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PUBLIC ATTITUDES & PERCEPTIONS IN RELATION TO THE USE OF HYDROGEN GENERATORS AT FESTIVALS

A RESEARCH REPORT PREPARED UNDER THE EDINBURGH FESTIVALS CLEAN POWER DEMONSTRATION PROJECT

Authors: Dan van der Horst, Connor Smith, Charlotte Bucke,
School of Geosciences, University of Edinburgh*

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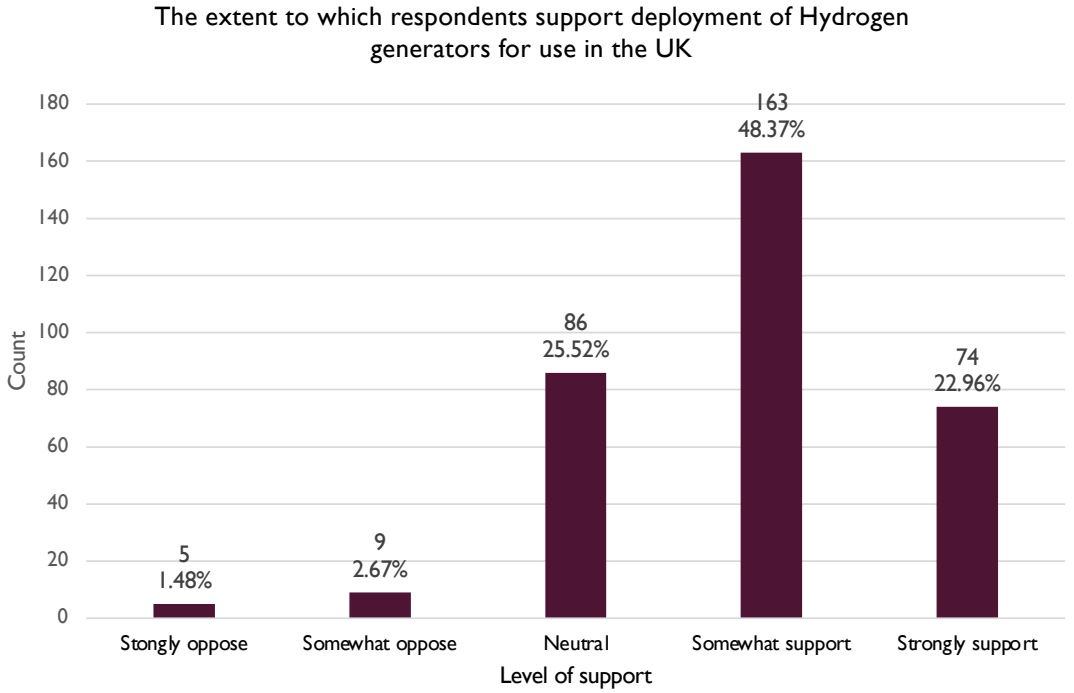
* For correspondence, please contact: dan.vanderhorst@ed.ac.uk

REPORT CONTENTS

SURVEY KEY FINDINGS 1: STRONG SUPPORT FOR HYDROGEN GENERATORS

- Survey (see appendices) respondents initial attitudes towards using Hydrogen to generate electricity were primarily neutral (42.10%), with 34.70% somewhat supportive and 21.10% strongly supportive. The remaining 2.20% were either somewhat or strongly opposed.

- However, after being informed of the pros and cons of replacing incumbent diesel generators with Hydrogen counterparts, 71.33% of participants strongly or somewhat supported the deployment of Hydrogen generators in the UK. This contrasted with 1.48% who strongly opposed deployment and 2.67% who were somewhat opposed. The remaining 25.52% were neutral.



SURVEY KEY FINDINGS 2: INFORMATION AS HIGHLY INFLUENTIAL

- Information provided strongly influences respondents perceptions of Hydrogen and Hydrogen generators; with some evidence to suggest that communicating balanced technological information positively impacts opinion:

  - Prior to receiving an information pamphlet (see appendices) from the research team outlining the pros and cons of replacing incumbent diesel generators with Hydrogen counterparts, the top 10 most common responses to the word "Hydrogen" were largely neutral. However, after information dissemination, the top 10 most common responses included more words with positive and negative connotations

  - These positive and negative associations reflected the pros and cons contained within the information pamphlet. Specifically, post information dissemination, survey participants acknowledge the positive environmental impact of Hydrogen and Hydrogen generators more. Conversely however, survey participants also acknowledge technological negatives including the potential higher cost of emerging technology and the flammability of Hydrogen as a gas (neither of which were raised by survey participants before receiving an information pamphlet).

SURVEY KEY FINDINGS 3: VARYING LEVELS OF TRUST & ENVIRONMENTAL CONCERN

- Concerning trust in organisations to communicate true and accurate information about energy technologies, 93.48% of participants stated that they strongly or somewhat trusted academic or research intuitions. Meanwhile, 40.74% stated strong or somewhat support for Scottish Government, 38.21% for energy industry corporations and 22.54% for UK Government

- Closely related, when thinking about trust in organisations' commitment to achieving a more sustainable future, 92.47% of participants stated that they strongly or somewhat trusted academic or research intuitions in this regard. Meanwhile, 41.17% stated strong or somewhat support for Scottish Government, 42.67% for energy industry corporations and 28.87% for UK Government

- Perhaps unsurprisingly, those who are more distrustful of the health and environmental benefits associated with Hydrogen generators are statistically significantly less supportive of deployment, whilst as concern for global climate change and local environmental issues increases, support for Hydrogen generators in the UK also increases

FOCUS GROUP KEY FINDINGS 1: PRODUCTION

- Pre-existing knowledge of varying Hydrogen production methods was extremely limited
- Support for grey Hydrogen was low with no participants suggesting this was their preferential production method
- Support for blue Hydrogen was also low with no participants suggesting this was their preferential production method. Several participants specifically expressed concerns regarding Carbon Capture and Storage technology
- Support for green Hydrogen was very high with the majority of participants suggesting that this was their preferential Hydrogen production method

FOCUS GROUP KEY FINDINGS 2: OWNERSHIP

- Investigation sought to gain insight into whether or not audience members attitudes and perceptions are influenced by the Hydrogen production ownership model, i.e. does the identity of the actors that operate and ultimately profit from the production and sale of Hydrogen influence audience members attitudes and perceptions
- Community-led was by far the most supported ownership model. The return of revenue to local communities was an influential factor promoting support. Some concerns still existed regarding the practicalities of delivery. However, concerns decreased when participants were informed that community-led Hydrogen production already exists, as opposed to being purely conceptual
- Industry-led ownership models were supported by a minority of participants. For most of these participants, the reason for this support was more to do with the perceived practicalities of delivery, rather than a normative or ideological pro-industry stance
- With regards to municipal ownership, a minority of participants suggested that they liked the idea in theory, but had reservations about how this may materialise in practice. Whilst some participants suggested that they were tentatively in favour, a handful objected to the model outright

FOCUS GROUP KEY FINDINGS 3: WILLINGNESS TO PAY & WIDER VALUE PROPOSITION

- To begin with, most participants expressed concern about any additional costs that may result from displacing diesel generators with Hydrogen counterparts at festivals and outdoor events . However, some suggested that they would be willing to pay a little more (~5-10%), even if they were not particularly happy about it
- After taking more time to consider this theme and discuss it with one another, opinion within groups shifted somewhat with an increase in the overall number of participants who suggested that they would be willing to pay a little more . Nevertheless, it should be noted that the majority of those participants who suggested that they would be willing to pay a little extra were, by and large, unimpressed with the notion
- Thinking about support as part of a wider value proposition (i.e. trying to take money out of the equation), all 25 participants expressed support for the displacement of incumbent diesel generators with Hydrogen powered counterparts. This could be interpreted as suggesting that an important factor limiting support for Hydrogen generators in festival/ outdoor event contexts is the potential price increase implications associated with new technology implementation.

