

**Unite the Union response to  
Department for Business, Energy & Industrial  
Strategy consultation entitled  
Decarbonisation Readiness Joint Call for  
Evidence on the Expansion of the 2009 Carbon  
Capture Readiness Requirements**



**1 Introduction**

1.1 This submission is made by Unite, the UK's largest Trade Union with over 1 million members across all sectors of the economy including manufacturing, financial services, transport, food and agriculture, construction, energy and utilities, information technology, service industries, health, local Government and the not for profit sector. Unite also organises in the community, enabling those who are not in employment to be part of our union. This response is sent on behalf of our members in numerous sectors of the economy, from energy generation to construction regeneration, public, private and voluntary sectors, both in and out of work and on behalf of a quarter of a million members in transport.

**2 Consultation Questions**

**1/ What type of organisation are you answering on behalf of?**

2.1 A Trade Union with members in the energy, chemical, paper, ceramics, metals and all other high carbon intensive industries.

**2/ Which technologies is your organisation mainly involved with?**

2.2 As a trade union our members are involved with all of the technologies listed in the consultation and more.

**3/ What are your views on the 300 MW threshold, and what challenges might the removal of the threshold present to developers?**

2.3 Unite believes that the 300MW threshold has caused developers to deliberately develop technologies that are less than this limit in order to maximise profits and minimise regulation. In many cases, the scale of the development could easily be adapted to produce more than 300MW but has not because the developer did not wish to be caught by the requirements applicable to facilities producing more than the limit. Unite agrees that the removal of the limits should remove the market distortion for peaking plants and support the rapid decarbonisation of the electricity system, especially now that the price of carbon is increasing.

**4/ What are your views on the inclusion of refurbishing plant in DR? how could we best define refurbishing plant in this context?**

2.4 Unite believes that moving to Decarbonisation Readiness (DR) may in reality mean that a plant has space set aside for the ability to connect to a Carbon Capture Utilisation and Storage (CCUS) network, should one be developed in that area. This space, may become nothing more than a car park. That has been the practice that has

**Unite the Union Response to the Department for Business, Energy & Industrial Strategy Consultation  
Entitled Decarbonisation Readiness Joint Call for Evidence on the Expansion of the 2009 Carbon Capture  
Readiness Requirements**

occurred with respect to all “Clean Coal” and “Clean Gas” power plants built up until now. As a result of no centralised plan to build the infrastructure to build a CCUS pipeline, no CCUS pipeline has been built.

- 2.5 There are parallels here today, with the events in London in the mid 1700’s. Although the problems caused by pollution had been identified by scientists in that the release of this pollution was damaging human lives, the initial cost of creating a solution was seen as prohibitive. It was not until Parliament was subjected to the Great Stink<sup>1</sup> that it finally acted to clean up the mess. In 1858, the pollution was untreated sewerage and industrial waste being dumped in the Thames. Despite the development between 1859 and 1875 of the London sewer system, we have returned to a situation where this is still happening due to the lack of forward thinking and investment. Today, the planet faces a far more deadly threat of the extinction of life as we know it unless we as a species, act in the next 10 years to reduce emissions. It would be unthinkable today to build infrastructure without putting in provision for the treatment of waste water and industrial waste. Up until the 1700’s, the streets where we walked were the place where the waste was dumped. Today, it is the air we breathe. It is time that the Government acted to force all polluters to stop using the atmosphere as a place to pump untreated waste.
- 2.6 Climate Change is causing the weather based disasters to become ever more powerful. In total, the 2020 season produced 30 named storms (top winds of 39 mph or greater), of which, 14 became hurricanes (top winds of 74 mph or greater), including seven major hurricanes (top winds of 111 mph or greater). Unite hopes it will not require a hurricane or major storm surge flood to impact Westminster and all sitting MP’s before it will act to implement funding for a CCUS network.
- 2.7 If built on the basis that all greenhouse gasses (GHG) need to be pumped into the nearest branch of such a CCUS network or stored until it can be collected, as is the case with human waste water and the sewer system, then revenue can be recovered from every producer of this waste until such time as the initial investment is covered. If a private investor wished to pre-purchase capacity, they could do so at a discounted rate. Such a system would then result in the funding for a CCUS network that is at least similar to that already operating from Norway, where environmentally responsible companies are able to pay the Norwegian Government to store the ship loads of Carbon Dioxide (CO<sub>2</sub>) that they have produced, rather than paying for carbon credits which prop up the economy and do nothing to reduce emissions.
- 2.8 In the north of Wales for example there is the potential to store CO<sub>2</sub> via a pipeline network linked to offshore storage in the Hamilton gas field as has been suggested by Cadent in their HyNet project. Whilst there are issues with the way in which Cadent plans to separate hydrogen from natural gas, which Unite will highlight later in this response, Unite applauds their proposals for a CCS network. In South Wales the deep coal mines offer a proved capacity of 70.1 Million tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>), a probable capacity of 104.9 MtCO<sub>2</sub>, and a possible capacity of 152.0 MtCO<sub>2</sub>, according to a study

---

<sup>1</sup> The Great Stink was an event in Central London in July and August 1858 during which the hot weather exacerbated the smell of untreated human waste and industrial effluent that was present on the banks of the River Thames. <http://www.choleraandthethames.co.uk/cholera-in-london/the-great-stink/>

by the University of Leeds. This probable capacity is the equivalent to 16 years of emissions from Port Talbot Steelworks<sup>2</sup>, which is located in the coalfield<sup>3</sup>. This of course could be replicated in any area with a deep coal mine. If all else fails Wales like many other regions have access to the sea for short coastal transport to areas with access to Carbon sequestering pipelines.

