

# DELIVERING BRITAIN'S CLEAN ENERGY FROM THE LAND



# JOINT STATEMENT BY THE PRESIDENTS OF THE UK FARMING UNIONS

Agriculture has a unique role to play in implementing the historic 2015 Paris Agreement on climate change, which takes effect internationally this year. Our industry supplies food, stores carbon and generates renewable energy, but farming is also on the frontline of climate change impacts, being particularly vulnerable to extreme weather events. However, British agriculture can address the challenge of producing for the future as well as tackling climate change.

Our declaration prior to the Paris Summit included a key ask on mobilising the huge potential of land-based renewables to deliver clean energy, contribute to national energy security, diversify farm businesses and bring additional benefits to the environment.

This booklet of 22 case studies, published ahead of the COP22 climate talks in Morocco, showcases our strong dynamic industry delivering on this potential. Our members have embraced a diversity of technologies at different scales to meet the needs of their business and the country. And we are confident that we can do even more in the years to come...



Mervyn Raymond

Stephen James

W. Allan Davis

John Williams

Farming's role in the UK economy has always been diverse: food, fibre, environmental stewardship and increasingly energy production, meeting both local and national needs. Modern, forward-looking farmers are integrating energy and food production to build businesses that are both environmentally sustainable and economically viable. Diversification into low-carbon renewable energy services of all kinds offers our farmer and grower members stable and predictable returns, making their agricultural businesses more resilient with a broader portfolio of enterprises for the next generation of farmers.

With three-quarters of British land area in the agricultural sector, our farmers can become energy producers in their own right, or hosts for energy plant developed by others. The biggest renewable energy resources available to agriculture are bioenergy (biomass, biofuels, biogas), wind power and solar photovoltaics – increasingly linked to battery energy storage. Renewables already account for over a quarter of UK electricity production and it is estimated that farmers own or host over half of the UK's solar power and anaerobic digestion capacity, as well as the majority of wind power. They also play a significant role in the supply or fuelling of renewable heat.

Although national government policy has recently been reducing the level of incentives available for low-carbon energy, further growth in agricultural renewables will be driven by the substantial reduction in costs experienced by some renewables (especially solar PV), and the emergence of other, new complementary technologies and applications. Renewable energy production has indeed become part of the agricultural growth agenda - a competitive investment as costs come down and the maturing industry becomes more self-sufficient, circumventing the need for Government support.



**SOLAR**



**WIND**



**BIO AD**



**BIOMASS**



**BIOFUELS**



**HYDRO**



**HEAT PUMP**



**STORAGE**





# SOLAR - ROOF MOUNTED (SMALL)

**NAME:** Robert Brunt (NFU Environment Forum)

**REGION:** England – North West

**SECTOR:** Mixed livestock and dairy

**SIZE:** 182 hectares farmed



## TECHNOLOGY:

10 kW solar panels installed in 2014

Produces 8,400 kWh electricity units per annum

10% of farm electricity demand is generated from solar power

## INVESTMENT:

£17,000

## PAYBACK:

A return of 12% on purchase price

## WHAT:

10 kilowatt, roof-mounted solar panels

## WHY:

It offered a good return on his investment

To reduce greenhouse gas emissions and lower the farm's carbon footprint

*"I believe I have an important role in helping manage and look after our beautiful landscape and countryside"*

## BENEFITS:

Complements other energy-saving practices:

- Water in a plate cooler is used to pre-cool milk and is then reused for washing down the parlour or for drinking water for the cattle
- The heat recovered from a fridge is used to warm the water used for washing and calf feeding, again saving electricity

Improves the carbon footprint of the farm

A fair return which helps support the farm business

1/4

of UK electricity is renewable today, and already about 10% of our national electricity production is from the land - wind, solar, biogas, straw, etc.

# SOLAR - ROOF MOUNTED (MEDIUM)



**NAME:** Mike McLaren

**REGION:** Scotland – Perthshire

**SECTOR:** Potatoes, broccoli and cereals

**SIZE:** 1052 hectares farmed



## WHAT:

Installed two solar photovoltaic schemes and an energy management system to reduce on-site energy use by potato and broccoli chillers

## WHY:

To off-set high energy costs of chilling crops

Energy independence

Implemented the energy management system to maximise returns

## BENEFITS:

Using approximately 70% of the electricity generated from their solar systems

Secure annual income

Consume less fossil fuels and save energy costs

## TECHNOLOGY:

Two PV schemes totalling 250 kW – 176 kW installed in 2013 and 74 kW installed in 2015

