Objection to application by IGas for the Installation of a Steam Methane Reformation (SMR) unit for the production of hydrogen from methane extracted from the Albury wellsite

Planning Application GU21/CON/00038
SCC Ref 2021/0130

This application is to produce hydrogen from natural gas without the use of Carbon Capture, Use and Storage (CCUS). IGas claim this will have minimal impact on CO_2 emissions from the site and *"As such, in environmental terms, the proposals will result in an overall reduction in emissions when compared to the current situation. This alone makes it a positive and sustainable proposal. "*

This is misleading.

This form of hydrogen production will still result in significant CO_2 emissions. This is basic science. This application contains misleading information both on the levels of emissions that will be produced and on the governments support for this form of hydrogen production.

The Science

At the point of use hydrogen emits only water vapour and therefore it is considered a low carbon form of energy.

However, hydrogen is not freely available. It has to be produced from a feedstock. Natural gas (methane, CH_4), like that produced at Albury, can be a feedstock but then carbon dioxide is an unavoidable by-product.

$$CH_4 + 2H_2O \rightarrow \mathbf{CO_2} + 4\ H_2$$

Equation 1.

Throughout this application IGas repeatedly states that hydrogen produces no emissions at the point of use but consistently omits to mention the additional emissions from hydrogen production. These additional carbon dioxide emissions will be released at the site.

Statements in the planning application that we consider incorrect and/or misleading.

Planning Statement produced by Union4 Planning

"1.7. *The UK Government acknowledges in its "Ten Point Plan for a Green Industrial Revolution" that hydrogen has a key part to play in the energy transition, providing a clean source of fuel and heat for our homes, transport and industry*. "

This planning application implies that it is supported by the Prime Minister's 10 Point Plan.

It is not.

The Ten Point Plan[1] has two key proposals for low carbon hydrogen production.

Hydrogen production from fossils fuels but with Carbon Capture use and Storage (CCUS). Here most of the emissions will be captured and not released into the atmosphere. This is commonly known as "blue' hydrogen.

The UK government has recently started investing in developing this technology in six low carbon hubs[2] as recommended by the Committee on Climate Change (CCC) in their 2018 report[3] They are all large industrial clusters with very high rates of industrial emissions. It is the scale of the projected emissions savings and the importance of the industries and jobs in these clusters[4] that justifies both government and industry investment. Two of these low carbon hubs are projected to be completed in the mid 2020s and a further two by 2030. These are all in the north of the country. The only planned cluster for the south will be at Southampton, but this is still at the very early stage of feasibility studies.[5]

The other main source of hydrogen in the Ten Point Plan is "green" hydrogen production; that is hydrogen produced from water using electrolysis. Where the electricity comes from renewable resources it results in very low emissions indeed. This is not proposed in this planning application.

Nor does the Committee on Climate Change (CCC) report set out the need for this form of "grey" hydrogen as stated in paragraph 5.5 of this application. The CCC report clearly sets out the need for "low carbon hydrogen" and clearly states that this is hydrogen with CCUS.

Government documents use the terms "low carbon hydrogen" and "clean hydrogen" rather than "blue "or "grey". They are quite clear that this is not the form of hydrogen proposed in this application. For instance, the Energy White Paper states
" CLEAN HYDROGEN. Hydrogen that is produced with significantly lower greenhouse gas emissions compared to current methods of production – methods include reacting methane with steam to form hydrogen and then capturing the carbon dioxide by-product (steam

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf

[2] https://www.gov.uk/government/news/green-boost-for-regions-to-cut-industry-carbon-emissions

[3] https://www.theccc.org.uk/publication/hydrogen-in-a-low-carbon-economy/

[4] https://www.zerocarbonhumber.co.uk/

[5] https://www.greeninvestmentgroup.com/en/news/2020/port-of-southampton-targeted-for-a-flag-ship-uk-hydrogen-hub.html

methane reformation with CCUS) or using renewable electricity to split water into hydrogen and oxygen (electrolysis).[6]

In paragraph 4.14 of the application IGas state "*Whilst the proposals hereby submitted do not include Carbon Capture Utilisation or Storage (CCUS), the single point of hydrogen production and therefore CO2 emissions, from the SMR generator, means that there is a strong potential for CCUS to be implemented as a second stage of these proposals. The applicant is actively pursuing this matter and is in discussions with various operators and advisors to make this second stage a reality.*"

It is important to note that planning applications must be assessed on the merits or otherwise of the current proposal (which in this case is for the installation of a Steam Methane Reformation unit) and not on any future changes which, in themselves, may well require their own planning applications.

CCUS is, at present a very costly and energy intensive process. The government is concentrating on the large industrial clusters to take advantage of economies of scale. Local, large scale industries will benefit directly from the hydrogen produced within the cluster and have particular access to abandoned North Sea wells to use for carbon storage. This is very different from the IGas facility in Albury. Moreover, given that gas production at the site is due to cease by 2033 it seems unlikely that costly facilities to capture carbon dioxide with long pay back times will be sought

We think the planning office should question the claims about a second phase closely. Is this merely an empty claim or are there concrete realistic plans?