- 2.9** It should not be forgotten that there are numerous solutions to utilise CO<sub>2</sub>. In horticulture the gas is used to speed up the growth of plants<sup>4</sup>. Similarly the gas can be used to speed up the growth rate of algae for use in animal feed and synthetic fuel generation<sup>5</sup>. The carbon can also be extracted to produce a solid or blended with water and basalt deposits<sup>6</sup> to form solid carbonates<sup>7</sup> offering alternative storage solutions as a mineral. CO<sub>2</sub> can also be turned into ethanol<sup>8</sup> or other sustainable fuel solutions or the carbon utilisation in the developing silver carbon battery technology<sup>9</sup>. All of these options provide the potential for mass employment in a range of industries that could extend the life of any sequestration solution.

**5/ What are your views on the potential inclusion of technologies such as heat, energy from waste, biomass and CHP in DR? Are there are any additional technologies to these which could be included?**

#### **Waste**

- 2.10** Unite would welcome the inclusion of technologies such as waste, biomass and CHP in the obligation to become DR. Unite believes that there are many types of industrial processes which cause the release of greenhouse gasses.
- 2.11** The use of CO<sub>2</sub> in fire extinguishers is a simply way in which the gas can enter the atmosphere. In commercial aircraft, the industry is looking at the replacement of diesel Auxiliary Power Units (APU) with fuel cells. The water produced from the cell can reduce the aircrafts need to carry a supply of water for passengers and crew to drink. Interestingly, the aerospace industry is also looking at the deoxygenated air as a replacement for on-board fire extinguishers. The same could be true in any hydrogen fuel cell vehicle, as a means to suppress fires.

---

<sup>2</sup> At current levels of CO<sub>2</sub> emissions

<sup>3</sup> See the Leeds study report here.

<https://eprints.whiterose.ac.uk/146290/3/4%20Evaluation%20carbon%20sequestration%20potential%20in%20the%20SW%20coalfield%20UK%20v06.pdf>

<sup>4</sup> <https://www.htgsupply.com/informationcenter/talking-shop/adding-co2-for-indoor-gardening/>

<sup>5</sup> <https://sustainablebrands.com/read/cleantech/pond-using-algae-to-turn-co2-to-our-many-advantages>

<sup>6</sup> Basalt deposits can be found near the surface in Britain from the Antrim coast in Northern Ireland, down to Guernsey in the Channel Islands. The dark-coloured basalt dyke on the isle of Mann was intruded as molten magma that rose almost vertically through the surrounding horizontal layers of Carboniferous limestone.

<https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3666.html>

<sup>7</sup> <https://pics.uvic.ca/projects/solid-carbon-negative-emissions-technology-feasibility-study>

<sup>8</sup> <https://www.motortrend.com/features/direct-co2-to-fuel-conversion-technologue/>

<sup>9</sup> <https://www.motortrend.com/news/toyota-solid-state-battery-ev-2021/>

**Unite the Union Response to the Department for Business, Energy & Industrial Strategy Consultation  
Entitled Decarbonisation Readiness Joint Call for Evidence on the Expansion of the 2009 Carbon Capture  
Readiness Requirements**

- 2.12 The use of the waste deoxygenated air from hydrogen fuel cell farms could be used to fight fires in other locations too, as a direct replacement for CO<sub>2</sub> and halon in places like computer server rooms, for example. Under current plans this valuable product is simply vented.
- 2.13 The removal of oxygen from a room can also stop items from deteriorating during shipment and as this “waste gas” is harmless to the environment yet can halt decay due to viruses and bacteria. This is why in hidden Egyptian chambers, for example, the absence of oxygen preserved everything so well.

### **Heat**

- 2.14 The production of heat, beyond what is required to accomplish an industrial process is in general, wasted, despite it requiring a great deal of energy to create. The waste heat is simply vented via things like cooling towers and in the case of nuclear plants, by passing very large quantities of sea water through the cooling system.
- 2.15 The one element of a Direct Air Capture (DAC) facility that makes the removal of CO<sub>2</sub> from the atmosphere so expensive is the requirement to provide heat. A DAC works by passing air through a filtering material which captures CO<sub>2</sub>. After a while, the capturing medium becomes saturated which can only be released and stored if the medium is subjected to over 100°C of heat. Once heated and the CO<sub>2</sub> released into CCUS network, the medium cools and is then reused. Clearly, waste heat from nuclear reactors, industrial processes, etc., should be used to reduce the need for heating elements in a DAC, making the cost viable.
- 2.16 Industries like steel, glass, ceramics, paper etcetera are all industrial processes that require large volumes of heat and produce large amounts that are currently allowed to dissipate into the atmosphere. Every ton of steel produced in 2018 emitted on average 1.85 tons of carbon dioxide, equating to about 8 percent of global carbon dioxide emissions. If we are to decarbonise, industries like the aforementioned Port Talbot Steelworks need to be converted to use a sustainable source of fuel be that hydrogen<sup>10</sup> or an electrical arc<sup>11</sup> to melt waste material. The waste furnace heat recycled to pre heat the next firing and/or used to generate electricity<sup>1213</sup>.

---

<sup>10</sup> <https://www.mckinsey.com/industries/metals-and-mining/our-insights/decarbonization-challenge-for-steel#:~:text=This%20uses%20green,achieve%20carbon%20neutrality.>

<sup>11</sup> <https://www.bhp.com/news/prospects/2020/11/pathways-to-decarbonisation-episode-two-steelmaking-technology#:~:text=Electric%20steelmaking%20differs%20from%20the%20integrated%20route%20in%20that%20the%20EAF%20feedstock%2C%20steel%20scrap%20or%20DRI%2C%20is%20already%20%E2%80%9C%20reduced%20and%20in%20its%20metallic%20form.%20The%20metallic%20charge%20only%20needs%20to%20be%20melted%20to%20convert%20the%20scrap/DRI%20into%20liquid%20steel.>

<sup>12</sup> An example of waste heat to power technology’s [https://www.epa.gov/sites/default/files/2015-07/documents/waste\\_heat\\_to\\_power\\_systems.pdf](https://www.epa.gov/sites/default/files/2015-07/documents/waste_heat_to_power_systems.pdf)