In 2015 the PV array produced 220,000 kWh achieving 880 kWh per kW of installed capacity

## INVESTMENT:

£220,000

## PAYBACK:

8-9 years (with change in Feed-in Tariff rates)

Farmers and growers own or host about

# 60%

of UK solar power – over 950 solar farms and more than 16,000 solar rooftops





# SOLAR - GROUND MOUNTED (MEDIUM)

**NAME:** Nigel and Patrick Joice

**REGION:** England - East Anglia

**SECTOR:** Poultry (broilers)

**SIZE:** 117 hectares farmed



## TECHNOLOGY:

300 kW- about 1200 modules  
- installed in 2013

## INVESTMENT:

£250,000 (in 2016 prices)

## PAYBACK:

Less than 10 years

## WHAT:

Ground-mounted solar photovoltaic arrays for on-site electricity needs

## WHY:

Energy independence for large broiler poultry enterprise

Complements poultry litter biomass heating plant

## BENEFITS:

Together with another 150kW on shed roofs, designed to meet 90% of daytime electricity needs on an annual basis

Insulates business from volatile energy costs

Installed on unused land close to poultry sheds

Easy access for maintenance compared with roof-mounted solar

Britain has nearly 1000 solar farms, which presently generate enough electricity annually to run

**1.5 MILLION HOMES**

# SOLAR - FLOATING (MEDIUM)



**NAME:** Mark Bennett

**REGION:** England – South East

**SECTOR:** Horticulture (soft fruit)

**SIZE:** 121 hectares farmed



## TECHNOLOGY:

Installed in 2014

200 kWp capacity

Expected electrical generation – of 197,000 kWh/year

103,000 CO<sub>2</sub>kg saved/year

## INVESTMENT:

£250,000

## PAYBACK:

6-7 years

## WHAT:

Sheeplands Farm was the first site in the UK to install floating solar photovoltaic panels

800 panels spanning half an hectare, mounted on polyethylene floats on the farm reservoir

## WHY:

Enables the farm to increase its energy independence without using up valuable land space

Complements 3 existing 50 kilowatt systems already on site

## BENEFITS:

Allows the farm to utilise its 60 million litre irrigation reservoir for on-site generation of renewable electricity powering reservoir pumps, a soft fruit production fridge, tractor workshop and industrial units

Floating panels perform more efficiently than similarly sized land-based panels due to the cooling effects of the water

Panels are fitted with solar-powered aerators which help to help naturally reduce algae growth in the water and are UV and corrosion resistant

Farmer has diversified into marketing floating solar systems for farm and utility-scale reservoirs, fish farms, mining, etc.

MORE THAN 1/3

of farmers and growers are using the sun, wind, farm by-products and energy crops to produce clean, low-carbon energy





# SOLAR - GROUND-MOUNTED (LARGE, GRAZED)

**NAME:** Stephen and Clare Morgan

**REGION:** Wales – Pembrokeshire

**SECTOR:** Mixed farm, livestock and poultry (eggs)

**SIZE:** 120 hectares farmed



## TECHNOLOGY:

46 MW - about 170,000 modules - installed between 2014 and 2015

## INVESTMENT:

Approximately £40m by the developer; farm receives ground rent and payment for maintenance services

## WHAT:

Large solar farm with sheep grazing across 12 fields (72 hectares)

## WHY:

Close to major electricity grid connection point

Significant ground rent and income from ancillary services

Complements diversified farm business

## BENEFITS:

Sheep flock maintains ground vegetation for solar farm operators

Farm worked closely with developers and contractors, both during installation and in longer-term maintenance

Increased income has led to the opportunity to invest in more land and properties

Farmers are finding creative ways to use land efficiently to produce clean energy and maximise ecological benefits – i.e. solar farms can boost biodiversity by creating wildlife refuges and pollinator reserves in the midst of farmland



# SOLAR - GROUND-MOUNTED (LARGE, BIODIVERSITY)



**NAME:** Guy Smith (NFU Vice President)

**REGION:** England – East Anglia

**SECTOR:** Mixed farm

**SIZE:** 283 hectares farmed



## TECHNOLOGY:

13 MW - 57,000 solar modules – installed 2014-15

## INVESTMENT:

Approximately £12m by the developer; farm receives ground rent

## WHAT:

Large ground-mounted solar farm managed for biodiversity across 19 hectares of land

