SLIDE 1 - GENERATING ENERGY – THE DRIVERS – POLICIES & OPPORTUNITIES

Delighted to be here today to speak at this conference and provide an outline of the key drivers that will impact the generation of energy in the livestock sector in the future. You know agriculture is hardly recognisable from when I entered the industry 35 years ago and none of us should underestimate the complexity of the issues we now face.

- A diverse range of economic drivers – the volatility we have experienced in global commodity markets in recent weeks is just part of this.
- An increasingly sophisticated end market and
- Increasingly intricate compliance protocols

Just to name a few.

But of course, it is climate change that now grabs the headlines and since the Stern Report was released last year, the whole subject has been taken much more seriously and has become a top priority for Governments worldwide. The impact on society as a whole, and agriculture in particular, are indeed profound.

An NFU survey undertaken to assess farmers' experience of climate change interestingly noted:

- 36% of respondents saw climate change as a threat to their livelihoods.
- But only 17% of respondents saw it as an opportunity.

Bioenergy and climate change are inextricably linked.

SLIDE 2 – KEY DRIVERS

To my mind there are three clear drivers outside the changing economics of commodity markets that will have a significant impact on our farming industry and individual business strategy in the future and these are:

- The Water Framework Directive
- Future Bioenergy Policy
- The Government and consumers' increasing understanding of the science behind global warming and its linkage, perceived or not, with the food they eat.

Of course, agriculture can rightfully be part of the solution to climate change but as **importantly** we need to recognise some of the problems that we generate in order to put the whole matter in true perspective.

But firstly, let's look at these three key drivers.

1. <u>The Water Framework Directive</u>

While there is no doubt that as an industry we have and will continue to make a significant contribution to improving environmental standards, the 'bar' will continue to be raised and in the context of today's conference we will have to:

- Use less fuel in our production processes
- Reduce diffuse pollution levels still further in our water catchements
- Manage the waste we produce more effectively
- Reduce the levels of pesticides and inorganic fertiliser we currently use

In essence, farming will become increasingly regulated and detailed; environmentally sound management will be a pre-requisite for anyone involved in production processes in the longer term.

Now it is not appropriate to say any more on this complex subject today, but the impact for the livestock sector in terms of both the liability, responsibility and the opportunity for waste management is significant and I will look at this area in more detail in a moment.

Turning to the next driver –

2. Bioenergy Policy

Really, I must just put this in perspective. With EU targets of 20% renewable energy by 2020 a new Energy White Paper was announced by the Government in May this year. This was, of course, initiated to meet these challenging new targets.

Given the constraints placed on transport fuels and the lack of policy support for renewable heat, perhaps as much as 35% - 40% of UK electricity will need to come from renewable sources by 2020. This represents a huge 9 – 10 fold increase, assuming smaller proportions for renewable heat (17%) and transport fuels (10%) in order to achieve 20% renewable energy overall. But even this would hardly put the UK on target to reduce carbon emissions by 26% - 32% by 2020 and certainly not 60% by 2050.

So substantial improvements in energy efficiency will be needed as well. The twin drivers of climate change response and sustainable energy targets will raise real opportunities for agriculture:

For example:

- Biogas plants producing electricity and heat.
- Small combined heat and power units.
- Increased opportunities for wind power
- The use of solar photovoltaics to meet some on-farm electricity use.

The proposed revision of our Renewables Obligations will be a major driver – although it will not come into effect until 2009. Banding of the RO will recognise the practical constraints of more mature technology such as on-shore wind power and will help bring forward investment in emerging technologies such as anaerobic digestion, biomas gasification, energy crops and photovoltaics.

While the Bill is currently in consultation, an outcome is expected later this year. At present there is in reality little detail and it would be conjecture to signal the final outcome.