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I - SURVEYS

SURVEYS - CONTENTS

1.1) GOALS & OBJECTIVES

The overarching goal was to find meaning in the data (i.e. survey responses) to derive knowledge that will allow informed decision-making.

1) To analyse qualitative data from survey responses.
2) To analyse descriptive statistics from survey responses.
3) To analyse quantitative data from survey responses.

Objectives:

1) Organise data (assign value labels to data)
2) Surface analysis (descriptive statistics)
3) Mid-depth analysis (correlations)
4) Deep analysis (tracking & ranking)

1.2) DATA COLLECTION

- A concise, 19 question survey was designed to explore attitudes regarding the displacement of incumbent diesel generators with Hydrogen counterparts (see appendices)
  - Three socio-demographic questions
  - Five questions asked prior to information dissemination (opinion based & associative).
  - Six questions asked post information dissemination (opinion based & associative).
  - Five additional questions within the realm of trust
- Surveys were distributed to randomly selected individuals at festival sites in Edinburgh during the summer (George Square) and winter (Princes Street Gardens) of 2021
- 340 respondents in total
- An information pamphlet was also presented to participants midway through the survey, outlining some of the pros and cons of the proposal (see appendices)

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1.3) QUALITATIVE ANALYSIS

KEY FINDINGS

- Information provided to audience members strongly influences respondents perceptions of Hydrogen and Hydrogen generators:

  - Prior to receiving an information pamphlet from the research team outlining the pros and cons of replacing incumbent diesel generators with Hydrogen counterparts, the top 10 most common responses to the word "Hydrogen" were largely neutral.

  - The exception here was an association made by 28 survey respondents between the word "hydrogen" and the word "bomb"; this could be perceived as a matter of fact statement or a negative association.

  - However, after information dissemination, the top 10 most common responses included more positive and negative associations

  - These positive and negative associations reflected the pros and cons contained within the information pamphlet and subsequently absorbed by the survey participants; specifically, post information dissemination, survey participants acknowledge the positive environmental impact of Hydrogen and Hydrogen generators more

  - Conversely however, survey participants also acknowledge technological negatives including the potential higher cost of emerging technology and the flammability of Hydrogen as a gas (both of which were raised by survey participants after receiving an information pamphlet).

QUALITATIVE SURVEY DATA

AIM

To identify and group respondents' perception of Hydrogen and Hydrogen generator based both on their level of knowledge before and after information about the technology had been communicated to them.

METHOD

- Record the number of times each association (word or phrase) was provided.
- Created a thematic coding framework to sort the data into a digestible format.
  - Combined use of inductive and deductive coding, based on the PESTEL macro-environment analysis tool.
  - Associations were grouped as either **P**olitical, **E**conomic, **S**ocial, **T**echnological, **E**nvironmental or **L**egal.
  - Additional group to include associations that seem to be ignited by opinion, a memory, or an emotion.
  - Assigned code to identify responses with positive, negative or neutral connotations

THEMATIC CODING FRAMEWORK EXAMPLE

Code name	Theme	Code label	Code definition	Code examples
T1	Technological	Positive	A technological response that has positive connotations or indicates a a better outcome from using H2 generators; suggests that the positives outweigh the negatives	"futuristic", "safe"
T2	Technological	Negative	A technological response that has negative connotations or indicates a worse outcome from using H2 generators. Suggests the negatives outweigh the positives	"damaging mining", "explosive", "needs more research"
T3	Technological	Neutral	Any technological response that indicates a general sense of uncertainty or sways neither positively or negatively. Stating a fact about the technology	"stores energy", "energy" "Hydrogen producer"

WHERE DID RESPONDENTS FIRST HEAR ABOUT HYDROGEN BEING USED TO GENERATE ELECTRICITY?

Source	Count
News	46
Secondary school	37
TV	25
Online	16
Workplace	14
Higher Education	9
Seen Hydrogen buses	9
Media	8
Relative or partner	7
YouTube	6
Research / reading	6
Word of mouth / in passing / conversation / a friend	6
Newspaper	5
Internet	5
Unsure / cannot remember	3
Whitelee Wind Farm	2
Council	2
Social media	2
Radio	2
Podcast	2
Documentary	2
Advert	1
Film	1
COP26	1
BP	1
Google	1
Falls of Clyde	1
Tokyo	1
Argentina	1
Proposed Legislation	1

ASSOCIATIONS WITH HYDROGEN & HYDROGEN GENERATORS

- Question 4

  "Please list the first word/phrases that you think of when you read the word **Hydrogen**"

- Question 5

  "Please list the first words /phrases that you think of when you read the words **Hydrogen generator**"

INFORMATION PAMPHLET

- Question 13

  At the beginning of the survey, we asked you what words/phrases came to mind when you read the words **Hydrogen**. Having learnt more about this topic, what words/phrases come to mind now?"

- Question 14

  "At the beginning of the survey, we asked you what words/phrases came to mind when you read the words **Hydrogen generator**. Having learnt more about this topic, what words/phrases come to mind now?"

Q4. PLEASE LIST THE FIRST WORDS/PHRASES THAT YOU THINK OF WHEN YOU READ THE WORD 'HYDROGEN'

- Top 10 most common responses:

Word / Phrase	Count	Code
gas	95	T3
water	85	T3
bomb	28	T2 or T3
power	28	T3
chemistry	23	T3
clean / clean energy / clean power	20	T1
science	20	T3
energy	19	T3
fuel	18	T3
element	18	T3

Q13. HAVING LEARNT MORE ABOUT THIS TOPIC, WHAT WORDS/PHRASES COME TO MIND NOW?

- Top 10 most common responses:

Word / Phrase	Count	Code
Energy	36	T3
Clean(er)	36	En1
Green	28	En1
Flammable	26	T2
Expensive	20	E2
Environmentally friendly	18	En l
Better for your health / healthier / healthy / protect our health	13	S1
Fuel	12	T3
Clean(er) energy/power	18	T3

Q5. PLEASE LIST THE FIRST WORDS/PHRASES THAT YOU THINK OF WHEN YOU READ THE WORDS 'HYDROGEN GENERATOR'

- Top 10 most common responses:

Word / Phrase	Count	Code
energy	61	T3
power	31	T3
green	17	En1
electricity	16	T3
machine	13	T3
clean	11	En1 & T1
eco friendly	9	En1 & T1
future	8	T1
environmentally friendly	6	En1

Q14. HAVING LEARNT MORE ABOUT THIS TOPIC (HYDROGEN GENERATORS), WHAT WORDS/PHRASES COME TO MIND NOW?

Top 10 most common responses:

Word / Phrase	Count	Code
expensive	21	E2
quiet / less noisy	14	S1
flammable	14	T2
environmentally friendly/ier	13	En1
clean	11	En1 & T1
green	10	En1
future	9	T1
ecofriendly / eco friendly /eco-friendly / eco / more ecological	8	En1
energy	8	T3

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1.4) DESCRIPTIVE STATISTICS

KEY FINDINGS

- Survey respondents initial attitudes towards using Hydrogen to generate electricity were primary neutral (42.10%), with 34.70% somewhat supportive and 21.10% strongly supportive. The remaining 2.20% were either somewhat or strongly opposed.
- However, after being informed of the pros and cons of replacing incumbent diesel generators with Hydrogen counterparts, 71.33% of participants strongly or somewhat supported the deployment of Hydrogen generators in the UK. This contrasted with 1.48% who strongly opposed deployment and 2.67% who were somewhat opposed. The remaining 25.52% were neutral.
- This level of support is significantly higher than the collapsed value of 55.80% support prior to information dissemination.

