Written Evidence Submitted by Anglo American (HNZ0087)

Introduction to Anglo American

Anglo American is a UK headquartered, FTSE 100 listed global mining company with a product portfolio that spans platinum group metals, copper, diamonds (through De Beers), iron ore, crop nutrients and several other minerals. Our portfolio of world-class assets produces many of the high-quality metals and minerals needed to enable a cleaner, greener and more sustainable future.

As one of the world's leading mining companies and one of the world's largest producers of platinum group metals, Anglo American takes an interest in the future role of hydrogen technologies. Platinum is a vital component in hydrogen and fuel cell technology that can be used in hydrogen-powered vehicles, the production of green hydrogen via electrolysis, or energy storage. The metal acts as the catalyst in the chemical process that converts hydrogen into electricity, with the only by-product being water.

Anglo American believes strongly in the potential of the "Hydrogen Economy", which can play a notable role in delivering the UK's decarbonisation ambitions. We are currently involved in a range of commercial initiatives to facilitate nascent ethical hydrogen value chains. We invest both directly in venture-focused research and start-up companies that develop new hydrogen and fuel cell products in addition to our Anglo American founded venture capital fund, AP Ventures, whose investments today include sector-enabling companies like Hydrogenious, Ballard, Altergy and United Hydrogen.

More broadly, domestically we are active executive members of the UK Hydrogen and Fuel Cell Association, H2 Mobility and have co-funded the rollout of hydrogen refuelling stations in the UK under the OLEV Hydrogen for Transport Programme. Furthermore, we have recently helped bring industry partners together to form the Aggregated H2 Freight Consortium (AHFC), a partnership established to understand what is required to facilitate commercial volumes of hydrogen fuel cell powered HGVs to the UK, including considering the development of 'hydrogen freight corridors' on routes of heavy road freight use. Our submission provides further information about the innovative work the AHFC is doing, which we hope will be of interest to the Committee. Finally, Anglo American has recently been confirmed as a member of the government's new '2020 Deployment Roadmap' hydrogen working group, sitting below the Hydrogen Advisory Council.

Internationally, Anglo American is a founder, steering and board member of the Hydrogen Council, launched in 2017, which brings together CEOs from over 100 multi-national companies, acting as an important conduit for international efforts and perspectives by corporates on hydrogen. We are also a proactive member of Hydrogen Europe, which partners with the European Commission through the Fuel Cells and Hydrogen Joint Undertaking to support research, technological development and demonstration activities in fuel cell and hydrogen energy technologies in Europe.

Most importantly, Anglo American is also facilitating the introduction of hydrogen across our own operations. We are part of the 'Green Hydrogen Consortium', made up of representatives from the mining sector, who are seeking to utilise green hydrogen to decarbonise their global operations. In addition, we are currently piloting a fuel cell electric mine haul truck with the goal to run on green hydrogen instead of diesel, as part of a project looking at the integration of renewable energy systems into mines.

Anglo American's Submission

Anglo American welcomes the opportunity to provide a written submission to the Science and Technology Committee's inquiry into the role of hydrogen in achieving net zero.

Our submission sets out the wider role hydrogen technology can play across the UK's economy, focusing specifically on transport as a key end-use sector. Our overarching recommendation is that government ensures it supports the wide range of sectors and applications where hydrogen can be of use, and takes comprehensive, coherent steps in terms of establishing clear policy, regulatory and financial support measures to ensure that these opportunities are fully maximised.

Taking a holistic, cross-sectoral viewpoint on hydrogen is essential to driving the successful development of the wider hydrogen economy by British businesses in the UK and beyond. Given our wider involvement in the hydrogen landscape beyond the UK, **we also urge the government to commit to international collaborations and efforts around hydrogen**, which provide opportunities for contributing insight and hearing from expertise and experiences in other countries who are also working to facilitate the development of hydrogen technologies.

Response to Inquiry Questions

1. The suitability of the Government's announced plans for "Driving the Growth of Low Carbon Hydrogen", including:

- **the focus, scale and timescales of the proposed measures;**
- **how the proposed measures—and any other recommended measures—could best be co-ordinated;**
- **the dependency of the Government's proposed plans on carbon capture and storage, any risks associated with this and how any risks should be mitigated; and**
- **potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel.**

The potential of hydrogen technology

There is significant economic opportunity for the UK in the development of a 'hydrogen economy', integrated across a range of economic and industrial sectors, which will help the UK meet its ambitious decarbonisation targets.

Whilst the vast majority of hydrogen production in the UK and across the world at present is from 'grey' carbon-emitting sources, there is significant potential for low-carbon and emission free hydrogen production in the form of 'blue' and 'green' hydrogen respectively. Whilst this is currently an expensive process, it is anticipated that with continued market development and maturity, backed up with appropriate support frameworks from government, costs will fall significantly as investment rises. This process will open up the opportunity to utilise clean hydrogen in a range of sectors across the economy, including the transport sector.