<sup>13</sup> See:- Industrial Decarbonisation & Energy Efficiency Roadmaps to 2050, Iron and Steel, March 2015, DNV-GL for BEIS

- 2.17 According to the ONS and BEIS statistics<sup>14</sup> there were 3.18 million people in fuel poverty in 2019 who might be able to benefit from the reutilisation of waste heat. Given the numbers who have suffered through the pandemic, earning 80% of their normal wage while on furlough or have been working from home and hence used more energy, the percentage for 2020 is expected to be higher than previous years.
- 2.18 If some of the waste heat was stored for later use, it could significantly reduce the amount of additional heat required for that industrial process. It is for this reason that a steel works never really cools down unless it is to close permanently. Whilst Unite recognises that there may be technical and economic difficulties in applying conventional heat recovery methods, Unite believes that the potential savings could outweigh the initial cost especially when the price of carbon is factored into the equation. Thermal energy storage (TES) systems can be placed on-site or the industrial waste heat can be transported by means of mobile TES systems to an off-site heat demand. In an article in Applied Energy in 2016<sup>15</sup>, over 50 industry case studies in which both on-site and off-site recovery systems are considered, are here reviewed.

### **Biomass**

- 2.19 Biomass is a way to extract power from nature as it converts fast growing woodland into pellets that can extend the life of a coal fired power station, producing what some would argue to be net zero power. Whilst Unite supports this process, the reality is that the process is not net zero as emissions are created to transport the tree to the processing plant and to ship the resulting pellets to the furnace. During shipment and prior to their use, the biomass pellets start to rot, producing greenhouse gasses (GHG's) and do not burn as well as they would if they were freshly dried, especially if they get wet. When these power stations were fired by coal, the coal was simply piled up outside in all weathers, however, storing wood pellets in this way results in them rotting faster.
- 2.20 If waste heat from the furnaces were used to keep the pellets dry and reduce moisture content, then the wood that is less likely to rot, will burn better.
- 2.21 Critics of biomass argue that burning wood is not greenhouse gas free activity; it releases carbon, stored over the previous decades, in one quick burst and also releases some other GHG chemical compounds. The latest International Panel on Climate Change (IPCC) report highlights that the next 10 years are going to be critical as we have a 40% chance of exceeding the 1.5 °C barrier set at the Paris Conference of the Parties (COP21). For an equal amount of heat or electricity, wood burning can release more CO<sub>2</sub> than burning gas, oil and even coal. Whilst this CO<sub>2</sub> will eventually be reabsorbed as new trees, this process could take 15 to 30 years to achieve. For logs from mature in Canadian woodland, it could take more than 100 years before the

---

<sup>14</sup> ONS Fuel Poverty Statistics  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/966509/Annual\\_Fuel\\_Poverty\\_Statistics\\_LILEE\\_Report\\_2021\\_2019\\_data.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966509/Annual_Fuel_Poverty_Statistics_LILEE_Report_2021_2019_data.pdf)

<sup>15</sup> Applied Energy Volume 179, 1 October 2016 pages 284-301 – A copy may be obtained through  
<https://www.elsevier.com/solutions/sciencedirect/contact-us>

atmospheric CO<sub>2</sub> is less than the alternative scenario of burning a fossil fuel, leaving the trees in the forest. The IPCC has proven that particles created by burning wood and other biomass—so called “black carbon”—are a major contributor to global warming. Many scientists believe that reducing or eliminating wood and other biomass burning to be one of the easiest and most effective ways for us to curb global warming.

- 2.22 That said, if the biomass plant was connected to a CCUS network as suggested above, to remove all the flue gas emissions, then there is the potential for biomass to go one better than being as they claim “Carbon Neutral” but would become carbon negative and create a carbon sink as the emissions from the burning wood and black carbon are pumped underground, rather than released into the atmosphere. The volume of carbon that is absorbed by the trees felled for biomass, is exceeded by the volume that is used to process the trees into pellets, ship them and amount of GHG’s released whilst the pellets are stored and utilised for fuel. Additionally in a number of cases biomass is co-fuelled with coal in order to remove the residual tar created when the tree sap is not consumed. Consequently, installing a CCUS to all biomass power stations should be a priority given the state of the planet’s battle to stay below 1.5 °C. Despite the emissions that are produced, the amount of emissions per GWh is still below the emissions from a natural gas turbine. Such a move to connect a biomass plant to a CCUS network would make these facilities a suitable use for trees that have become less efficient at removing GHG’s from the atmosphere.
- 2.23 If the waste heat from the biomass power station were used to provide heat to a DAC, the volume of carbon captured and stored could be significantly increased rather than wasting this heat in cooling towers.
- 2.24 However, before a biomass power plant can become a carbon sink it often needs to be converted from coal to biomass, a task that requires a lot of investment. Maintaining the status quo would not result in a carbon neutral outcome so it needs to be addressed urgently.

### **Shortages**

- 2.25 The UK has recently been facing increased demands on the network to supply homes and businesses with electrical power to replace fossil fuels. The demand for carbon free hydrogen generation, power to recharge vehicles and replace petrol, diesel and natural gas will place a substantial additional burden.
- 2.26 According to the Government’s recent report, final energy consumption (that is, excluding non-energy use), was 142.0 million tonnes of oil equivalent (mtoe) in 2019, 1.4 mtoe (1.0%) lower than in 2018, with all sectors contributing to the decrease<sup>16</sup>. Total electricity generated in 2019 was 323.7 TWh ( $\cong$  27.833 mtoe), a decrease of 2.8% compared to 2018 (332.9 TWh). If we are to replace all fossil fuels with electricity, assuming a simple 1:1 replacement of one energy source with another, the