- Meanwhile, when asked whether or not they had a desire for Hydrogen generators to be used at festivals near to them or festivals they associate with, 75.68% answered "Yes", 3% answered "No", whilst the remaining 21.32% answered "Don't know"

CONTINUED…

- Those who feel like festivals are 'done to them' support Hydrogen generators at nearby festivals more than audience members
- Perhaps surprisingly, older generations are more supportive than younger generations of Hydrogen generators being used
- No statistically significant difference between males and females was found concerning either support for Hydrogen generators in the UK or at festivals near them

- With regards to how much respondents knew about Hydrogen being used to generate electricity prior to receiving an information pamphlet from the research team, 65.29% stated that they had not heard about it before, or had heard of it but knew nothing. In contrast, 28.78% of respondents stated that they knew a little, whilst the remaining 5.93% stated that they knew either a fair amount, or a lot

CONTINUED…

- Concerning trust in organisations to communicate true and accurate information about energy technologies, 93.48% of participants stated that they strongly or somewhat trusted academic or research intuitions. Meanwhile, 40.74% stated strong or somewhat support for Scottish Government, 38.21% for energy industry corporations and 22.54% for UK Government

- Closely related, when thinking about trust in organisations' commitment to achieving a more sustainable future, 92.47% of participants stated that they strongly or somewhat trusted academic or research intuitions in this regard. Meanwhile, 41.17% stated strong or somewhat support for Scottish Government, 42.67% for energy industry corporations and 28.87% for UK Government

DESCRIPTIVE STATISTICS - INITIAL OPINION OF USING H2 TO GENERATE ELECTRICITY? (Q8)

Level of support	Frequency	Valid Percent
Strongly oppose	3	1.1
Somewhat oppose	3	1.1
Neutral	**120**	**42.1**
Somewhat support	**99**	**34.7**
Strongly support	60	21.1
Total	285	100

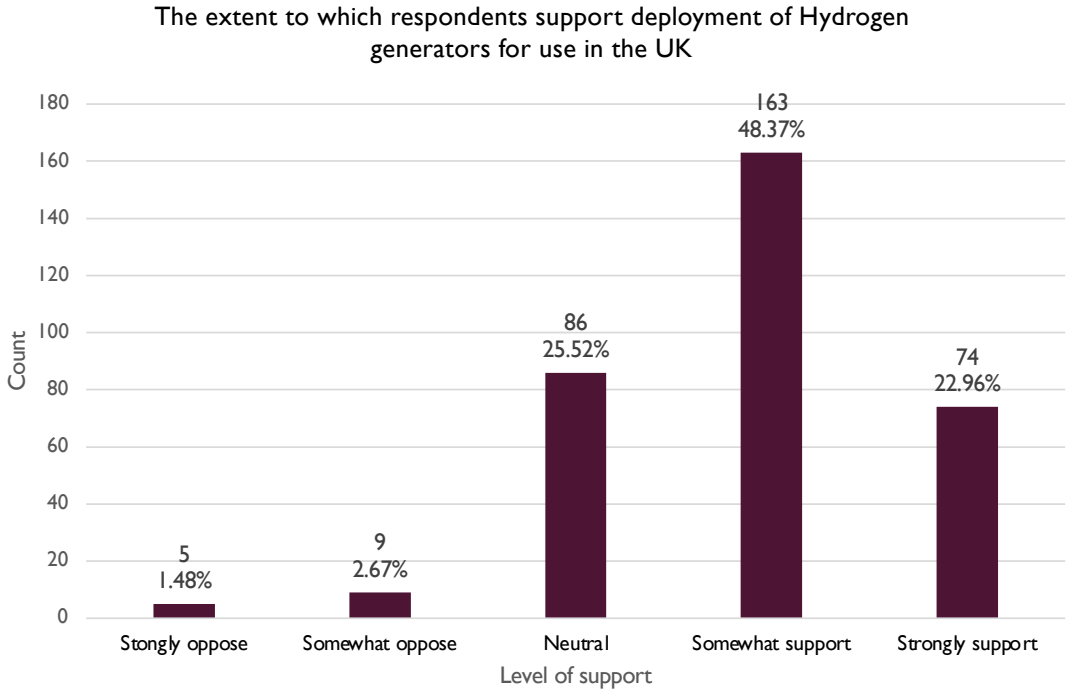
Unsurprising that 'neutral' is the most common finding as many people do not know about the technology so have a neutral opinion.

This trend is commonly seen among new technologies that are described as alternatives to fossil fuels.

DESCRIPTIVE STATISTICS – THE EXTENT TO WHICH RESPONDENTS SUPPORT DEPLOYMENT OF HYDROGEN GENERATORS FOR USE IN THE UK (Q11)

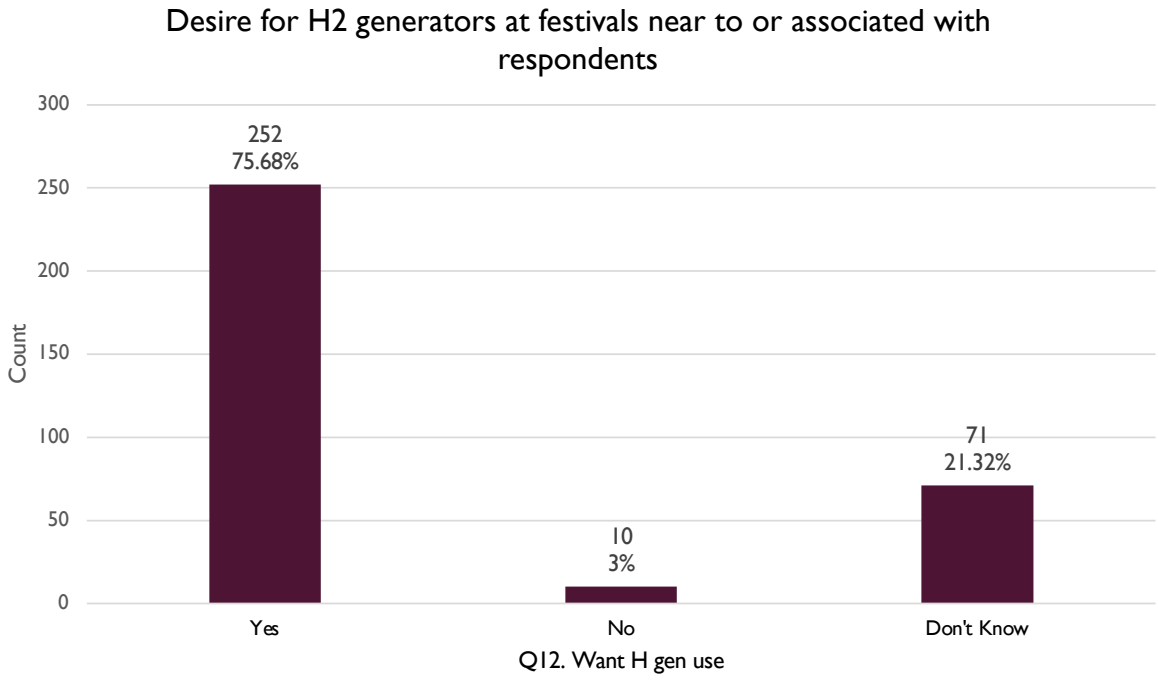
Level of support	Frequency	%
Strongly oppose	5	1.5
Somewhat oppose	9	2.7
Neutral	86	25.5
Somewhat support	**163**	**48.4**
Strongly support	74	22.0
Total	337	100.0

This is a great result for an emerging technology after information dissemination.



DESCRIPTIVE STATISTICS – NUMBER OF RESPONDENTS WHO DESIRE H2 GENERATORS TO BE USED AT FESTIVALS NEAR TO THEM OR FESTIVALS THEY ASSOCIATE WITH (Q12).