For example, since 2010 there has been a 60% decline in the cost of electrolysis to produce green hydrogen.[1] Further falls in electrolysis costs, and costs for renewable power, will continue to accelerate this trend. By 2030, it is expected by the Hydrogen Council that the cost of blue and/or green hydrogen will fall by up to 60%.

[1] Hydrogen Council, 'Path to hydrogen competitiveness'

Hydrogen has the ability to decarbonise a wide range of economic and industrial sectors and processes. A key area is hydrogen's potential application within the transport sector, now the most polluting sector in the UK, with a particular emphasis on tackling emissions from HGVs, buses and ships.

The Government's 'Driving the Growth of Low Carbon Hydrogen' ambitions

Anglo American supports the ambitions set out by the UK Government around driving the growth of low carbon hydrogen within the November 2020 'Ten point plan for a green industrial revolution' announcement, including the target of 5GW of low carbon hydrogen production capacity by 2030 and the scale-up of hydrogen deployment activity through the 2020s (neighbourhood, village, town). Furthermore, recognising the role industrial 'SuperPlaces' can play in facilitating the development and deployment of hydrogen technology and associated processes to early benefit is a sensible approach to catalyse the wider hydrogen economy and value chain in the UK.

Whilst these ambitions represent a rational starting point and springboard for kickstarting the hydrogen economy, **we advise that the government does not treat these parameters as the limit of the UK's hydrogen ambitions through the 2020s.** The government needs to think about the rollout of hydrogen technology beyond demonstrative areas, moving beyond a 'proof of concept' mentality to a wider, more holistic deployment roadmap across the whole hydrogen value-chain at scale. This wider thinking and planning will be required simultaneously if the UK is to maximise the benefits it derives from this technology.

This emphasises the importance of ensuring a comprehensive and cross-cutting hydrogen strategy, backed up by the necessary long-term policy, regulatory and financial support frameworks to provide certainty to those organisations seeking to make investment commitments over the long-term. Whilst specific funding announcements are important and welcome, including the £240 million Net Zero Hydrogen Fund announced within the 'Ten Point Plan', there is a need to move beyond one-off funding pots to sustained, long-term financial support, similar to that seen in the renewable power sector. The work within BEIS on developing hydrogen business model support frameworks will be critical, however attention also needs to be given now on the necessary political and financial support to facilitate nascent end-use sectors, including the transport sector. Industry is ready to commit significant levels of investment to hydrogen, reported to already be in the region of £3bn, however government needs to do the groundwork to unlock this in the form of support frameworks.[2]

The need to facilitate wider end-use markets for hydrogen is reinforced by ambitious associated targets, most notably the 2030 phase-out date for new internal combustion engine (ICE) vehicles. As we note within this submission, it would be unwise for the government to view battery electric vehicles (BEV) as the sole alternative solution to decarbonising transport. Hydrogen fuel cell electric vehicles (FCEV) are an established proven alternative and should play a significant role in the Government's efforts around decarbonising transport. In order to meet this target, **a wider ambition than the objectives set out within the government's 'Driving the Growth of Low Carbon Hydrogen' ambitions will be required to facilitate the rollout of hydrogen transport in the 2020s.**

The need for a comprehensive hydrogen strategy

Anglo American welcomes the commitments made to develop hydrogen technology in recent publications beyond the 'Ten Point Plan'. The December 2020 Energy White Paper provides

[2] 'Hydrogen Strategy Now' Campaign

supportive comments around the potential of hydrogen, whilst pledging to establish the UK as a world leader in the deployment of clean hydrogen, which it states "will be critical in reducing emissions from heavy industry, as well as in power, heat and transport".[3] Meanwhile, the Committee on Climate Change's (CCC) recent report on policies for the UK's Sixth Carbon Budget states that hydrogen will make a "crucial contribution to net zero" and "will require a concerted, coordinated push from Government".[4]

Anglo American welcomes the Government's intention to publish a hydrogen strategy in 2021. Whilst 2020 has seen statements of ambition around hydrogen technology, there is now a real need to deliver the hard policy proposals that will facilitate the rollout of hydrogen across the UK. It is essential that this strategy encompasses the whole hydrogen value-chain – covering production, supply, storage, and end-use across a range of sectors – including transport, heating and industrial processes.

