Bennamann Ltd response to the Transport Committee's Inquiry

Fuelling the future: motive power and connectivity

Response date: 21st January 2022

About Bennamann Ltd

Bennamann Ltd[1] is an SME company developing, manufacturing, marketing and deploying innovative technology for the commercially viable local production, distribution and use of 'better than zero carbon' biomethane fuel sourced from the fugitive methane emissions of organic waste, including livestock farm manure slurry.

At Bennamann we believe that offering our customers end-to-end solutions is the key to unlocking the power of fugitive methane and the company's innovations include: patented fuel tanks for storage, transport and use of liquid biomethane; equipment to process and liquify biomethane at small-scale locally off-gas-grid and off-power-grid; proprietary engineering for optimised small-scale fugitive methane capture and processing; and satellite enabled technology for optimised methane sourcing as well as Internet of Things (IoT) enabled equipment monitoring, control, diagnosis, metering and customer billing.

When integrated around the 'Bennamann Cycle'[2] [3] and deployed through our innovative business models, our technologies create a circular economy that delivers a wide range of environmental and economic benefits, which add value for our customers and help unlock a local clean energy revolution.

Bennamann is based in Cornwall, United Kingdom.

Response to Inquiry

1. The effect of Government fuel policy on future road, rail, air and maritime connectivity.

The UK Government's current fuel policy is driven by their (Department for Transport - DfT) Transport Decarbonisation Plan[4], which is primarily focussed on transitioning to electric or hydrogen based vehicle technologies, and supporting infrastructure, as they become available in the decades ahead. A fundamental effect of this policy for future road connectivity is that it will lead to infrastructure-based connectivity deficits in the longer term.

For example, the provision of infrastructure to support DfT's cited technologies for zero emissions vehicles (i.e. Battery Electric; Electric Road Systems; Hydrogen Fuel Cells) will be especially challenging, particularly in terms of technical and commercial viability, beyond the UK's central regions bounded by London, Leeds, Greater Manchester, Birmingham and Bristol - effectively the M1, M62, M6, M5 and M4 corridors with spurs to key ports such as Dover, Southampton and Felixstowe. This is because engineered technical solutions and the commercial business models for long distance operation of electric and hydrogen vehicles are still unproven and the investments required to develop and deliver them will be substantial.

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[1] Bennamann | Delivering a Local Clean Energy Revolution

[2] Bennamann – Introduction Video – Circular Solution (vimeo.com)

[3] Bennamann – Animation – Circular Solution (vimeo.com)

[4] Transport decarbonisation plan - GOV.UK (www.gov.uk)

As a result, infrastructure deficits are likely to emerge outside of the UK's most heavily trafficked transport corridors and many zero emission technologies, particularly those for Heavy Goods Vehicles (HGVs), will potentially not be viable in rural and less populated areas of the nation. The potential result will be that the North of England, Scotland (other than Glasgow Edinburgh belt), Wales, Eastern England and the South West beyond Bristol will suffer from a lack of acceptable solutions leading to connectivity deficits that (setting aside the barrier this will pose to transport decarbonisation and achieving the UK's net zero target) are fundamentally contrary to the Government's "Levelling Up" agenda.

Whilst Hydrogen and Electric vehicles will require substantial investment in technology and infrastructure to deliver acceptable levels of connectivity, there are 'ready to use' technologies and infrastructure elements based on Biofuels, such as Biodiesel and Biomethane, that can be deployed today; can use much of the existing infrastructure; and can maintain current connectivity levels into the future whilst delivering the Government's ambitions and targets for transitioning to net-zero.

2. Whether and how the Government is 'technology neutral' in its regulation and assessment of alternative fuels, and how its policies on alternative fuels influence investment, research, development and production.

As stated in our answer to Question 1, the UK Government's current fuel policy is driven by DfT's Transport Decarbonisation Plan and primarily focussed on transitioning to future electric or hydrogen based vehicle technologies, and supporting infrastructure, as they become available. There are two fundamental issues with this policy. The first is that through this policy the Government is not 'technology neutral' in its regulation and assessment of alternative fuels, the second is that it has negative impacts in the alternative fuels sector on investment, research, development and production. In the short term, this potentially effects the uptake of ready to use technologies and infrastructure elements that can have significant positive impacts on the overall effectiveness and cost of decarbonisation in the longer term.

On the first issue, the Government's current approach to alternative fuels does not allow for competitive low carbon, zero carbon or 'better-than-zero' carbon technologies and innovative commercial developments that are close to market or deployable today. The recently published Physical Science findings of the IPCC's Sixth Assessment Report[5] highlights the need for immediate action on climate change mitigation through Greenhouse Gas (GHG) emissions reduction. Such action requires the maximum use of existing proven technologies and business models over the next decade through to 2030, as well as the achievement of net zero GHG emissions by 2050. Supporting the take up of these technologies and infrastructure elements at scale in the short term potentially represents better value in the longer term with regard to overall costs, sustainability and achieving net-zero[6] [7]. Constraining innovation and the marketplace by effectively 'backing a winner' does not make economic or policy sense.