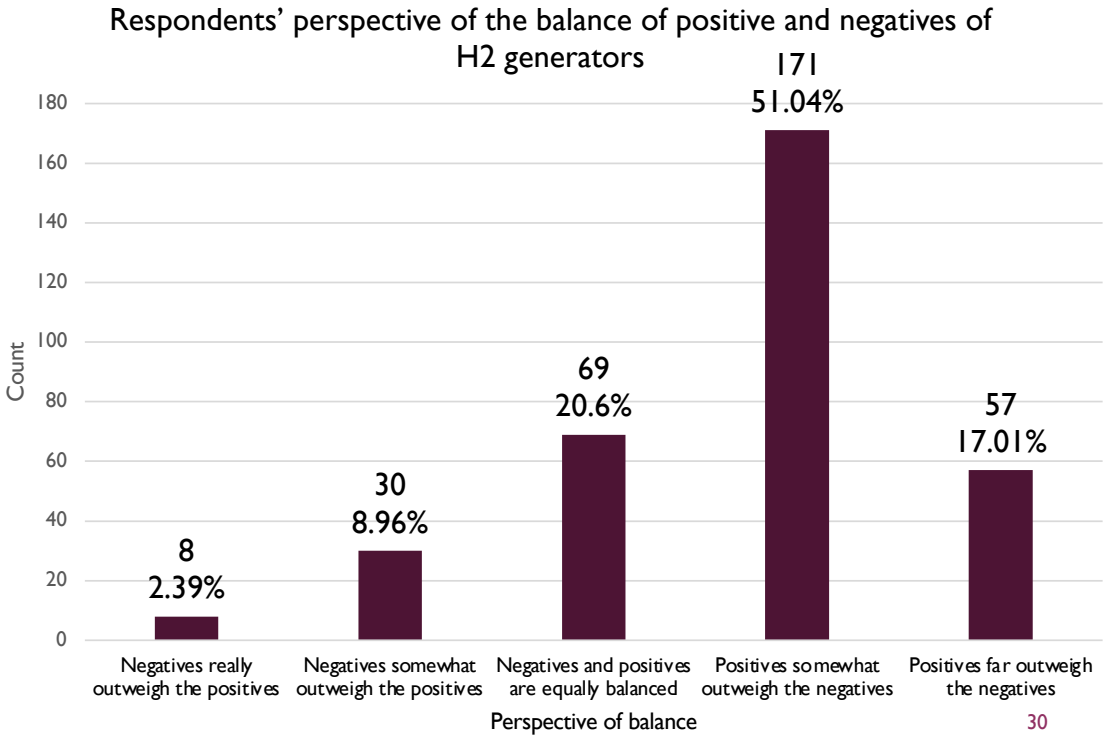
Opinion	Frequency	%
Yes	**252**	**75.7**
No	10	3.0
Don't Know	71	21.3
Total	333	100.0



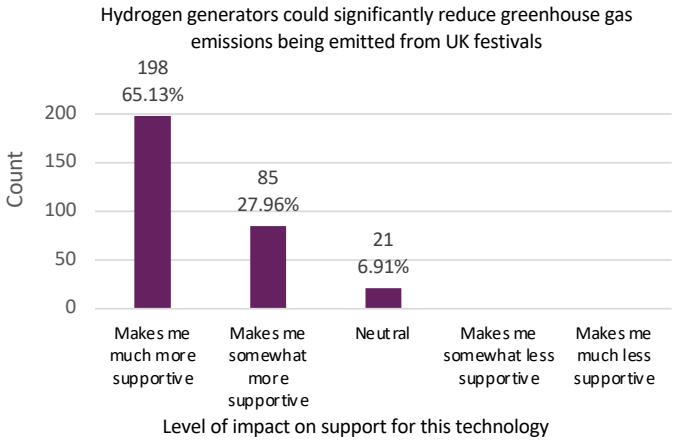
This is another great result for an emerging technology after information dissemination.

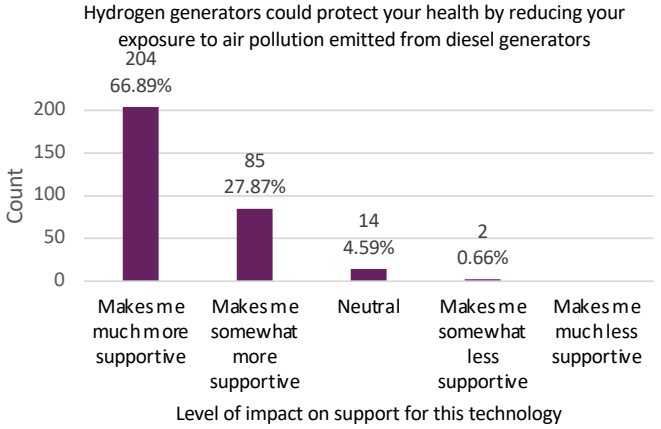
DESCRIPTIVE STATISTICS – HOW RESPONDENTS FEELS ABOUT THE OVERALL BALANCE OF POSITIVES AND NEGATIVES OF THE HYDROGEN GENERATOR (Q10)

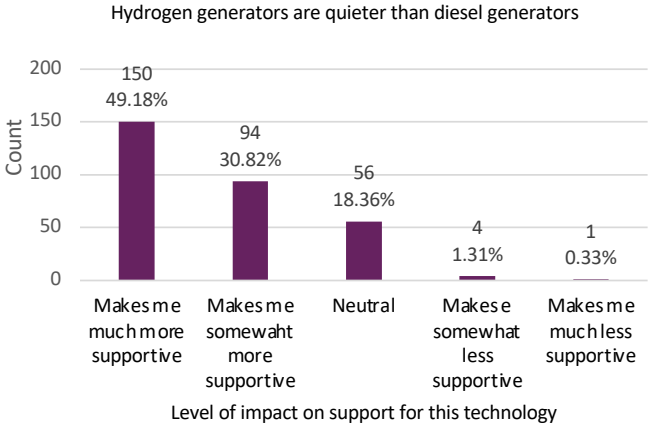
Perspective on balance of positives and negatives	Frequency	%
Negatives really outweigh the positives	8	2.4
Negatives somewhat outweigh the positives	**30**	**9**
Negatives and positives are equally balanced	69	20.6
Positives somewhat outweigh the negatives	**171**	**51**
Positives far outweigh the negatives	57	17
Total	335	100

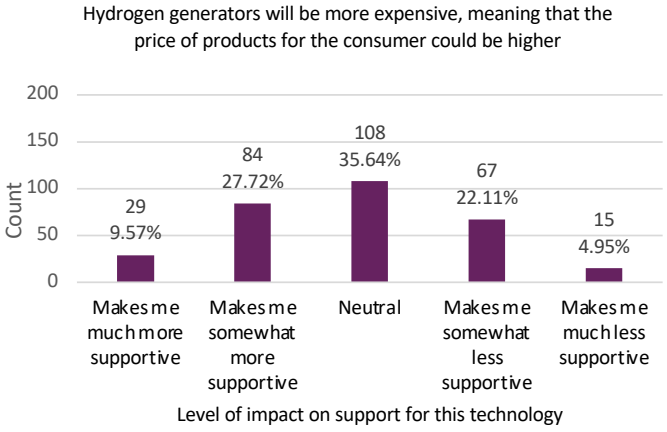


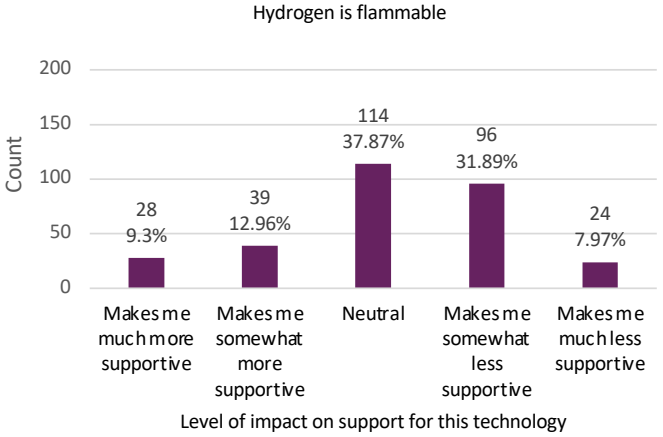
Descriptive statistics – the extent to which varying positive and negative impacts of the technology shapes support (Q9)