Whilst attention has largely focused on scaling up the production of blue and green hydrogen, **a comprehensive hydrogen strategy cannot ignore the necessary policy, regulatory and financial support frameworks for facilitating end-use markets.** The CCC also advises the government to ensure its hydrogen strategy considers actions across end-uses sectors.[5]

To meet these objectives, the Government's hydrogen strategy should:

- **Prioritise developing a clear roadmap across the 2020s** for developing low-carbon hydrogen use, production and infrastructure for distribution, with a commitment to ensuring the wide-ranging applicability of hydrogen technology is fully maximised, including in the transport sector.
- **Ensure a cross-government approach** that encompasses the areas within each department where hydrogen has prospective applications (this would include for example the Department for Transport, Department for Business, Energy and Industrial Strategy, HM Treasury and Ministry of Housing, Communities and Local Government) to coordinate its approach to hydrogen – spanning supply, storage, heating, and transport.
- **Move financial support from ad hoc demonstration and proof of concept schemes towards facilitating the wider commercialisation of the hydrogen sector.**
- **Include a plan for the urgent decarbonisation of hard-to-reach areas** like heavy transport and maritime.

Hydrogen in Transport

Hydrogen stands to play a significant role is in the transport sector, with widespread potential for the deployment of hydrogen fuel cells in a range of transport modes, including HGVs[6], buses[7], ships[8], trains and more. Hydrogen also has a particular advantage in several transport applications. It is light and energy dense, making it notably well-suited to transport that is required to travel long distances or needs quick refuelling times. The transport sector is an optimal area for the early adoption of hydrogen, given the relatively easy scalability of projects – for example rollout could initially focus on a smaller fleet, which could then be ramped up after proof of concept.

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[3] GOV.UK, Energy White Paper: Powering our Net Zero Future, p.127.
[4] CCC, Policies for the Sixth Carbon Budget and Net Zero p.137.
[5] ibid
[6] National Infrastructure Commission, 'Better Delivery: the challenge for freight'
[7] The Independent, 'World's first hydrogen double-decker buses coming to London to fight air pollution'
[8] FT, 'Orkney's ageing ferries look to ditch diesel for hydrogen'

With appropriate government support, the transport sector can be a key early adopter of hydrogen technology, which brings benefits to the UK's decarbonisation efforts, with transport representing over a third of total UK emissions in 2019. [9]

Increased recognition and support for FCEVs

FCEV's are a viable and established technology in the transport sector, however greater government support is needed to facilitate the deployment of FCEV vehicles in the UK. FCEVs are on the roads in the UK today. In London there are hydrogen buses, Green Tomato Cars has FCEVs in its taxi fleet, and the Metropolitan Police has received 11 Toyota Mirai FCEVs to work as both marked and unmarked vehicles.[10] Transport for London announced in 2019 that it will take delivery of 20 double-decker hydrogen buses, built by Wrightbus in Northern Ireland.[11]

Using hydrogen is as simple as filling up a regular internal combustion engine tank in a diesel or petrol vehicle. This means hydrogen fuel cell electric vehicles (FCEV) can be refuelled in a matter of minutes, whilst the energy density and lightness of hydrogen makes it ideal for users that need to carry heavy payloads, such as LGVs, HGVs and buses.

To support the earlier 2030 phase out of conventionally fuelled vehicles it is clear that a range of technological solutions will need to be utilised, primarily BEVs and FCEVs. **However, there is concern the government isn't focusing enough on hydrogen's applications in transport.** Despite the proven benefits of FCEVs, the Department for Transport's March 2020 'Transport Decarbonisation Plan: Setting the Challenge' document only makes two substantive references to hydrogen – in relation to its potential application in large vehicles and rail - instead focusing significantly on BEV applications. A failure to properly recognise the benefits of fuel cell technology in transport modes will be a significant missed opportunity. Evidence from a range of sources, including the Hydrogen Council[12] and the National Infrastructure Commission's Freight Study[13] show that hydrogen-fuelled vehicles have a role to play alongside BEVs.

With current policy support mechanisms more focused towards BEV related activity, there is a risk that the Government will fail to realise the significant benefits delivered by hydrogen powered mobility solutions, which can complement, rather than compete, with electrified modes of transport, and in some cases offer a more practical and cost-effective solution.

As such, **the Government should ensure its Transport Decarbonisation Plan, and the wider work of the DfT, is fully engaged on broader Government efforts to facilitate the wider hydrogen economy in the UK. The Government therefore needs to facilitate and ensure a role for hydrogen and fuel cells in the future energy mix for the transport sector. Anglo American have a number of associated recommendations:**

- Government should **adopt a technology neutral approach** that ensures hydrogen is not put at a disadvantage as a result of its policies in relation to low-carbon transport technology.