On the second issue, because of investor perceived risks associated with the Government's 'backing a winner' approach leading to future "stranded assets", this policy stifles potential investment in close to market and ready to use technologies and infrastructure that can decarbonise transport in the short-term and lead to an overall lower cost of transitioning to net zero in the longer term. In this regard, the Government's current policies on alternative fuels sends a signal to the marketplace that will act as a brake on the uptake of these technologies, as well as on investments in the fuel production and delivery infrastructure required to support them. For example, as a result of the Government's

[5] AR6 Climate Change 2021: The Physical Science Basis — IPCC
[6] ADBA-Biomethane-to-transport-report-June-2021-FINAL.pdf (bennamann.com)
[7] Potential-of-biomethane-in-the-transport-sector.pdf (bennamann.com)

announced phase out dates for the sale of new non-zero emission road vehicles, including those using alternative fuels (biofuels), investors will be reluctant to provide funding to assets that are liable to become "stranded" after implementation of these phase out dates[8]. Such an outcome will hinder the transition to net zero in the short term and make achieving the net zero target more difficult than necessary in the longer term. As an illustration of this issue, according to modelling work recently undertaken by Element Energy[9], rapid deployment of biomethane technologies over the next decade could deliver a 38% reduction in GHG emissions from HGVs, whereas deferring decarbonisation while focussing on the development of electric and hydrogen technologies will result over the same time period in a 6% reduction.

Additionally, one potential unintended consequence of a policy that introduces a phase out date for the sale of new non-zero emission vehicles will be a stimulation of sales of existing non-zero emission technologies as the deadline approaches, followed by a sharp collapse of the market for alternative zero emission vehicles thereafter. For example, witness that in Q3 & Q4 of 2013, the sales of Euro V vehicles were at record high levels and sales of Euro VI vehicles in Q1 &2 of 2014 were extremely low. In the case of HGVs, such an outcome will create 'lock-in' of a non-zero emission asset base in the UK at the phase out date, thereby hindering the transition to net zero while these vehicles continue to be utilised well beyond normal replacement cycles in a bid by operators to delay the adoption of unfamiliar technologies and infrastructure. Unless the supporting infrastructure for zero emission HGVs is fully proven, broadly deployed and commercially attractive, and new zero emission HGV technologies are widely proven by early adopters ahead of the phase-out date, fleet operators will keep non-zero emissions (diesel) vehicles running as long as technically and commercially possible, thereby making it harder for the UK to achieve its net zero target.

3. The infrastructure required to develop, produce, store and dispense alternative fuels.

Across the UK, rural communities have within them a considerable untapped resource of alternative fuel in the form of the biomethane that can be derived from fugitive methane emitted by livestock manures. In many cases these sources of energy are relatively small, being at the small farm scale, but when used on-site and aggregated and distributed locally to meet rural energy demand, they represent a considerable opportunity for the provision of alternative fuels to decarbonise transport. The challenge is how to access this unused 'better than zero' carbon source of energy (under REDII the biomethane default value for manure is associated with a large methane credit of 206%; this significantly lowers the carbon intensity of biomethane production to -85gCO2e/MJ, which is better than zero) when the rural production site is small-scale; is not served by an injection point to the gas grid; and, as in many cases, suffers power grid connectivity deficits constraining biogas processing.

To meet this challenge, Bennamann[10] has been developing and proving a suite of technical solutions and business models that enable commercially viable off-gas and off-power grid utilisation of these local rural energy resources, through the efficient and optimised small-scale, capture, processing, storing, aggregation and distribution of fugitive methane in the form of compressed biomethane gas and liquid fuel[11]. For example, the company's £1.22 million "Energy Independent Farming" project, which is part-funded by the ERDF[12], demonstrated the use of manure slurry to establish energy independent livestock farming (including self-sufficiency in power, heat and fuel for farm machinery

[8] ADBA National Conference 2021 | Phasing out sales of non-zero emissions HGVs – a misguided announcement (adbioresources.org)
[9] 20210325-CADENT_HYDROGEN_TRANSPORT_REPORT.pdf (element-energy.co.uk)
[10] Bennamann | Delivering a Local Clean Energy Revolution
[11] Bennamann – Introduction Video – Circular Solution (vimeo.com)
[12] Energy Independent Farming - Bennamann

such as tractors[13]) whilst simultaneously generating farm business income through local sales of surplus biomethane[14].