---

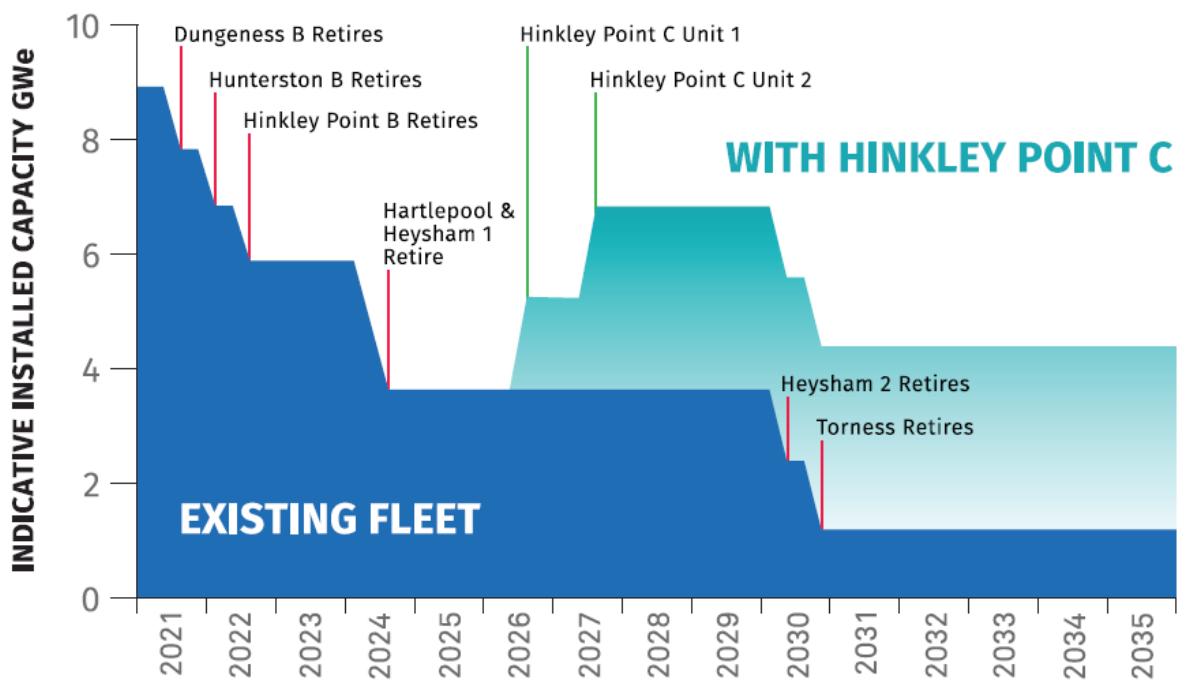
<sup>16</sup> [The Department for Business, Energy and Industrial Strategy press release October 2020](#)

**Unite the Union Response to the Department for Business, Energy & Industrial Strategy Consultation  
Entitled Decarbonisation Readiness Joint Call for Evidence on the Expansion of the 2009 Carbon Capture  
Readiness Requirements**

UK will require more than 5.1 times the current generational capacity if we are to return to the economic activity seen in 2019 post the COVID-19 pandemic. Of course, this assumes that the UK population will not increase and there will not be any losses in the replacement of one energy source with another.

- 2.27 The production of green hydrogen using electrolyzers is supposed to be just 60-70% efficient, so if we are to have a greater reliance on green hydrogen over blue or grey hydrogen, Unite estimates the energy requirements could grow to in excess of 7 times the current demand. Since around 40% of electrical power is currently generated by fossil fuels, this too will eventually need replacing. This increases the need for the current fleet of electrical power generation facilities to increase by more than 11.5 times.
- 2.28 Between now and 2050, the nuclear generation industry will face a dramatic reduction in output, unless of course, the plans for Sizewell C and Bradwell B are realised as illustrated below. Whilst wind energy can help keep the lights on, if there is too much or too little wind, these turbine blades will not turn. The amount generated from wind cannot match the second by second changes in demand of the Grid so the amount generated needs to exceed peak demand in order to produce some form of electrical storage that can be released in an instant to bridge any gaps. Wind turbines are only designed to last between 10 and 25 years (depending on location and design) and consequently, all the current turbine farms will need to be replaced before 2050. Therefore, Unite recommends that there is at least **14 times the current electrical generation capacity** in order to keep UK plc's economy flowing.

**Nuclear capacity to 2035**



**Unite the Union Response to the Department for Business, Energy & Industrial Strategy Consultation  
Entitled Decarbonisation Readiness Joint Call for Evidence on the Expansion of the 2009 Carbon Capture  
Readiness Requirements**

2.29 Under the circumstances, Unite would support any form of new sustainable form of power generation (within reason). Whilst the Government has given the green light for 16 new Small Modular Reactor (SMR) facilities and some additional wind farms, these will not be enough to meet our future needs.

**6/ What are your views on potential exemptions from DR? Would it be suitable to exclude plant which operate below a certain level of annual carbon emissions and/or running hours?**

2.30 Ordinarily, Unite would believe that, by setting a lower limit beyond which the rules do not apply would allow unscrupulous producers to invest in several facilities whose capacity combined is below the threshold. In this case, however, Unite hopes that it is unlikely that there will be that many cases where the exemption will apply with a limit set to the proposed limit.

**7/ Beyond grandfathering of Capacity Markets agreements, is there anything more that we could do to ensure that the DR requirements do not affect the Capacity Market?**

2.31 The Capacity Market principle only works if there is more generational capacity chasing the demands of the National Grid. As outlined earlier, Unite remains unconvinced that this will be the case, due to the delays that have already impacted the construction of much needed capacity.

**8/ What are your views on implementing DR through environmental permitting rather than the planning consent process?**

2.32 Unite believes that whilst the planning consent process has its place in ensuring that local developments do not adversely impact local communities, the urgency of additional capacity requirements strongly suggest the need for a national infrastructure delivery plan which can shortcut the system to remove the excessive unnecessary delays to project development.