- We also recommend as a further priority that the **government commits to an investment fund for fuel cell and electrolysis technologies.** The government has already launched, in

[9] GOV.UK, 2019 UK greenhouse gas emissions, provisional figures, p.1.
[10] Auto Express, 'Fleet of 11 Toyota Mirai police cars to enter service with the Met'
[11] The Guardian, 'London to have world-first hydrogen-powered doubledecker buses'
[12] National Infrastructure Commission, 'Better Delivery: the challenge for freight'
[13] Hydrogen Council, 'Path to hydrogen competitiveness'

2017, the Faraday battery challenge - a £246 million investment fund for research into developing battery technology.[14] Similar support for investment and research in hydrogen fuel cell technology is vital in scaling the technologies up and bringing costs of electrolysis to produce 'green' hydrogen down.

- We recommend that **2030 targets be established for the number of hydrogen-fuelled vehicles across different modes**, and the associated infrastructure, which should form part of the wider Transport Decarbonisation Plan. Targets are proven to drive innovation and technological development – and we are seeing progress in the rail sector stemming from the Government's commitment to phase-out diesel trains by 2040.

- We also recommend that **support for hydrogen vehicles and infrastructure moves away from one-off competition-based support to a stable and ongoing subsidy support environment**. This should cover the range of vehicle applications, alongside suitably scaled hydrogen refuelling infrastructure with the prime objective of enabling hydrogen delivered at the pump prices to match diesel fuel costs for users. This will help to level the playing field with regards to hydrogen infrastructure.

- To meet its targets, **Government should establish a cross-departmental team; one which includes representatives of industry and local governments, to look at decarbonising transport** and how this interacts with the wider economy. **Consideration should also be given to working groups for particular modes of transportation (similar to the government's 'Jet Zero Council') as well as wider public sector fleet procurement.**

- For the parts of the transport sector where range, refuelling times and payload capacity are important, **government should proactively support the development of fuel cell technology, by investing in research and providing financial support**, as they have done with BEVs.

- To maximise the opportunity for decarbonisation, **Government should finance both hydrogen refuelling and recharging points** until the technologies become commercially viable, at which point it can be left to the market

- Anglo American supports the calls by the UK Hydrogen and Fuel Cell Association (UK HFCA) for Government to consider the inclusion of hydrogen rail, maritime, aviation and non-road machinery within the RTFO mechanism, including:
    - Allowing hydrogen produced from existing renewables, which are currently curtailed.
    - Allowing hydrogen produced from grid-connected electrolysers via PPAs with renewable power providers.
    - Allowing hydrogen from biowaste (with carbon capture) to qualify under the RFTO dRFTC mechanism.
    - The extension of RTFO requirements on fuel suppliers after 2032.

- Anglo American also supports suggestions made by H2 Mobility around potential commercialisation support for hydrogen, including a financial support per kg of hydrogen sold and support to help stimulate hydrogen vehicle purchase.

[14] GOV.UK, 'Faraday battery challenge: Industrial Strategy Challenge Fund'

Anglo American's submission goes into more detail about specific applications for hydrogen within the transport sector in our response to Questions 5 and 6.

2. The progress of recent and ongoing trials of hydrogen in the UK and abroad, and the next steps to most effectively build on this progress

In its May 2019 report on 'The UK's contribution to stopping global warming', the Committee on Climate Change (CCC) warned the Government that it must now start planning for how it meets emissions targets in more challenging sectors, specifically citing long-distance HGVs and ships.[15] Accordingly, the CCC recommended that the Government immediately supports the facilitation of large-scale hydrogen trials and that it also establishes an overarching hydrogen strategy, to support the development of low-carbon hydrogen use, production and infrastructure. Similarly, the Hydrogen Council's recent 'Path to Hydrogen Competitiveness' report identified a national strategy as one of the key steps in enabling and accelerating a hydrogen economy.[16]

Hydrogen in Transport Trials

The Government should take a strategic approach to facilitating the rollout of hydrogen technology in the transport sector, focusing on where it can have the most impact earliest on – akin to its approach utilising the Industrial 'SuperPlaces' for establishing early bases of hydrogen production, distribution and use.

Early focus for the use of hydrogen in the transport sector should therefore be around the issue of road freight and the heavier, more polluting vehicles that constitute this sector. Road freight represents a significant emitter in the transport sector, with HGVs responsible for 17% of all emissions from the transport sector, despite only making up 5% of journeys[17]. The Hydrogen Council's 'Path to Hydrogen Competitiveness Report' concludes that hydrogen fuel cell technology lends itself to heavier vehicles with long ranges, heavy payloads and high operating times.[18] With road freight transportation in the UK focused on key distribution routes, **the government should seek to establish early hydrogen 'freight corridors' along such routes, which will deliver the infrastructure necessary for a significant proportion of UK freight transport to utilise hydrogen vehicles and could subsequently serve as basis/hub for wider roll-out**. Hydrogen transport trials based on key freight corridors would deliver the most impactful benefit and be geographically located so as to act as a bridge towards facilitating the necessary infrastructure along key UK transport routes, allowing more efficient deployment through the 2020s.

