	From	Question	Answer
Ian McCluskey – intro session			
1	[09:49] Andrew Blair (Guest)	Are all the evidence reports available on the working group website?	Yes – links to the documents are part of the consultation document
3	[09:50] Anish Goswami (Guest)	Could you explain the WOBBE Index ?	[09:52] Brown, Martin John (Guest) Wobbe Index is a key gas interchangeability factor. It's equal to the CV divided by the square root of the relative density [09:51] Willcox, Shane (Guest) WI=GCV/sqrt (RD) in Mj/m3 [09:52] Thomas Isaac (Guest) Wobbe - It is a measure of energy delivery capacity of a gas for a constant dP
3	[09:52] Anish Goswami (Guest)	and the sooting index?	The sooting index or “soot index” is a measure of the potential for soot production and deposition in appliancesand is predominantly associated with radiant gas fires. It is defined as the aeration which first gives rise to observable soot divided by the natural aeration of the burner. The numerical evaluation of the soot index is given by: $SI = 0.896 \tan^{-1}(0.0255C_3H_8 - 0.0233N_2 - 0.0091H_2 + 0.617)$

Dave Lander – Dutton Revisited			
4	[09:52] Jim Sibley (Guest)	What is the evidence for removing the sooting index?	Answered during webinar Gases distributed in the UK do not generally reside near the sooting index limit (or the right -hand part of the acceptable interchangeability operating envelope. With controls on hydrocarbon dewpoint and the inclusion of relative density, the need for a sooting index control is not required.
5	[09:53] David Hurren (Guest)	Did I miss something - on question of Cv - how do you manage hydrogen within these limits to get to calorific requirements? Not completely clear	Wobbe Index can account for hydrogen addition to natural gas. Addition of small quantities of hydrogen will reduce both the CV and WI. The delivered WI will still have to comply with the proposed gas quality limits. The largest constraint on the H2 amount that can be added is the lower Wobbe Index limit. With the current limit typically between 0% about 3% H2 can be added to biomethane and typically between 0% and 20% H2 can be added to natural gas. The new proposed limit will extend the amount of H2 that can be added to biomethane to between 0 and 10%.

6	[09:54] Chris (Guest) Chris Bielby	Do you think the Government fully understand the challenge of reaching Net Zero ? With 14 million gas boilers, approxi mately 38/40 million gas appliances within the UK and fuel poor customers there needs to be a huge customer awareness initiative. Chris Bielby	Agree this is a very challenging target
7	[09:54] Paul Youngman (Guest)	What were the risk factors that the HSE will consider in relation to having emergency spec gas limits as the new “normal" limits	The main risk is associated with CO poisoning and this has been assessed and results have been presented in the webinar
8	[09:55] Dalia Majumder-Russell (Guest)	It would be helpful to understand how the work so far has considered more hydrogen in the gas network. Currently not clear if/to what extent this has been done	Yes there is potential for more hydrogen in the network and there are projects aimed at achieving this. The changes in the proposed IGEM specification are intended to enable future changes to achieve these goals. For example the lowering of the WI limit enables additional H2 see q5.

9	[10:00] leem	Regarding training, there are a significant amount of questions regarding changes to standards, the building of awareness and competence around how utilisation and emergency engineers roles would/will/are affected, especially in the H21 region. Is there a plan to involve providers into working groups in the near future?	There has been a lot of discussion with the downstream industry on HyDeploy. There is no change in the criteria for safe combustion required. For 100% Hydrogen EU Skills are currently consulting with key stakeholders. Hands on training facility is being set up at Spadeadam.
10	[10:05] Paul Youngman (Guest)	Would you label the diagram clearly	[10:10] Simon Gant (Guest) Horizontal axis needs two decimal places on the "Proposed revisions to Dutton approach" slide
11	[10:10] Jim Sibley (Guest)	Is EN 12676 the correct number as looking on the BSI Shop this standard covers Anti-glare systems for roads. Performance and characteristics?	[10:12] Andrew Blair (Guest) BS 16726 [10:12] Brown, Martin John (Guest) The EN is EN16726 [10:13] Willcox, Shane (Guest) EN 16726 Gas infrastructure - Quality of gas - Group H

12	[10:12] Terry Burke (Guest)	A link to the slides would be very much appreciated.	These have been sent to the attendees and will be on the IGEM website
13	[10:24] Willcox, Shane (Guest)	Is it not possible for soot to block a heat exchanger on a older style boiler?	Answered during webinar [10:25] Brown, Martin John (Guest) Yes soot can block heat exchangers - but most UK gases are nowhere near the limit. [10:26] Willcox, Shane (Guest) But could if the boiler was not serviced regularly or working correctly Regular servicing and maintenance is recommended
14	[10:25] Jim Sibley (Guest)	Working toward the European requirement (using RD) will be of great benefit to GB as most appliance manufacturers now have their parent company in main land Europe.	RD is recognised and being a more commonly used gas interchangeability factor. As presented, the RD is a good proxy for the current Dutton propane-nitrogen factor and so all the benefits are still included.