The commercial roll-out of alternative fuel provision based on fugitive methane locally sourced from livestock manure slurry and processed to biomethane in small-scale upgrading plants, is scalable and viable in the UK. For example, there are circa 35 – 40,000 cattle farms across the UK, of which approximatley 70% (29,000 holdings) have herds with less than 150 cattle. Bennamann's farm-scale fugitive methane sourcing, processing, storage and distribution technology could potentially enable these farms to become economically viable better than zero carbon energy producers. This would result in an estimated emissions saving of circa 34 Million tonnes CO2e annually for the UK, or 7.5% of total UK CO2e emissions, just from the mitigation of the manure slurry fugitive emissions, before accounting for the emissions savings that will accrue through the use of the derived biomethane for transport fuel provision.

Bennamann's alternative fuels model is proven to be technically and commercially viable and will result in reductions in fugitive methane emissions from livestock agriculture, thereby responding to the IPCC's recommendation to urgently tackle this source of GHG emissions[15] and helping the UK achieve its Global Methane Pledge commitments[16], whilst simultaneously contributing to achieving the nation's short term (by 2030) transport decarbonisation goals and longer-term net zero by 2050 target. The relatively small scale of many of the UK's livestock farms is such that in the absence of this local production, distribution and use model they will effectively be excluded from participation in the nation's efforts to decarbonise transport, as well as miss out on potential business income that incentivises fugitive methane emissions abatement. The notion that all transport sector biofuels should be used for marine applications and aviation[17] will not prove tenable when the opportunities for integrating small-scale production are considered. The quantities of methane produced would not justify the cost of transport to facilities for producing bio aviation or marine fuel, either on financial or environmental grounds, and grid injection would not be possible in many cases as 1,000s of sites are remote from gas mains infrastructure.

By supporting the deployment of this type of local approach to alternative fuels production, the UK Government can not only contribute to decarbonising UK transport and meeting the nation's legally binding net zero targets, but also create economic green growth and skilled jobs that help maintain the viability of farms and rural communities whilst simultaneously helping to increase their energy security and resilience and contribute to delivering a circular economy model for livestock agriculture.

4. **Steps that the Government could take to maximise the utility of the UK's existing transport stock, while meeting its climate-change commitments.**

To maximize the utility of the UK's existing transport stock, while meeting climate change commitments, the Government could encourage the widescale adoption of biofuels. For example, biodiesel (particularly HVO) can help address the existing diesel vehicle parc and many fleet operators have invested in natural gas vehicles having realised the economic and environmental benefits of running them with biomethane.

Government can encourage take up and use of biofuels by fiscal incentives linked to carbon savings. Currently there is no difference between fuel duty for fossil fuels and for biofuels. It would be relatively

[13] Julie Skentelbery - Methane Tractor - Dr Chris Mann - BBC Sounds
[14] Farmers-Weekly-Bennamann.pdf
[15] AR6 Climate Change 2021: The Physical Science Basis — IPCC
[16] Homepage | Global Methane Pledge
[17] Transport decarbonisation plan - GOV.UK (www.gov.uk)

straightforward for Government to taper fuel duty based on the carbon footprint of the fuel. In such an approach, fossil fuels could remain at current duty levels (or higher), whilst biofuels could be incentivised by lower duty based on the CO2 footprint. Analysis that considers the carbon intensity (i.e. gCO2e/MJ) of the energy used in transport vehicles based on a full understanding of well-to-wheel (WTW) GHG emissions incurred from its sourcing, processing, distribution and use should be adopted as the foundation of net zero related UK alternative fuels policy making.

5. **The contribution that alternative fuels could make to sustainability, transport decarbonisation and connectivity.**

Biofuels already make an important contribution to decarbonising transport vehicles through ready to use technologies and can continue to provide cost effective, commercially attractive solutions for reducing carbon emissions both in the short and long term. Indeed, many studies have shown that biomethane is a proven, effective, and immediately available alternative fuel currently being adopted by many flagship HGV fleet operators in the UK and has the potential for substantial scale-up of production and use in the very near term[18] [19] [20] [21] [22], thereby offering a significant pathway to meeting short term decarbonisation goals as well as helping the nation meet its legally binding net zero by 2050 target. Biomethane can be used as a drop in replacement fuel for natural gas vehicles, both Compressed Natural Gas (CNG) and Liquified Natural Gas (LNG), and its use for HGVs is growing in the UK freight sector. Fleet operators with biomethane vehicles and commitments include John Lewis Partnership, Sainsbury's, Asda, Howard Tenens, DHL, Ocado, Hermes, DPD, Veolia, and a range of Local Authorities including the urban examples of Islington Borough and Camden Borough as well as the rural unitary authority of Cornwall Council[23]. It is estimated that around 2,000 HGVs currently operate on biomethane in the UK.