The third and last key driver is the

3. Government's and consumers' understanding of the science behind global warming and its linkage with the food they eat. So, what does this mean? Well, actually to be concise, it is simply Global Warming & our Social Conscience

Well, L&G, we must accept that agriculture is the second largest source of UK greenhouse gases contributing 7% of total emissions. Of this:

SLIDE 3 – AGRICULTURAL EMISSIONS

- 1% is from carbon dioxide (in use of diesel fuel)
- 36% of the UK methane emissions comes from livestock and livestock waste (a greenhouse gas 21 times more potent than carbon dioxide)
- 67% comes from UK's nitrous oxide emissions. A greenhouse gas 310 times more potent than carbon dioxide coming partly from livestock manures, but mainly from the use of artificial fertilisers.

While these will present real challenges for the sector, it will undoubtedly mean that farmers will have to maximise the efficient use of their inputs, protect the large stocks of carbon held in agricultural soils and further drive innovation to mitigate emissions.

So climate change and greenhouse gas emissions may be watchwords of today, but I can assure you our **carbon footprint** will be the watchword of tomorrow.

So, what does it actually mean?

The carbon footprint of a product is the total emissions of greenhouse gases in carbon equivalents produced during its life cycle. While the Carbon Trust have initiated some calculations, it is, at present, far from a precise science; but there will be pressure from

the Government, probably in the form of carbon allowances, which will enable those efficient producers with spare allowances to sell to those who are not as efficient.

However, we can already see that there will be increased downward pressure from the retail sector which will require those below them to look at their business carbon efficiency as they seek to reinforce their own environmental credentials.

With two major retailers already stating their intention to be carbon neutral, almost certainly they will be demanding that their suppliers look at both their energy requirements and impacts before very long. This, I believe, is the 'tip of the iceberg', not just a passing fad, and will have a significant impact on all food producers regardless of scale or sector.

Today, of course, we are focussed on the livestock sector and these drivers should encourage those involved in the sector to look carefully at generating their own energy, as well as reducing the environmental impact of their activities, given that:

- Livestock units are growing in size.

- Nitrate vulnerable zones have increased in area.

- Energy and fertiliser costs are increasing disproportionately to output values.

- With a strong dependence on supermarkets there is an increasing need for producers to develop their 'green credentials' to provide that much needed marketing edge for the future. Otherwise we are destined to become a nation of vegetarians and how boring that would be!

While many may say this is simply a pipedream – I would say the principles have been established and the course is already set. I am sure the following speakers will provide clear examples of what can be achieved. But we must be realistic in that widespread roll

out of bioenergy projects within the sector will depend on incentives, returns and, of course, Government legislation.

Now, I am not going to cover the science behind anaerobic digestion, but suffice to say biogas plants collect and utilise the methane that would otherwise be released into the atmosphere. It is an interesting thought that the manure from 5 cows could produce sufficient electricity for a single household for a year. Under the process of bacterial fermentation 40% - 60% of the organic matter is converted to biogas. A mixture of methane and carbon dioxide is used as a fuel source for both heating and electricity production, the remainder is left as a relatively odour free digestate that can be used as a soil conditioner / fertiliser.

Historically, we have seen poor uptake of AD units in the UK – we currently have 1 centralised unit (Holdsworthy) and around 20 operating on-farm units. Research tells us that the primary barriers to development are:

SLIDE 4 – BARRIERS TO UK BIOGAS DEVELOPMENT

- Poor economic returns
- High capital costs of installation
- Technical problems and the availability of support and research information
- Lack of soft loans
- Little or no external income streams to support the debt
- No incentives from agri-environmental schemes
- No benefits to operators through ‘carbon credits’

So, with only 1 centralised and around 20 operational on-farm units in existence today and with most producing only heat, we clearly lag far behind many other European countries.

So, what have others achieved in Europe? This table is taken from a DEFRA survey in late 2005.

European AD Development

Country	Agricultural AD Plants (No.)
Austria	300
Belgium	6
Denmark	58 + 20 CAD
France	3
Germany	> 3,000
Great Britain	< 20
Ireland	5
Italy	80
Netherlands	12
Swizterland	71

So, let's look at two European countries that have lead the field and see why this is.