## WHY:

The planning application supported enhancing the site's biodiversity through a planting scheme for new hedgerows and trees

Secured income - not linked to volatile markets and weather

Enhances diversified business

## BENEFITS:

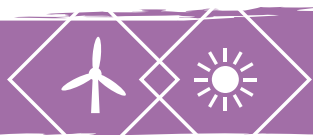
Multi-functional use of land – energy and wildlife

Consistent with NFU's wider support for voluntary environmental management

Supports biodiversity through voluntary agri-environmental measures:

- Pollen mix planted in between and around the rows of panels (suitable for shaded & non-shaded areas)
- Mowing performed with wildlife in mind – some areas left unmown or not mown during ground nesting season
- Additional hedgerows planted around solar farm
- Bird boxes situated across the farm





# WIND (SMALL) & SOLAR

**NAME:** Stephen James (NFU Cymru President)

**REGION:** Wales – Pembrokeshire

**SECTOR:** Dairy

**SIZE:** 202 hectares farmed



## WHAT:

50 kilowatt wind turbine and 33 kilowatt roof-mounted solar panels

## WHY:

To reduce his carbon footprint

To create a sustainable future for his grandchildren.

To reduce electricity costs

## BENEFITS:

Cools milk during the day

Sustainable farming for future generations

“Feel-good factor”

Additional income helps support other ventures such as converting an Aga cooker to electricity and implementing heat recovery units to cool the milk whilst heating the water



## TECHNOLOGY:

Wind turbine – Installed 1 year ago and produces 162 kWh per year, earning an 18p/kWh tariff

144 solar panels – installed 4 years ago and produces 32 kWh per year

## INVESTMENT:

Wind - £240,000  
Solar - £77,000  
(includes grid connection and planning)

## PAYBACK:

Wind: 6 - 7 years  
Solar: 5 - 6 years





# WIND (MEDIUM)



**NAME:** John Seed

**REGION:** Scotland – Berwickshire

**SECTOR:** Arable

**SIZE:** 200 hectares farmed



## TECHNOLOGY:

A 75kW refurbished Vestas V17

Rated wind speed: 6.8 m/s

Produces 140,000 kWh / year

## INVESTMENT:

£174,125

## WHAT:

75 kilowatt wind turbine

## WHY:

To reduce energy costs

To be as self-sufficient and sustainable as possible

Can harvest and dry crops quickly and efficiently

## BENEFITS:

Has significantly reduced business energy costs

Uses approximately 50% of the energy produced on-site

Benefit of approximately £35,000 a year in reduced electricity costs and Feed-in Tariff payments

Reduces reliance on volatile world fuel markets

Ties in with other renewable enterprises: 950 kilowatt batch boiler and a 50 kilowatt solar PV array

We estimate that farmer-owned wind turbines alone already meet the annual needs of

**200,000  
HOUSEHOLDS**





# WIND (MEDIUM)

**NAME:** Carson family

**REGION:** Northern Ireland

**SECTOR:** Mixed Farm

**SIZE:**



## TECHNOLOGY:

Installed in 2009

## INVESTMENT:

Cost of turbine plus enhanced grid connection

## WHAT:

A reconditioned Vestas 75-kilowatt V17 wind turbine

## WHY:

Coastal location of the farm makes it an excellent site for a turbine – utilises natural resources

To reduce high running costs - farm is an energy intensive, 170 sow pig unit using heat lamps, a feed mixer and a grain dryer

Provides electricity to the farm house, the pig unit, the lambing barn and a beef rearing unit

## BENEFITS:

Reliable and efficient (previous attempt at installing a 20-kilowatt turbine in 2006 had been unsuccessful)

