

DOING OUR BIT FOR



NFU'S NET ZERO STRATEGIC ADVISORY BOARD

Our goal of net zero by 2040 is ambitious. It means agricultural production as a whole being a net zero contributor to climate change. But it's achievable; our approach is in line with the Committee on Climate Change and Britain's green recovery as we emerge from Covid-19 lockdown. We have outlined practical steps under our three pillars of net zero steps and each farm will plot their own path. These 26 case studies show the start of our national aspiration

in the lead up to COP26, the international climate change summit in November 2021. The more we come together as an industry, the more successful we will be, improving business resilience as well as our environment. We want British farming to lead the world in climate-friendly food, produced to our high standards of food safety, animal welfare and environmental stewardship. We are looking to Government, industry and other stakeholders to work with farmers and help us on this journey.



Stuart Roberts



John Davies



Richard Bramley



Graham Young



Matt Culley



Ali Capper



Thomas Binns



Phill Crawley



Richard Findlay



Mark Wycherley



Simon Gadd



Tom Clarke



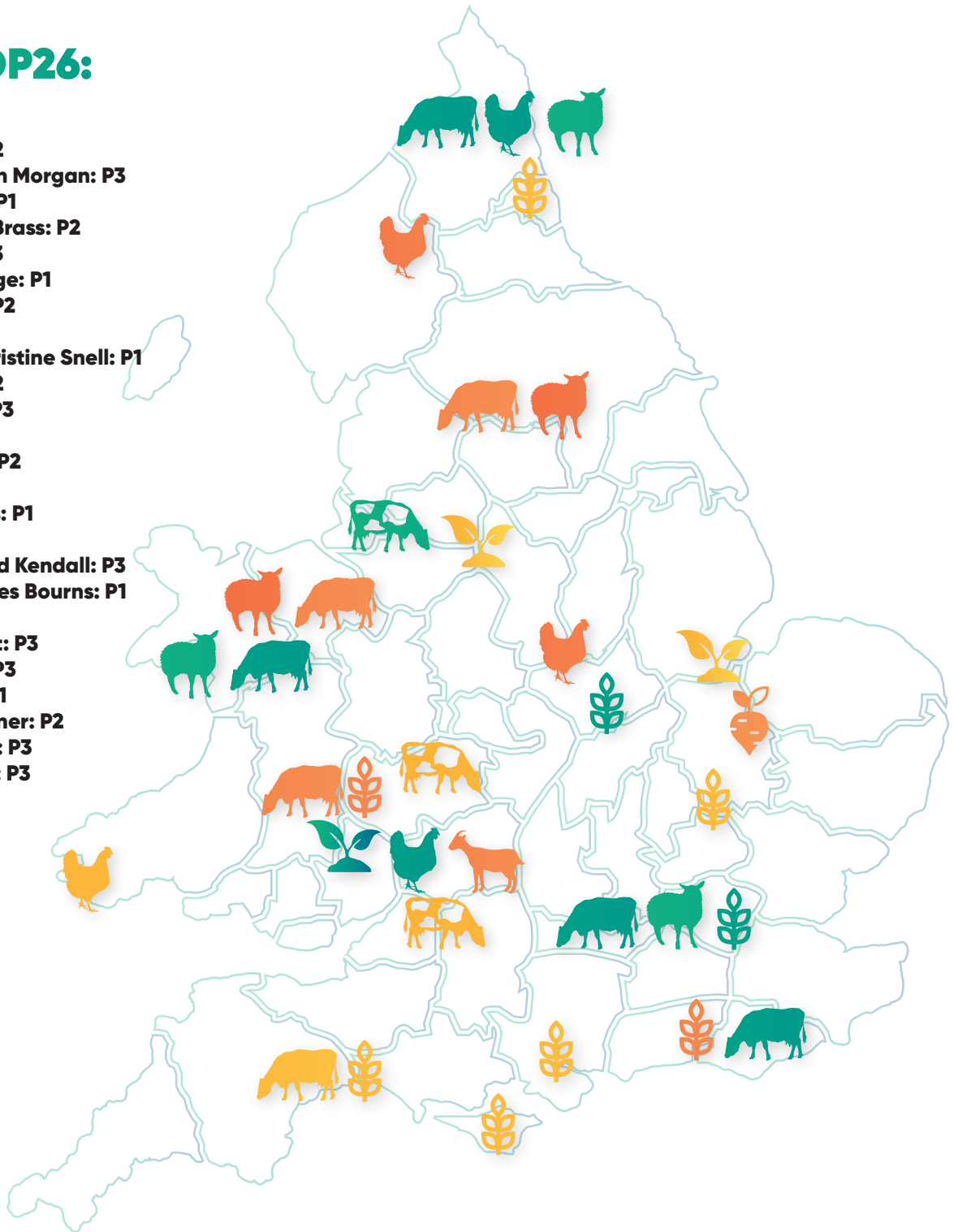
David Martin



Haydn Evans

26 for COP26:

1. Harri Parri: P1
2. Guto Davies: P2
3. Clare & Stephen Morgan: P3
4. David Craven: P1
5. David & Helen Brass: P2
6. Phil Pearson: P3
7. Simon Bainbridge: P1
8. Rachel Hallos: P2
9. Brett Askew: P3
10. Anthony & Christine Snell: P1
11. Steve Klenk: P2
12. Joel Beckett: P3
13. Ian Matts: P1
14. Phill Crawley: P2
15. Robin Buck: P3
16. Stuart Roberts: P1
17. Tom Clarke: P2
18. Peter & Richard Kendall: P3
19. Charles & James Bourns: P1
20. Lizzie Dyer: P2
21. Martin Howlett: P3
22. Colston Gay: P3
23. Ian Sturmer: P1
24. Dominic Gardner: P2
25. Caroline Knox: P3
26. SF Bate & Son: P3



PILLARS:

P1:  Productivity improvements and better resource use

P2:  Farmland carbon storage in soils and vegetation

P3:  Boosting renewable energy and the bio-economy



Dairy



Sugar Beet



Poultry



Sheep



Beef



Arable



Horticulture



Goats

CHARLES AND JAMES BOURNS

The Bourns' ~2ha family poultry business has two sheds each holding 32,000 birds.



WHAT WE'RE DOING

"We were faced with two choices: sell the farm or refurbish the sheds. As my son James wanted to come back to the farm we decided to refurbish. We didn't have to start from scratch – the old sheds were stripped back to the timber frame and skin, so we didn't need planning permission."

- **Completely refurbished sheds with automation, double glazing, insulated roof and walls, and LED lighting**
- **Enabled the business to get a Climate Change Agreement**

"We've had to adapt to the tech in the new sheds. Next up we'd like to install biomass boilers using woodchip and/or poultry litter, as well as solar PV but the policies have to be right. Accessing finance for the next generation is still going to be a challenge."

AND

PILLAR 2:

>0.5km hedges including hedgeline trees

DOING OUR BIT FOR NET ZERO



• **IMPROVED PRODUCTIVITY BY 49% PER KG OF MEAT IN TERMS OF ENERGY USE**



• **IMPROVED CONSISTENCY OF PRODUCTION THROUGH THE YEAR**

OTHER BENEFITS



25% LOWER ELECTRICITY AND LPG BILLS

IAN MATTS

Ian is part of a 2000ha arable joint venture of owners and tenants, plus a contracting business.



WHAT WE'RE DOING

"Blackgrass and cover cropping have been our challenges. We should be getting better results with cover cropping but after six years it's still work in progress."

- **Mapping soil types led to variable rate seed plans allowing better targeting of seed rates and more even crop canopies. Regular P, K, Mg and pH testing using GPS-aided grid system, creating soil index contour maps**
- **Buys N from factories using abatement technology to remove 90% N₂O produced during manufacturing; real-time variable rate fertiliser spreading**
- **Different machines have tracks or low ground pressure tyres and is working with Michelin to optimise tyre pressure across different operations**
- **Machinery is well maintained for energy efficiency and fieldwork planned to minimise journeys**

"The next step is to really crack cover cropping and move to no-till. In the past we went too quickly – this time we're focussed on improving the soil first. A challenge for the future is to better understand the correlation between lab tests and what actually happens in-field."