Firstly, let's take Germany – there has been a very large uptake of on-farm units since the 1990's with over 3,500 units now operating with a combined capacity of over 800MW. It has been stated that this still only represents 3% of the country's potential for biogas production and they are forecasting that by 2020 this number of plants could rise dramatically to 42,000 with 8,500 MW capacity.

So, what has favoured this development – it is principally economics.

SLIDE 6 – GERMANY – KEY DRIVERS FOR DEVELOPMENT

- For small scale AD system farmers the additional tariff is nearly twice that of ROC in the UK.

Furthermore:

- Additional tariffs are available for CHP (Combined Heat & Power)

- Technological advances enable dry fermentation and co-digestion with energy crops, thereby increasing the overall potential for biogas production.

There was, of course, a great deal of preparatory work undertaken prior to the introduction of legislative drivers in the 1990's – technology has been developed, training made available and financial assistance offered.

In Denmark – the uptake in technology has mainly been focussed on the development of CAD plants with now over 20 operating in the country. The reason why? – Legislation!

SLIDE 7 – DENMARK – KEY DRIVERS FOR CAD DEVELOPMENT

- 6-9 months slurry storage is required in Denmark

- They have very tight restrictions on manure application

- **No** organic wastes are allowed to go to landfill

- Power companies are obliged to purchase electricity produced from Biogas at a pricing structure agreed by law.

SLIDE 8 – DANISH CAD PLANT

- An example of a CAD plant is at Lemvig. Not only is it the largest plant in the world (built in 1992) but it involves 80 farmers collaborating to deal with the slurry from their farms. The plant takes in 362 tonnes of manure and 75t of alternative biomass every day and produce heat and power.

  The capital cost 15 years ago was £5.2m but the Danish Government provided a 40% grant for decentralised storage of digestate - (60 tanks were built). It has been held up as a shining example of what can be done by collaboration and government support.

So in Denmark there has been a real legislative push to develop bioenergy but many of the drivers which we are **now** experiencing in terms of waste management and storage may lead us to the same scenario.

But, of course, this is only part of the story. In Denmark there have been significant Government financial pre-conditions such as:

SLIDE 9 – DANISH FINANCIAL PRE-CONDITIONS

- Government investment grants providing 20% - 40% of costs.

- Biogas and heat from biogas being exempt from energy tax.

- State production grants of DKK 0.27 per KWh of electricity produced.

- Low interest rate, long term loans (20 years) provided.

In addition

- Co-digestion is considered advantageous and supported by the country's environmental authorities.

- Heat sales are made possible through District Heating Systems which are widespread. (8-9 month heating period.)

- The biogas company generally provides the storage facility investment and farmers then rent the capacity they need.

In Germany – the pricing structure was set for 20 years which provided real certainty for any investment and return analysis before initiation. But of course, as I have mentioned, currently over 100,000 ha of crops (wheat & maize) are grown in Germany for biogas, and this area is forecast to **quadruple** within the next four years.

Without doubt, these two countries are the leaders in the field and there is much both producers and Governments can learn from their success which has been driven by co-ordinated legislation and financial and technical support.

A recent survey for DEFRA looking at methane management and recovery options from manure and slurry in the UK concluded that the primary targets for methane reduction by AD would be dairy units in the West and pig units in the East, simply because of the volume of feedstock required.

So, L&G, what are the real challenges to developing AD and CAD systems for the livestock sector in the UK?

SLIDE 10 – CHALLENGES FOR AD IN UK?

- Firstly, a steady source of feedstock. The Landfill Directive will, of course, put increasing pressure on other forms of waste disposal, although AD will need to be a cost competitive alternative.

While much of the treated slurry would be sent back to livestock farms, a revenue stream from the sale of digestate would be financially most beneficial; **but** regulations surrounding the required standards (and agreement on who sets them) would need to be put in place. Currently this is not in place.