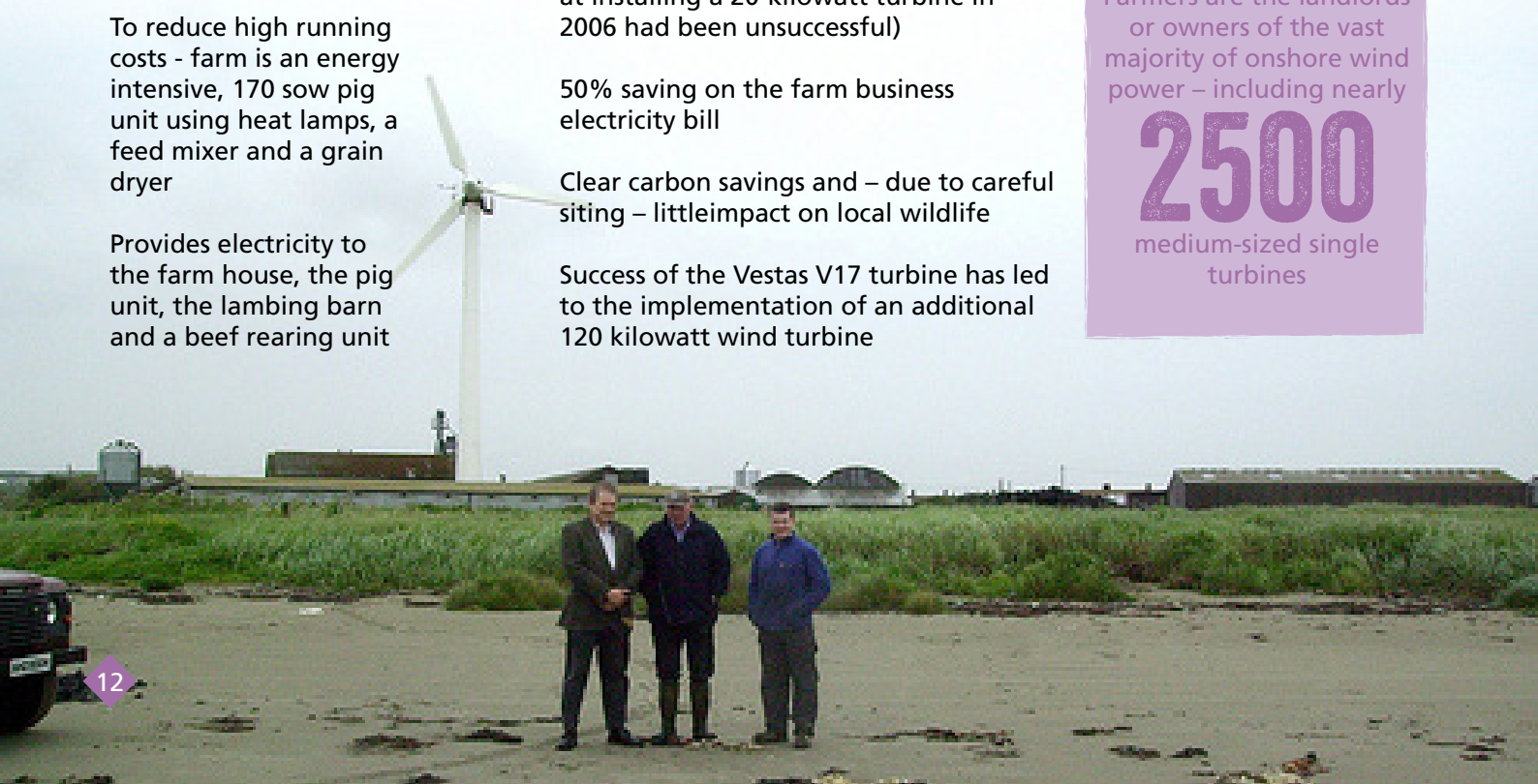
50% saving on the farm business electricity bill

Clear carbon savings and – due to careful siting – little impact on local wildlife

Success of the Vestas V17 turbine has led to the implementation of an additional 120 kilowatt wind turbine

Farmers are the landlords or owners of the vast majority of onshore wind power – including nearly

**2500**  
medium-sized single turbines





# WIND (LARGE)



**NAME:** Andrew Stewart

**REGION:** Scotland – Lanark

**SECTOR:** Livestock and dairy

**SIZE:** 283 hectares farmed



## TECHNOLOGY:

E-82 - 2.3MW wind turbine  
E48's - 800kW each turbine

## INVESTMENT:

£7.6m

## PAYBACK:

8 - 10 years

## WHAT:

Installed a single Enercon E-82 wind turbine and two Enercon E48 turbines

## WHY:

Secured funding from the Community and Renewables Energy Loan Scheme (CARES) of £149,000 for the E-82 turbine

Support the farm business

Not keen to lease land to developer due to poor rates

## BENEFITS:

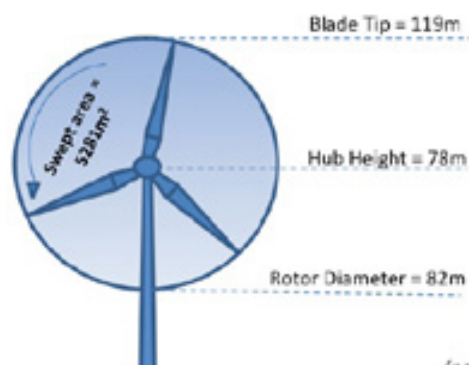
Additional annual income from the 1.2 hectares of land the turbines sit on which could not be achieved through traditional farming methods