AND

PILLAR 2:

Continue to make use of muck for straw agreements and moving to more sewage sludge
Trialling cover cropping and crop residues incorporated where possible. Have tested soil microbial activity
Hedges around every field; in-field and hedgeline trees and small farm woodlands

PILLAR 3:

Solar PV across the different businesses

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DID YOU KNOW?

N fertiliser is up to 80% of the GHG footprint of a wheat crop



• **LOWER GHG FERTILISER HELPS TO REDUCE THE CARBON FOOTPRINT OF CROP**

OTHER BENEFITS



VARIABLE N APPLICATIONS ACCORDING TO CROP REQUIREMENT HAS INCREASED YIELDS BY 3.5% ON AVERAGE, REDUCED LODGING AND LOWERED THE INPUT COSTS PER TONNE

DAVID CRAVEN

David manages 2,500 Holstein cows and 1,400 dairy heifers in addition to 2,200ha of arable, maize and grass.



WHAT WE'RE DOING

"Pre 2014 our herds, young stock and equipment on the farm were spread out with insufficient housing."

- Investment in new sheds designed with expert input and including technologies that allow earlier disease detection
- Programme of using sexed semen
- Feed is mostly grass, home-grown silage and grain and in bought-in feed, rapeseed meal has replaced soya
- Composted manure and slurry returned to cropland
- Min-till practiced for over 25 years

"We've already reduced our GHG dairy footprint by 16%. Next up is better use of manure, and more and better home-grown forage, then over the longer-term livestock health and cow longevity, and more renewables. We have introduced a carbon budget for 2020, with the aim of reducing our emissions by a further 14%. Our aim is to have one of the lowest carbon footprints of any farm."

AND

PILLAR 1:

300kW solar PV with surplus exported to grid

PILLAR 2:

Soil analysis every three years drives cultivation and manure management strategies
>200km hedges, 4km new last year tree planting scheme on some less productive land

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DID YOU KNOW?

Diseases can increase GHG emissions by up to 24% per unit of milk produced



• MASTITIS REDUCED FROM 35% TO 9%



• 40% LESS INORGANIC FERTILISER USE ACROSS ALL CROPS (BY INTEGRATING ARABLE AND DAIRY)



• REPLACING SOYA WITH RAPESEED MEAL

OTHER BENEFITS



ECONOMIES OF SCALE REDUCED FIXED COSTS >30%



REDUCED ANTIBIOTIC USE >60%



DEVELOPING SPECIALISM IN THE TEAM; NOW EMPLOY >50 PEOPLE, 40 FULL-TIME, AS WELL AS PLACEMENT STUDENTS AND APPRENTICES

IAN STURMER

Ian runs a 182ha tenanted arable and beef finishing unit, part of a contract farming system which rears, grows and finishes >4,600 dairy-bred steers a year.



WHAT WE'RE DOING

"We looked at this model of finishing as our solution to building an economically sustainable system that produces beef consumers will value."

- **Vaccination and welfare protocols applied and recorded across all units**
- **Feed intake monitored daily to deliver ad-lib ration with no waste**
- **Record, monitor and accurately forecast animal performance**
287.2kg average carcass deadweight, typical grade O-/O+ 3/4L
- **New sheds incorporate LEDs and ventilation systems**
- **Latest lorries and new lighter trailer**

"We want to get a better understanding of genetic variability, and are considering selecting semen and working with dairy farmers to improve growth rate, performance and meat quality. We're building a new muck store so we can apply FYM at the right times. We're also interested in taking part in research on eating quality traits, such as meat tenderness, flavour and colour."

AND

PILLAR 2:

Muck and soil sampling ensure correct FYM application; muck for-straw agreements with local arable farmers utilises excess manure
Growing early maize to establish a winter crop in suitable conditions and get a good cover to limit soil erosion. Continuous maize under-sown with grass

PILLAR 3:

Roof-top solar PV

OTHER BENEFITS



COLLABORATIVE APPROACH HAS ALLOWED EACH BUSINESS TO FOCUS AND SPECIALISE, LEADING TO IMPROVED ANIMAL PERFORMANCE AND TO THE BUILDING OF RELATIONSHIPS WITH LOCAL ARABLE AND DAIRY FARMERS



MARKET VOLATILITY REDUCED THROUGH OPERATING AT SCALE IN AN INTEGRATED SYSTEM WHERE MORE COSTS CAN BE ACCURATELY FORECAST



DRAMATICALLY REDUCED ANTIBIOTIC USAGE ACROSS MODULAR SYSTEM



MOST UNPRODUCTIVE FIELDS NOW UNDER LOW INPUT GRAZING OR PLANTED WITH WILD BIRD FEED

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DID YOU KNOW?

Utilisation of dairy-cross beef calves reduces the GHG footprint of a kilo of beef as some emissions are attributed to the dairy sector



• **DRAMATIC IMPROVEMENTS IN THE FEED CONVERSION RATIO, REDUCED WEIGHT AT SLAUGHTER AND GREAT CONSISTENCY HAS IMPROVED PRODUCTIVITY AND LOWERED THE GHG FOOTPRINT**



• **SIGNIFICANTLY REDUCED FUEL CONSUMPTION**



SIMON BAINBRIDGE

Simon's >650ha organic upland family business includes 160 Black Baldies, 1,500 breeding ewes (Swaledale, north of England Mule, Aberfield and Highlander ovine genetics) as well as 8 flocks of 3000 organic free-range layers.



WHAT WE'RE DOING

"Moving to spring calving has been a hugely efficient advance for us, offering better use of our pasture resources and fodder, driving the accompanying animal growth and health gains."

- **Breeding maternal high health status cattle with comprehensive vaccination programme and yearling bulling heifers weighed and pelvic measurements taken**
- **Using genetics to find a ewe that produces two healthy lambs, can live in the hills, eat very little and produce excellent meat**
- **Forage including vetches, barley and undersown with new multi species leys including clovers, then taken as wholecrop to feed weaned calves and finishers. New leys are double grass/clover yields over tired swards. Brassicas finish lambs**

"I'm sure our challenges are the same as for many others – finance, time, consolidation, connectivity too – broadband is rubbish in rural Northumberland and it's holding us back. We've maxed out on renewables because the grid connection is a limiting factor. I want to know how will we be rewarded for carbon sequestration and storage in the future?"

AND

PILLAR 2:

Applying poultry manure has led to more grass above and root mass below ground, and carbon in our soils
Planted >7km of new hedges which we are now laying so we will have >12km
~20ha of established woodland and over 4000 trees planted around the farm and on ranges – each free-range flock has 1.5ha range with 500 trees in each

PILLAR 3:

20kW wind turbine and 54kW solar PV powering the farm and layers

OTHER BENEFITS



HOME-GROWN PROTEIN CROPS REDUCE EXPOSURE TO FEED PRICE VOLATILITY



POULTRY MANURE APPLICATION HAS ALSO INCREASED THE FARM'S CARRYING CAPACITY AND RESILIENCE

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Diseases can increase GHGs up to 113% per unit beef carcass



• HEALTH, GENETICS AND FEED ARE THE THREE CRUCIAL ELEMENTS IN HITTING PRODUCTIVITY GOALS



• USING LEGUMES IN THE SYSTEM MEANS THAT THE FARM'S CARBON FOOTPRINT DOES NOT HAVE TO BEAR THE GHG COST ASSOCIATED WITH THE MANUFACTURE OF INORGANIC N FERTILISER

ANTHONY & CHRISTINE SNELL

Anthony and Christine grow strawberries, raspberries, blackberries, blueberries, blackcurrants, redcurrants and chuckleberries on 182ha.



