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Date: Monday, 26th March 2024
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Dear Colleague,

The Hydrogen Energy Association's response to the DESNZ and DfT consultation on 'Non-road mobile machinery: decarbonisation options.'

I am writing on behalf of the Hydrogen Energy Association (Formerly the UK Hydrogen and Fuel Cell Association) and in response to your current consultation on the decarbonisation options for Non-road mobile machinery. The Hydrogen Energy Association (HEA) is the leading pan-UK trade body in the hydrogen energy sector, with a Mission to support the growth of our members and the sector, and to ensure that the right policy framework is in place. Our 110 plus member companies represent over 200,000 employees globally, with combined revenues over £400 billion, and cover the entire value chain from raw material sourcing, to supply chain and components, financing, professional services, B2B and consumer facing solutions.

With over 15 years of experience, the HEA is a leader in advocating for and accelerating the transition to Net Zero in the UK through the deployment of hydrogen & fuel cell solutions. We promote and represent our members' interests across the hydrogen space, and campaign for the best policy outcomes for the industry across the full range of applications and opportunities.

Due to the high energy output and flexibility demands of Non-Road Mobile Machinery (NRMM) operation, it is increasingly likely that hydrogen will play a substantial role in the decarbonisation of the sector. Thus, it is crucial that the operational viability and economic feasibility of both hydrogen Internal Combustion Engine (ICE) and Fuel Cell (FC) technology are supported in the policy evolution of the NRMM sector.

In this Consultation, the questions that are of direct relevance to our members and their objectives are as follows: **30-38; 41; 45-48**.

Q30. Do you agree that these are the main opportunities and potential co-benefits to the deployment of NRMM decarbonisation options?

Whilst some of the main opportunities and co-benefits of decarbonisation options for NRMM are outlined, these are not applicable for all technologies. In Chapter 2, the decarbonisation opportunities and evidence provided for hydrogen appears disproportionately small in comparison to electrification.

Much of the challenging working conditions in which NRMM operates is more suited to the flexibility that hydrogen solutions provide, and this should be reflected in the Government's plans.
An opportunity that is perhaps overestimated is the reductions in noise pollution, as the sites where NRMM is deployed are generally very noisy regardless, particularly in urban areas, for example. From an air pollution perspective, switching to hydrogen would improve air quality in that the only emissions from combustion are water and a small amount of Nitrous Oxides (NO_X), with only water being emitted from fuel cells.

31. Are there any other opportunities and / or potential co-benefits?

From the perspective of hydrogen as a zero-carbon fuel, there are other notably opportunities of using ICE and FC technologies. Hydrogen ICE offers reduced initial investment for manufacturers looking to switch from fossil fuels, and the NO_x emissions of hydrogen ICE are minimal to the extent that an increasing number of countries consider it a zero-emissions technology. Hydrogen ICE maintains engine familiarity for operation, performance and maintenance, allowing for a high power output and fast refuelling times.

Fuel cells have the advantage of low operational costs and reliability; they have been proven to maintain operation in challenging and rough working environments. The technology releases no emissions and the lack of harmful substances in its composition, such as battery acid, present upcycling opportunities. The modular technology of the FC also make it easily scalable, which is an important asset for the range of NRMM applications.

Both technologies have the advantage of high skills transferability from the existing oil and gas sector. Increasing the demand for hydrogen would reduce the pressure on the grid, which would otherwise be increased if the entire NRMM sector was electrified. As an early mover in the global hydrogen economy, the UK has the opportunity to capitalize on the new clean growth opportunities of both hydrogen ICE and FC technologies if it acts now.

32. Do you agree that these are the main technical barriers to the deployment of NRMM decarbonisation options? If not, which barriers listed do not apply and/or what additional significant technical barriers exist?

A barrier that is not included here and must be given adequate consideration is the harsh and unstable material environments in which NRMM operates. Equipment must be durable and able to operate at a high intensity for many hours before or after sitting idle for long periods of time. Some of the machinery included within the NRMM sector have significant power throughputs and, thus, the scalability of the decarbonisation solution must be considered. So too must the mobility requirements of the machinery (i.e. will it be in a relatively fixed site location or will it need to constantly switch sites?).