15	[10:26] Danny McFarlane (Guest)	Completely understand appliance mix, especially instantaneous water heaters have changed, however there appears to be some assumptions that we are looking at correctly installed and serviced appliances, I may be wrong I also believe the Oban work serviced appliances before testing, and only looked at a change to the high limit. the bigger risk is older appliances, and those more likely not to be serviced, cooker grills, gas fires etc.	[10:28] Willcox, Shane (Guest) The appliances in Oban were tested in an "as found" condition. [10:28] Phil Bradwell (Guest) Oban appliances were tested as found and not serviced prior to testing [10:31] r hewitt (Guest) some of the Oban appliances were in pretty poor "as found" condition too, as I understand The review of work that has been done in HyDeploy covered pre and post GAD appliances. The main issue is malfunctioning appliances which are dangerous irrespective of age and gas quality.

Martin Brown – Domestic			
16	[10:32] eddie (Guest)	you say appliances need to be set up correctly and maintained at that level - who by?	Answered during webinar
17	[10:34] martin (Guest)	What levels of Hydrogen mixed with Natural Gas does the changes in Wobbe Index allow. 10% Hydrogen, 20%Hydrogen, 50% Hydrogen or even more?	[10:34] Thomas Isaac (Guest) 28.4% [10:35] Willcox, Shane (Guest) 28.4% hydrogen in methane will give the lower GSMR limit of 47.20 MJ/m3 [10:35] Thomas Isaac (Guest) but would be greater under the proposed increase in Wobbe range [10:35] Phil Bradwell (Guest) depends on WI of the prevailing gas that is blended [10:35] Dave Lander (Guest) It depends on the initial Wobbe index of the natural gas. Typically up to 20% hydrogen would be possible, although gas at the lower limit would not accommodate any. Most gases do permit 15%-20%

18	[10:36] martin (Guest) So this change to WI does not take us all the way to 2050 predicted gas mix?		[10:37] Thomas Isaac (Guest) It is a stepping stone to 2050 [10:37] Willcox, Shane (Guest) the gas quality will change over time [10:37] Phil Bradwell (Guest) could never meet 2050 targets through just blending alone [10:37] Willcox, Shane (Guest) the IGEM standard will change to reflect this [10:38] Dave Lander (Guest) I don't think blends of natural gas with more than 20% hydrogen are expected. The 2050 target considers contribution of blends and pure hydrogen [10:39] Phil Bradwell (Guest) nb. previous GGG chart showed complete change to 100% hydrogen + Bio to meet 2050 This WI range has no bearing on the predicted gas mix for 2050. These changes are important for the next steps to assist further decarbonisation. The proposed standard is intended to enable a safe and flexible approach to gas quality specification which avoids the need for continual legislative changes and exemptions to accommodate future gas quality changes.

19	[10:39] Paul Youngman (Guest)	Would that be an average everywhere of 20% as at the blending point concentration of H could be higher?	[10:40] Thomas Isaac (Guest) 20% at the point of blending [10:41] Phil Bradwell (Guest) blending all the network to 20% will only in fact reduce current CO2 emissions by around 7% [10:43] Kimpton, Sarah Karen (Guest) ....unless the gas is biomethane rather than fossil fuel [10:44] Paul Youngman (Guest) Thanks Phil - so only a partial solution with a driver to have transformational change to reduce further [10:45] Phil Bradwell (Guest) correct a move above 20 is a move to 100% only i.e. new boilers for all There is no proposed change to the Hydrogen content at this stage.
20	[10:43] martin (Guest)	IMHO gas will still be regarded as 'bad' for climate change unless higher Bio-Methane and Hydrogen concentrations are considered in a faster timescale	