WHAT WE'RE DOING

"Initially, adapting substrate-growing to field scale production was seen as a challenge, but now it's commonplace."

- **Tabletop system has increased strawberry quantity: over 10 years crop yield has improved from 25t/ha to up to 40t/ha; more fruit is class 1 and larger berry size from a plant that crops for longer**
- **Strawberries are all grown hydroponically in coir growbags and 23% of cane and bush crops area grown in coir substrate pots allowing greater accuracy**
- **Detailed monitoring of temperature and humidity in the tunnels and of moisture and nutrition levels in the substrate**

"I'm immensely proud that our strawberry production is carbon neutral. We've done this by improving yields without significantly increasing inputs, generating clean energy for processing and new hedges and trees are storing more carbon across the farm. Pest and disease control is a real test but by increasing use of IPM and biological control we feel we're making real strides."

AND

PILLAR 2:

Continual hedge and tree planting plan

PILLAR 3:

180kW rooftop solar PV supplies freezer and packhouse
Fruit not suitable for any commercial product is sent to a local AD plant

DOING OUR BIT FOR NET ZERO



INCREASED
CROP PRODUCTIVITY



GHG
REDUCED GHG INTENSITY
OF PRODUCTION

OTHER BENEFITS



DIVERSIFYING INTO A FROZEN LINE HAS EXTENDED OPERATIONS TO 11 MONTHS OF THE YEAR AND HAS OFFERED NEW EMPLOYMENT OPPORTUNITIES



SOLAR PV MEETS THE BUSINESS' ELECTRICITY NEEDS



INNOVATION HAS SAVED WATER NUTRITION APPLIED BY UP TO 50%

HARRI PARRI

Harri runs his 290ha family business (upland and lowland) including 210 Stabilisers, 320 Lleyn and 550 Lleyn x NZ Suffolks, arable and free-range eggs.



WHAT WE'RE DOING

"It's hard being continually under pressure to produce cheaper food but we want to keep making efficiencies and increasing productivity. By producing more from less we are reducing the GHG emissions per unit of production."

- **High health and balanced nutrition for soil and livestock enables good genetics to thrive**
- **Performance-recorded herd: calves weaning weight is 10kg heavier, breeding bulls selected from £Profit index and potential breeding bulls sent to a Net Feed Efficiency unit**
- **Early-lambing flock based on high index rams. By mid-May, everything over 35kg sold for slaughter. Remainder weaned with ewes sent off to the hill, allowing one farm to be shut up for silage**
- **Precision muck and fertiliser spreading**

"Monitoring and measuring allow annual targets and assessment of improvements so next steps are mapping fields for NPK and pH, and utilising grass better. We want to get into variable rate application even in smaller areas and we're putting in infrastructure on both lowland farms to rotationally/paddock graze. It'll be challenging as the whole area is in an arable rotation."

AND

PILLAR 2:

Home-grown barley, oats, fodder beet, swedes and red clover are grown in rotation with grass
Soils sampled annually and receive poultry muck and manure

PILLAR 3:

55kW wind turbine

DOING OUR BIT FOR NET ZERO



- **MINIMISING DAYS TO SLAUGHTER, ENSURING CARCASS HITS SPEC AND STRICT CULLING REGIME CONTRIBUTE TO A LOWER GHG FOOTPRINT**

OTHER BENEFITS



REDUCING DAYS TO SLAUGHTER OFF GRASS IS CRUCIAL FOR OVERALL PROFIT AND EFFICIENCY



MUCK FROM POULTRY AND WINTERING CATTLE REDUCES GHG COST OF BOUGHT IN ARTIFICIAL FERTILISER AND BUILDS SOM



GOOD TEAM OF PEOPLE WORKING ON THE FARM IS CRUCIAL FOR BUSINESS DEVELOPMENT AND ENABLES US TO HAVE A BETTER WORK AND LIFE BALANCE



ZERO CARBON ELECTRICITY POWERING FARM BUILDINGS INCLUDING NEW POULTRY SHED



DIVERSE ROTATION CREATES A RANGE OF HABITATS FOR WILDLIFE





STUART ROBERTS

Stuart's 110ha organic family business is part-owned part-tenanted, comprising arable, 50 ewes, a small pedigree Hereford herd and 200 laying hens.



WHAT WE'RE DOING

"We started off with a stockless cereal rotation but the weed burden made it too difficult. Introducing sheep has led to a 34% increase in yield."

- 2-year clover leys grazed by sheep in wheat, oats, rye rotation for milling markets and has converted the worst performing parts of farm into permanent pasture
- On-farm trials identified yield benefits of older cereal varieties
- Working with vet to grow sheep flock with highest health status
- Trialling heat detection collars with cattle
- Building new farmyard with handling facilities

"We want to do more work on finding the best blend of livestock and technology so our next step is bringing RTK wider-spaced drilling and inter-row hoeing alongside the animals. And I know I need to get better at regular soil testing so that the crop and livestock genetics we're putting so much effort into get the right nutrients. We're still learning to get the best from what we've got as is every other farmer in the country. But if all of us, big and small, owner and tenant, take action now, I know that together we can produce the most climate-friendly food in the world."

AND

PILLAR 2:

Leys and manure aiming to increase soil organic matter
~5km hedges, ~5ha ancient woodland and ~0.5ha trees planted 10 years ago

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- MATCHING CROP VARIETY TO SYSTEM AND RE-INTRODUCING ANIMALS WITH THE BEST HEALTH AND GENETICS HAVE IMPROVED PRODUCTIVITY

OTHER BENEFITS



BUILDING THE NEW FARMYARD AWAY FROM THE FARMHOUSES AND THEIR YOUNG FAMILIES DONE PARTLY WITH HEALTH AND SAFETY IN MIND



AREA CONVERTED TO PERMANENT PASTURE HAS BECOME A HUGE NATURAL ASSET VALUED BY THE LOCAL COMMUNITY



DOMINIC GARDNER

Dominic is a 1st generation farmer, contract farming or holding FBTs on 1050ha arable and 82ha fallow with 1000 breeding ewes.



WHAT WE'RE DOING

"Complicated cover crop mixes can increase the cost of seed and leave you trying to get rid of it at the other end. So I've tried to find something that fits my system - that gives near continual soil cover, leaves the lowest possible N in the soil at the end of the season and then give a relatively predictable window when that N will be available again."

- **Stubble turnips provide quick winter cover which is grazed by sheep, and absorb excess N. Two-year grass leys used on difficult soils and topped**
- **Trying to limit straw sales but has one muck for straw agreement, and manure from neighbouring horse enterprises bought on to farm**
- **Aiming not to move too much soil but use the range from ploughing to no-till as required**
- **Hedges and trees planted annually across the estates**

"Building resilience in our soils has been supported by stewardship schemes to date so it would be great to see cover crops in ELMs. But changes to soil can take time, so I want to be able to farm somewhere long enough to make a difference."

AND

PILLAR 1:

Great precision through N management and planning with agronomy and soils advice coupled with soils and tissue testing and yield mapping. Sheep get the best from land not suitable for mainstream arable and system improved by using good quality ram genetics and growing more winter forage cover crops.

PILLAR 3:

Solar PV on grain stores

DOING OUR BIT FOR NET ZERO



- **INCREASING SOIL ORGANIC MATTER AND REDUCING SOIL EROSION HAVE BUILT UP STORES OF CARBON**
- **LOWER LEVELS OF NITRATE LEACHING HAVE REDUCED INDIRECT N2O EMISSIONS**

OTHER BENEFITS



LOW COST COVER CROP THAT THE BUSINESS CAN GROW WELL WHICH HELPS AVOID GREEN BRIDGE OF OVER-WINTERED STUBBLES. GRASS LEYS HAVE HELPED BLACKGRASS MANAGEMENT. SOILS HAVE BETTER WATER HOLDING CAPACITY



LEARNING FROM OTHERS IN THE ARUN TO ADUR FARMER'S GROUP, A VOLUNTARY INITIATIVE COVERING > 10,896 HA OF CHALK DOWNLAND



YIELD MAPPING HAS IDENTIFIED AREAS WHICH WERE CONSISTENTLY UNPRODUCTIVE AND SO WERE TAKEN OUT OF PRODUCTION

[Back to map](#)



DAVID & HELEN BRASS

David and Helen are producers and packers of free range and organic free range eggs from 140 flocks – over 1.5 million birds.