Government can accelerate the adoption of hydrogen HGVs by supporting trials that will accelerate understanding, development and rollout, the provision of adequate hydrogen stations and providing incentives for business to invest in ultra-low emission HGVs. Anglo American welcomes the government's recent announcement of £20m for freight trials to pioneer hydrogen and other zero emission lorries to support industry to develop cost-effective, zero-emission HGVs in the UK.

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[15] The Committee on Climate Change, 'The UK's contribution to stopping global warming'
[16] Hydrogen Council, 'Path to hydrogen competitiveness'
[17] GOV.UK, 'Freight Carbon Review', p.7.
[18] Hydrogen Council, 'Path to Hydrogen Competitiveness Report', p.32

The Committee on Climate Change's (CCC) report on the UK's 6th Carbon Budget urges the government to end new diesel HGV sales by 2040 at the latest, as well as implementing large-scale trials of zero-emission HGVs in the early-2020s, with a comprehensive plan published setting out how this will be delivered, as well as including stronger purchase/incentive proposals and infrastructure plans.[19] The CCC provides more detail on what it expects to see from low-carbon HGV trials within its report, including infrastructure deployment, collaboration with business, commercial-scale participation, a broad scope, real world operations and lasting a sufficient duration alongside strong communication of the findings.[20] Anglo American supports these recommendations.

The setting of target dates has been helpful in driving activity and focusing attention on new ICE vehicle phase-out and around diesel trains, with 2030 and 2040 phase-out dates respectively. Setting a long-term phase out date helps to provide certainty on the government's long-term policy objectives and helps facilitate planning timescales for investment decisions.

3. The engineering and commercial challenges associated with using hydrogen as a fuel, including production, storage, distribution and metrology, and how the Government could best address these

AND

4. The infrastructure that hydrogen as a Net Zero fuel will require in the short and longer term, and any associated risks and opportunities.

The wide-ranging applicability of hydrogen, as well as the challenges around scaling up production, securing appropriate storage, distribution and end-use markets – from industrial processes, heating in homes to varied transport modes – add to the importance of a comprehensive strategic approach as part of the government's upcoming hydrogen strategy.

With a key commercial challenge being cost, **the government's work around the development of hydrogen business models represents a key pillar of work to establish a supportive regulatory environment.** Whilst the government's current work around business model focuses on facilitating supply, there will also need to be the incentivisation of – making this fuel source a commercially attractive alternative across sectors. Mechanisms such as financial support schemes, investable funding mechanisms to build capacity and reduce costs – similar to those schemes developed to support the renewable power sector – will be required.

Challenges in the road vehicle sector

1. **Commercial barriers**

In 2019, to coincide with the launch of the ultra-low emission zone (ULEZ) in London, Anglo American undertook research with Opinium to understand the perspectives of fleet operators in London as to how the zone would affect their operations. The research sample was 345 senior managers+ that were either based in the ULEZ or whose operations meant they travel in and out of the zone, and 145 respondents who are decision-makers with responsibility for vehicle

[19] CCC, Policies for the Sixth Carbon Budget and Net Zero, p.53.
[20] CCC, Policies for the Sixth Carbon Budget and Net Zero p.63-64.

purchasing/leasing based in Greater London. We sought to understand the perspectives of fleet operators regarding low emission vehicles, and hydrogen fuel cell vehicles specifically.

This research provides useful data to understand the considerations of fleet operators. This included insights into the barriers preventing fleet operators in London from switching to low emission vehicles, and importantly what changes would be required to encourage them to make the switch. Key findings included:

- 48% of those responsible for purchasing or leasing vehicles said that cost is a barrier to acquiring a ULEZ-compliant vehicle.
- Two thirds (63%) said they would support the government providing financial or other incentives for businesses to purchase vehicles that meet the ULEZ requirements.
- After receiving more information on hydrogen fuel cell vehicles through our survey, 62% said their business was more likely to consider purchasing or leasing hydrogen fuel cell vehicles.

2. Infrastructure Challenges

In terms of the steps required to encourage operators to switch their fleets, when discussing hydrogen fuel cell vehicles specifically, our research with Opinium found that:

- Almost two-thirds (61%) said that refuelling infrastructure would be a barrier.
- Seven in ten (71%) said their business would support more investment in hydrogen infrastructure.

