Module 4
Air quality, climate change, energy and waste

- Ammonia NH3+ not a GHG – Gothenburg Protocol Objectives 2030

- Methane CH4 GHG (25 x CO2) 1kg CH4 = 25 kg COe
- Nitrous Oxide N2O GHG (300 x CO2) 1kg N2O = 300kg COe
- Carbon dioxide CO2 GHG

- Odor – nuisance

Carbon dioxide equivalents (CO2e) used to express GHG as above

Air Quality

- Agricultural account for around 88% of NH3+ emissions.
- High concentrations of NH3+ in air means N is deposited onto land.
- Damages habitats by changing species of plants present and pollutes streams, rivers & other water bodies.
- NH3+ can be converted to N2O & released from soils.
- Combines with substances in air to form fine particles, which harm human health.

Use of Urea

- From 1st April 2024, fertilisers containing urea that are not protected/inhibited can be used only between

15th January and 31st March.

- Outside this window, fertilisers containing urea that are protected/inhibited must be used.
- Detailed requirements are set out in a Red Tractor Standard

Mitigate Ammonia NH3+ emissions

- Apply protected/inhibited fertilisers if they contain urea - < 70%
- Covers on slurry stores - < 80% for rigid cover, <60% for plastic sheeting < 40% for floating covers.
- Allow cattle slurry store to develop natural crust - < 50%
- Cover solid manure store with plastic sheeting - < 60% reduction increased loss during spreading
- Use slurry band spreading application - 30% for short grass, 60% for trailing shoe in long grass.
- Use slurry injection application techniques - <70% shallow injection.
- Incorporate manure into soil - < 60% reduction if incorporated within 6 hours, < 40% for FM and < 60% for poultry manure if incorporated within 24 hours.
- Slurry acidification - < 50% adjust pH to 6
- Avoid spreading during hot and windy conditions with no rainfall expected
- Humid soils improve diffusion – rainfall upon fertilizer application significantly reduces ammonia emissions by distribution of fertilizer in the soil and mitigation of peak pH peaks and maximising recycling opportunities.

Nitrous Oxide (N2O)

- GHG
- 300 x CO2 e
- Produce under anaerobic conditions in the soil
- Thiobacillus dinitrogen and other denitrifying bacteria favor these conditions NO3, NO2, N2O
- Nitrification process NH4+ - NO2- NO3- small amounts of N2O produced

Mitigation N2O

- Drainage - mole - > 30% clay
- Add OM – improves workability – porosity – reduces bulk density
- Cover crops – adding N – exudates – reduce transpiration
- Roots in – feeding the biota
- Avoid Compaction – reduce cultivations
- Reduce fertilizer use – type of fertilizer – timing

Methane (CH4)

- GHG
- 25 x CO2 e
- Anaerobic conditions
- Ruminants Livestock – feed – efficiency
- Landfill – reduce waste

Carbon dioxide (CO2)

- GHG
- Used as equivalents for GHG

Lost by:

- Burning of fossil fuels
- Cultivations
- Breaking down OM
- Biota activity

Mitigate Carbon dioxide (CO2)

Reduce:

- Cultivations – number and depth
- Cropping - longer
- Rotations

Odour

Caused through:

- Manure & slurry application
- Livestock

Mitigation:

- Inject
- Incorporate
- Pre rainfall
- Wind direction
- Wind strength
- Weather conditions

For odour to count as a statutory nuisance it must do one of the following:

- unreasonably and substantially interfere with the use or enjoyment of a home or other premises
- injure health or be likely to injure health

Climate Change

Caused through

- Increase GHG
- Release carbon by cultivations
- Soil conditions – Anerobic – Water logging
- Loss of OM
- Livestock
- Manure & fertilizer application

Mitigations

- Reduce cultivation
- Crop diversity
- Increase rotation
- Add OM
- Livestock reduction
- Livestock diet
- Livestock housing conditions
- Livestock Breeding

Carbon Emissions

- Cultivations - reduction
- Crops - perennial
- Rotation – longer greater diversity
- Cover crops – keeps soil covered

Net Zero

- NFU 2040
- 25-year plan 2050
- Carbon off set by sequestering via photosynthesis
- Reduce cultivations
- Audit farm
- Renewables – solar – biogas – geothermic (Eden Project) – heat source pumps