WHAT WE'RE DOING

"We've found that tree density and placement are important – it may look random but it's essential that planting is planned. It's proved a win-win for better egg production and biodiversity. Without trees the farm would be a poorer place and it makes us feel like we're making a difference."

- **Self-funded >214,000 trees including rowan, sessile oak, English oak and field maple for range enrichment (tree planted pasture)**
- **Expert advice has informed planting plans across 20% of the range area**

"We have plans to plant more trees but we're taking a holistic approach from farm to packing station focussing on innovation, reducing energy use and minimising carbon emissions. We already have one of the lowest carbon footprints in the industry. Next we want to trial LED lighting in pullet rearing units and the longer-term challenge is to work with research to halve mortality in five years."

AND

PILLAR 1:

New pullet rearing unit with technology collecting data on water consumption, mortality rates etc.
Natural ventilation and differential underfloor heating mean birds feather 2–3 weeks earlier and leave 100g heavier on 0.5kg/bird less feed

PILLAR 3:

200kW solar PV
500kW ground source heat pump
Biomass boiler (waste wood, tree thinnings) generating 400kW heat

DOING OUR BIT FOR NET ZERO

GHG



- **THE CARBON IN TREES LOWERS THE BUSINESS' GHG FOOTPRINT – EACH TREE WILL TAKE UP HALF A TONNE OF CO2 PER YEAR WHEN MATURE – AND A ROLLING PROGRAMME OF PLANTING MAINTAINS CONTINUITY IN CARBON STORAGE**

OTHER BENEFITS



REDUCED INPUT COSTS AND IMPROVED BIRD WELFARE



PROVIDE ACCESS TO TRAINING COURSES FOR PRODUCERS, 50% OF WHOM ARE ON SMALL FAMILY HILL FARMS BUT NOW MAKING A VIABLE LIVING, ENABLING YOUNGER GENERATIONS TO RETURN TO FARM



SOLAR PV PANELS IN THE FIELDS ALSO PROVIDE SHELTER FOR THE HENS



DISTRICT HEATING SYSTEM EXPORTS EXCESS CLEAN ENERGY TO HOMES IN THE VILLAGE

TOM CLARKE

Tom's 400ha family business is part-owned, part-tenanted, growing sugarbeet and other crops.



WHAT WE'RE DOING

"Investing in new kit and working with a longstanding workforce to try new approaches have been challenges in the past. Action to reduce soil lost with the harvested crop is being boosted by a whole supply chain approach."

- **Moving 75% less soil than we used to so now only ploughing regularly before potatoes. Been experimenting with min/no-till for wheat**
- **Upgraded beet drill means less soil disturbance at drilling and more beet lifted in Feb/Mar missing riskiest of winter weather**
- **Over-wintered stubble HLS option chosen to protect soils but is implemented on greater acreage**
- **'Nurse' crop of barley drilled ahead of sugarbeet to reduce wind erosion and beet tops retained to return organic matter to soil**

"The changes I've made on the farm so far have come about from me just thinking about what we were doing, but finding different ways of managing peat to try and slow rates of loss is going to be particularly challenging in the future. Robotics hold the prospect of better protecting soils and radically reducing fuel and input use. Climate change is a significant challenge which is why I volunteered to represent the Sugar Board on the NFU's net zero steering group."

AND

PILLAR 1:

Variable rate drilling and fertiliser application
Soil testing and monitoring
Better beet genetics has improved productivity

PILLAR 3:

Straw supplied to Ely biomass power station
Roof-mounted 55kW solar PV mostly for export to the grid

DOING OUR BIT FOR NET ZERO

CO₂

- **REDUCING SOIL DISTURBANCE AND EROSION WILL KEEP SOIL AND CARBON IN THE FIELD AND ALTHOUGH BEET TOPS ARE A LIKELY SOURCE OF N₂O EMISSIONS, THEY ALSO RETURN USEFUL ORGANIC MATTER**

OTHER BENEFITS



REDUCED CULTIVATIONS HAVE STREAMLINED WORK REQUIREMENTS AND REDUCED COSTS



THE POWER STATION IS ONLY 7KM AWAY SO IS A READY LOCAL MARKET



BEET GENETIC IMPROVEMENTS HAVE LED TO 25% INCREASE IN YIELD OVER LAST 10 YEARS

PHILL CRAWLEY

The family business that Phill runs is made up of 300,000 colony cage and 250,000 free range layers, packing 5 million eggs a week plus contract free range production



WHAT WE'RE DOING

"We got over taking productive arable land out of long-term food production. Now, we're thinking about planting more trees if the business case stacks up and ideally if long-term support was available. As well as minimising a farm's carbon footprint, trees have great benefits for the welfare of the birds, so everyone is a winner."

- **>65,000 trees planted over 40ha (40% oak, rowan, whitebeam, and elder). Some plantings were part-supported by retailer or grants, more recently solely paid for by the business**
- **Fast-growing poplar and willow planted close to the sheds to provide quick cover**

"Looking forward, more solar PV would be great because it's now cost-effective but we need to get over the Distribution Network Operator limit or accept no export payment allowance. I'm also thinking about future impacts on flexibility – would I be allowed to remove trees which weren't grant aided if I wanted to go back to arable?"

AND

PILLAR 1:

Trees provide foraging opportunities and natural shelter encouraging birds to roam in greater numbers and further, making more use of the range area reducing potential poaching. Also led to improvements in maintaining feather cover and shell colour Robots and tech used for inspection, detection and loading during packing improving efficiency

PILLAR 3:

385kW solar PV across seven sites

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DID YOU KNOW?

Renewables supplied over 40% of UK electricity in the first three months of 2020, more than the output from fossil fuels.



- **TREES PROVIDE A GROWING STOCK OF CARBON REDUCING THE GHG FOOTPRINT OF THE BUSINESS**

OTHER BENEFITS



SOLAR PV GENERATES 30% OF ELECTRICITY NEEDS SAVING ~£60,000/YEAR ON ENERGY COSTS BUT THE BUSINESS HAS HAD TO INCREASE PACKHOUSE CHILLING CAPACITY AS THE PV PANELS WERE RADIATING HEAT INTO THE BUILDING



LOWER NUMBERS OF PALE EGGS MEAN LESS SECOND QUALITY EGGS DURING SUNNY WEATHER AND IN WINTER, IMPROVED FEATHER COVER INSULATES THE BIRD KEEPING FOOD CONSUMPTION DOWN BECAUSE THE BIRD IS USING LESS ENERGY TO MAINTAIN BODY HEAT

STEVE KLENK

Steve manages 1214ha of arable (775ha) and grassland, and 600 beef cattle.



WHAT WE'RE DOING

"Getting into the no-till mindset took some time and we're on the road to finding the right companion crops e.g. red clover with OSR, buckwheat with OSR."

- ~160km of hedges (hawthorn, blackthorn, hazel, elm and holly). Some hedges have not been cut since 2003 and have grown to around 6m x 4m
- Have let some hedgeline trees grow up (in one 100m of hedge there are 30 trees) and has >200ha managed woodland
- Cover crops of spring oats, spring barley, phacelia, crimson clover, berseem clover, buckwheat and peas
- Tramlines are in the same position every year and combine and trailers are on tracks
- Well-rotted manure is used rotationally based on cropping, soil type and soil indices supported by soil testing every four years including for soil organic matter

"At some point we'll have to rotationally coppice the hedges. We've already reduced inorganic N use by 20% reducing GHGs and aim to cut use by a total of 50% over the next five years."

