

YORKSHIRE & THE HUMBER FARMER & RESEARCHER GROUP

Minutes of a Meeting of the Food and Farming Forum Farmer Group

Trip to: West Beacon Farm, Woodhouse Eaves, Loughborough, LE12 8TE, by kind permission of Professor Tony Marmont.

On Tuesday 19th October 2010 – Renewables

Farmer Group Members:

Steve Willis (Chair)
Jim Williams
Rob Copley
Gareth Gaunt
David Hugill
Stephen Ramsden
Geoff Sykes

Present:

John Hughes (FERA)
Angus Gaudie (Stamfrey Farm)

Secretariat:

Deborah Hare (Project Manager)

Apologies for absence

Keith Blenkiron
Peter Bainbridge
Anna Longthorp
David Airey
Tim Dunn
Richard Houseman
Chris Redfearn

1. **Sustainable Agricultural Partnership Conference in San Francisco, (held 10-11th August), attended by David Hugill**

David Hugill attended the Sustainable Agricultural Partnership representing the Food and Farming Forum. David reported back to the farmer group with key messages from the conference.

David reported that there were many issues discussed during the two days as they debated the various components of sustainability. He said it soon became clear that the North America farmer's idea of sustainability did not match that of others in the building. David quoted that one person said "We do not need to pay people to measure our carbon footprint" and another said "I am the third generation on my farm, do you think I am not going to work hard to preserve topsoil and prevent nutrient loss so that my children can follow in my footsteps".

David explained that supply chains were very much to the fore and some of the best presenters were those with a story to tell on how their producers were striving to farm sustainably. The need to update skills was seen as important. Alison Dennis from Burgerville, a restaurant chain with a strap line of Fresh Local and Sustainable based in Washington and Oregon States saw farmers who had good communication skills as being vital for the supply chain. David quoted Ms Dennis saying "Farmers have a good story to tell and the last thing I want is when someone puts a microphone in front of them is that they go quiet".

The relationship between suppliers and supermarkets are key to sustainability. The world's largest banana exporter recalled a deal with a UK supermarket where the price offered was below the cost of production for the third world farmers who grew the product. This led to a chain reaction in the UK with other supermarkets stating their obligation to their customers of matching the price of their competitors.

David reported that bio technology can play a vital part in future sustainability. There was plenty of GM debate over the two days. He said there is probably more opposition to GM in the US than over here, mainly due to the fact that it is happening right now. Some farmers were seeing or hearing of breakdowns in the form of pest resistance leading to using more pesticides. The group commented that is it right that so much of the global GM crop is controlled by one company? Angus Gaudie said there will be issues about developing resistance to pesticides and said there will be parts of GM that we cannot manage without, but at the same time there will be some GM that causes the problems. Gareth Gaunt gave the example that we do not want willow resistant to rusts but wanted willow varieties to tolerate rust, therefore need to find another way around it.

David reported that bio pesticides reduce the amount of chemical used to produce a crop by using bacteria, fungi and other natural products to control pests and weeds. As one delegate observed, in an age when there is an obsession to show low carbon figures on food labels surely low in chemicals would sit better with consumers.

David said whenever he returns from a visit to the States he is always asked about carbon trading. He said that it is happening but still in pockets rather than "across the piste" but the early adopters to carbon farming are being penalised as they have already sequestered their carbon before the trading was introduced. Protocols are being researched and written which farmers need to adhere to prove they are entitled to sell credits.

Gareth Gaunt remarked that in the States there a lot of problems with water and questioned if that came up at the conference. David said when he flew in over the desert he could see the irrigators and remarked that with the need to produce enough food for the growing population the desert needed to be used. Consolidating water to be used for irrigation was covered at the conference; a presentation was given on taking the salt out of the water (desalination) and David commented that a lot of Nuffield Scholars are looking into issues around desalination.

Angus Gaudie remarked that unless the world population numbers start to level there will be a point when we cannot produce enough food. Steve Willis commented that in countries such as Africa they are bringing in vaccination programmes which is a way of controlling the birth rate, families may now only have 1 or 2 children where as previously they were having around 10 children.

David is attending the next Sustainable Agricultural Partnership conference which is held in London in 7-8th December 2010, where he will be speaking on 'mob grazing' and other

farming practices to reduce the carbon footprint of agriculture. See the website for further details www.sustainable-agricultural-partnerships.com

2. **Tour of West Beacon Farm by Andy Barton**

West Beacon Farm is an integrated sustainable energy generation network. Refer to the website www.beaconenergy.co.uk for further useful information.