Our research thus demonstrated that refuelling infrastructure for hydrogen vehicles is currently a major obstacle to fleet owners and operators making the transition to these vehicles. Importantly, however, our survey has demonstrated an appetite amongst London fleet operators for switching to hydrogen fuel cell vehicles. They have also demonstrated a willingness to support more investment in this infrastructure. Greater support of and investment in infrastructure will therefore be vital to accelerate the transition towards hydrogen fuel cell vehicles – from both the public and private sectors.

HM Treasury's Net Zero Review Interim Report, published in December 2020, considers surface transport, noting that without the necessary infrastructure networks for low-carbon vehicles "there are limited incentives for firms to make changes to their fleet".[21] Whilst there remains at present a lack of adequate hydrogen refuelling infrastructure across the UK, the upside is that a refuelling network could largely leverage that of the current network of fuel stations. In terms of cost, it will likely be cheaper to provide the infrastructure for a hydrogen solution for road freight. CCC analysis found that a hydrogen-based switchover would require 800 refuelling stations to be built by 2050. whilst electrification would need 90,000 depot-based chargers for overnight charging.[22] UK H2 Mobility reports that just 330 nationwide hydrogen refuelling stations could be enough to provide close to home refuelling for 50% of the population.[23]

3. Regulatory Challenges

There is a need for governments to ensure that regulatory protocols appropriately reflect the growing presence of alternatively fuelled vehicles and do not create barriers to rollout. **The government should consider establishing a workstream within the hydrogen strategy to consider**

[21] GOV.UK, Net Zero Review Interim Report, p.89.
[22] Committee on Climate Change, 'Net Zero Technical Report – Surface Transports'
[23] UK H2Mobility, 'Phase 1 Results'

regulatory barriers / legacy legislation and work to update these in line with the growing presence of FCEV (and BEV) vehicles.

Hydrogen FCEVs have robust safety standards and regulations regarding the fuel storage system, the vehicle itself, and the roadway structures on which they operate.

However, some regulatory frameworks continue to consider hydrogen fuel cells as a high-risk concern, with hydrogen fuel defined as a legally classified product which is considered dangerous to transport. A December 2018 report focused on the UK by HyLAW, the initiative to remove legal barriers to the deployment of hydrogen and fuel cell technologies, notes that uncertainty and misconceptions continue to exist. **The report states that a clear and unified set of rules for service and inspection companies working with FCEV and hydrogen powered vehicles is required, covering cars, trucks and buses and L category vehicles.**[24]

FCEVs in confined/covered spaces

The HyLAW project also notes that there is uncertainty around the use of FCEV vehicles in confined spaces, such as tunnels and parking garages. ADR (formally the European Agreement of 30 September 1957 concerning the International Carriage of Dangerous Goods by Road) is an overarching UN agreement which in some cases has been interpreted as restricting the use of hydrogen fuelled vehicles. Article 2 states that, with the exception of certain exceptionally dangerous materials, hazardous materials may in general be transported internationally in wheeled vehicles, provided that two conditions relating to the previously listed factors are met. It also includes specific vehicle and tank requirements and other operational requirements.

Under ADR rules, hydrogen carriage is currently excluded through ten UK tunnels that have category C, D, or E limits on the transit of ADR substances deemed flammable / explosive cargoes, including hydrogen, which can also restrict access by certain types of alternatively fuelled vehicles. This has real-world impacts on the deployment of FCEV vehicles, with some fuel cell buses in London unable to use tunnels. A further case in point is the Channel Tunnel where, whilst there is no legal basis for their prohibition, FCEVs are currently prevented from using this key freight access route for the UK.

Similarly, whilst there are no specific legal restrictions on FCEVs and hydrogen combustion vehicles being parked in conventional confined parking facilitates, car park operators can apply specific limitations and restrictions do apply for buses and trucks.

The HyLAW report recommends setting out a coherent basis in the context of local planning and safety related control frameworks for allowing hydrogen powered vehicles to use car parks and tunnels nationally, which could form part of the proposed workstream around identifying and mitigating unnecessary regulatory barriers to hydrogen vehicle deployment across the UK transport network.

The Aggregated H2 Freight Consortium (AHFC)

In an attempt to understand and overcome regulatory and infrastructure-based challenges in relation to developing a hydrogen-based transport system, Anglo American has helped bring together industry partners to form the Aggregated H2 Freight Consortium.

The consortium has been established to understand what is required to bring commercial volumes of hydrogen fuel cell powered heavy goods vehicles to the UK, through aggregating the demand for

[24] HyLAW, UK National Policy Paper, p.11.

fuel cell trucks and vans across a number of fleet operators who are ready to work together to facilitate the critical decarbonisation of this sector and enable the introduction of viable hydrogen vehicles.

One of the Consortium's key considerations is investigating the concept of 'hydrogen freight corridors', involving the installation of hydrogen refuelling infrastructure deployed along high traffic freight corridors. The concept of 'freight corridors' are already gaining traction in other jurisdictions, including a corridor spanning Belgium, the Netherlands and Germany targeted 1,000 hydrogen fuel cell trucks by 2025.