AND

PILLAR 1:

Using liquid nitrogen has led to more even spread and less overlap
Doing more tissue tests so we've got a better idea of what the plants are doing
Moved from min-till through strip-till to no-till reducing diesel use

PILLAR 3:

Have a share in an AD plant fed by maize, chicken muck and wholecrop
50% of the digestate comes back to the farm

OTHER BENEFITS



HAVE SAVED MONEY ON HEDGE CUTTING. BIGGER HEDGES HAVE PROVIDED A BIT MORE SHADE FOR CATTLE, SUPPORTED MANY MORE FLOWERS, BIRDS, INSECTS AND DETERRED POACHERS. EXISTING 6M MARGINS HAVE MEANT THAT THE LARGER HEDGES HAVEN'T AFFECTED THE CROP AND THAT FERTILISER HASN'T REACHED THE HEDGES WHICH HAVE CONSEQUENTLY GROWN MORE SLOWLY.



COVER CROPS HAVE HELPED TO STOP NUTRIENTS FROM LEACHING AND RUNNING OFF THE FIELD

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DID YOU KNOW?

Estimates of carbon density for UK hedgerows are between 15 tC/ha (short hedges, 1.5m) and 30-40 tC/ha (tall hedges, 2.7m) with an equivalent amount of below-ground biomass



- HEDGES AND WOODLAND HAVE INCREASED C STORED ON THE ESTATE

RACHEL HALLOS

Rachel has 80 Salers and 300 Scottish Blackface ewes on her 809ha upland tenanted family farm.



WHAT WE'RE DOING

"We are nothing fancy and we still have so much work to do but we believe with the support of our partners we can farm sustainably for future generations. We've had to be brave in letting partners know what we could do and what wasn't realistically possible."

- 249 dams to block grips and raise peatland water table with an additional 1015 dump bags heather brush and 1790 heather bales
- 41ha sphagnum plugs planted

"Next we want to experiment with herbal leys to fix N, for more diverse grazing and improved soil health, and we're working with the landlord to plant more trees in gullies. It's interesting that water retention has taken over from heather as the must-have, but more water could make it a very different farm. We need to understand what it might look like in 10–20 years' time for the next generation."

AND

PILLAR 1:

Signed up to a licensed Cattle Health Scheme Certification Standard. The herd runs on £21.46 per cow health budget for the year

Using performance-recorded genetics and aiming for easy-calving cows

New building enables more breeding cattle and covered storage for manure

DOING OUR BIT FOR NET ZERO



• WETTED-UP PEAT LOSES LESS CO₂



• GOOD PASTURE MANAGEMENT MAINTAINS THE CARBON STORED IN THE SOIL

OTHER BENEFITS



COST SAVINGS ON BOUGHT-IN FORAGE



DIVERSITY OF SPECIES IN FLOWER-RICH MEADOWS CUT FOR HAY LOVED BY LIVESTOCK



RE-WETTING THE MOOR HAS CREATED HABITAT FOR WADING BIRDS AND SLOWED THE FLOW OF WATER INTO THE VALLEYS



LIZZIE DYER

Lizzie and her partner own 11ha and access grazing on another 61ha to finish over 500 ex-dairy free-range billy kids every year.



WHAT WE'RE DOING

"Post-weaning coccidiosis has been one of our biggest challenges and how we manage our grassland is an important strategy in tackling it. We've used the kids' ability to eat anything to start new fields off on the right foot and to manage and revitalise our hedges."

- Took two years to improve grassland fertility and over the last five years application of nutrients is determined by results of soil testing. Fields are strip-grazed but kids are not returned for six months to increase grass productivity and to manage worm infection risk
- Planted >300 native trees in a wet field and ~600m hedge over last 10 years while also managing almost 0.5ha of ancient woodland

"We already run all the electric fences off portable PV panels and would love to install some solar PV on our buildings, but we just don't have funds for this at the moment. After the year that we and just about every farmer has had, becoming resilient to the volatile weather is going to be an on-going challenge. I think we're pretty typical farmers. We're trying to keep things simple but that has paid dividends – we've halved our fuel bill just by planning journeys so that we're doing more than one thing when we go out."

AND

PILLAR 1:

Kids purchased from high health status dairy farm and rigorous attention paid to health when on farm
Over-winter feed all locally grown with no soya

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Utilisation of ex-dairy kids reduces the GHG footprint of a kilo of goat meat as some emissions are attributed to the goat milk sector

CO₂

- IMPROVED GRASSLAND MANAGEMENT AND NEW HEDGE AND TREE PLANTING HAVE INCREASED CARBON STORED ON THE FARM

OTHER BENEFITS



SKINS PROCESSED INTO HOME FURNISHINGS



THE BUSINESS UTILISES WOOL TO INSULATE ITS BOXED MEAT – THE BIOECONOMY IN ACTION

GUTO DAVIES

Guto holds a family tenancy on 245ha with commonland and 40 Limousin, 5 Highland cattle, 530 hefted ewes (Welsh Mountain, some Welsh Hill Speckle).



WHAT WE'RE DOING

"We're making the best of our what we have on our farm – slowing the degradation of peat, and making sure that our system, with livestock playing a vital role, fits the land."

- 12km grips blocked in 2015 to raise the water table. More ditches filled a couple of years later have created a network of pools filling with moss
- Small woodland parcels across the farm and > 600m of new hedge planted a year ago

"So far the blocked grips haven't caused us any issues but our scanning has been a bit disappointing so vaccination is on the cards. Also on the list is faecal egg counting. And for the future I'd like to put in some new leys but they are expensive."

AND

PILLAR 1:

Flock genetics and the cattle have been chosen to live off the resources available

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Peat restoration projects across the UK, mostly on upland bogs, have helped reduce emissions

CO₂

- WETTED-UP PEAT LOSES LESS CO₂



- NEW HEDGES WILL STORE MORE CARBON

OTHER BENEFITS



SECURING OUR FIRST TENANCY HAS PROVIDED A HOME AND LIVELIHOOD TO RAISE A FAMILY



HIGHER GRAZING PRESSURE REMOVED MOLINIA AND SELECTIVE GRAZING BY CATTLE CREATED MORE DIVERSE HABITAT



SLOWER FLOW OF WATER OFF THE LAND; NO RISK OF LOSING SHEEP IN DITCHES



BRETT ASKEW

Brett runs a 526ha part-owned part-tenanted arable farm.



WHAT WE'RE DOING

"Chopping and changing biofuel policy has been a real headache, as is finding a profitable break crop. I can provide wheat at 10% protein which is refined to produce fuel for my car and protein feed at 34% energy for feed rations."

- **HEAR (High Erucic Acid Rapeseed) OSR varieties have up to 50–55% erucic acid in oil**
- **Wheat for conversion to transport biofuel**

"Solar PV is on my wish list and perhaps I could let some hedgeline trees grow but I am worried about shading. And I'd like to set research a challenge – please breed wheat which uses half the amount of N."

AND

PILLAR 1:

Variable-rate NPK application

Min-till wheat and OSR

Legumes in the rotation have reduced inorganic N applications

PILLAR 2:

~10km hedges and >12ha woodland

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

The future bioeconomy needs to produce both short-life biodegradable plastics and long-lived materials that lock up carbon for decades.