Due to these challenging operating conditions, certain technologies, such as Battery Electric and Tethered Electric, may not be suitable for all NRMM applications. Remote sites, areas with high grid constraints, and construction sites pose issues for the provision of electricity and reduce the viability of electric solutions. Hydrogen ICE and FC solutions are not subject to the same constraints, and ICE in particular offers the benefits of the similar durability and flexibility experienced with diesel ICEs.

33. Do you agree that these are the main financial and economic barriers to the deployment of NRMM decarbonisation options? If not, which barriers listed do not apply and / or what additional significant financial and economic barriers exist?

The specified financial and economic barriers are all relevant to the decarbonisation of NRMM. As mentioned, CAPEX costs are a significant hurdle to negotiate; it should be noted that this is due to the cost of the supporting equipment and infrastructure needed to operate NRMM, as well as the machinery itself. How this infrastructure and machinery will hold its value over time is another economic barrier to adopting decarbonisation options that investors are confronted with. Without clear direction from the Government, it is difficult to ascertain what the residual value of decarbonised NRMM technology will be in the future. As well as CAPEX considerations, the current price of low-carbon fuels relative to diesel resembles a large financial barriers for investors and operators.

Another substantial economic barrier for NRMM decarbonisation is the risk factor associated with the unproven lifetime assumptions of early-stage technology, which presents a significant financial challenge for emerging technology in a sector with high levels of leasing and rental. Hydrogen ICE offers some benefit here in mitigating risk for existing financial models relative to other solutions with lower a lower Technology Readiness Level (TRL). It also offers more optionality for repowering and upcycling, thus extending the equipment lifetime and counteracting the inflationary costs of adopting new technology within the timescales of the decarbonisation targets.

In terms of the productivity and uptime requirements of the NRMM, the commercial and contractual business models related to the sector are currently exposed to high levels of financial risk due to the limited availability of alternative fuel / power options and the supporting infrastructure. While the supply chain is being developed, Hydrogen ICE based dual-fuel solutions (on new or existing equipment) can mitigate the productivity risks associated with full reliance on alternatives, as well as deliver substantial emission reductions.

34. Do you agree that these are the main infrastructure and fuel supply barriers 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?

The HEA agrees with the specified infrastructural and fuel supply barriers, however, the Government must also focus on ensuring that the availability of different technologies will be achieved within the timescales of the Climate Change Act.

The initial availability of alternative fuels, particularly in more remote areas away from demand hubs, is another significant concern, one which co-located hydrogen generators could help ease. The speed at which different fuel supplies will be available to NRMM will also hinge on how the different safety profiles of low-carbon solutions intersect with that of the site-specific safety requirements where NRMM operates. In terms of a whole system supply, new low-carbon projects are finding that timely grid connections currently present a large barrier to decarbonization efforts. An estimated 100km of additional electric cabling will be needed every day until 2040 to meet future demand for electric

lines.[1] With current estimates for the cost of electrical cables at ~£1 million per km,[2] the scale-up of hydrogen could substantially alleviate the cost associated with expanding and reinforcing the grid.

35. Do you agree that these are the main operational barriers to the deployment of NRMM decarbonisation options? If not, which barriers listed do not apply and / or what additional significant operational barriers exist?

An important barrier that is not included is the logistics of transporting / transmitting the fuel / electricity to the site and storing it in situ. Unlike other sectors, the intensive operational demands of NRMM usually requires infrastructure to transport fuel to the machine rather than vice versa, and this is challenging in transient environments such as construction. As such, refuelling solutions must be flexible and adaptive to support the changing operational demands of NRMM. This may present an operational barrier to the decarbonisation options available to NRMM, as they do not have the same energy density as diesel and may require more frequent intervention. Unlike the long charging times inherent with electrification, refuelling solutions of hydrogen applications can be mobile and relatively similar to diesel in terms of refuelling speed.

A further consideration is the potential weight increase of decarbonised NRMM, which could result in additional ground compaction and transportation requirements.

