers or merchants. The cost of ownership and expertise to maintain is no more than a large Tractor !

Environmental Benefits.

- Digestate has high water retention, using this instead of fertilisers aids crops growth
- Significant reduction of agricultural ammonia and sulphur emissions.
- Pasteurisation. Pathogens including livestock diseases inactivated.
- Parasite and weed seed control.
- Odour reduction.
- Feedstock sourced locally from the farm with minimal or no road traffic.
- No nitrogen emissions.
- Increase in organic matter.
- Improved soil structure.
- Biofuels created from AD process can be used to power farm equipment.
- Reduced imported energy to run the farm.
- Improves soil, water & air quality.
- Enhances food productivity.
- Carbon negative.
- Sustainable & indigenous.



For further information

(e) biogas@jjcarter.com (t) 01264 721630