2.33 Since before reactor 2 at the Wylfa Magnox power station was switched off (in 2012), there had been calls to build its replacement by both the sector and local community. Nonetheless, the application was not formally received by the planning inspectorate until 20<sup>th</sup> September 2016. Almost five years earlier (on the 31<sup>st</sup> October 2011), the application was received by the Planning Inspectorate to build Hinckley Point C. It will therefore, take 15 years from application to the first power generated to produce new nuclear power.

2.34 The UK does not have 15 years to build and pass through the number of new nuclear planning consent processes and construction phases that are needed to provide the base load power required by the industry. Given the demand from other nations for replacements to coal and natural gas, it is also unlikely that there will be the skilled manpower to construct these plans either unless there is some way in which the process could be streamlined. The same could be said for planning proposals for new wind farms, electrolysers, DAC facilities and improvements to the national power supply grid.



2.35 In the circumstances, Unite recommends the use of national key Infrastructure pre-planning approved projects where existing designs are replicated at multiple sites. Duplication of designs will provide economies of scale and eventually reduce the cost of decommissioning.

**9/ If we were to implement DR through environmental permitting, how can developers be given confidence that their site will be compliant with DR prior to construction?**

2.36 Providing that developers stick rigidly to an off-the-shelf pre-determined design and the inspection of the geology is confirmed as suitable, developers and investors could be assured that developments and new facilities will be approved so they could see a swifter return on their investment.

**10/ What are your views on the two-yearly review of DR requirements? Should this be retained and is the frequency suitable?**

**11/ How frequently should the DR requirements be reviewed? Should this be made a legislative requirement?**

2.37 Given that the review of the scientific evidence by the IPCC is every 6 months and given the most recent paths are showing an exponential growth path in the temperature and CO<sub>2</sub> levels, Unite believes that the review period should currently remain at every 2 years but should become more frequent as we get closer to 1.5 °C, or Unite's fears that supply will not meet future demands will be realised

2.38 Unite believes that the DR requirements should be reviewed and adapted to include new technological developments like the process discovered by the German company Graforce, to turn animal waste and sewage into green hydrogen, nitrogen and pure water using plasmalysis<sup>17</sup>. The use of plasmalysis instead of conventional sewage treatment and animal waste storage, could make a considerable dent in the energy requirements of the country to produce green hydrogen if the energy requirements are as advertised.

**12/ How can we future proof DR again further technological development, e.g. new decarbonisation technologies and/or simplify the process for adding new techs to DR?**

2.39 Technology is developing daily and it would take a team of experts to properly assess any new discovery before inclusion in the list of DR requirement plans. Thankfully every university faculty should contain such experts in the sciences or post degree level masters' students capable of determining the value of one idea over its rival from an academically sound standpoint to prove if results can be replicated. Similarly, the Government is fortunate in that it can also call on the services of UK business leaders to determine if there is a financial practical application to the discovery; to NGO's like the trade unions who can assess the impact on any civil society and to swaths of members of the judiciary and legal services to provide assurances that such designs do not infringe any intellectual property rights.

---

<sup>17</sup> <https://www.farmonline.com.au/story/6668499/new-tech-turns-manure-into-hydrogen/>

**13/ Are there any alternative decarbonisation options, beyond low-carbon hydrogen and CCS which are already developed enough to be included in Decarbonisation Readiness? If so, then please include details on how their readiness could be assessed for a combustion power plant.**

- 2.40 Unite has become aware of evidence that the production of Blue hydrogen through steam methane reforming (gas SMR) could generate **20% more emissions** over its life-cycle than if natural gas was burnt instead<sup>18</sup>. The reasons for this are that only a limited amount of the tonnage of natural gas is converted to hydrogen and carbon monoxide during scientists at Cornell University, New York, and Stanford University, California, found.
- 2.41 Unite has also become aware of a method from Germany that can convert sewage and animal waste into green hydrogen, nitrogen and clean water through a process called plasmalysis<sup>19</sup>. The Graforce process claims to be able to halve the world's energy demands.
- 2.42 Unite would stress that the use of any contained combustion method will result in the production of nitrogen oxides which will in turn result in the production of ozone, a powerful greenhouse gas. Unite would therefore, strongly suggest the use of a hydrogen fuel cell farm which can turn hydrogen and air into electricity, water and deoxygenated air. The latter is an effective fire suppressant which could be used as a direct replacement for CO<sub>2</sub> fire extinguishers.

**14/ What are your views on our suggested design principles?**

- 2.43 Unite feels that the proposals are robust but given the growing body of evidence that suggests that blue hydrogen, using the current industrial gas SMR process, is a dead end. The Union is yet to be convinced that the design principals will conclude that the future for blue hydrogen is sustainable.
- 2.44 Until all avenues have been exhausted however, Unite will continue to support the idea of using Blue hydrogen as there are few alternatives at scale. Utilising the emerging idea of auto-thermal (gas ATR) technology with CCUS, may significantly reduce emissions compared SMRs but the process is not perfect. There are pathways to potentially generate a carbon-negative hydrogen if it is extracted from bio-methane or through the gasification of waste allied with CCUS, however, there are limits on the supply of bio-methane. Unite feels that the scale of the challenge to bring on stream enough sustainable energy generation and electrolyzers to replace the hydrogen generational capacity from the gas SMR Blue hydrogen process, for use in

---

<sup>18</sup> <https://www.edie.net/news/8/Blue-hydrogen-could-produce-more-emissions-than-burning-natural-gas--academic-study-finds/>

<sup>19</sup> <https://fuelcellsworld.com/news/new-tech-turns-manure-into-hydrogen/#:~:text=The%20German%20company%20Graforce%20has,CO2%2C%20inexpensively%20and%20highly%20efficiently.&text=%E2%80%9CHydrogen%20from%20feces%20has%20huge%20energy%20potential>

transport, etc., would range from difficult to near impossible in the timescale, requiring war time levels of investment and industrial mobilisation.