- **SUPPLYING A NEW BIOECONOMY – THE OIL IS USED FOR INDUSTRIAL LUBRICANTS AND FOOD PACKAGING AND WHEAT FOR BIOETHANOL**

OTHER BENEFITS



BOTH OSR AND WHEAT GO TO LOCAL MARKET

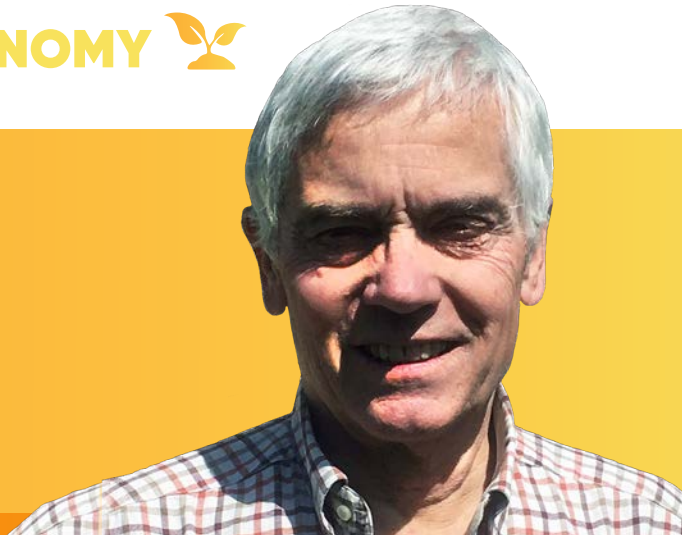


DISTILLERS DRIED GRAINS AND SOLIDS (DDGS) SUBSTITUTES FOR IMPORTED PROTEIN. LOCAL DOMESTIC BIOFUEL REFINERY PUTS IN A WHEAT PRICE FLOOR AND A CEILING ON PROTEIN PRICE GIVING THE ENTIRE SUPPLY CHAIN CONFIDENCE TO INVEST



ROBIN BUCK

Robin's >600ha family horticulture business grows potatoes, celeriac and daffodils among other crops.



WHAT WE'RE DOING

"It's been a challenge to start measuring all these things that produce GHGs because we do want to reduce our emissions. We started out with an energy audit and have moved on from there."

- **Roof-mounted 180kW solar PV**
- **Switched to 100% green power for all additional electricity demand**

"Our next step will definitely be to install more solar PV. And the challenge for the future is tackling the GHGs from nitrogen fertiliser application – it's about a third of our emissions. Our ultimate ambition is to become carbon neutral or even carbon negative. We are a long way from that but over the years we have taken many small steps to reduce our GHG emissions and we are seeking to make improvements every year."

AND

PILLAR 1:

Latest computer-controlled coldstore equipment
LED lights, inverters on electric motors, improving insulation in chill stores
The most fuel-efficient tractors and machinery
Energy and carbon audits, tracking progressive improvements in business' GHG footprint

PILLAR 2:

Planted 6km of hedges and 2ha of trees over past 18 years
Cover crops return organic matter to soil

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

GHG footprint from 10 daffodils is 98.8g CO₂e which is 50% of just one stem rose from Kenya at 183g

GHG



- **REDUCING GHG EMISSIONS PER TONNE BY MORE THAN 25% OVER 10 YEARS THROUGH ENERGY EFFICIENCY AND RENEWABLES**

OTHER BENEFITS



SOLAR PV PRODUCES ~60,000KWH/ YEAR SAVING THE FARM OVER £5,000 IN ELECTRICITY COSTS



BETTER MACHINERY WITH SATELLITE GUIDANCE HAS LED TO LESS DIESEL USAGE



BUILDING IMPROVEMENTS HAVE LOWERED ELECTRICITY CONSUMPTION

S.F. BATE & SON

SF Bate and Son is a family business of 1400ha combinable crops, 300ha grain maize and 270ha organic forage.

WHAT WE'RE DOING

"It took time and resource to get planning permission for the biomass boiler. Now that it's up and running we aim to heat the farm workshop over winter to improve workforce productivity."

- **100kW roof-mounted solar PV**
- **3MW straw-fuelled biomass boiler**

"Next up is planting over 100 trees. We can see that expanding our product line and building strong relationships with the end buyer will be challenges for the future. We want to be a price maker not a price taker."

AND

PILLAR 1:

More precision across the business e.g. GPS steering on all machines, liquid N application with auto-section shutoff
Biosolid applied to maize and high-K ash from biomass boiler recycled to arable land
Legumes fix N for the organic forage crop along with digestate from local AD plant

PILLAR 2:

>10km hedgerows and 60ha native woodland

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

1 tonne of straw can provide 3500kWh of heat



- **CREATED ON-FARM CIRCULAR BIOECONOMY – ARABLE ENTERPRISE SUPPLIES BIOMASS BOILER TO DRY GRAIN NEGATING ANY NEED TO BUY IN FEEDSTOCK AND REPLACES OLD FOSSIL FUEL GRAIN DRIER**

OTHER BENEFITS



THE BIOMASS BOILER HAS DIVERSIFIED FARM BUSINESS AND SAVED INPUT COSTS



SOLAR PV MEETS FARMYARD ELECTRICITY USAGE WITH SURPLUS EXPORTED TO GRID



USING BIOSOLID FROM WATER SECTOR REDUCED RELIANCE ON INORGANIC FERTILISERS AND ASSOCIATED GHG EMISSIONS

PETER AND RICHARD KENDALL

The 700ha family arable business run by Peter and his brother Richard also produces 360,000 chickens 7.5 times a year and contract farms another 650ha of arable.



WHAT WE'RE DOING

"We're trying to plan chicken production patterns to avoid peak electricity tariffs, since the ground source heat pumps are fairly energy hungry."

- 330kW solar PV
- Two 995kW straw-fed biomass boilers
- 960kW ground source heat pump

"Next up is getting more from chicken litter and possibly installing batteries. We're also asking ourselves how do we replace soya in chicken feed – is insect protein the answer? – and how do we reduce the use of heavy, fuel hungry tractors. Net zero 2040 is a massive challenge and getting our response right will provide genuine business opportunities as well as reducing costs and making our farming systems more sustainable."

AND

PILLAR 1:

Soil mapping and variable P application
Moving to min/no-till and trialling cover crops
Tracks and low ground pressure tyres on machines
Poultry housing automated with tech, is heavily insulated and has underfloor heating

PILLAR 2:

Poultry muck applied to improve soil organic matter
~12km new hedges and about 15ha woodland including 3ha planted 10 years ago

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

GHG emissions from feed production represent 60–80% of the carbon footprint of eggs, chicken and pork



- GENERATING CLEAN ELECTRICITY AND HEATING FOR THE BUSINESS AND FARMHOUSES, AND CREATING A MORE CIRCULAR SYSTEM

OTHER BENEFITS



USEFUL INCOME FROM RENEWABLES WHICH ARE LESS WEATHER DEPENDANT



APPLYING POULTRY MUCK HAS LOWERED THE COST OF BUYING-IN FERTILISER



PHIL PEARSON

Phil runs his UK-wide family business producing 650 million tomatoes/year.



WHAT WE'RE DOING

"Improving energy efficiency was initially a challenge but we've embraced some of the most advanced technology and our natural resources to allow us to produce tomatoes for 12 months of the year, and help the business be as efficient as possible."

- **Combined Heat and Power (CHP) plants on all sites with waste heat and CO2 used to grow the crop; some waste CO2 sourced from third party company**
- **Thermal storage tanks store hot water from CHPs to allow heat to be used when the CHPs are off**
- **Fully closed-loop AD producing compostable packaging from waste tomato leaves**
- **Ground source cooling used to manage irrigation water temperature and cool packing facilities**

"This is the circular bioeconomy in action – harnessing biology to generate energy and other products like the punnets. Our next step is to increase co-operation with other business sectors including using CO2 from biomass power generation. And we will continue improving resource efficiency including reduce fertiliser consumption further. We think we can drive innovation into new technology and re-purpose ideas from other sectors."