A key strategic route for road freight in the UK is between Folkestone and Dover on the south coast and London, linking up with road freight from the continent.

As outlined in our response to Question 2, **Anglo American believes that an effective catalyst for scaling up infrastructure would be to focus attention on hydrogen transport trials, pilots and investment along strategic freight corridors.**

Key steps as part of this activity should include:

- A feasibility study of the route and economic impact of a hydrogen freight corridor along a high traffic route.
- A public consultation on the specific requirements of modal transition points and new infrastructure requirement to promote the transition to hydrogen powered technology and drive lower freight emissions.
- A review of historic regulations that stand in the way of openness to hydrogen powered technology adoption and commit to overturning these where they are identified and it is safe to do so, encompassing those challenges outlined in our response to Question 3.

5. Cost-benefit analysis of using hydrogen to meet Net Zero as well as the potential environmental impact of technologies required for its widespread use

AND

6. The relative advantages and disadvantages of hydrogen compared to other low-carbon options (such as electrification or heat networks), the applications for which hydrogen should be prioritised and why, and how any uncertainty in the optimal technology should be managed.

Following on from our previous explanation of the potential for hydrogen in the transport sector, we have focused in more detail on the advantages hydrogen presents for a range of transport modes.

1. **Road Freight (HGVs, LGVs, Vans, Fleets)**

Freight transportation is a key application for hydrogen. The transport sector accounted for 34% of total UK emissions in 2019, with the large majority of emissions resulting from road transport.[25] HGVs are responsible for 17% of total transport emissions yet only represent 5% of journeys, making them a key priority area for action. HGVs and vans account for 8% of total UK emissions.[26] Despite

[25] GOV.UK, 2019 UK greenhouse gas emissions, provisional figures, p.1.

DEFRA's Air Quality Plans, the UK is breaching EU pollution limits in 16 urban air quality zones. Research suggests that high levels of nitrogen oxide and particulate matter, known to be damaging to health, have been linked to old diesel engines which are common amongst LGVs.[27]

Zero emission hydrogen technology allows companies to decarbonise without compromising payload capacity or the economics of their business.[28] It is more suitable for the long ranges, heavy payloads and high operating times in the freight industry. The National Infrastructure Commission's April 2019 freight study identified hydrogen as one of the most viable alternatives to diesel in the freight sector.
The Hydrogen Council's 'Path to Hydrogen Competitiveness' report found that from 2020 to 2025, in the short term, hydrogen could become competitive in transportation, particularly for large vehicles with long ranges.[29] For instance, with improvements in scale and utilisation, the cost of a single trucking journey of 300 km will drop by 40 per cent.

It will also likely be cheaper to provide the infrastructure for a hydrogen solution for road freight. CCC analysis found that a hydrogen-based switchover would require 800 refuelling stations to be built by 2050. whilst electrification would need 90,000 depot-based chargers for overnight charging.[30] UK H2 Mobility reports that just 330 nationwide hydrogen refuelling stations could be enough to provide close to home refuelling for 50% of the population.[31] The CCC and Ricardo Energy's analysis in May 2019 for the Zero Emission HGV Infrastructure Requirements found that deploying hydrogen refueling stations would be the cheapest option to decarbonise HGVs, costing a total of £1.7bn. While the strategic deployment of ultra-rapid charge points necessary to enable the required performance of BEV HGVs was projected to cost £10.7bn.

2. Passenger Vehicles

The role for FCEVs in the passenger vehicle market should not be discounted in favor of a solely battery electric approach. Range and recharging times are some of the primary issues that consumers cite regarding switching to zero harmful emission vehicles. FCEVs offer an excellent solution with ranges over 400 miles[32] on a single refueling, a 3-5-minute total refueling time and a similar refueling method to petrol and diesel vehicles.[33]

This is a benefit to driving uptake amongst consumers, with FCEVs not requiring any change in driver behaviour, with ranges and refuelling experiences that are comparable to existing diesel and petrol cars, which makes switching easier. With performance attributes that are far more comparable to internal combustion engine (ICE) vehicles for consumers than BEVs, this familiarity could be important in converting skeptical members of the public to adopt zero harmful emission alternatives.