- Market economics favour the use of biogas for electricity generation – why? because AD falls under the Renewable Obligations. The use of heat produced can, of course, only have a local value because of the high cost of connection to properties.

- While the value of the energy market in the UK has recently been at an all time high, it is volatile as we have seen these last few months. So, both the perceived and actual risks to those that invest are high.

- AD has an advantage of being a 'base load' generator and therefore quite importantly can add to the security of both energy supply and our grid stability.

However, there are technical problems and high costs associated with grid connection. The issue of both grid connection and market volatility are likely to be more significant to on-farm AD plants because of the relative scale of the units and their potential output.

- While local heat from electric generation may attract additional income, the cost of transporting it is high and therefore the realised value in most instances is minimal or zero! The availability of district heating systems in Denmark has made CAD highly successful there.

- In the UK the Community Energy programme does offer grants to develop district heating systems but the uptake and development has been very limited.

- Lastly, there is the cost of financing a project. **All** AD plants require relatively significant capital expenditure and pay backs are generally long term.

So, what are the Government incentives that are in place today?

- Renewable Obligation / ROC's – new banding in 2009
- CCL exemption
- Landfill tax

The Enhanced Capital Allowance Scheme is currently operated for water and energy technologies. AD fits this category, thus there is an urgent need for suppliers of AD plant and systems to include their equipment on the Technology List so that investors can benefit from ECA's.

SLIDE 11 – REDUCING THE RISK

Risk and its management is, as always, key. This slide demonstrates what can happen when probability is high and severity quite serious. So, the real key to encouraging investment is to **reduce risk** through long term guarantees on income, capital grants and / or favourable loans. These currently do **not** exist in the UK. While there are bio-energy grants for biomass fuelled heat and combined heat and power projects; opportunities for applications have so far been held for a period of 10 weeks each year. Grants of between £25k - £1m are awarded over a 5 year period at a rate of up to 40% of the difference between bio-energy and fossil fuel.

Of course, there are still other drivers associated with the acceptance of the technology and economics by farmers, the public and Government and these would need to be addressed. However, commercial exploitation of AD would be more attractive if:

- Reliability of a supply of feedstock could be guaranteed - crops and biomas may prove to be the solution as found in Germany; but again this adds more pressure to the production of food versus fuel debate which is already gaining momentum with construction of ethanol plants on our East Coast that will take 3 million tonnes of grain.

- Secondly, if technology was developed to make systems more efficient in power production and automation of use.

- Thirdly, if access to wider markets for digestate could be made easier.

- Fourthly, if closer links were established with the disposal of industrial and municipal waste, thereby providing 'gate fee' income which simply is **not** forthcoming from the intake of livestock slurries.

- And finally, if access was provided to the heat supply market, particularly in new residential developments.

So, in summary to realise the potential for this specific area of generating energy, we desperately need a joined up strategy to plan, support and secure this market for the future. It can make a valuable contribution to energy production, a reduction in methane gas emissions, as well as reducing diffuse pollution in our water catchments.

Well, I make no excuses for focussing today's paper on biogas and AD systems due to the added environmental benefits of using this technology. However, I must now make mention of both wind and solar power.

SLIDE 12 – POTENTIAL FOR WIND

Taking wind first – globally the wind market grew by 32% in 2006. Germany remains the clear leader, although the UK is now positioned 8th in the world.

The UK has the best wind resource in Europe, an asset that has the potential to provide a considerable proportion of the UK energy market in the future.

DTI estimates that by 2050, up to 30% - 40% of the UK's electricity generation could be produced by small and micro generation technologies, including 6% from small wind energy generation. Small scale renewable energy technologies generate clean and

renewable energy with no harmful emissions. Clearly, there is an enormous opportunity for farmers to reduce power costs and improve their 'green credentials' for the marketing of produce. I know we will hear more about this from Karin later this morning.

There is, of course, an array of uses for wind turbines that are standalone and **not** connected to the grid.