As mentioned in Q.34, safety standards are crucial, and any new technology incorporated into the NRMM sector must meet stringent safety standards. More resources must be allocated to the establishment of standardised operational practices to ensure new technologies do not experience delays coming online.

36. Do you agree that these are the main regulatory barriers to the deployment of NRMM decarbonisation options? If not, which barriers listed do not apply and / or what additional significant regulatory barriers exist?

Additional barriers include changes in safety risk assessments. As has already been the case with the rollout of hydrogen production facilities, safety standards have not kept pace with new technology deployments, causing delays in the permitting and consenting processes. The UK must ensure that it has robust standards and permitting regimes in place to support hydrogen for NRMM, and we recommend that this be aligned with equivalent overseas industries to prevent the creation of artificial barriers for adopting hydrogen technologies.

As a starting point, the UK should align with the EU's inclusion of hydrogen ICE as a zero-emissions technology or risk disadvantaging UK industries and disincentivising investment.

[1] https://knowledge.energyinst.org/new-energy-world/article?id=138536
[2] https://www.nationalgrid.co.uk/downloads/6184/underground-cable-costs-report.pdf

37. Do you agree that these are the main knowledge and information barriers to the deployment of NRMM decarbonisation options? If not, which barriers listed do not apply and / or what additional significant knowledge and information barriers exist?

The ERM study used to identify the main knowledge and information barriers, as well as for the categories specified above, makes problematic assumptions about technology availability and readiness in terms of the decarbonisation solutions available to NRMM. The reality is that, besides 100kW or smaller battery solutions, all other technologies are in very early stages of availability and deployment. The assumption of technology readiness in the ERM report represents a knowledge and information barrier that could have adverse impacts on Government decision making by misaligning expectations. The study also lacks detail on other material aspects of the NRMM sector, which have equally large implications for decarbonisation. This includes best practices for agricultural machinery operation, which has large implications for emissions. Knowledge and information relating to the decarbonisation of NRMM sector must be more holistic in terms of the consideration of all the adjoining processes and practices.

38. Are there any barriers to the adoption of decarbonisation options for the NRMM type(s) and / or sector(s) that you are interested in which have not been included in this section?

An additional barrier to the adoption of decarbonisation options for NRMM may result from the way in which the transition to Net Zero is strategized. We caution against a focus on the endpoint of NRMM decarbonisation without sufficient consideration of the pragmatic steps needed to get there. A detailed roadmap with clear targets for milestone of at least every 5 years must be developed, and we recommend that this be clearly linked to the wider roadmap for hydrogen growth in the UK. An absence of strategic planning means there is no safety net allowing industry to take the necessary financial commitments to decarbonise. Greater clarity is needed for the NRMM transition in order to reduce the increasing disparity between levels of uncertainty and the requirement for change.

A further barrier is that the increased Total Cost of Ownership (TCO) of low-carbon solutions is not being reflected in rental rates for the use of the equipment, which reduces the incentive to decarbonise.

Overall, the Government must recognise that the decarbonisation of NRMM cannot be satisfied by a single technology. Favouring particular technologies, such as electrification, should be avoided, as this risks undermining other solutions, as well as any new solutions developed in the future. To reiterate, a well functioning decarbonised NRMM sector will include a range of technology options which reflect the specific requirements of NRMM such as durability, flexibility, robustness. Hydrogen solutions are particularly well suited to meet these requirements, and any future Government policy decisions should reflect this.

41. Do the policies contained in Tables 2 and 3 provide sufficient support for NRMM decarbonisation? If not, what are the gaps in the current policy landscape?

No - the policies contained in Tables 2 and 3 are too granular and do not provide a long-term whole systems approach (see response to Q.45 below). The majority of the policies themselves are not specific to NRMM and lack a clear strategy and roadmap with which investors can make informed

decisions. A clear timeline should be developed that mandates the decarbonisation of NRMM with systemic emissions targets, as well as proposing the technologies that are most suitable to reach these goals.

45. How could government best contribute to establishing optimum market conditions to increase the rate of NRMM decarbonisation?

