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Circulation: [nrmm.cfe@energysecurity.gov.uk](mailto:nrmm.cfe@energysecurity.gov.uk)

Contact: Sarah Batchelor / Dr Jonathan Scurlock; Transport Adviser / Chief Adviser, Renewable Energy and Climate Change

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## DESNZ / DfT / Defra call for evidence Non-road mobile machinery: decarbonisation options

The National Farmers' Union of England and Wales (NFU) would like to make the following key points in response to this consultation:

- **there are technical, commercial availability, infrastructure and fuel supply barriers to decarbonising NRMM on farms**
- **the agricultural entitlement to reduced-duty 'red' diesel must remain in place until more low-carbon fuel switching options are commercially available**
- **increased support for technology demonstrators is required, as well as incentives and tax reliefs for farmers to invest in purchasing and operation of low carbon NRMM**
- **access to drop-in diesel replacement fuels such as HVO will be needed for 'legacy' agricultural machinery for decades to come.**

The NFU represents over 45,000 farmer and grower businesses across England and Wales". In addition, we have 20,000 NFU Countryside members with an interest in farming and rural life.

Our trade association is the largest farming organisation in the UK, providing a strong and respected voice for the industry and employing hundreds of staff to support the needs of NFU members locally, nationally and internationally. We are engaged with government departments covering agriculture, rural affairs, environment, energy, climate change, employment, infrastructure and transport issues, directing policy into real economic opportunities for rural diversification and job creation. The NFU champions British agriculture and horticulture, to campaign for a stable and sustainable future for our farmers and growers.

With 75 per cent of national land area in the agricultural sector, NFU members have a significant interest in land-based renewable energy production, where they can benefit directly as energy producers themselves or as hosts for energy plant developed by others. Our own market research, as well as that of other organisations, suggests that nearly two-fifths of farmers and growers have already invested in some form of renewable energy production for self-supply or export to other users. We estimate that farmers own or host about 70% of Britain's solar power capacity, over half of AD capacity and the majority of wind power, while playing a significant role in the supply or fuelling of renewable heat.

In 2019 the NFU set out its vision for agriculture to achieve a net zero contribution to climate change across the whole of agricultural production by 2040, focussed on three key areas or 'pillars':

- Improving the productive efficiency of farming across all sectors, to reduce our emissions
- Increasing on-farm carbon storage in vegetation and soils
- Boosting production of land-based renewable energy, including bioenergy for processes coupled to carbon capture, to generate credits for greenhouse gas (GHG) emissions avoided and GHG removal.

## General comments

The NFU has consulted with our own members as well as other stakeholders in the agricultural industry concerning the decarbonisation of Non-Road Mobile Machinery, and we have summarised their input in our replies to questions below. Our response to this Call for Evidence is also supported by the National Farmers' Union of Scotland, the Ulster Farmers' Union, and the Agricultural Engineers Association.

The NFU notes that this Call for Evidence does not ask specifically about a possible phase-out date for diesel-powered machinery, but rather that it is still considering the various low-carbon technological options. We note also that the accompanying technical report by ERM Consultants focuses predominantly on industrial non-road mobile machinery (NRMM), despite agriculture accounting for nearly half (45%) of all NRMM fuel use. It is regrettable that agricultural decarbonisation options were not also reviewed. Independently, the NFU is also participating in a DESNZ task-and-finish group on hydrogen internal combustion engines for NRMM.

The NFU would like to see strong Government support for low-carbon sustainable biofuel alternatives and accelerated introduction of electric farm machinery. Incentives, tax allowances and demonstration projects would all help to develop the agricultural market, especially for biomethane and electric machinery which is only just emerging from the prototype stage.

Reduced-duty 'red' diesel is the main fuel used in the majority of agricultural machinery, essential for many farm businesses and maintaining food production. The NFU notes that this was recognised in recent government policy, when agriculture was exempted from removal of the entitlement to use red diesel and rebated biodiesel in most sectors from April 2022. It is critically important that this agricultural entitlement remains in place until a suitable range of low-carbon alternatives are commercially available, and until farmers have had sufficient time to invest in new machinery. An increase in the cost of agricultural diesel would make NFU members uncompetitive with producers in many other countries that provide their agricultural sectors with a reduced fuel duty rate, subsidies, or tax allowances on diesel, at a time when they are facing increased pressure on costs as a result of significant inflation across a range of agricultural inputs.