21	[10:46] Willcox, Shane (Guest)	will higher NOx emissions caused by higher WI cause an issue with compliance with eco-design NOx limits? what is the effect of higher WI on the performance of Oxy-depletion sensors (ODS)?	Higher NOx will arise from higher WI. The exact amount will be dependent on the appliance and how close it is currently operating with respect to the eco design limits . [10:49] Phil Bradwell (Guest) As you know Kiwa are currently carrying out tests on ODS at higher WI and blends of H2 expected to be complete by the end of this year Answered during session
22	[10:52] Richard Miles (Guest)	comment on the gasqual and where we need to be careful using the results- most of the EU appliances are lower CO2 and therefore lower CO values than the UK where we upped them to meet SEDBUK efficiency targets. The results from gas qual do back up the UK work	It is always important to be careful in the consideration of the data and understand the underlying modes of operation. It is clear that there is a direct correlation with regard to aeration, and this links to Wobbe Index. There is good consistency in the results trends from all the studies mentioned.

23	[10:52] Jim Sibley (Guest)	It would be useful to understand what the 29 appliances were in general terms - cooker, combi...	[10:55] Dave Lander (Guest) Important to understand that our body of evidence has increased significantly in recent time: DTI exercise 10s of test; GasQual 100s of tests; OGM 1000s of test. And we now have a significant body of tests post OGM... The information is available in the GasQual report. Link in consultation document footnote #63
24	[10:57] Nigel Holmes (Guest)	Martin - very useful update on the NOx emissions from typical appliances. If NOx reduces for lower WI gases, does this mean that H2-CH4 blends will reduce NOx emissions from appliances?	[10:58] Willcox, Shane (Guest) there is evidence to suggest this There is some conflicting information in the peer reviewed literature. In some cases NOx emission increases with H2 addition, in several others it decreases. It is dependent on burner and appliance type. In many instances the NOx emission on using H2/Natural Gas blends is lower than for NG alone. Generally yes
25	[10:59] Harris Edward (TT/SGB-GIS) (Guest)	And when the installer is doing these checks at servicing how does he know what the gas quality is compared to the gas the appliance was set up on.	This remains one of the key challenges for servicing and maintenance activities. There are two proposed approaches – the first is to have a device that measures the Wobbe Index, and the second is to use gas from a cylinder with known WI. There is a desire from the gas networks to supply more gas quality information, but it is difficult to get the resolution on a house but house basis

26	[11:00] Paul Youngman (Guest)	Is there an increased Safety risk from the increase in CO?	The magnitude of the increase in CO emission as the Wobbe Index increases is relatively modest, but it does increase, and this cannot be avoided in standard combustion systems. This increase in CO emission will increase the Safety Risk factors but not to a great extent. The gas industry in the UK has made great steps forward in reducing the number of CO-related incidents, and this change in WI upper limit is not expected to increase the number of incidents significantly.
27	[11:00] Catherine Litster (Guest)	What about industrial users such as power generators, has any testing taken place?	Industrial users have experience in using higher Wobbe Index and lower Wobbe Index gas. Limited testing has taken place, but gas turbines fuelled by LNG are in operation, and lower Wobbe Index gas distributed around Europe Has been used in industrial installations.

28	[11:00] Neil Macdonald (Guest)	Oban appears to have used only the generic BS 7967 CO/CO2 ratio “action levels” to verify safe appliance combustion, not manufacturers’ instructions (MI’s), which are frequently more stringent for premix boilers (and often with specific CO2 and/or O2 values). What specific evidence do we have that a national roll-out at these WI parameters would not alter the combustion of installed pre-mix boilers to a degree which risks previously safe appliances being deemed “unsafe” by industry norms, i.e. IGEM’s G/11 standard guidance (GIUSP), which defers to the combustion values given in the appliance MI’s?	[11:02] Nigel Holmes (Guest) Comment - would be worth getting Tom Collins update on his H2 boiler performance and NOx emissions [11:04] Richard Miles (Guest) The eco design is based on nominal gas G20 if tested in a lab for surveillance then this is the gas that should be used - if in the field then a wobbe number will be needed to adjust the figures [11:04] Brain, Philip (Guest) Most of the hydrogen appliances being developed under the Hy4Heat programme have reported lower NOx emissions than their natural gas reference appliances The DTI studies did focus on combustion performance ratio and the impacts of different Wobbe Index gas. For well maintained and correctly installed appliances the impact is small. It does raise a further point in the Flue Gas Analysers need to have the correct combustion factors for the natural gas used, to ensure that conversion of measured values is done correctly.