AND

PILLAR 1:

Working closely with seed companies to drive in-house development of new varieties to increase production and quality
Tomato leaves used to produce compost for organic tomato crops
LED top-lighting and LED inter-lighting in glasshouses allow for UK production out-of-season and glasshouses also fitted with thermal screens

OTHER BENEFITS



LEDS MAKE IN-CROP TEMPERATURE MUCH EASIER TO MANAGE SO WE HAVE MORE FLEXIBILITY AROUND PLANTING DATE WHEN IT'S HOT OUTSIDE



EMPLOY OVER 2,300 PEOPLE ACROSS 8 SITES



GROUND SOURCE COOLING SAVES 40% OF THE ELECTRICITY

DOING OUR BIT FOR NET ZERO



• **AD PLANT TURNS 3.5 TONNES OF LEAF WASTE INTO A RANGE OF PRODUCTS, INCLUDING BIO-PLASTICS AND LEAF FIBRE CELLULOSE USED IN THE MANUFACTURE OF PACKAGING FILM AND PUNNETS.**



• **SUPPLY OVER 211,500 MWH ELECTRICITY ANNUALLY TO GRID**





MARTIN HOWLETT

Martin runs a 113ha mixed family farm of Continental cross with Aberdeen Angus beef cattle, 200 continental ewes, miscanthus and arable.



WHAT WE'RE DOING

"The miscanthus was always a long-term investment and grown on marginal land the economics stacked up. Now we can pay more attention to detail on the productive land to make it work harder for us, whilst conscious of the farm business overall carbon footprint."

- 4ha of miscanthus planted in 2005 on marginal grade 3 land, yielding 10-12t/ha
- 100kW biomass boiler with bought-in woodchip as feedstock

"From 2015-2018 we were burning miscanthus in the boiler but then the RHI rules changed. I'm just about to try my first GHG calculator and for the longer-term I'm looking to install a full biosecurity system for the farm to combat disease challenges."

AND

PILLAR 1:

Work with vet to screen beef for BVD and Johnes as part of High Health Programme
New integrated cattle handling system
Soil testing and targeted fertiliser application

PILLAR 2:

Restored >4km Cornish hedge bank and have planted small pockets of trees in wetter areas of the farm

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Over 15-years a crop of miscanthus can increase SOM by up to 55%



- REDUCED GHG FOOTPRINT AS THE BIOMASS BOILER HAS REPLACED OIL FOR HEATING THE FARMHOUSE, THREE HOLIDAY HOMES AND AN EDUCATION CENTRE ROOM FOR SCHOOL VISITS



- MISCANTHUS CROP DEBRIS AND ROOTS HAVE INCREASED CARBON STORAGE ON FARM

OTHER BENEFITS



REDUCED EXPOSURE TO VOLATILE ENERGY MARKETS AND GUARANTEED FIXED/INDEX LINKED INCOME THROUGH RHI. THE MISCANTHUS HAS BEEN USED FOR BEDDING ON-FARM AND SOLD OFF-FARM, NOW CONTRACTED TO SUPPLY BALES FOR EQUINE AND LIVESTOCK BEDDING AT £75/T EX-FARM PLUS STORAGE PAYMENT AFTER 1ST JUNE



MISCANTHUS CONTINUES TO YIELD CONSISTENTLY WITHOUT ANY INPUTS AND SUPPORTS BIODIVERSITY



JOEL BECKETT

Joel farms 202ha mostly tenanted land growing maize, lucerne, temporary and permanent grass with usually 300 Pedigree Holsteins, 30 dry cows, plus 240 followers but currently only milking 210 cows.



WHAT WE'RE DOING

"As a dairy farm one of the best things we thought we could look at is how we handle the slurry the cows produce in a way that benefits the business and also the climate. In recent years we've also been trying to deal with mycoplasma in the milking herd which had been a struggle to diagnose and affected performance for several years, but now we're seeing very positive results after vaccination."

- 44kW AD
- 36kW solar PV

"The covid-19 crisis meant that our processor was only paying 10ppl for some of the milk so we've cut back on production by reducing the number of cows we're milking and spring grazing one group in order to mitigate losses. We're also looking into direct sales opportunities in order to increase financial security. Going forward we will better plan and manage grazing and diversify our crop rotation to include more wholecrop and a variety of cover crops in a bid to improve soil health and further reduce use of inorganic N."

AND

PILLAR 1:

Applying digestate and slurry by dribble bar and immediately incorporating it into the maize ground before establishment together with growing lucerne reduces amount of inorganic N required

Keep a close eye on milk components and work with a nutritionist to make best use of feed

PILLAR 2:

After maize we re-seed with grass to limit erosion

Almost 13km of hedgerows and nearly 1ha woodland

DOING OUR BIT FOR NET ZERO



- AD REMOVES THE CH₄ PRODUCED BY MANURE AND SLURRY, AND GENERATES ALL THE ELECTRICITY THE BUSINESS NEEDS. ANY SURPLUS IS SOLD TO THE GRID

OTHER BENEFITS



RENEWABLES HAVE PROVIDED INCOME DIVERSIFICATION



REDUCED AMMONIA EMISSIONS AS A RESULT OF DRIBBLE BAR APPLICATION OF DIGESTATE AND SLURRY



COLSTON GAY

Colston runs the part-owned part-tenanted family business made up of 607ha grass, 162 ha arable, a 450 organic dairy and milk processing unit, plus 300 breeding ewes and finishes 350 cattle/year.



WHAT WE'RE DOING

"The bottom line is that carbon footprint relates to how efficiently you can produce your product. So, the more efficient your milk production is, the lower the carbon footprint and the greater the opportunity for financial gains. I believe we still have room to improve."

- **250kW AD (feedstock – slurry, manure, straw bedding; lower quality grass and maize silage); slurry fed continuously from shed to plant**
- **Roof-mounted 30kW solar PV**

"I've been using the heat generated from the AD plant on-site. I might try drying maize and use that as bedding, which would save money and provide added feed value for the digester. Utilising what would otherwise be left in the field could give us a significant saving to the cost of production. I'm monitoring our C footprint – we've seen an 11% reduction already from 1.4 to 1.25 kg CO₂e/l n dash – and I'll use data to drive efficiencies, rather than outright expansion."

AND

PILLAR 1:

Improved yield from forage has had big impact on efficiency of cows, hedges and trees across the farm

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Better forage quality can reduce enteric methane production by ~ 5% per unit of fat protein corrected milk



- **AD PLANT AND SLURRY-FEED SYSTEM HAVE REDUCED CH₄ EMISSIONS FROM MANURE BY 40%**



- **FOOTPRINT FOR FUEL AND POWER HAS REDUCED BY 33%**

OTHER BENEFITS



PUTTING POORER QUALITY SILAGE THROUGH THE AD PLANT MEANS WE DON'T HAVE TO BUY-IN ANY ADDITIONAL FEEDSTOCK



INVESTMENT AND BUSINESS DEVELOPMENT WILL SUPPORT OUR SONS' FUTURES ON THE FARM

CLARE & STEPHEN MORGAN

The Morgans have a diverse 130ha family business; they manage 84,000 free range hens, 150 fattening cattle and 400 Aberfield cross-bred breeding ewes, alongside 15 letting properties and one holiday cottage.



WHAT WE'RE DOING

"By diversifying from the original business of potatoes, arable, beef and sheep we have spread our risk, making our income stream more stable and protecting it from agricultural market volatility. Getting planning permission for the solar PV, hen sheds and conversions was challenging but hasn't put us off."

- **46MW solar farm built in 2014/15 on 30 year lease and sheep grazing maintains ground vegetation**
- **Farmer-owned 120kW ground-mounted solar PV**
- **350kW biomass boiler heats 16 converted barns and farmhouse**
- **Feedstock is 60% woodchip which comes from the farm**

"Next, we'd like to double our farm-owned solar, install batteries when they're economically viable and source hens with better production and longevity i.e. 500 eggs in 100 weeks. And the challenge for the future – an economic replacement for soya."

AND

PILLAR 1:

Good genetics leading to 330 eggs/hen/flock over 72 weeks
Aiming for less labour and resource intensive ewes (Aberfield ewes with Primera, Highlander and Abertex rams). Undertake regular worm counting.