We echo our response to Q.38 in the sense that Government must give more foresight to a pragmatic, long-term roadmap that details specifically how NRMM will be supported in achieving the endpoint of Net Zero by 2050. The support should align with the appropriate international standards and be technology neutral.

The Government must develop a way of driving the procurement requirement. Currently about 60% of all construction is ultimately paid for by Government; thus, the use of indirect support and subsidies could be a palatable way of supporting the NRMM sector rather than a single large funding pot.

While the funding for developing new technologies, such as hydrogen ICE and FC, is important, equal consideration must also be given to enabling the rollout of the technology. As such, the transport, storage, and distribution of hydrogen needs to be accelerated and prioritised if it is to be a viable business case for applying to NRMM sites. Specifically, the Government must recognise that the transportation of hydrogen via pipeline is not a suitable or timely solution to support the growth of hydrogen NRMM technologies. Emphasis must be placed on developing the non-pipeline transportation of hydrogen, which would allow for the flexibility and wide-reaching coverage required by NRMM applications.

In terms of the RTFO, it is important to highlight the discrepancy of the interpretation of the legislation that currently enables hydrogen combustion NRMMs to claim RTFCs, but not FC engine generators. The existing definition in the RTFO suggests that NRMM must be 'internal combustion engine powered.' By recognising hydrogen FCs under the RTFO, the Government can help expand the decarbonisation opportunity for NRMM by maximizing optionality for hydrogen applications. We therefore recommend that hydrogen FC technology be included within the RTFO framework.

Similar to the Zero Emissions Mandate that was recently incorporated for the sale of non-zero emission road vehicles, the HEA recommends that a decarbonisation strategy for NRMM is underpinned by clear and robust CO_2 emission targets. This would provide clarity to industry stakeholders and drive broader action towards decarbonisation across different sectors.

Leading by example, the Government should sponsor dedicated trials of decarbonised NRMM solutions to gather valuable operational data and demonstrate the business case of the technology to the private sector. A step further would be for the Government to procure decarbonised NRMM for use in its own projects, which would help stimulate demand for the technology by encouraging investment into the supply chain.

46. How might the role of government change over time in aid of NRMM decarbonisation?

In the early stages, it is important that Government plays an active role in leading the sector towards decarbonisation. Such leadership is currently lacking relative to other sectors, and this has translated

into uncertainty and delayed investment. While the ultimate aim is to reduce the need for Government intervention, interim goals and targets must be continuously evaluated and assessed to ensure that the sector will reach Net Zero by 2050. More broadly, the Government must move its strategy away from a silo approach towards a far more holistic strategy. Within this, there needs to be increased cross-sector collaboration and alignment. If the right frameworks are developed at the outset, the role for Government will decrease substantially over time.

47. What factors should we consider when assessing the suitability of different policy options?

A key consideration for assessing the suitability of policy options should be the extent to which it has the flexibility to accommodate future technologies. Given the breadth of applications in the NRMM sector, new solutions are continuously coming online and any policy framework or support mechanism should not only reflect this, but should actively encourage innovation.

48. Are there any existing models or international examples of policy that government could implement to incentivise NRMM decarbonisation?

The Netherlands has introduced a Subsidy for Clean and Zero Emission Construction Equipment (SSEB), which includes separate funding strands for purchasing, retrofitting, and experimental innovation. Local Authorities (Las) in the Netherlands have more devolved power and have thus enacted high low-emission standards, which is driving the procurement of zero-emission alternatives. The European Commission as a whole has set more specific targets and standards in relation to NRMM, and we recommend the UK aligns with these to increase international competitivity.

Lessons can also be taken from Norway where the Government there provides subsidies for the purchase of electric NRMM, which can be as much as 40% of the additional cost of the machine compared to the diesel alternative. This would be an effective way of encouraging the initial investment of the most suitable NRMM applications in the UK, not just electric.

Ultimately, the HEA commends the Government's willingness to explore the decarbonisation options for NRMM; this is the start of a transformation which must include hydrogen if we are to achieve our decarbonisation objectives.

We would welcome the opportunity to discuss our recommendations further.

Kind Regards,

Celia Greaves
CEO