- Do they have details for these plans and what is the timescale they are looking at? This is particularly important as the planning statement acknowledges in paragraph 6.83 that "…the well site is unlikely to be producing gas by the 6th carbon budget, with the cessation date of all operations currently being early 2033..". It is legitimate to question therefore, whether IGas would really be prepared to invest in costly carbon capture technology when the cessation of the site is potentially a little more than 10 years away. Indeed, they state, in paragraph 4.4 that the increase in gas extraction could bring forward the cessation date of the site. How soon would this be?
- What percentage of CO_2 do they propose to store? The most advanced and costly CCUS systems can, in theory, store up to 95% maximum, but the two working sites that do exist in N America[7] store considerably less than this.
- Where could they store this carbon dioxide? Presumably not at the site as the carbon dioxide could infiltrate their methane source. Would this mean be transporting it to somewhere like Southampton? Is this practicable considering the

[6] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future P.127
[7] https://onlinelibrary.wiley.com/doi/epdf/10.1002/ese3.956

costs and emissions from the transport, and what is the timescale for a Southampton cluster to be ready to take it?

"1.9 Overall, the production of hydrogen from methane using the proposed highly efficient production units (using a process known as Steam Methane Reformation - SMR) generates low levels of ……air emissions (CO2 and relatively limited NOx). As such, this will have minimal impact on ….CO2 emissions from the site and a net improvement in CO2, NOx and SOx emissions at the end of the supply chain, through the displacement of diesel through use in buses and HGVs. As such, in environmental terms, the proposals will result in an overall reduction in emissions when compared to the current situation. This alone makes it a positive and sustainable proposal."

This is an example of the application misleadingly emphasising the low emissions at the end of the supply chain "through the displacement of diesel on buses and HGVs" While this is true, the activity proposed at the Albury site is the beginning of the supply chain not the end of it. At Albury the proposal is to produce the hydrogen and, as equation 1 showed, carbon dioxide is an inevitable by-product of the SMR process.

Paragraph 1.9 also claims that because of their "highly efficient production units" this process will have minimal impact on the CO_2 emissions on the site. This claim is highly misleading for several reasons.

For every Kg of hydrogen produced in the SMR process there will be about 9.3 kg of carbon dioxide produced and released into the atmosphere[8]. The planning application states that the site would have the capacity to produce 1,000 Kg of hydrogen per day (Para 4.50)

That would result in an additional 9,300 Kg of carbon dioxide per day. This is nearly 10 tonnes a day - hardly minimal.

The use of SMR will result in the release of additional greenhouse gas emissions. The statement "*the proposals will result in an overall reduction in emissions when compared to the current situation"* **is simply not true.**

There are further sources of additional greenhouse gases. The SMR process requires both heat and pressure, both of which require energy. This energy will come from the natural gas produced at the site.
This has two consequences.

- Firstly, using this gas for production purposes at the site will produce yet more carbon dioxide emissions at the site itself.
- Secondly, at present the site exports both gas and electricity. (Para 1.5) These both go directly towards some form of end use; they are part of the energy supply available to households and industry. If the gas is used in the SMR process instead the energy is no longer available for general use. Presumably this will have to be

[8] https://www.forbes.com/sites/rrapier/2020/06/06/estimating-the-carbon-footprint-of-hydrogen-production/?sh=34c0626f24bd

made up from other sources, and these sources will produce their own carbon dioxide emissions.

Methane, natural gas, is notorious for the way it can leak through joins, seals, compressors etc.[9] Methane has 85 times the warming potential of carbon dioxide over a twenty-year period, and over 100 times in the first ten years. The control of methane leaks is increasingly recognised as a significant contribution to the fight against climate change[10]. We are not clear what measures IGas takes to monitor, detect, and reduce methane leaks at their site, but the addition of SMR, which includes the use of high pressures, is likely to have a proportionate increase in methane leaks.

The IGas application suggests they plan to use a
modular system produced in the US by Bayo Tech[11]. The Bayo Tech specifications include

Emissions

CO2 (gross)	8.9 kg per kg H2
CO2 (net)	**10.1 kg per kg H2**
SOx	Negligible, removed before conversion
NOx	Complies with local limits
Noise	< 80 decibels at 20 feet

The emissions figures are slightly different to those we quoted above and may be more applicable to US circumstances. However, under these calculations the 1,000 Kg capacity of the model would lead to over 10,000 Kg of carbon dioxide emissions per day.

The planning application argues that using of hydrogen produced at the site will save up to ≈ 2,769 tonnes CO_2 eq a year. This fails completely to consider the emissions resulting from the production of hydrogen. The Greenhouse as Assessment produced by Air Pollution Services uses the following table as justification.