Farm Carbon Emissions

- Burning fossil fuels
- Cultivations
- Bare soil

Calculating Carbon Emissions on Farm

See AHDB Carbon Tool Kit

Carbon Reduction Practices on Farm

- Energy efficiency reduces a farms CO2 emissions and lower their C footprint
- Monitoring of fuel use with meters - record for different jobs
- Renewable energy as electricity source to reduce reliance on fossil fuels
- Switch to energy efficient lighting sources - LEDs
- Switch to light cultivations such as plough reducing to min till
- CO2 – reduce diesel use produced from burn of fossil fuels
- Methane – from ruminant livestock – greatest contributor from Agric
- N2O released from soils under anaerobic conditions and to a lesser extent during nitrification process

Climate Change & the Farm

- Reduce energy use
- Meter – Monitor energy use
- Lights
- Cultivations
- Clear accounting

Energy Use & Efficiency Improving Electricity

Renewable electricity generation:

- Solar panels, wind turbines or other sources of renewable energy.
- Depending on location, on a hill or low in a valley, limitations for wind turbines close to the M.O.D operations, and any infrastructure that might impinge on landscape character.

Green energy tariffs:

- Works by the supplier promising to match all or some of the electricity you use with renewable energy, which it then feeds back into the National Grid.

The more people who sign up to a green energy tariff, the bigger the percentage of green energy in the national supply

Energy Use & Efficiency Maximising Heating

- Insulation: Check insulation, loft, floor and wall cavity insulation, and gaps in window and door frames.
- Draught excluder for windows and doors.
- Check your thermostat: Turn down your thermostat when your property is not occupied and at night.
- Renewable heat generation: Options for renewable heat generation, ground or air source heat pumps. Viability of some technologies for individual dwellings must be considered, particularly when it comes to electricity supply. Renewable technologies can also be used to heat water.
- Windows: Replacing single-glazed windows with double-glazed windows could reduce heat loss by up to 75%. Restrictions may apply for listed buildings.

Energy Use & Efficiency Maximising Lighting

- **Fixtures and bulbs:** Upgrading lighting fixtures
- **Natural light:** Use natural light as much as possible
- **Upkeep:** Ensuring that light fixtures are kept clean
- **Security lighting:** Consider solar powered security lighting.
- **Automatic lighting:** Consider automatic lighting for some buildings.

Energy Use & Efficiency Maximising Office Equipment

Equipment:

- Ensure energy saving features on office equipment are enabled.
- Only purchase equipment with a high energy efficiency rating, and ensure all equipment is switched off when not in use (especially overnight).

Printing:

- Only print when necessary and ensure this is done double-sided.

Heating:

- Prevent use of portable electric heaters where possible, as these are generally energy inefficient.

Energy Use & Efficiency Maximising Vehicles

Electric vehicles (EVs):

- Making the **switch to electric**, could have long term financial benefits and of course environmental benefits, particularly where charging infrastructure is powered by renewables.

Driving economically:

- **Drive smoothly**, accelerate gently, and read the road ahead to avoid heavy braking.

Maintenance:

- Ensuring your vehicles and machines are **well maintained** will enable fuel efficiency, for example, ensuring tyres on tractors and machinery are suitably inflated for the task.

Also consider

- (if applicable) livestock watering systems, irrigation systems, greenhouses, grain drying and farm shop operations).

Energy Efficiency Advice for Arable Farmers

- Largest energy usage on arable farms is **crop storage and drying**.
- **Transport and cultivation** considerable source and the inputs which go into growing crops comprise another large source.
- The '**embodied energy' in fert**. , especially ammonium and nitrate based fert. , with around a tonne of oil used to manufacture each tonne of chemical fertiliser.
- **Reducing artificial fert**. will increase energy resilience & emissions.

Crop storage and drying

- High temp. dryers require **55litres of oil per ha** of crop dried.
- Controls set to the right setting - **can waste up to 25%** of the energy used.
- Humidity key to crop storage and drying - could save up to **40%** of energy.
- Cooling crops rather than drying them could save **10%**
- Maintenance, ventilation fans at the appropriate size, accurate moisture measurement and aeration.
- Mixed flow driers **save 50%** compared to conventional basic crossflow driers. Adding recirculation crossflow driers can save up to **30%** of energy.
- Dryer operating at the right capacity, neither too heavily loaded.
- Harvesting at the **right time** for drying.