SLIDE 13 – STANDALONE OPPORTUNITIES

- Wind powered water pumps
- Remote electric fencer units
- Power for isolated dwelling houses and stock buildings
- Cold storage for agricultural produce

To name just a few.

There are grants available under the Low Carbon Building Programme and there are three schemes with grants ranging from £5,000 up to £1 million, but the latter would be, in effect, for large scale building projects. Anyone looking at wind power should make contact with Low Carbon Building Programme concerning their eligibility for financial support.

Like AD – producing power from wind that can be fed into the grid will have a much higher capital cost and the pure financial viability will depend on the energy contracts available and the cost of connection to the grid.

Climate change and concerns over energy security mean that the UK will need a mix of renewable energy technologies, both small and large scale, and wind power will undoubtedly have its place. Fully evaluating the full costs of investment and the likely pay-back period is an essential fundamental before any decision is made.

Finally, I must say a few words on solar energy. Photovoltaic systems use energy from the sun to generate electricity. PV only requires daylight **not** sunlight so will generate some power on cloudy days.

SLIDE 14 – PHOTOVOLTAIC GENERATION

This picture illustrates what can be achieved on a field scale in Spain. In the UK the development will more likely be based around roof systems.

So, how does it work?

There are one or two layers of semi-conducting material, usually silicon. Light creates an electric field across the layers causing electricity to flow. The greater the intensity, the greater the flow – quite simple really.

Depending on scale, you could see returns of 2% - 3% at today's energy prices. Again, the Low Carbon Building Programme is the body that deal with grants on installation.

The key issue and the limiting factor on growth in this sector has, in fact, been the shortage of silicon. Like most forms of renewable power, Germany leads both in technology and use. As technology advances, we could see the development of its use in intensive livestock units in the UK but to date uptake is minimal.

So, L&G, let me try and draw all these thoughts and ideas to a sensible conclusion.

Today, I hope we will have taken one small step forward in raising awareness of the opportunities in generating renewable energy and providing some momentum to take some of these initiatives forward.

There is great potential for generating power on livestock farms both to reduce costs and provide income but:

SLIDE 15 – POTENTIAL FOR POWER GENERATION

- First, in terms of AD - farms need to collaborate

- Secondly, government needs to provide greater financial incentives which are straightforward to access. The present key arrangements are certainly both difficult to understand and not straightforward to access.

- Thirdly, research needs to develop more cost effective / innovative technology.

We know DEFRA are looking at this whole issue very carefully. The latest study by ERM showed that one of the largest potentials for energy recovery is through AD of agricultural slurry and manure.

Ladies and gentlemen, our goal must be to reduce our carbon footprint while improving our environmental credentials, not only to meet current and future legislation but also to develop the marketability of our produce. Managing our carbon footprint will, I am sure, become a 'given' for supplying the food sector in the future.

Our society needs agriculture now more than ever before. Yes, we can provide solutions which is great news, but we must be aware of the pitfalls as well as the dangers of getting left behind.

Quite a challenge for us L&G. Andrew and Karin will, I am sure, inspire you even more to think about the opportunities. But to be in a position to exploit these opportunities, we will have to lobby our political masters very hard.

SLIDE 16 - SUMMARY

We are already 15 years behind the market leaders – Germany and Denmark. We need a clear Government strategy to support the development of energy generation. Such a strategy would need to encompass finance, legislation and local planning issues of

energy generation. Additionally, we need the Government to provide an environment which gives us and our financiers the confidence to invest.

The Energy White Paper does go some way to support the NFU view that every farmer should have the opportunity to become a net exporter of energy, but at present the whole renewable sector seems stalled by a compendium of different measures with insufficient clarity to help an individual initiate a project. After all, simplistically, it's development is about risk and reward.

Today, the market could be stalled by a lack of Government commitment. Agriculture could play a key role in reducing UK emissions thus mitigating the effects of climate change.

Thank you for listening so patiently. I very much hope this sets the scene for the papers that follow.