- 2.45 A recent study conducted for the Zemo Partnership<sup>20</sup> examined hydrogen production pathways and the use of hydrogen in vehicles. Whilst this study was informative, it was also steered and sponsored by Shell, the owners of the gas networks, Universities of Bath, Brighton and Cambridge to name but a few.
- 2.46 Needless to say, that it would be a pointless exercise to use electricity to create hydrogen only to put through a gas turbine, unless the hydrogen was used as electrical energy storage and had run out of fuel cells.

**15/ What are your views regarding the four proposed assessments for demonstrating hydrogen readiness? Are there additional assessments which would be beneficial?**

- 2.47 Unite is extremely concerned about the plans for the continued use of natural gas and the plans to use hydrogen co-firing to generate electricity. As highlighted by the latest UN reports by the World Metrological Office, the UK is already at 1.2 °C above preindustrial levels and has a 40% chance of having a year in the next 10 that will exceed the 1.5 °C Paris Agreement limit. Burning hydrogen or any fuel in a compressed air environment will cause the production of nitrogen oxides (NO<sub>x</sub>). These oxides are a precursor to acid rain, photochemical smog, and react in the presence of sunlight to create Ozone, a very powerful greenhouse gas roughly 1,000 times as strong as CO<sub>2</sub>.
- 2.48 Committing the UK to generate electricity using even a blend of blue gas SMR hydrogen and natural gas will bind the nation to a continued release of millions of tonnes of CO<sub>2</sub>, which as a nation committed to tackling climate change is unacceptable. Even if there were the capacity to supply these gas combustion powered stations with Blue gas ATR hydrogen or bio-methane based hydrogen, there will still be the issue of NO<sub>x</sub> emissions to contend with.
- 2.49 Unite feels that given the evidence, unless there can be some guarantee that **all** gasses from the production of blue hydrogen and gas turbine powered generation can be contained, some alternative needs to be deployed. Fortunately there are alternatives, but all will require vast levels of financial support.

**16/ What are your views on the suggested requirements for hydrogen ready plants to demonstrate hydrogen blend capability from the point of construction, including the example of 2030 as a cut-off for 100% hydrogen.**

- 2.50 Unite does not believe that the proposals are moving fast enough and suggests a far earlier deadline given the science which is suggesting a far sooner deadline than 2050 when the world will need to be reaching net zero. Unite would suggest that the industry needs to show in the next 2 or 3 years that clean gas powered electricity can work and provide power to the UK Grid. If it can, then it is Unite's policy to support it.

<sup>20</sup>

<http://zemo-ebooks.org.uk/2021/Hydrogen-WTT-Pathways-Study-Full-Report/#p=1>

**17/ We would welcome views on if there are any additional and/or necessary items for hydrogen combustion that might have space requirements (e.g. NOx abatement equipment) and what their specific requirements might be?**

- 2.51 Unite understands that NOx gas scrubbing is one of the most common forms of NOx treatment, with sodium hydroxide (NaOH) being the conventional scrubbing medium. However, the absorbed NOx is converted to nitrite and may present wastewater disposal problems. Scrubbing solutions containing hydrogen peroxide are also effective at removing NOx and can afford benefits not available with NaOH. For example, hydrogen peroxide adds no contaminants to the scrubbing solution and so allows commercial products to be recovered from the process, e.g., nitric acid. Unite understands that the size of any such NOx scrubbing facility would depend on the volume of gas to be processed.
- 2.52 There are numerous examples of working NOx abatement facilities currently in operation around the world. It is shocking that the UK Government has yet to require NOx abatement technology as a mandatory requirement for all existing and new facilities.

**18/ Would it be suitable to require plants that have a choice between hydrogen and CCS to set-aside enough space for whichever technology requires the most space, even if they are planning to meet the DR requirements through hydrogen? How could we ensure that this would only apply to sites which are likely to be able to retrofit CCS as well as to convert to hydrogen?**

- 2.53 Unite believes that both CCUS and NOx abatement facilities are a minimum requirement for the continued use of any existing gas fired power stations. If space is an issue then Unite recommends that they purchase neighbouring land to treat these exhaust gasses or face closure. Unite does not believe that a single gas power station should be allowed to continue operation without retrofitting to become a zero carbon and zero GHG station.
- 2.54 Unite would stress that if such stations are to close, staff are given the opportunity to find alternative employment in a hydrogen fuel cell farm using hydrogen derived from waste or in some other activity that will reduce the volume of GHG emissions into the atmosphere. These are often highly skilled engineers who may be able to utilise the same building structure to house banks of fuel cells instead of turbines in a fuel cell farm. The reuse of such a facility could greatly enhance the volume of electricity produced on the site and reuse the existing Grid connectivity.
- 2.55 A conventional combustion-based power plant typically generates electricity at efficiencies of 33 to 35%, while fuel cell systems can generate electricity at efficiencies up to 60%, even higher with cogeneration using the heat of the reaction to produce more power. The reuse of an existing gas fired power station would be ideal for such cogeneration to be exploited. The problem is that for a fuel cell to work, it needs a source of pure hydrogen and air. Due to its contaminants, Blue hydrogen is not an option unless a way could be found to remove and store these waste gasses.

**Unite the Union Response to the Department for Business, Energy & Industrial Strategy Consultation  
Entitled Decarbonisation Readiness Joint Call for Evidence on the Expansion of the 2009 Carbon Capture  
Readiness Requirements**

**19/ We would appreciate your views on these issues, including whether there are any we have overlooked, and how we can best assure/assess that developers have considered all the relevant technical issues.**

2.56 Unite would strongly suggest that the Government review the scientific evidence to properly evaluate the continued use of natural gas, the blue hydrogen production methodology, the assessment of existing plants for the inclusion of a closed loop NOx abatement and CCUS technical solution and the feasibility of converting waste water to green hydrogen for use in a cogenerated fuel cell farm within the existing structure of an ex-gas powered station.