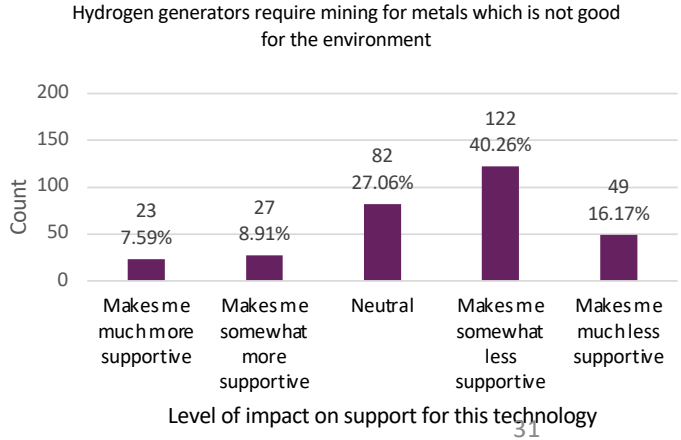












Descriptive Statistics – Demographics, role in festival

Role in Festival	Frequency	%
Member of the audience	**284**	**83.5**
Operator (front of house)	0	0
Operator (back of house)	1	0.3
Performer	0	0
Edinburgh resident who 'has festivals done to them'	29	8.5
n/a	25	7.4
Holds multiple roles*	1	0.3
Total	340	100

The tables on the right show what each role think of the questions below:

Question 8 - "What is your current opinion of using Hydrogen to generate electricity?"

- Strongly oppose (1)
- Somewhat oppose (2)
- Neutral (3)
- Somewhat support (4)
- Strongly support (5)

Q11 – To what extent do you support or oppose deployment of Hydrogen generators for use in the UK?

- Strongly oppose (1)
- Somewhat oppose (2)
- Neutral (3)
- Somewhat support (4)
- Strongly support (5)

Q12 – Would you like festivals that occur near to you (or ones that you are associated with as an operator or performer) to be using Hydrogen generators instead of diesel generators?

- Yes (1)
- No (2)
- Don't Know (3)

What are respondents' uninformed opinions on using H2 to generate electricity (Q8)?
Very little difference among different roles.

Role in Festival	Mean support (value)	Mean support (label)	Number of respondents
Member of the audience	3.77	Neutral – Somewhat support	237
Operator (back of house)	3	Neutral	1
Edinburgh resident who 'has festivals done to them'	3.88	Neutral – Somewhat support	25

Do people with different roles in festivals support deployment of H2 generators in the UK differently (Q11)? **Only ever so slightly - those who feel like festivals are 'done to them' support H2 generators in the UK more.**

Role in Festival	Mean support (value)	Mean support (label)	Number of respondents
Member of the audience	3.89	Neutral – Somewhat support	281
Operator (back of house)	3	Neutral	1
Edinburgh resident who 'has festivals done to them'	4.03	Somewhat support	29

Would people with different roles in festivals like H2 generators to be used at festivals near to them, over diesel generators? (Q12) **YES – Those who feel like festivals are 'done to them' support H2 generators at nearby festivals more.**

Role in Festival	Mean answer (value)	Mean answer (label)	N
Member of the audience	1.45	Yes	280
Edinburgh Resident who 'has festivals done to them'	1.14	Yes	29

DEMAND IS THERE WHEN ASKED

Descriptive Statistics – Demographics, age

Age	Frequency	%
18-29	**226**	**66.7**
30-39	56	16.5
40-49	18	5.3
50-59	17	5.0
60-69	16	4.7
70-75	5	1.5
75+	1	.3
Total	339	100.0

What are differently aged respondents' uninformed opinions on using H2 to generate electricity (Q8)? **Surprisingly, the older generations are more supportive than the younger generations of H2 generators being used.**

Age	Mean support (value)	Mean support (label)	Number of respondents
18-29	3.67	Neutral-Somewhat support	187
30-39	3.72	Neutral-Somewhat support	47
40-49	3.87	Neutral-Somewhat support	16
50-59	4.19	Somewhat support	16
60-69	3.75	Somewhat support	12
70-75	4.00	Somewhat support	5
75+	5.00	Strongly support	1
Total			284

Do differently aged people support deployment of H2 generators in the UK differently (Q11)?

The trend of the older generations being more supportive continues after info provided.

Age	Mean support (value)	Mean support (label)	Number of respondents
18-29	3.86	Neutral-Somewhat support	223
30-39	3.75	Neutral-Somewhat support	56
40-49	3.83	Neutral-Somewhat support	18
50-59	4.06	Somewhat support	17
60-69	4.06	Somewhat support	16
70-75	4.00	Somewhat support	5
75+	5.00	Strongly support	1
Total			336

Do differently aged people want H2 generators to be used at festivals near to them, over diesel generators? (Q12)

Not drastically, the ages group that answered 'Yes', the most was 30-39.

Age	Mean answer (value)	Mean answer (label)	Number of respondents
18-29	1.47	Yes	221
30-39	**1.39**	**Yes**	**56**
40-49	1.50	Between Yes and No	18
50-59	1.59	Leaning towards No	17
60-69	1.40	Yes	15
70-75	1.50	Between Yes and No	4
75+	1.00	Yes	1
Total			332

DEMAND IS THERE WHEN ASKED

Descriptive Statistics & mid-level analysis – Demographics, gender

Gender	Frequency	%
Female	**208**	**61.5**
Male	130	38.5
Non-Binary	0	0
Other	0	0
Prefer not to answer	0	0
Total	338	100.0

Do different genders have a different uninformed opinion on using Hydrogen to generate electricity (Q8)? **No statistically significant difference.**

Gender	Mean support (value)	Mean support (label)	Number of respondents
Female	3.64	Neutral-Somewhat support	169
Male	3.87	Neutral-Somewhat support	115

Do different genders support deployment of H2 generators in the UK differently (Q11)? (mid-level analysis). **No statistically significant difference between males' and females' level of support for H2 generators to be deployed in the UK**

Gender	Mean support (value)	Mean support (label)	Number of respondents
Female	3.83	Neutral-Somewhat support	207
Male	3.92	Neutral-Somewhat support	128

Do different genders want H2 generators to be used at festivals near to them, over diesel generators? (Q12)**. No statistically significant difference between males and females, with regards to wanting H2 generators at festivals near to them.**