The UK (Sports Utility Vehicle) SUV market, comprising larger vehicles, has enjoyed increasing popularity amongst consumers, accounting for 21.2% of new car sales in 2018.[34] This is an increase from 6.6% of new sales in 2009, with SUV models producing around a quarter more CO2 than a medium-size car due to their extra size and weight, according to the UK Energy Research Centre

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[26] ECIU, Net zero: cars, lorries, buses and trains
[27] Independent Transport Commission
[28] Ballard, 'Fuel Cell Trucks: Solution to Heavy Duty Transport Emissions'
[29] Hydrogen Council, 'Path to hydrogen competitiveness'
[30] Committee on Climate Change, 'Net Zero Technical Report – Surface Transports'
[31] UK H2Mobility, 'Phase 1 Results'
[32] Auto Express, 'Hyundai NEXO SUV: UK pricing and specs'
[33] National Hydrogen Scenarios, 'How Many Stations, Where, and When?'
[34] BBC News, 'Rise of SUVs 'makes mockery' of electric car push'

(UKERC).[35] The weight of these larger vehicles means they have greater power requirements, which in turn means more batteries are needed that have diminishing performance returns due to battery weight. FCEV options are also likely to provide viable options in this vehicle class.

To achieve a 2030 ICE phase out date, the production of vehicles will need to increase rapidly to meet consumer demands. BEV supply chains have struggled to meet demand in the UK market, where BEV sales account for 3-4% of new car sales.[36] Having a dual technological approach will benefit these supply chains and reduce risk, as FCEVs do not have the same mineral requirements that BEVs do. An over-reliance on BEVs as the technological solution for passenger cars would exacerbate existing supply chain risk and could potentially slow the pace of transition**.**

The Government should therefore be cognisant of the applicability and benefits of FCEV technology to the passenger vehicle market, particularly in the case of larger vehicles and in relation to comparable range and refueling parameters, which can help overcome barriers to mass adoption of zero-carbon vehicles. Specifically, Government should honour technological neutrality across transport use cases, including passenger vehicles, rather than distinguishing uses via vehicle type.

3. Buses

Fuel cell electric buses (FCEBs) are one of the most widely adopted fuel cell applications and are already being publicly operated in several countries. It has an advantage over BEV technology due to faster refuelling times and superior ranges.

We welcome recent government announcements around hydrogen buses, including the hydrogen bus only town initiative**.** Given the importance of refuelling infrastructure**, Government should look to co-fund hydrogen refuelling stations for buses under the condition the infrastructure can also be used for public refuelling infrastructure.**

4. Trains

Hydrogen technology is an effective replacement to diesel stock on non-electrified railway lines, due to hydrogen's energy density and fast refuelling times. With concurrent investment in the production of low and zero-carbon hydrogen, train operating companies will be able to decarbonise their operations without the need for expenditure on electrifying tracks, helping the UK meet its carbon budgets earlier and achieving its climate targets.

We welcome the Government's commitment to phase out diesel trains by 2040. Clear, ambitious targets help to drive progress and innovation around alternate technologies, and we are seeing subsequent progress in relation to hydrogen trains. **Government should ensure the sustained rollout of hydrogen trains beyond initial pilot and demonstration schemes ahead of 2040 diesel phase-out target.**

5. Maritime

The shipping sector also needs to reduce the amount of pollution it creates, however recent studies have reported that overall emissions from the sector, and its share of total of global emissions, are currently increasing.[37] Hydrogen and ammonia provide tested and proven options for decarbonising

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[35] Autocar, 'Report: soaring SUV sales causing car emissions to rise'
[36] Next Green Car, 'Electric car market statistics'
[37] Reuters, 'Shipping's share of global carbon emissions increases'

ships, however, they require associated infrastructure including hydrogen production and transportation.

Anglo American welcomes the commitment to 'green ships' within the government's Ten Point Plan, as well as the £20 million commitment to the Clean Maritime Demonstration Programme. The Government's Clean Maritime Plan of July 2019 outlines a vision for zero emission ships to be "commonplace globally by 2050, with the UK seen as a role model".[38] The plan mentions hydrogen and ammonia throughout as fuel options to enable decarbonisation. The strategy outlined an expectation that by 2025:

- All vessels operating in UK waters will be "maximising the use of energy efficiency options" and that all new vessels being ordered for use in UK waters will be being designed with zero emission propulsion capability.
- The UK will be building clean maritime clusters focused on innovation and infrastructure associated with zero emission propulsion technologies, including bunkering of low or zero emission fuel.

With the average lifespan for commercial ships 25 years, in order to meet the 2050 net zero target, zero or ultra-low emission ships will need to be available as an option from 2025. This is an ambitious timescale. **Given the urgency of decarbonisation, investment in these production technologies needs to be ready quickly, or some emissions will remain locked in.** The maritime sector needs to decarbonise, and hydrogen will be an important means of achieving this. **As the home of the International Maritime Organisation (IMO), the UK has an opportunity to position itself as a global centre of low carbon maritime innovation, including hydrogen.**

(January 2021)

[38] GOV.UK, Clean Maritime Plan, p.1.