**20/ We welcome your views on how to design a meaningful assessment for hydrogen fuel access.**

2.57 Unite would suggest that any meaningful assessment for hydrogen fuel generation needs to consider the purity of the hydrogen gas produced and importantly, post storage. Unite has become aware of plans within the East Midlands Freeport Energy park that intends to use natural underground storage that had previously been used to store natural gas. The storage in question contains deposits of natural sulphur that in the presence of hydrogen gas will react to form hydrogen sulphide. Whilst this may not have been an issue when the area was used to store natural gas, the hydrogen sulphide contamination would be a major issue if fed into a fuel cell. Hydrogen Sulphide will react violently with water to produce sulphuric acid that will damage and severely limit the life of this equipment.

2.58 If sulphides are a contaminant in the hydrogen supplied to a plant producing synthetic crude oil, the resulting fuel will produce particulates that will ruin the synthetic fuels' chances of reducing issues with air quality and induced cloudiness when used in aviation.

2.59 Unite stresses that it would support clean gas powered generation if a closed loop can be guaranteed, where any natural gas extracted will not add additional pollutants to the atmosphere. Unite does not believe, however, that the current proposals for the integration of hydrogen gas in a mix or in a 100% pure replacement are robust enough to provide a sustainable solution.

**21/ We welcome your views on our likely position to make the hydrogen fuel access assessment non-compulsory in the short-term, with a view to making "passing" it mandatory in future to reflect the anticipated development hydrogen economy.**

2.60 The development of a hydrogen economy is going to be based on the various methodologies which can be employed to use this gas as a medium to transfer energy and the volume of investment that can be raised to create a sustainable solution.

2.61 Just a few months ago, Unite would have recommended the expansion of blue hydrogen technology to provide the volumes of hydrogen required as it should have been a relatively simple matter to capture and store the waste gasses from the process to extract hydrogen from natural gas. Given the increasing volume of articles that suggest that Blue hydrogen is a white elephant technology that will cause more

pollution than simply continuing to burn fossil fuels, Unite has realised that there are alternative options to extract hydrogen from natural resources.

**22/ We appreciate your views on the viability of on-site hydrogen supply and/or storage for hydrogen-fuelled peaking plants.**

- 2.62 On-site hydrogen generated supply is a viable alternative to the need to run a portable generator. The use of the fuel cell in a hydrogen fuelled family car should provide enough power to light several houses and it is very likely that the fuel cell will still have enough life to outlast that vehicle and for several that follow. The only issue is the supply of pure hydrogen.
- 2.63 The viability of a hydrogen fuelled peaking plant would provide a way of instantly adding power to the Grid to meet demand without the need to power a turbine 'just-in-case' there is a demand for power, as is the case currently with the back-up capacity used to fill in gaps between renewable supplies and the demands of the Grid network.
- 2.64 Such a peaking plant could provide the capacity to provide enough supplies to give a larger generator like a nuclear reactor time to come on stream. Due to the increasingly long-term, minute by minute unpredictability of the strength of the wind, due to climate change and the window in which wind power can operate. A Small Modular Reactor (SMR) can closely follow the demands of the Grid, due to its reduced thermal capacity but they are no match for the capacity that can be provided from just one EPR reactor, similar to that under construction at Hinkley Point.
- 2.65 The storage of this hydrogen needs to be stored in a facility that can compress the gas and place it in liquid state in tanks. Unite does not recommend geological storage for the reasons set out earlier.
- 2.66 A compressed tank based hydrogen peaking and storage system can then be easily be capable of storing, releasing any excess stored green hydrogen beyond that required into the wider economy. This is a major advantage over the water pumped storage facilities that are currently employed as excess pumped water cannot easily be removed from the system for use elsewhere.

**23/ What factors are viewed as critical in determining whether conversion to hydrogen is economically feasible? What would be your economic considerations?**

- 2.67 Unite believes it is critical to ensure that there is a closed loop system that only allows the required oxygen to enter and all waste gasses to be treated or stored. If space and the economics do not work out due to the inefficiencies of the combustion to power process, then the conversion from natural gas powered turbines to hydrogen fuel cell co-generation might be a better option. This will initially be expensive but could result in an increase in the generation capacity of the plant, potentially doubling its output.
- 2.68 Once the natural gas network is not in use, it could easily be converted to transport hydrogen to any gas powered generating facility. If the gas pipeline network was to

supply an increasing volume of hydrogen mixed in the supply at source, then the pipeline should be capable of being isolated from the rest of the network. At the Pembroke power station, a dedicated 4.5 km gas pipeline was horizontally drilled under the Haven estuary from the LNG import facility demonstrating that it is clearly technically possible to create a pipeline where none existed before with minimal disruption.

**24/ What are your views on our proposed updates to the CCR requirements?**

- 2.69 Unite would argue that the CCR economic feasibility test must include a section covering the ability to cover the liability for leak prevention, at any time in the future, from any carbon storage facility. CCUS only works if the emissions are locked away securely, removing them from any influence they could have over the planet's environment. For this reason, Unite supports the need for such infrastructure to be publically owned rather than leaving the future to the hands of private enterprise. Periodic economic reviews to see if a company is viable is a snapshot of the health of a business. It cannot cover the loss and damage caused globally, if the storage system or economic model collapses. Unless it is publically owned, what guarantees are in place that the storage location is secure?

**25/ What are your views on how the transport and storage test for CCR should be updated?**

- 2.70 Several countries are accepting shipping tanker loads of CO<sub>2</sub> to inject into their existing CCUS networks. If a facility is not directly plumbed into a CCUS network then the transport carbon emissions need to be included in the calculations of the originating plant's carbon tax liabilities.