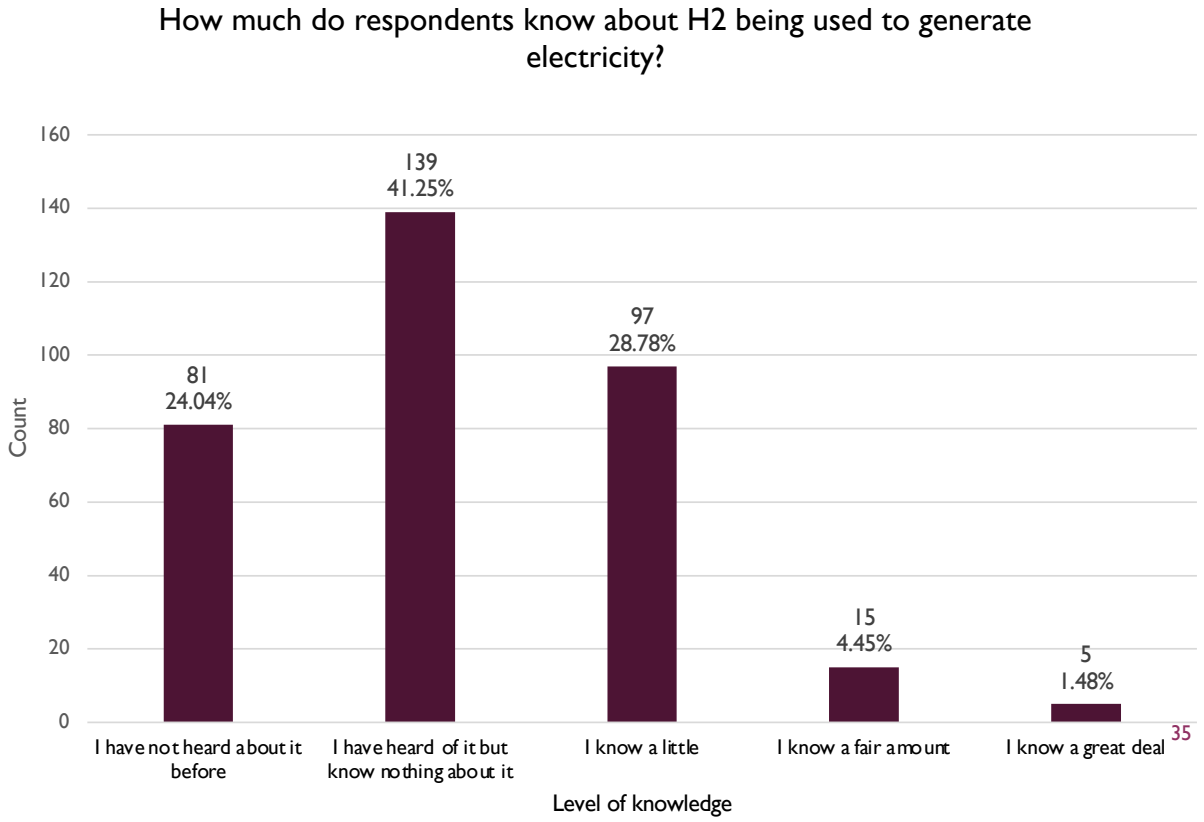
Gender	Mean answer (value)	Mean answer (label)	Number of respondents
Female	1.04	Yes	159
Male	1.03	Yes	101

NO SIGNIFICANT DIFFERENCE

DESCRIPTIVE STATISTICS HOW MUCH DO PEOPLE KNOW ABOUT H2 BEING USED TO GENERATE ELECTRICITY? Q6

Level of knowledge on H2 being used to generate electricity	Frequency	%
I have not heard about it before	81	24
I have heard of it but know nothing about it	**139**	**41.2**
I know a little	97	28.8
I know a fair amount	15	4.5
I know a great deal	5	1.5
Total	337	100

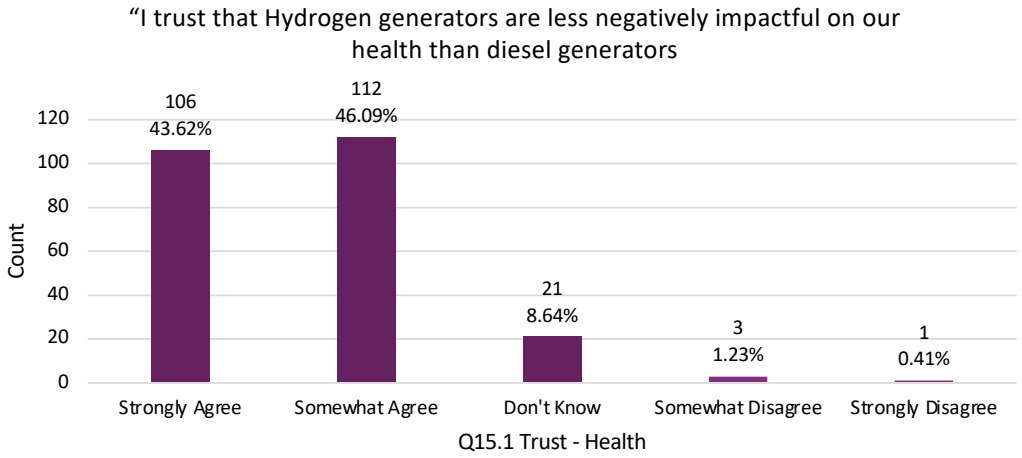
Unsurprising finding due to status as an emerging technology



Descriptive Statistics – Trust in health & environmental benefits (Q15)

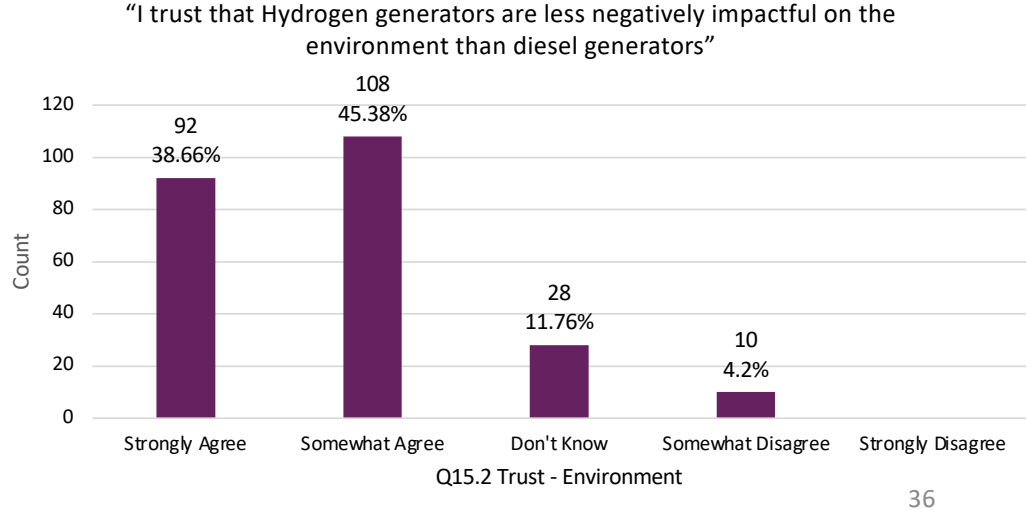
The extent to which respondents agree or disagree with "I trust that Hydrogen generators are less negatively impactful on our health than diesel generators"

Extent of agreement (trust)	Frequency	%
Strongly agree	106	43.6
Somewhat agree	**112**	**46.1**
Don't Know	21	8.6
Somewhat disagree	3	1.2
Strongly disagree	1	0.4
Total	243	100.0

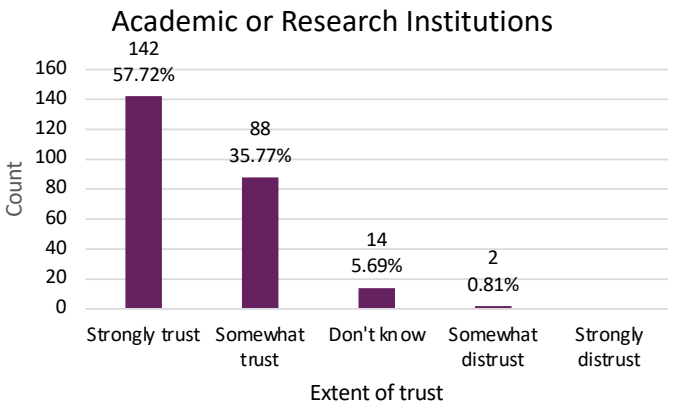


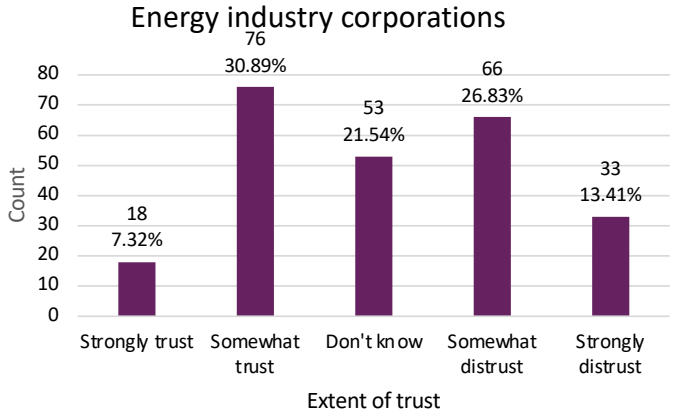
The extent to which respondents agree or disagree with "I trust that Hydrogen generators are less negatively impactful on the environment than diesel generators"