Lower energy costs and fossil fuel output

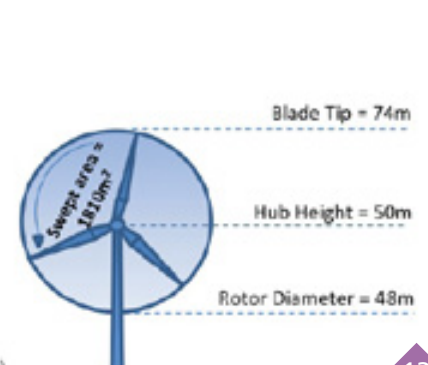
Sustainable farming

Community supported – a proportion of profits amounting to £10,000 per MW goes annually to Lesmahagow Community Council to aid various community projects

E-82 (2.3MW)



E-48 (800kw)



(not to scale)



# HYDRO (MINI)

**NAME:** Remony Farm and Estate

**REGION:** Scotland – Perthshire

**SECTOR:** Mixed livestock

**SIZE:** 3083 hectares farmed



## WHAT:

Two high-head hydro schemes at Acharn Burn and Remony Burn

## WHY:

Hydro has always been fundamental to sustaining the estate (first implemented in 1925)

The old scheme needed replacing and reconnecting to the grid

Sustainable farming for future generations - current generation had benefited from the original hydro scheme

## BENEFITS:

The Acharn Burn scheme produces on average over one million kilowatt-hours of electricity a year (cutting the electricity bill in the main house to zero)

Sell excess energy to the national grid – additional income supporting the farm and estate

The project benefits from Feed-in Tariffs – Remony Hydro is locked on to an index-linked rate of 15.98 pence per kilowatt hour

Lowers the estate's carbon footprint and greenhouse gas emissions

## TECHNOLOGY:

Acharn Burn – capacity of 360kW. Re-developed in 1992 (from a 30kW scheme built in 1925)

Remony Burn – capacity of 490kW. Installed in 2013. During the first 8 months of operation produced 780,000 kWh

## INVESTMENT:

Re-development scheme at Acharn Burn cost £318,170 in 1992

Remony Burn - £4.1m

## PAYBACK:

Acharn Burn – 4.5 years  
Remony Burn – 11 years





## NAME:

David Finlay

## REGION:

Scotland – Dumfries

## SECTOR:

Mixed livestock and dairy

## SIZE:

340 hectares farmed



## TECHNOLOGY:

Output – 25kWe  
Installed 2013, commissioned 2014

## INVESTMENT:

£210,000 – about one-third of the cost of a typical farm digester

## PAYBACK:

Estimated 6.5 years

## WHAT:

Scotland's first AgriDigestore - a combination of a slurry store and 25 kilowatt digester

## BENEFITS:

Converted slurry tower into an anaerobic digester (no planning issues)

Generate enough electricity and hot water to run the dairy

## WHY:

To pre-empt pressure from retailers and government for farmers to cut their greenhouse gas emissions

Help to lower farm input costs

Increased fertiliser and waste management efficiency

Feed digester with cattle slurry and grass silage

Enhance the fertiliser value of the slurry and reduce its pollution potential

Cut greenhouse gas emissions and energy use substantially leading to more sustainable farming

Significantly reduces farm business and energy costs

Increase crop nitrogen uptake from bio-fertiliser

"Simple, robust and farmer friendly"





# BIOENERGY – AD (MEDIUM)

**NAME:** Blakiston Houston Estates

**REGION:** Northern Ireland

**SECTOR:** Dairy

**SIZE:** 300 hectares farmed



## TECHNOLOGY:

Installed in 2011-12

Estimated annual output of 2 million m<sup>3</sup> of biogas producing about 4m kWh electricity and 4.5m kWh heat from the combined heat and power system

## WHAT:

A 500 kilowatt Hochreiter Anaerobic Digester

## WHY:

Low input costs - around 1000 tonnes of slurry/manure, 9000 tonnes silage, 2000 tonnes of fodder beet and 1300 tonnes of vegetable peelings and trimmings per year

To diversify and develop the farm business

Help maintain a profitable and resilient business not so vulnerable to low market prices