Take four cuts silage with higher protein levels, paddock grazing cattle moved every 1–2 days and leys established by min/no-till

PILLAR 2:

16km of hedges and ~10ha of woodland

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Up to 40% of farmers and growers are using the sun, wind, farm by-products and energy crops to produce clean, low-carbon energy



- **SOLAR PV AND BIOMASS REDUCE THE FARM'S CARBON FOOTPRINT AND HELP DECARBONISE THE WELSH ECONOMY**

OTHER BENEFITS



DIVERSIFIED INCOME AND ENERGY INDEPENDENCE



REDUCED USE OF ANTIBIOTICS





CAROLINE KNOX

The 470ha family business run by Caroline and her father is part-owned, part-tenanted involving arable, maize, veg and turf.



WHAT WE'RE DOING

"I can't put into words what it was like trying to get planning permission and grid connection for the solar farm quickly before the Feed-in Tariff changed. It was also quite challenging working in partnership with other farmers to develop the AD plant because we're traditionally sole operators. Our farming practice changes and adaptations now have climate costs as one of key pillars of all decision making. The route to getting it right can be meandering though."

- A stream of renewable energy projects – solar farm, rooftop solar PV, biomethane-AD, biomass heating
- 6MW AD (and 5MW solar farm) have been sold and the farm now provides half the feedstock for the biogas plant. Have trialled different varieties of maize and rye as feedstock
- 150kW farm-owned rooftop solar PV

"We've never been afraid of a change in business direction and farming practice, so next we're aiming to mulch the cover crops before drilling. Future challenges are increasing soil organic matter to balance soil health with the valuable rental contribution for potatoes and turf. We also need to understand how to best utilise the digestate on farm to benefit soil health."

AND

PILLAR 1:

Trialling direct drilling
Soil testing
Maize under-sown with clover

PILLAR 2:

Planting species-rich cover crops and have used sheep to graze stubble turnips
Hedges allowed to grow up and have some woodland across the farm

OTHER BENEFITS



SELLING SOME OF THE RENEWABLES ENABLED INVESTMENT IN NEW PROJECTS



N2O FROM FERTILISER MANUFACTURE AND CO2 RESPECTIVELY



STORING MORE CARBON ON FARMLAND BY MAXIMISING HEDGE GROWTH AND BUILDING SOIL ORGANIC MATTER. SOIL MEASURES HAVE REDUCED EROSION AND RUN-OFF AND DIVERSE COVER CROP MIX HAS BENEFITTED BIODIVERSITY

DOING OUR BIT FOR NET ZERO

DID YOU KNOW?

Britain now has around 100 biomethane plants putting low-carbon gas into the network, but this number needs to grow to more than 1000.

GHG



- REDUCING THE BUSINESS' GHG FOOTPRINT WITH THE HISTORY OF RENEWABLES AT DIFFERENT SCALES AND THROUGH EXPORT TO THE GRID



- BIOMETHANE PRODUCTION DECARBONISES OTHER SECTORS OF THE ECONOMY



CARBON FOOTPRINTING / CARBON CALCULATION

Carbon calculators help assess progress towards net zero by providing an estimate of the GHGs from a product or farm business. Some also estimate the carbon sequestered by soils and trees.

Carbon calculators freely available on the market include:

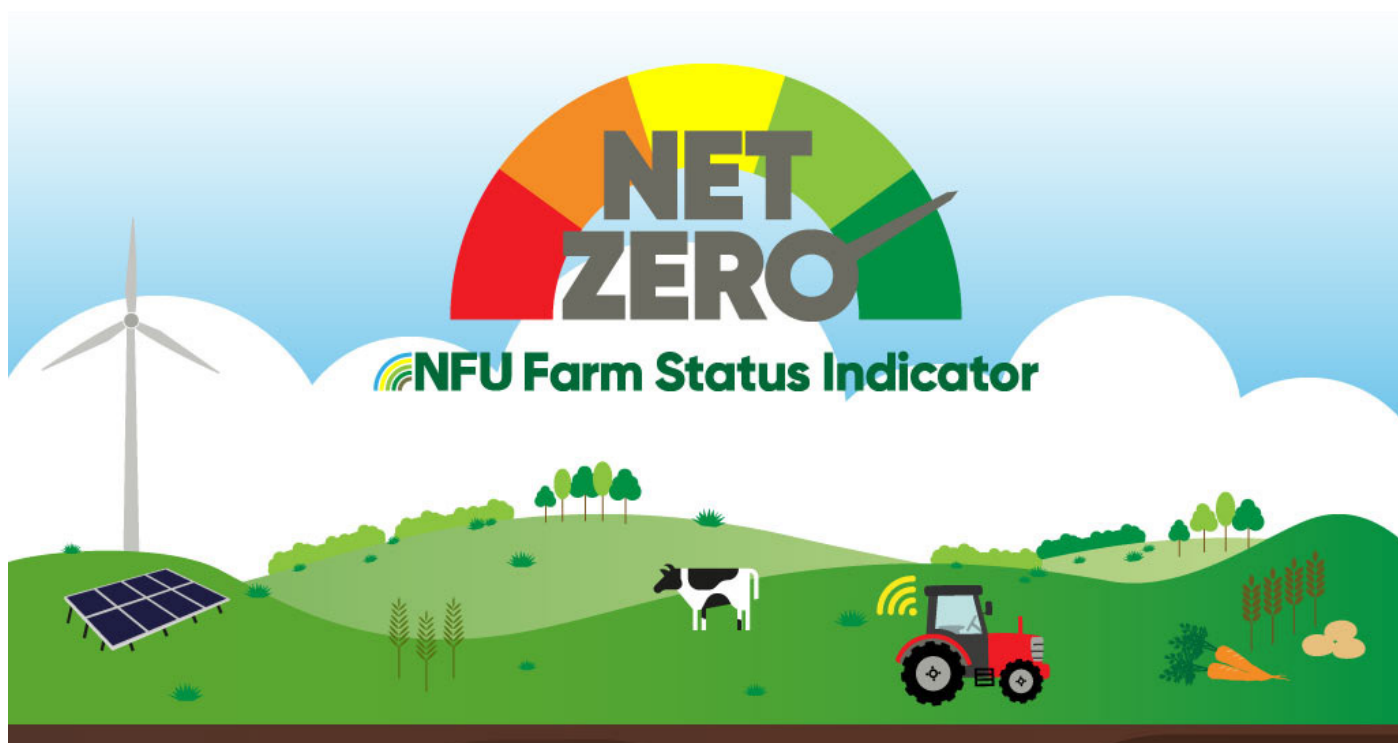
Agrecalc, Cool Farm Tool and Farm Carbon Calculator.

Find tutorials on the calculators here:

- **Agrecalc**
- **Cool Farm Tool**
- **Farm Carbon Calculator**

Read about the experiences of the NFU net zero steering group in testing these calculators [here](#).





HOW DO I MAKE A START?

- If you're an absolute beginner, try out the **NFU Farm Status Indicator**. It's a quick and simple introductory tool giving you a GHG balance score from 1-5. It's not a carbon calculator. Having got your score, you will be signposted to info to help you move to the next stage.

NFU Energy

Carbon accounting can be a complicated task, and understanding both the inputs and the results from the available calculators can be difficult.

NFU Energy has experience in on-farm carbon accounting, and offers a consultancy service to:

- **Assist you in choosing the most appropriate calculator for your product or farm.**
- **Advise and help with the data inputs to ensure that you are getting a representative figure for your farm/produce.**
- **Analyse your carbon equivalent emissions figure to further explain the results and give quantified recommendations on areas of improvement.**

Alternatively, if you do not want to use one of the available calculators, we also offer a more bespoke full calculation project.

If you are interested in carbon accounting and reducing emissions, call the NFU Energy team on 024 7669 6512.