Andy Barton was the tour guide for the session providing the group with an in-depth, informative insight into the farms renewable energy systems and future ideas. Andy explained the systems the farm has built up over the last 25 years to find alternative ways of generating energy. Most of the technology used at West Beacon Farm is quite often pre-commercial bringing with it trial work and problem solving, with the aim to help inform future technological developments.

Heat Pump

Initially a heat pump was bought to heat the house, this works like a fridge in reverse. The lake serves as the source for the heat pump, thereby the lake is cooled. During winter the water on the surface of the lake stays frozen a little bit longer. The pump uses 4kW electricity to produce 10kW heat. The pump has been running for 20 years but is inefficient as it uses a lot of electricity.

Combined Heat and Power Unit

This unit is used when there is not enough power. It produces electricity and heat that is useable. The unit runs on propane and they have looked to use hydrogen. The group asked if the units were commercial and affordable, Andy said they have to be of a certain size, if using 15kW they can be viable. It was questioned what happens if the national grid shut down, Andy explained they are on 3 phase and have a DC link.

Wind turbines

Two wind turbines (each at 25kW) were bought, and have been installed for about 20 years. They are 2 bladed and the blades are made out of fiberglass. There is a small laptop located in one of the turbines to capture data. The turbines are made to run at one speed but they control the speed, this increases the efficiency generating an extra 1kW of power. They are very robust. There is a gear box which is used as wind speed increases. They breakdown on average once every 18months, for servicing they can be tipped over.

The turbines generate power when not required and vice versa. They have used battery storage, so when there is a peak of wind power the energy is stored. Managing this is a difficult problem and Andy explained they have been working on it for a long time, he said they are almost there but then they have been saying that for nearly 10 years.

Andy said they compare the output of the wind turbines to other sites. They have data for seven years history of wind speeds and solar, and they log participation manually.

Hydro power

There is a small hydro station on the farm generating about 1kW of power. Andy commented that the archimedean screw is the most efficient. There are two water turbine systems in the station, one uses water from the lake the other uses water from the stream. There was not enough water flow in the stream therefore they created the lake. From the lake there is a pipe running down the hill to the generator, the water flow from the lake is at a height of 18m. The generator powered by the lake cuts in as the water levels rise in the lake, around 4pm daily they let the lake levels drop. This system does not run that much for the infrastructure that was put in. The group was shown the

water filter in the stream, this keeps the stream free of leaves and twigs, Andy said they have never had a blockage in it and it is designed to self clean.

Solar – Photovoltaic (PV)

There are two sets of PV panels, poly-crystalline cells and mono-crystalline, both rated at 3kW. This system is about 90% efficient from when they were put in 20 years ago, and there is virtually no maintenance. The Solar PV systems need to be south facing. There is an option with this system for it to occupy roof space, they make good roofing material as they are waterproof. Free standing systems require planning. The domestic scale Feed in Tariff (FIT) is 35p/unit for a 4kW system therefore the return is about 7%.

The group asked Andy how they worked and he explained that the panels are black to absorb the light, the light excites electrons in the semi conductor which pumps electrons to drive the electric current. On a dull day they are about 5% efficient and the performance actually reduces when the weather is too hot. Andy commented that Professor Tony Marmont has a residence in Arizona and the PV system at West Beacon Farm can generate as much power as the one in Arizona.

The group asked how much a system would cost, Andy has had some recent quotes and said a 4kW system fully installed varied from £17.5 – 19.5K. From that you can earn around £1700/year including the FIT. Andy stressed that to claim FITs the product needs to be certified and the installation needs to be certified under the Microgeneration Certification scheme (MCS).

There is also a solar thermal unit on the garage which can generate up to 7kW / day of heat.

Andy said the solar PV is the best generator of energy and advised to make sure the house is well insulated first.

Water conservation

In the garage there is a water purifier, it has a backwash on the filter and takes the impurities out of the rainwater. A unit costs around £150.

Energy Storage - Hydrogen

Renewable energy generation is dependent on the weather, therefore an irregular supply. There is battery storage at the farm and this provides a few days energy storage. Andy explained how Professor Tony Marmont and Loughborough University have looked at ways of longer, larger scale energy storage from the renewable systems to balance the surplus and deficit of energy. There is a process which involves the electrical integration of renewable energy into stand alone systems incorporating hydrogen storage.