**26/ Are there additional areas for change we have not identified? Please provide justifications.**

- 2.71 The utilisation of stored atmospheric captured CO<sub>2</sub> from a DAC can be used to produce a net zero crude oil from which, a net zero synthetic aviation fuel (SAF) can be created. Under our current understanding SAF is the only way to decarbonise long haul flights. Doing so, can also reduce induced cloudiness and reduce long haul fuel burn by up to 3%.
- 2.72 There are similar uses for captured CO<sub>2</sub> including its potential use in horticulture, where the increased atmospheric concentration of CO<sub>2</sub> is currently achieved by burning natural gas. Providing that the CCUS network does not contain gasses that would be toxic to the plants and anyone that consumes them, this should not be considered as an alternative to a hole in the ground. Of course, if horticulture was to be seen as an alternative, the increased atmospheric CO<sub>2</sub> needs to be contained in an airtight structure until ambient CO<sub>2</sub> levels match those outside the greenhouse area.

**27/ What impact could the changes discussed in this call for evidence have on your business's administrative costs for planning permission and environmental permitting? Please specify which of the proposed changes will have the most impact.**

**Unite the Union Response to the Department for Business, Energy & Industrial Strategy Consultation  
Entitled Decarbonisation Readiness Joint Call for Evidence on the Expansion of the 2009 Carbon Capture  
Readiness Requirements**

**28/ We anticipate developers are already considering future decarbonisation options following the EWP. What impact are the changes discussed in this call for evidence likely to have on your investment decisions for new build plant? Please specify which of the proposed changes will have the most impact.**

**29/ How do you currently manage the long-term risks of decarbonisation in your investment decisions? What additional work will the proposed changes cause?**

2.73 Unite believes that all CCUS networks should be publically owned as set out earlier.

**30/ Are there any specific impacts on small and micro businesses that are not covered above? If so, please provide details of the anticipated one-off and on-going costs.**

2.74 Unite is not aware of any specific impacts.

**31/ Please tell us if you think there are any other impacts not covered above, in particular wider impacts on the energy system and security of supply**

2.75 Unite is very concerned that due to decisions that have been made on the composition of the future energy supply system, that too much faith has been attributed to the ability of the decarbonisation of both the natural gas fired power stations, domestic heating and cooking supplies and the ability to convert both natural gas to blue hydrogen and the substitution of natural gas with hydrogen. Given the above outlining the problems with gas SMRs, Unite would caution against putting all of the nation's eggs in one basket.

2.76 Given how precious a commodity green hydrogen supplies will become, Unite believes a more sustainable solution would be the replacement of heating options with heat pump technology. As heat pumps extract the heat from the local environment, they can provide more heat energy from the system than the amount of energy put into them. As a consequence, such systems can be up to 200% efficient in turning energy into heat. There are issues with the deployment of heat pumps and the noise they create if not located professionally. Heat pumps appear to provide a far better solution for the supply of heating than replacing a natural gas boiler with one using hydrogen, especially so if the supply is hydrogen from a brown, black or grey hydrogen source.

2.77 Unite believes that, as with the roll out of smart meters, it should be the responsibility of dual fuel energy suppliers, to assist homeowners and industrial/commercial customers with the conversion of their heating needs from natural gas to heat pumps. This could also be made obligatory under changes in building regulations especially for rental properties.



### **3 Conclusion**

- 3.1 In conclusion, Unite is becoming increasingly alarmed at the Government's proposals to rely heavily on the conversion of natural gas to blue hydrogen and its use as a direct replacement fuel in gas fired applications such as domestic/industrial heating and electrical generation.
- 3.2 Unite is keen to see a just transition of workers' roles applied, allowing the likes of offshore oil and gas workers to build on their skills to work on CCUS platforms, wind farms and wave powered generation, for example. Workers previously installing smart meters could be retrained to become part of the workforce installing heat pumps, upgrading Grid connectivity for electric car home charging and in the move away from gas supplies.
- 3.3 The combustion of any fuel in air in a confined high pressure environment will create NO<sub>x</sub>, a gas that creates Ozone in the presence of sunlight, which is a health hazard in its own right. As Ozone and the particulates from combustion can lead to further global warming, Unite believes that as such, all emissions from any combustion need to be contained and where possible treated before inserted into a CCUS network.
- 3.4 Whilst Unite supports the use of clean sustainable gas powered generation using a CCUS, or the conversion to hydrogen power, it appears that such a change may cause more emissions, not less, to enter the atmosphere. Equally, burning biomass in a converted coal fired boiler does not appear to be as sustainable as it has been marketed. Unite recommends that before a large portion of the Government's eggs are placed in the one basket, a full scientific root and branch evaluation of the emissions from each option needs to be assessed. This should not simply assume the promoters or its political supporters' facts are correct nor just consider emissions of CO<sub>2</sub>, NO<sub>x</sub> and black carbon at the point of use.
- 3.5 Waste heat should be treated as a valuable commodity as it can remove the need for alternative ways to heat homes and businesses. This includes the use of waste heat in a DAC facility. Without DAC facilities and the greater deployment of natural carbon sinks, the IPCC believes that warming will exceed 1.8 °C.
- 3.6 Even with these plants, there is currently just a 50:50 chance that the planet's warming can be stabilised at 1.5 °C. The WMO has also highlighted that we are at 1.2 °C of warming above pre- industrial levels and we face a situation where there is a 40% chance of one year in the next 10, exceeding the 1.5 °C barrier. Consequently, there is a degree of urgency internationally that actions are taken to address the issue of a conversion to a carbon free economy early into the century, preferably in the next 10 years.
- 3.7 Unite believes reliance on just wind and other renewables with a far smaller share of nuclear power will not be enough to power the UK plc's. Unite therefore, believes than more should be done to support a faster roll out of new nuclear facilities.

20th September 2021

Rob MacGregor  
National Officer Energy  
Unite the Union  
128 Theobalds Road,  
Holborn, London,  
WC1X 8TN

Jim Mowatt  
Director of Education  
Unite the Union  
128 Theobalds Road,  
Holborn, London,  
WC1X 8TN

For further information please contact Colin Potter, Research Officer in the Unite the Union, Research Department.