## BENEFITS:

About 15% of the electricity produced is used on the farm with the remainder sold to the grid

Supports other farm enterprises - about 20% of the heat produced is required to maintain the plant temperature and surplus heat is used to heat polytunnels for salad crop production and dry wood for the estate wood chip enterprise

Digestate from the system (estimated at 12,000 tonnes per annum) is spread back on the land saving on fertiliser costs

The greenhouse gas savings from the production of renewable electricity and heat and the reduced use of fertiliser on-farm is calculated at around 1500 tonnes of carbon dioxide equivalent per year

## INVESTMENT:

About £2m



# BIOENERGY – AD (LARGE, BIOMETHANE TO GRID)



**NAME:** Neville Peachey

**REGION:** England – Isle of Wight

**SECTOR:** Arable

**SIZE:** 486 hectares farmed



## TECHNOLOGY:

The plant produces 600m<sup>3</sup> of biomethane per hour from approx. 45,000 tonnes per annum of different silages, along with 18 tonnes per day of food grade CO<sub>2</sub>

Features an add-on 250 kW combined heat and power unit to meet on-site energy needs

## WHAT:

A partnership of local farmers set up the AD plant

The crops feeding the digester are supplied by up to 30 farmers – 6 of whom are members of the partnership

## WHY:

Local investment supporting local farmers

Do not have to transport crop products across to the mainland

More control over the crop once it has moved off farm

Reliable market for crops grown

## BENEFITS:

Reliable source of income

Part-owned by local farmers

The plant sells food grade CO<sub>2</sub> which can only come from "green" sourced feedstocks i.e. no waste food or cattle slurry

## INVESTMENT:

The plant cost £9 million - financed by £2m from partners and £7m from Lloyds Bank

## PAYBACK:

Good return price for feedstock

Any profit the plant makes is re-invested for future expansion





# BIOENERGY – AD (LARGE)

**NAME:** Wyke Farms

**REGION:** England – South West

**SECTOR:** Dairy

**SIZE:** 607 hectares farmed



## TECHNOLOGY:

Three 4,600 cubic metre digesters installed in 2012

The plant annually converts 75,000 tonnes of waste into energy

The digesters pump out 13,500m<sup>3</sup> of gas and 23,000 kWh of electricity every day

There are two 500 kW V12 CHP units on-farm

## INVESTMENT:

£14m

## PAYBACK:

5 years

## WHAT:

Anaerobic digester plant producing bio-gas which is turned into electricity for the farm and dairy, fuelled by farm and food waste that would otherwise be landfilled or sent to landfill

The farm runs eight electric vehicles on its own clean power and plans to run milk collection tankers and other farm vehicles on compressed bio-methane in 2017

Surplus energy and 'upgraded' biogas is sold back to the grid so that others can be 'green' too

## WHY:

Wyke Farms' 100% Green strategy is an investment for the future, protecting the land which the family has farmed for over 150 years

To create a sustainable working farm by harnessing natural resources - farming and food co-products and residues

To share knowledge and help others, Wyke Farms pay a premium to milk suppliers working in a sustainable way

## BENEFITS:

As well as biogas, Wyke Farms has solar PV and a water re-use plant - all part of their 100% Green strategy to save up to 20,000 tonnes of CO<sub>2</sub> per year

All the cheese and butter produced on-farm is 100% self-sufficient - any excess power is exported to the local grid

The by-product digestate from Wyke's plant, high in nitrogen and phosphates, is spread on their land or given away free to local farmers, reducing the need for manufactured fertilisers

Additional digesters currently being built will mean Wyke can produce more 'green' power for others to use, while investment in more electric vehicles and biomethane tankers will make the business completely energy independent

Wyke Farms make

**14,000 TONNES**  
of Cheddar a year using bio-gas from their digesters



# BIOENERGY – BIOETHANOL (SUPPLY)



**NAME:** Brett Askew

**REGION:** England - North East

**SECTOR:** Arable

**SIZE:** 526 hectares farmed



## TECHNOLOGY:

Ensus plant - annual capacity of 400m litres of bioethanol

Vivergo – uses 1.1m tonnes of wheat to produce 420m litres of bioethanol per year

## INVESTMENT:

Time and cost of planting and harvesting the wheat

## PAYBACK:

£5 per/tonne for feed wheat

## WHAT:

Supplies wheat to bioethanol plants Ensus and Vivergo - producers of transport fuels