Surplus electricity is used to power a process called electrolysis, this divides water into hydrogen and oxygen, the gases are then stored in pressurized tanks. Andy showed the group the equipment, noting numerous pressure regulators and valves and commented that with hydrogen they have to keep cleaning the pipelines out and as hydrogen has a small molecular size the pipe work is vulnerable to leakage. They noticed they were using a large voltage of electricity during the electrolysis process and have looked at developing electrolyser technology to convert renewable energy into hydrogen fuel more efficiently.

Fuel cells are used to convert hydrogen back into electricity. A hydrogen fuel cell uses hydrogen as its fuel which is recombined with oxygen and as a result generates electricity and hot water. At West Beacon Farm they have been working with two different

fuel cells, one was manufactured in the United States the other in Loughborough. Andy informed the group that a typical fuel cell costs around £10K. Fuel cells can operate continuously as long as the necessary reactant and oxidant flows are maintained. They found that the fuel cells were only lasting about 400-600hrs then they would go flat, the main stack inside was burning out. It was costing about £700 to repair them. Only when there was 300-400kW did the fuel cell become more efficient. Andy said fuel cells need to be run at least 1hr a day or the plates dry out.

The group were shown the 48 steel hydrogen storage cylinders on the farm, these can store about 3 weeks worth of stored electricity for the site. Andy highlighted that they have to have all the appropriate safety equipment in place when dealing with this type of system.

Unfortunately this hydrogen and renewable integration project is flawed as the storage requires too much energy. All of the equipment from West Beacon Farm is going to be moved to Loughborough University for the students to continue work with it to see if it could be made to work. Andy said there could be a future for it but it is quite a way off.

The group was shown the main computer on the site which controls the energy generated from the various systems. This is currently a manual system as they have to use a reset button, but they are aiming towards an automatic system.

The Farm House

The house has been fitted with many innovate energy systems including a ground source heating and cooling system and a rainwater harvesting system. More recently the outside of the house has been insulated with an 'e-skin' using strawbales, this has provided double the insulation whilst leaving the inside of the house untouched.

Electric and Hybrid Cars

At West Beacon Farm there is a solectra electric car which can do speeds around 70mph and a hybrid car which combines a petrol engine with an electric motor.

Professor Tony Marmont

We were delighted to be joined by Professor Tony Marmont towards the end of the tour, he provided the group with a very informative brief overview of the ongoing work.

Tony used to be a pilot and it was when he noticed the ice caps on the Alps receding and other changes to the global environment that he became very interested in climate change and renewable energy.

Tony reiterated the fact that they need to be able to store the renewable energy and the issues they have had with the hydrogen storage project, in that the fuel cells kept breaking down.

Tony shared with the group the interesting concept of Air Fuel Synthesis Ltd. With oil becoming in short supply and in excess of \$200 / barrel, the aim is to produce transport fuel using carbon dioxide from the air and hydrogen from water. The objective is not to make money but to save the planet.

The fuel is made by a Fischer-Tropsch (FT) process which involves the use of a carbon feedstock, a sustainable source of this is carbon dioxide from the atmosphere (wind farm). The question is how to extract carbon dioxide from the air. A research project is looking at using sodium hydroxide to be sprayed on the air, this reacts with the carbon dioxide and forms sodium carbonate. This solution is pumped to a special electrolytic cell

where an applied current causes the carbon dioxide to be released. The carbon dioxide and hydrogen then go through the FT process to make the synthetic fuel.

Tony is now building a pilot plant costing around £1million, the plant will produce 10 tons of synthetic fuel per day and this will then be scaled up. To make all UK oil as synthetic they would need to produce 140,000 tons of oil per day. For this type of plant there is no raw material cost, just depreciation, maintenance and insurance costs.

Tony has a meeting with the Energy Minister at the Department of Energy and Climate Change in November. The Government is concerned about energy security and Tony referred to Shells Annual Report 2009, page 8 quoting that insecurity of supply in 2015 will lead to social disturbance.

Tony and his team are talking to people in China, Malaysia, America and other countries, they believe Britain is too small to conquer this on its own and have persuaded five different groups throughout the world to work on this project. Tony informed the group that atmospheric fuel is about 15 months away; they will build the prototype, make mistakes and learn from it.

See the website for further information www.airfuelsynthesis.com