29	[11:02] Pullin, Darren (Gas Registration) (Guest)	Has the increase on water vapour/condense emissions amount been measured and are there values for them?	The changes to the Wobbe Index limits will only have a modest effect on the water content in the flue gas. The changes can be calculated from combustion theory. More significant changes will result if hydrogen is used, especially at higher concentrations
30	[11:08] david.bendle	My understanding of the OGM trial was 'unsafe' appliances were rectified / replaced before the trial. Were the removed appliances tested? Whilst I fully accept unsafe appliances must be rectified do we have any evidence whether the trial gas increases their level of risk further?	The OGM trial tested all appliances "as found". Ones that were found to be unsafe were replaced or repaired. The underlying result was that appliances that were unsafe on the "normal" natural gas would still be unsafe with the higher Wobbe Index gas. However, all the installed appliances operating on the increase Wobbe Index gas did not result in any new CO incident and all appliance checks confirmed good overall performance.

Sarah Kimpton – I&C			
31	[11:11] eddie (Guest)	your diagram showing the change in quality is noted by I&C operators in the NW who can tell when Morecambe bay gas replaces St Fergus as they have to change burner settings	Thank you – it would be useful if those operators could respond to the consultation. What factors alerted these consumers to changing gas quality? How do they know that there is a change from Morecambe to St Fergus gas?

32	[11:16] Neil Macdonald (Guest)	For the UK map data shown, do we know where G20 (50.72) roughly sits, as an average, in the regions where bandwidth is >3MJ/M3?....i.e. is it in the middle of the range or towards an extreme?	[11:21] Dave Lander (Guest) Hi Neil - not sure what your question is, but G20 is WI 50.72 and RD 0.555, so it is outside all of the regional plots [11:37] Neil Macdonald (Guest) Hi Dave, thanks, it was to query whether in some areas we may already be seeing 47.5 - 51 (for example), so if the appliance set-point was not at G20, but perhaps towards 47.5, and we go up to 52.85, whether risk increases....if 50.72 stays pretty much in the middle of the distributed range, an assumption Oban made in stating a safe range of 5-6 MJ/M3, then that would be preferable of course (if not able to be guaranteed) [11:38] Brown, Martin John (Guest) Neil, I'll a look - at the ranges, Was there a specific region you're interested in? [11:40] Neil Macdonald (Guest) Not really Martin, perhaps just those areas where we seem to have a wider bandwidth currently....appreciate this is select data from a certain time period, and that we would have to assume distribution of the full range, whatever that becomes...many thanks - Neil

33	[11:17] john.baldwin	What would be useful is looking at existing biomethane projects as far as FWACV target they meet (by adding propane) and then modelling the impact of a change in Wobbe at the LNG terminals caused by not having to ballast with N2. Then look at these biomethane projects and calculate the estimated increase in FWACV caused by the change in wobbe caused by less Bal lasting with N2 (this only applies to biomethane projects that are in the south of GB - ones in Scotland don't see any LNG but do have to meet a higher FWACV target at most times)	Answered in webinar re FBM Widening the range of Wobbe Index will have an impact on customer billing. For that reason, Cadent is carrying out the Future Billing Methodology project which seeks to address these issues and also allow unpropanated biomethane into the network (providing it is GS(M)R compliant).

34	[11:24] Paul Youngman (Guest)	What was the sample size how many responders were there to PS and IC customers	There were 22 responses to the consultation of which four were operators of gas turbines or gas engines. There was also a workshop which had representation from a wide range of stakeholders. Details of who attended and the results of the consultation are available in the DNV GL I&C report (a copy is available from the IGEM website)

Dave Lander – Network Safety			
35	[11:26] john.baldwin Probably should be in the I&C section?	It would sense to link the change in wobbe and its potential adverse impact on biomethane (and net zero) to the Future Billing project implementation - both changes implemented at the same time would be good (a bit like when FWACV was introduced in 1998 it was done at same time as change to odorisation to move from beach terminals to LDZ entry)	The implementation of the Future Billing Methodology project would support biomethane injection and the removal of the need for propanation even without any changes to the Wobbe Index. If the two were linked it could delay the reform of the FWACV. It is also useful to remember that Future Billing is about calorific value and not Wobbe Index – some increases in Wobbe Index can be associated with a reduction in calorific value.
36	[11:41] Jim Sibley (Guest)	It also appears that gas velocity has a big impact?	Assume this is in relation to fracture propagation issue. Gas velocity through the pipe is not a factor. The Decompression Wave Velocity is affected by the rate at which the gas flows out of any fracture.
37	[11:44] Paul Youngman (Guest)	How will transmission user safety cases be coordinated?	The processes covering this remain unchanged by this proposal. Safety Cases are reviewed periodically to ensure they are up to date.