## WHY:

More consistent price/market for wheat

Northern-based plants mean the crop is transported shorter distances

Member of the Red Tractor Scheme and holds a Grain Passport – high farming standards and assured grain

## BENEFITS:

Additional source of income to support the farm business

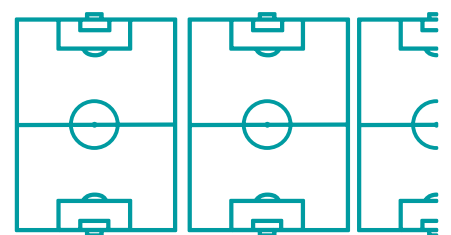
Arable farmers have a domestic market for their previously exportable surplus wheat

Livestock and dairy farmers benefit from a local protein-rich animal feed (Distillers Dried Grains with Solubles or DDGS) - the co-product of biofuel production. Ensus, for example, generates 350,000 tonnes of DDGS annually

In years when grain quality is not as high there will still be a market for the crop

A modern diesel car driving typical annual mileage could run entirely on vegetable oil or biodiesel from oilseed rape grown on 1.5 hectares of cropland – the area of

**2½ FOOTBALL PITCHES**



# BIOENERGY – BIOMASS (SMALL)

**NAME:** Jimmy Ireland

**REGION:** Scotland - Ayrshire

**SECTOR:** Mixed livestock and arable

**SIZE:** 364 hectares farmed



## TECHNOLOGY:

A Heizomat 100 kW boiler installed in 2014 and produces 131,400 kWh

## INVESTMENT:

£55,000

## PAYBACK:

5-6 years

## WHAT:

Installed a 100 kilowatt woodchip biomass boiler to heat the farm house, an agricultural building and a workshop

## WHY:

To reduce fuel costs

Farming for a sustainable future

## BENEFITS:

The boiler has offset the £3000 per annum previously spent on kerosene

Eligible for the Renewable Heat Incentive Scheme at a rate of 8.8 pence per kilowatt hour

Paved the way for other renewable energy initiatives – such as a second boiler to serve a new drying floor and a 3.6-kilowatt rooftop solar PV system

Agriculture plays a substantial role in the supply or fuelling of renewable heating, including

**OVER 4000**

biomass-fired commercial boilers



# BIOENERGY – BIOMASS (MEDIUM)



**NAME:** Mark Pope (NFU Environment Forum Chair)

**REGION:** England – South West

**SECTOR:** Arable

**SIZE:** 278 hectares farmed



## TECHNOLOGY:

200kW Glenfarrow biomass boiler installed 2013

## INVESTMENT:

£28,000

## PAYBACK:

7 years

## WHAT:

British made biomass boiler heating farm buildings

## WHY:

To replace fossil fuel electric heating for farm buildings

Lower the farm's carbon footprint

## BENEFITS:

A source of income to support the core farm business

Uses wood from the farm, miscanthus and straw – low running costs

Saves on electricity costs

Eligible for Renewable Heat Incentive payments





# BIOENERGY – BIOMASS (SMALL, SELF-SUPPLY)

**NAME:** Martin Howlett

**REGION:** England - South West

**SECTOR:** Mixed livestock, suckler beef, sheep and arable

**SIZE:** 112 hectares farmed



## TECHNOLOGY:

100kW Guntamatic boiler installed in 2015

Annual miscanthus yield of 10-12 tonnes/ha

## INVESTMENT:

£100,000 including district heating network

## PAYBACK:

9 years

## WHAT:

Installed a biomass boiler to heat the farmhouse, three holiday homes and an education centre room for school visits

## WHY:

Can fuelled using miscanthus grown on-farm on previously setaside land

To reduce reliance on fossil fuels in the form of oil-fired boilers and electric night storage/immersion heaters

To reduce exposure to volatile energy markets

## BENEFITS:

Support farm's basic principle of self-sufficiency

Guaranteed fixed/index linked income through eligibility for the Renewable Heat Incentive scheme (6.8 pence per unit over 20 years)

Lowers the carbon footprint of the farm business

Supports the farm business and subsidiary enterprises







**NAME:** Steven Clarke

**REGION:** England – North West

**SECTOR:** Sheep

**SIZE:** 121 hectares farmed



## TECHNOLOGY:

Planted 8 varieties of willow over 11 hectares for a local mill burning 500,000 tonnes of biomass fuel per year