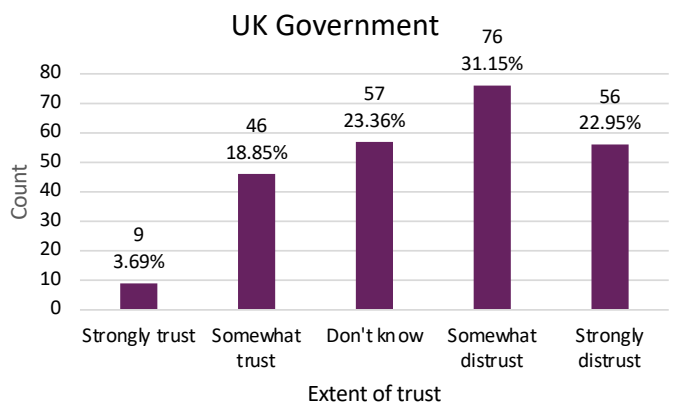
Extent of agreement (trust)	Frequency	%
Strongly agree	92	38.7
Somewhat agree	**108**	**45.4**
Don't Know	28	11.8
Somewhat disagree	10	4.2
Strongly disagree	0	0
Total	238	100.0

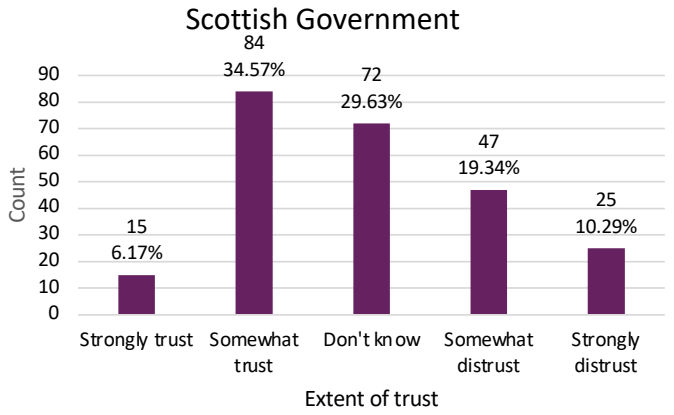


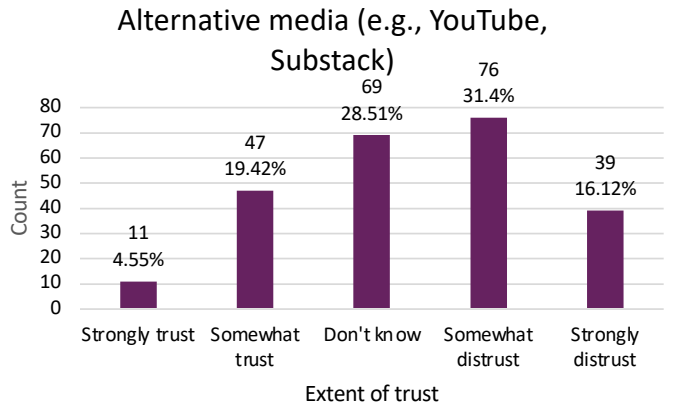
Descriptive Statistics – Trust in organisations to communicate true and accurate information about energy technologies (Q16)