8.7. **The likely GHG emission savings from using the hydrogen produced as a fuel have been determined by comparing it with diesel fuelled buses and other low carbon alternatives. The comparison is set out in Table 13.**

Table 13: Comparison of bus GHG emissions for different fuels [a]

Fuel	Emission rate (g CO_2-eq/km) [b]	Annual Journey length (km) [c]	Tonnes CO_2-eq per year	Tonnes CO_2-eq during Sixth Carbon Budget	Lifetime Mt CO_2-eq
Hydrogen	-	2,433,333	0.00	0.00	0.00
Diesel	1,138.02	2,433,333	2,769.17	13,845.86	0.17
B100 Biodiesel	899.57	2,433,333	2,188.96	10,944.79	0.13
Compressed Natural Gas	0.005	2,433,333	0.01	0.06	<0.01
Biomethane	0.005	2,433,333	0.01	0.06	<0.01
Biogas	0.005	2,433,333	0.01	0.06	<0.01
Hybrid	711.34	2,433,333	1,730.93	8,654.64	0.10
Fuel Cell Electric Vehicle	-	2,433,333	0.00	0.00	0.00

Table notes:

a. Emissions account only for those released from buses, not the production or transport of fuel.

b. Emission rates calculated using Defra's EFT for a single bus travelling at 20 kph.

c. The consumption of hydrogen per bus is 9-10 kg/100km for a 12 m bus and 12-15 kg/100km for a 18 m articulated bus (NewBusFuel, 2017). Since the SMR will produce 1,000 kg of hydrogen per day (365,000 per year), it is estimated that buses could

Note A states ***"Emissions account only those released by buses, not the production or transport of the fuel"***

This table, and the conclusion are highly misleading. The production of the fuel is of the utmost relevance in this case. As already discussed, the emissions from the production of the fuel amount to around 10 kg carbon dioxide per Kg of hydrogen produced. This must be taken off the purported emissions savings. If hydrogen were to be produced at capacity level for 365 days a year it would amount to close to3,600 tonnes per annum. We would argue that not only is this likely to wipe out these purported emissions savings, it could also increase the overall emissions and thereby add to Guildford's overall emissions and to climate change.

National Policies

The Planning application quotes numerous sections of national documents, such as the NPPF, the Energy White paper and the DEC Annual Energy Statement (2014). Many of these quotations seem to be simply copied and pasted, with no supporting statements as to how these relate to these planning proposals. Presumably the applicants wish to give the impression that somehow, they are complying with the sustainable and climate mitigation policies contained in these documents. However, some are also used to support misleading statements.

For instance, in paragraph 5.14 the applicants refer to paragraph 215 of the NPPF. This refers to the three phases of development required in onshore oil and gas exploration. The most recent NPPF does not actively support such exploration, it merely outlines that there are three distinct phases that require planning consent. This requirement is for new developments, which is not the case at Albury, the site already exists and has been in operation for years. This paragraph of the NPPF is irrelevant as far as this application is concerned but seems to be an attempt to add legitimacy to the proposal.

In paragraph 5.17 the applicants consider the issue of energy security and the problems of UK dependency on gas imports. Yet they are proposing to reduce the availability of UK onshore gas by using some of their supply to manufacture hydrogen. All conversion of energy from one form to another involve considerable energy losses. The calorific value of the hydrogen produced will be considerably less that the calorific value of the natural gas used to make it. Presumably it will require additional imports to make up for this loss.

Paragraph 5.22 quotes government plans and funding to promote low carbon hydrogen but omits the fact that these proposals at Albury are not for low carbon hydrogen. The "grey" hydrogen produced at this site will have considerably higher emissions than burning the gas directly. Similarly, quotes from the Energy White Paper in subsequent paragraphs are all about low carbon, that is "blue' hydrogen, and therefore do not apply to this proposal.

In the Air Quality Assessment commissioned from Air Pollution Services the applicants state that the proposed development " *will lead to less than 1% of the local authority carbon budget for Guildford".* They use this to argue that the development should be considered de-minimus and negligible.

Guildford has set a target of 2030 to reach net zero emissions but we are unclear how far it has got in its plans to cut emissions to within its carbon budgets. However, it must be evident how difficult it is to achieve these. Any additional emissions in one area will mean that emissions must be cut in another. If permission is granted, in which area will the nearly 1% of emissions be cut to balance these hydrogen production emissions? In paragraph 1.11 the application states that the hydrogen produced would power 25-50 buses a day. Does that justify this 1% increase when other, low forms of hydrogen production are available? In Kent[12] for example, Ryse Hydrogen are building a plant in Herne Bay, using electricity from the nearby wind farm. They expect to be in production by 2022. This will be truly low carbon hydrogen.

Conclusion

- This proposal to produce high carbon, "grey" hydrogen at this site should be refused.
- Numerous claims in this application are misleading and some are untrue.
- The production of high carbon "grey" hydrogen is likely to increase the carbon footprint locally and to add to climate change.
- It is questionable, given their high costs and therefore long pay back times, whether carbon capture technologies will ever be adopted at this site as it is currently due to cease operations in 2033.
- Government energy and climate change policies do not support this form of hydrogen production.

[12] https://rysehydrogencanterbury.co.uk/about-the-scheme