Natural gas vehicles will operate with methane derived from any primary source and when the fuel utilised is biomethane obtained from agricultural manures it results in a better than net zero carbon footprint[24] (as noted in our answer to Question 3, under REDII the biomethane default value for manure is associated with a large methane credit of 206%; this significantly lowers the carbon intensity of biomethane production to -85gCO2e/MJ). This is because fugitive methane is released to the atmosphere when manure is stored in the open environment (typically as slurry in open surface pits, tanks or lagoons) and its capture for fuel use prevents this damaging GHG entering the atmosphere. Methane is 86 times (by mass) more powerful as a greenhouse gas than carbon dioxide over a 20-year period and because of this the recently published Physical Science findings of the IPCC's Sixth Assessment Report[25] emphasised the urgency in tackling fugitive methane emissions from sources such as agricultural manures.

To meet the UK's short-term and long-term transport decarbonisation targets, many UK biomethane suppliers are scaling up the production of fuel sourced from agricultural manures and Bennamann is leading the way in the integration of 1,000s of small-scale livestock farms into the biofuels market, whilst simultaneously tackling the issue of fugitive methane emissions from agricultural manures[26]. As described in our answer to question 3, the company has developed technologies and commercially

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[18] ADBA-Biomethane-to-transport-report-June-2021-FINAL.pdf (bennamann.com)
[19] Market_opportunities_decarb_HDVs using HBRF_2021.pdf (bennamann.com)
[20] RenewableFuelsGuide_March2020.pdf (bennamann.com)
[21] Intro-to-Biofuels.pdf (cenex.co.uk)
[22] 20210325-CADENT_HYDROGEN_TRANSPORT_REPORT.pdf (element-energy.co.uk)
[23] RenewableFuelsGuide_March2020.pdf (bennamann.com)
[24] LowCVP-WTT_GHG_Emission_Factors-Review_and_recommendations.pdf (bennamann.com)
[25] AR6 Climate Change 2021: The Physical Science Basis — IPCC
[26] https://bennamann.com/downloads/videos/Bennamann_Process_and_Cycle.mp4

attractive business models that enable small-scale livestock farms to become energy independent as well as local energy providers based on processing their animal manure slurry. The approach also delivers savings on farming input costs beyond those associated with energy bills, such as reducing fertiliser bills through using soil restoring post-processed biologically enhanced digestate (a by-product of the Bennamann process) to underpin carbon sequestration and regenerative practices[27].

Bennamann's alternative fuel not only helps decarbonise transport through its direct use in proven combustion engine technology, but also as an energy source for electric vehicle (EV) charging. In this regard, the company secured £668,577 of ERDF funding to demonstrate the use of farm sourced fugitive methane to power mobile off-grid EV charging units, with waste heat recovery for use locally in space and water heating[28]. This pioneering integrated energy-transport-heat innovation will deliver a step change to the roll-out of EV charging infrastructure, particularly in off-power-grid or power grid constrained rural locations, as well as help support a transition to more sustainable livestock farming, a green recovery led economic growth and levelling up, through the creation of cle an energy jobs and business activity.

The successful incentivisation of biomethane as an alternative fuel through the approach discussed in our answers to this Inquiry will not only help the Government maintain current levels of connectivity (see our answer to question 1) and realise transport decarbonisation to net-zero, but also achieve a myriad of other policy objectives including:

- decarbonisation of the difficult to tackle sectors of heat and agriculture, in the quest to achieve the UK's legally binding net zero target by 2050 as well as meet the nation's Paris Agreement commitments;

- meeting the targets of the Global Methane Pledge that aims to deliver at least a 30% reduction in fugitive methane emissions by 2030 on a 2020 baseline[29];

- climate emergency and net-zero carbon aspirations of rural local authorities nationwide, while simultaneously delivering distributed local energy, improved local energy security and rural resilience;

- green recovery led local growth, rural economic development, and delivering the Levelling Up agenda, through creating sustainable low carbon farming and local clean energy sector related jobs that improve rural livelihoods and drive post-pandemic economic regeneration.

- the Clean Air Strategy 2019 through the reduction of ammonia emissions from livestock farming;

- the Agriculture Act, Environment Act and Environmantal Land Management Scheme (ELMS) through sustainable and regenerative low carbon farming that enhances biodiversity, delivers environmental growth, and creates a circular economy model for livestock agriculture.

(Ends. 21/01/2022)

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[27] Improving Soil Health in Cornwall for Farmers & Landowners on Vimeo
[28] Mobile Off-grid EV Charger With Bioheat - Bennamann
[29] Homepage | Global Methane Pledge