## Responses to selected consultation questions

*Q11. Do you represent or hold expertise on NRMM in a specific sector?*

Yes, agriculture and horticulture. The NFU notes that unlike some other sectors, some agricultural NRMM is also permitted to be used on public roads, e.g. to move between farmyards and fields.

*Q14. Are you able to provide any additional information regarding the NRMM product lifecycle?*

Yes. Some of the most heavily-used agricultural machinery may be replaced after 5 years, while other machinery may be retained for long periods (e.g. 20 years). Investment cycles differ from farm to farm, and also within types of equipment used on farm. For example, workhorse tractors would have a

shorter life span for many, while combine harvesters will more generally be on longer investment cycles. Setting an arbitrary date for ending diesel machinery sales, even if options were available for low-carbon NRMM, would be a blunt tool that could force hugely prohibitive investment that could not be justified.

Some large specialist machinery (e.g. sugar beet and pea harvesters) may be arguably better suited to retrofitting with low-carbon engine technology rather than complete replacement. A sugar beet harvester normally lasts around 12-15 years; however, larger agricultural contractors are inclined to replace them every 2-5 years, to avoid increasing maintenance and repair costs and to ensure that the machine is economically justified within the business.

An online poll of NFU members on NRMM lifecycles indicated that:

- 15% of machines are kept from 1 to 5 years,
- 26% of machines are kept from 6 to 10 years,
- 30% of machines are kept from 11 to 15 years, and
- 18% of machines are kept for 16 years or more.

A “one-size fits all” approach cannot really be applied to the agricultural sector, since no two farming operations are the same. Each farm’s management and operational style is dictated by the topography of the land, business objectives, and many other factors. The machinery requirements of large-scale cropping in the Cambridgeshire fens cannot be compared to or applied to an upland livestock farm in Devon. Likewise, buying practices range from purchasing second hand machinery outright and retaining it for decades, to leasing or buying new equipment for up to 5 years before exchanging it for new machinery.

*Q15. Are you able to provide any additional information regarding how NRMM is used in the sectors presented in Table 1?*

Yes – notably omitted from the list of agricultural equipment are skid-steer loaders, wheel loaders, and telehandlers (large telescopic fork-lift trucks). These types of vehicles are often confined to operations in farmyards. A growing range of telehandlers is already available in low-carbon options such as battery electric.

*Q17. If you own, rent, or lease, and/or operate NRMM, what are the main considerations when deciding what machines to procure and whether to buy outright or rent/lease?*

The main drivers for procurement are build quality and dealer backup service. Farmers may be taking a big risk on a piece of new equipment expected to last for 20 years, so they prefer proven technology. Some will prefer buying with staggered payments, including maintenance, to ensure equipment lasts and to protect the farmer from volatile lending rates.

Buying considerations, like product lifecycles, vary between different sizes of business and between farm sectors:

- in horticulture and large-scale cropping, the biggest items of machinery such as potato harvesters are quite likely to be cooperatively owned in the future, with several farmers owning a stake, due to increasing capital costs.
- in the poultry sector, outright purchase of new alternative-fuel technology may become less commonplace, with an increase in leasing as farmers avoid risk and mitigate their uncertainty about the performance of new technologies and fuels. Leasing with an “escape clause” may allow termination of the agreement if the machine is not suitable for their farming practices.

NFU polling found the following factors impacting buying style:

- 38% Machine lifecycle and efficiency,
- 18% Maintenance Cycles of machines,

- 29% Business Cashflow, and
- 12% Technological advances.

*Q18. DESNZ commissioned research suggests that around 33% of construction machinery is owner operated versus 67% which is either hired or leased. How does this compare to the sector(s) in which you are interested?*

It is vitally important that any research considers the full range of industries using NRMM. NFU polling found that in general around 85% of machinery is owned outright (through a variety of buying methods), compared to only 11% leasing – although buying styles may differ between specific farm sectors (see below):

- 32% single payment for outright ownership,
- 28% multiple payments for outright ownership,
- 25% hire purchase buying scheme, and
- 11% leased machinery.

Some farmers on Hire Purchase schemes may opt to swap out machinery at the end of the payment cycle, switching to new Hire Purchase agreement for the replacement equipment. In the sugar beet sector, machinery is mostly owned outright, although some contractors are exploring lease options due to the increasing costs of new equipment. We estimate that around 30% of such machinery is leased, on terms of around 2-3 years before the machine is sold on at a reduced cost.