## INVESTMENT:

Cost of clearing the land and planting willow

## PAYBACK:

Payments made at 3 year intervals over 22 years

## WHAT:

Supplies willow used as biomass fuel to Iggesund Paperboard Mill

## WHY:

Economic use of floodable farmland

Long-term biomass supply contracts for farmers

Chance to supplement farm income using short rotation woody crop

## BENEFITS:

Long-term contract bringing in a secure income

Mill takes responsibility for both harvesting and transporting the crop

Environmental benefits:

- Supplying a mill powered by renewable energy
- Local mills mean the crop only travels a short distance
- Perennial crop roots help prevent flooding and soil erosion





# HEAT PUMP – GROUND SOURCE

**NAME:** Mrs E & Mr T Bargman

**REGION:** England – South East

**SECTOR:** Organic beef and veal

**SIZE:** 44 hectares farmed



## TECHNOLOGY:

A 64 kW heat pump system

For every kW of electricity put into the heat pump 4.6 kW are returned as energy for heating and domestic hot water



## WHAT:

Ground source heat pump system heating 4 farm cottages

## WHY:

To lower the carbon footprint and on-going running costs of the site

To heat on-site dwellings

Concern about the next generation of farmers - keen to "do their bit" for a sustainable future

To offset the methane greenhouse gas emissions of the cattle

## BENEFITS:

Greenhouse gas emissions reduction of about 45% compared to previous oil-fired heating systems

Enhances the farm's strong commitment to sustainability

Lower business input costs through fuel savings

## RENEWABLE ENERGY DIVERSIFICATION

offers our sector stable and predictable returns - making our agricultural businesses more resilient





# STORAGE



**NAME:** Gelli Aur College Farm

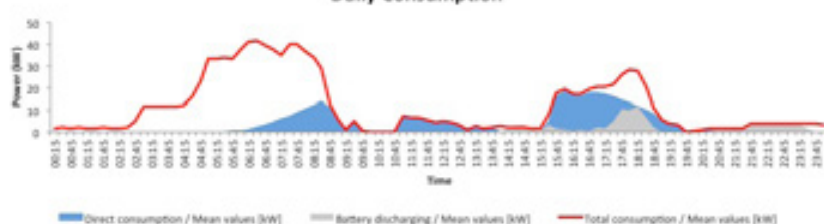
**REGION:** Wales – Carmarthen

**SECTOR:** Dairy and livestock

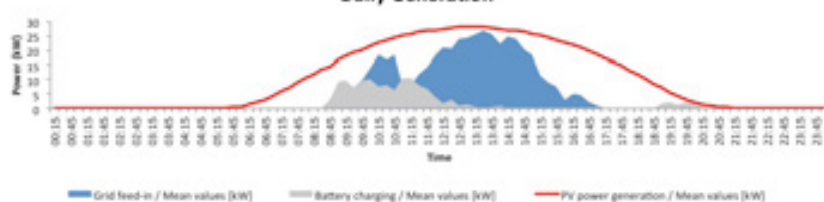
**SIZE:** 240 hectares farmed



Daily Consumption



Daily Generation



## TECHNOLOGY:

25 kWh lithium-ion battery pack

Typically achieves 21 kWh charge and 16 kWh discharge on a daily basis

## INVESTMENT:

Supported by the Welsh Government and the European Agricultural Fund for Rural Development

## WHAT:

Farm-scale battery electricity storage system

## WHY:

Supports 50kW rooftop PV on the Gelli Aur College Farm

Increase income and lower running costs

Battery can be charged from solar PV during daylight hours or cheap rate grid electricity at night

## BENEFITS:

Increased utilisation of PV output by 17% in May and June of 2015 with up to 45% daily self-sufficiency achieved

Lowers the running costs of the development centre

Can be used as a demonstration to college students and local dairy farmers

New disruptive, clean technology for managing energy costs

158 kWh/day PV generation, of which 57% meets farm demand directly, 13% charges batteries and remaining 30% is exported

Two similar

## 25 KWH SYSTEMS

installed on nearby dairy farms supporting solar and wind power - using lead acid batteries instead



## FRONT COVER

Three generations of the Gilman dairy farming family from Staffordshire, in front of their 50-kilowatt farm wind turbine (David and Lesley, left; Andrew and Lyneth, right; Evan, Jonty and Eliza, centre). Picture: Mease Valley Photography, Tamworth.

The Gilmans feature in a complementary booklet of renewable energy case studies from the World Farmers' Organisation.

## ACKNOWLEDGEMENTS

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Scottish case studies: Renewable Development Initiative which was a joint initiative between the Scottish Government and NFUS facilitated by Savills



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