*Q25. Has fuel switching been attempted in the NRMM type(s) or sector(s) that you are interested in? If so, please list the alternative fuels that have been switched to.*

The NFU is familiar with a number of feasible drop-in replacement low-carbon biofuels that can be used in agricultural machinery - 100% biodiesel, pure plant oil (PPO) and hydrotreated vegetable oil (HVO) - although some of these require minor engine modifications. Previously, we have advocated for tax incentives on high-blend biofuels based upon estimated carbon savings, but these proposals have not been backed by Government policy. Other low-carbon options, available now or likely in the near future, include biomethane, hydrogen (in fuel cells or combustion engines), ammonia as a combustion fuel, and battery electric power – but all of these require substantial adaption of machinery or its replacement.

An online poll of NFU members found that only a small proportion had explored alternative fuels on farm (all of which were battery electric). One sugar beet member explored the option of GTL (gas-to-liquid fuel, a cleaner diesel replacement) but lengthy delays in GTL fuel delivery led to cancellation of the order. An arable cropping member who switched two machinery items from diesel to battery electric – a Side-by-Side All-Terrain Vehicle (SBS ATV) and a telehandler – noted safety concerns with the lack of engine noise, resulting in some ‘near misses’. The increased weight of the SBS ATV was an issue when traversing fields, and the telehandler operating and charging times were less effective compared with the diesel equivalent (4.5 house operating time, compared with 7h). Power cuts were also a concern, impacting charging efficiency and often preventing charging the two machines together.

Nestlé has explored switching sugar beet growers to HVO, which can deliver an estimated 90% reduction in GHG emissions, but the increased costs of the fuel and infrastructure were deemed prohibitive. The NFU and its supply chain partners agree that significant financial and industry support would be required to enable farmers and growers to make this fuel switch.

*Q28. What do you see as the necessary fuel switching options for the NRMM type(s) and/or sector(s) that you are interested in?*

We foresee battery electric technology becoming more widely available for smaller and general-purpose agricultural machinery, but it is presently unclear what fuel switching options will be most practical and available for larger heavy-duty agricultural work. It may be that no one solution is suitable

for all machinery and use cases, so several different options should be available to ensure that farmers are able to adapt in the most suitable manner for their farming styles.

*Q32. Do you agree that these are the main technical barriers [limited commercial availability, unsuitability] to the deployment of NRMM decarbonisation options?*

We agree that, at present, there is low commercial availability of much agricultural machinery with alternative powertrains. Only small electric tractors and a limited choice of biomethane tractors are currently available, together with a wider choice of electric telehandlers. Some existing machinery is certified for use with HVO drop-in replacement fuel, and JCB's hydrogen combustion technology appears promising if they can prove its safety in fuel distribution and handling.

For those trialling electric machinery on farms, there are challenges around battery capacity/duration and recharging times, which can affect business efficiency when having to use the machine for extended periods of time. This may dictate choice when considering fuel switching. Prototype hydrogen fuel cell powertrains have raised concerns around their robustness and therefore suitability for agricultural applications.

NFU arable sector members were concerned that if battery electric machines replaced current diesel machinery, there would be an increased reliance on specialist engineers to carry out maintenance work. Workshop safety and mechanical retraining was also raised; at present, most farmers are able to conduct basic maintenance and repairs to their own agricultural machines. Our livestock and uplands sectors highlighted potential staff safety issues around lone working, in case a battery electric machine (quadbike or ATV) ran out of charge in remote locations, such as on moorland.

Within the sugar beet sector the biggest challenge is availability of machinery, regardless of decarbonisation technology. There are few beet harvester manufacturers, and demand exceeds supply, so machinery is normally made to order, pushing up costs. Manufacturers have neither the time nor capital to invest into research and development of alternative fuel powered systems. Sugar beet contractors often rely on a limited fleet of machines, normally one per business, travelling significant distances to complete their work with no backup or replacements, so performance and reliability are key.

Combine harvesters and beet harvesters often run for 12-15 hours per day at peak times of the year. Crop harvests could be significantly delayed if these machines were battery electric, requiring periodic stoppages to recharge – even if such facilities were available in-field rather than requiring a return to base.

*Q34. Do you agree that these are the main infrastructure and fuel supply barriers [grid connections/capacity, limited fuel supply chain] to the deployment of NRMM decarbonisation options? If not, which barriers listed do not apply and/or what additional significant infrastructure and fuel supply barriers exist?*

We agree that many British farms (throughout England, Wales and the other Devolved Administrations) are constrained by weak energy grid connections, whether for extra electrical loads like electric vehicle charging or to enable on-site generation to meet this need. Improved rural electricity grid access is urgently needed, including streamlined and fairer processes to obtain flexible connections that make use of on-site battery storage, export-limiting devices, and communications technology. Related supply chain constraints include the limited availability of biomethane and/or the gas grid within reasonable distance of most farms.

While there is growing recognition of the opportunities for clean energy self-sufficiency on farms (e.g. Defra's current Improving Farm Productivity grants for connecting rooftop solar PV), we can anticipate that delays and cost in upgrading grid infrastructure will hold back increasing electrification of farm

machinery and other processes for at least the remainder of this decade - and that significant increases in on-site energy generation would be needed to cover the additional needs of farm machinery.

The accessibility of other alternative fuels including availability and distribution would also be key, and these may pose other challenges such as fuel handling safety and planning / landscape issues. Farmers need to understand more about the potential distribution methods and infrastructure required for alternative fuel sources such as hydrogen (e.g. tankers, pipelines).

Lastly, while battery electric drivetrains appear to be a viable option for some machinery such as telehandlers, there are concerns over the increased weight that battery electric poses for larger farm machinery, and the subsequent impact on fields and soil compaction, especially with increased occurrence of wet weather and flooding.

Our NFU member poll found the following indicative barriers to uptake of alternative fuels:

- 13.4% Cost of new machinery,
- 12.5% Cost of upgrading existing machinery,
- 11.5% Limited availability of fuels and machinery,
- 11.5% Lack of alternative fuel infrastructure and limited supply chain,
- 10.5% Lack of knowledge of alternative fuels and their use in NRMM,
- 9.6% Unsuitability of adapting existing machines to be powered by alternative fuels,
- 8.6% Potential safety concerns of alternative fuels including storage and infrastructure,
- 7.6% Alternative fuel powered machines are not comparable to their ICE equivalents,
- 8.6% Cost of upgrading farm infrastructure to accommodate alternative fuel requirements, and
- 4.8% Potential safety concerns of machines.

Considering these responses, 34.5% of respondents cited costs as a barrier; while limited supply, infrastructure and availability of both fuels and machinery accounted for 23% of responses. Overall, there appear to be significantly more barriers than incentives at present to the uptake of alternative fuels, including costs of replacement machinery; cost of upgrading farm infrastructure; lack of knowledge of alternative fuels; and safety concerns about both machines and alternative fuel systems.

*Q44. What additional policy principles should government consider with regards to NRMM decarbonisation?*

Any proposed regulation requiring the sale of new NRMM in the UK to be low or zero carbon from a certain date should only be implemented when a sufficient choice of low-carbon options is available. Significant support for technology demonstration projects to raise awareness of alternatives will be required in the meantime, going beyond Defra's present Farming Innovation Programme and Farming Equipment & Technology Fund, and including adequate incentives for farmers and growers to invest in purchasing and operation of low-carbon NRMM. These could include full tax relief on capital expenses for extended time periods, and support for uptake of more expensive alternative fuels. Machinery must be broadly comparable in performance, efficiency, and price, to ensure that businesses are not negatively affected by having to decarbonise.

Continued access to drop-in replacement fuels such as HVO will be needed for a considerable 'legacy' fleet of agricultural NRMM for decades to come. Such considerations would include vintage agricultural machinery or niche machinery where decarbonisation may not be an option. We would also like to emphasise that while agricultural machinery is primarily used off-road, many machines need to be kept within road legal requirements. In addition to our concerns about weight and soil compaction (Q34, above), we note that the battery weight of large electric machines could exceed the current legal weight limits, and/or compromise the load weight that the vehicle is allowed to carry or tow.

The NFU notes that much of this Call for Evidence is not relevant to agricultural NRMM, so we request a future dedicated consultation on the government's policy proposals for agriculture – which should include an impact assessment covering the specific machinery requirements of all farming sectors, farm sizes and types. Given the national importance of food security, it would be appropriate and important to conduct a discrete consultation for agricultural machinery independent of the construction sector.

Lastly, many farm businesses rely upon the second-hand export market as a mechanism for selling on existing machinery and upgrading, to ensure that the farm can keep up with the latest developments in technology, efficiency and productivity. The NFU notes that in the longer term, new decarbonised machinery will need to be suitable for the second-hand export market. If this is not an option, such machinery will be significantly devalued, affecting business cashflow. It is therefore important that UK policy on agricultural NRMM is aligned with trends in other countries.