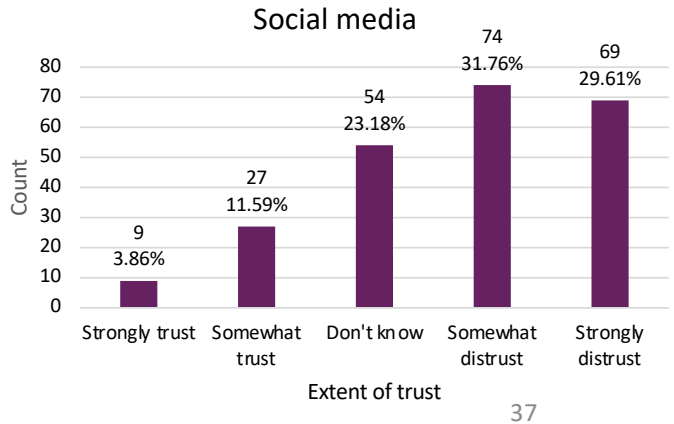




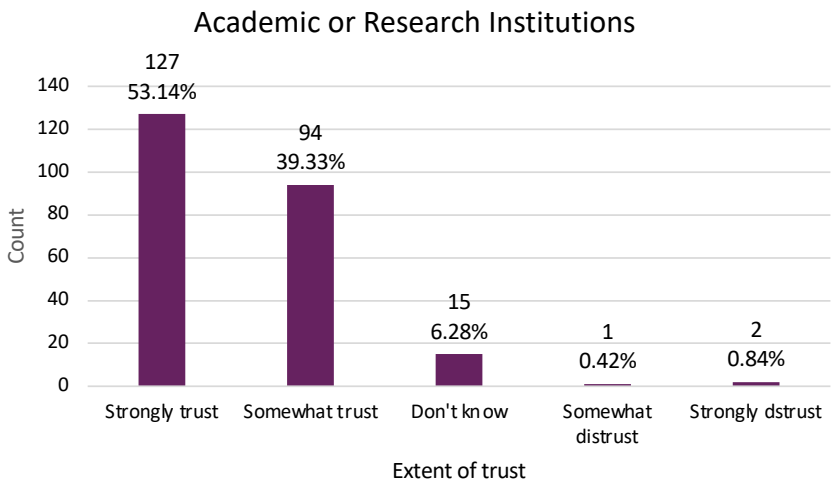


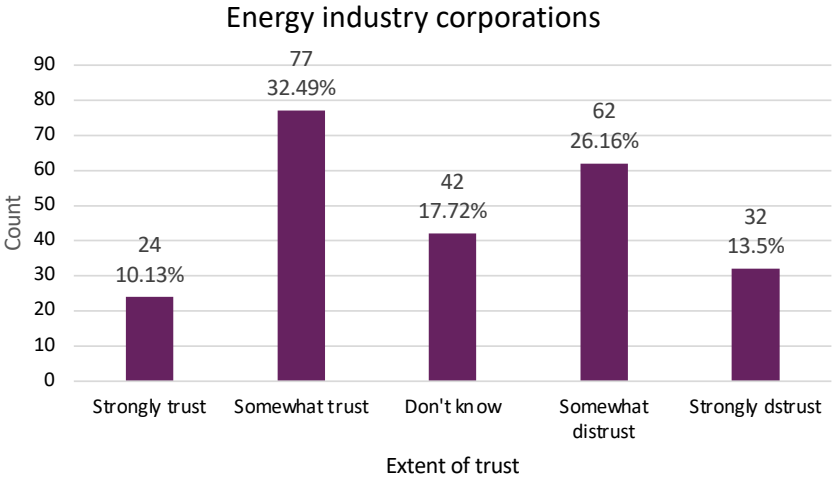


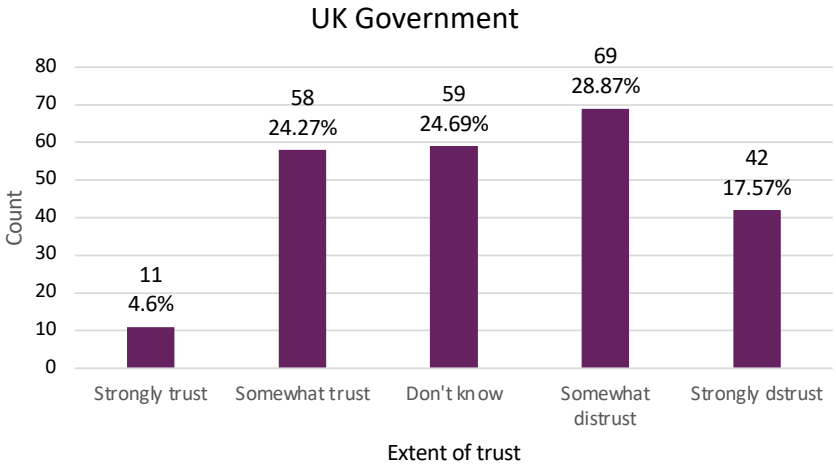


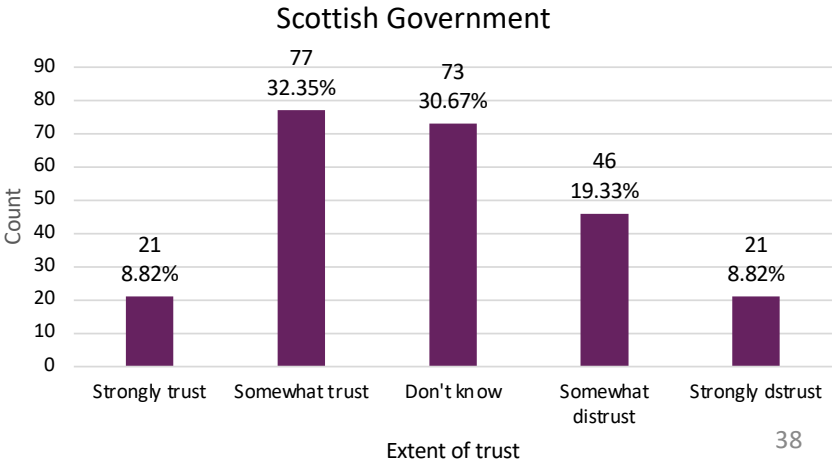


Descriptive Statistics – Trust in organisations' commitment to achieving a more sustainable future (Q17).





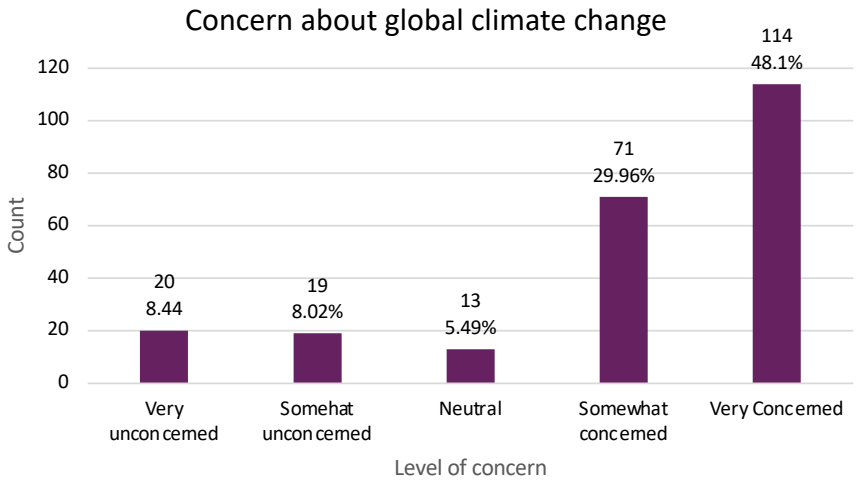




Descriptive Statistics – Environmental Views (Q18 & Q19)

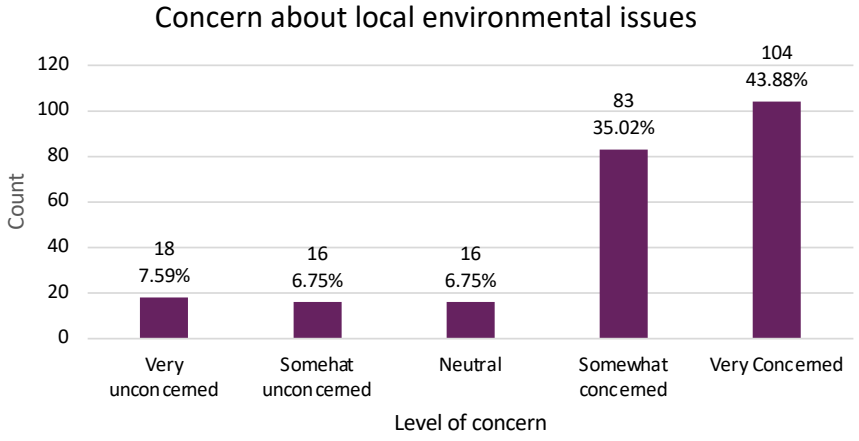
The extent of respondents' concern about global climate change

Level of concern	Frequency	%
Very unconcerned	20	8.4
Somewhat unconcerned	19	8
Neutral	13	5.5
Somewhat concerned	71	30
Very concerned	**114**	**48.1**
Total	237	100.0



The extent of respondents' concern about local environmental issues (e.g., fly tipping, air pollution)

Level of concern	Frequency	%
Very unconcerned	18	7.6
Somewhat unconcerned	16	6.8
Neutral	16	6.8
Somewhat concerned	83	35
Very concerned	**104**	**43.9**
Total	237	100.0



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1.5) QUANTITATIVE ANALYSIS

KEY FINDINGS

Communicating balanced technological information positively impacts opinion

- As people increasingly feel like the positives and negatives are balanced, support for Hydrogen generators both in the UK and at nearby festivals also increases.
- Those who are more distrustful of the health and environmental benefits are statistically significantly less supportive of Hydrogen generators in the UK and at nearby festivals.
- As concern for global climate change and local environmental issues increases, support for Hydrogen generators in the UK increases.
- Most significant correlations are weak to moderate, simply highlighting that there are multiple determinants of opinions of Hydrogen generators

PRIORITISING ANALYSES

Mid-level analyses were conducted against the three core survey questions: Q8, Q11, and Q12.

Before information dissemination

Question 8 - "**What is your current opinion of using Hydrogen to generate electricity?"**

- Strongly oppose (1)
- Somewhat oppose (2)
- Neutral (3)
- Somewhat support (4)
- Strongly support (5)

42.1% answered neutral
34.7% answered somewhat support.

Many people neutral most likely due to being a new technology.

Commonly seen among new technologies that are described as alternatives to fossil fuels.

After information dissemination

Question 11 - "**To what extent do you support or oppose deployment of Hydrogen generators for use in the UK**?"

- Strongly oppose (1)
- Somewhat oppose (2)
- Neutral (3)
- Somewhat support (4)
- Strongly support (5)

48.4% answered somewhat support
25.5% answered neutral

More support after info.

Great result for an emerging technology.

Question 12 - "**Would you like festivals that occur near to you (or ones that you are associated with as an operator or performer) to be using Hydrogen generators, instead of diesel generators**?

- Yes (1)
- No (2)
- Don't Know (3)

75.7% answered yes

3% answered no.

21.3% answered don't know

Great result

DOES LEVEL OF KNOWLEDGE ABOUT HYDROGEN BEING USED TO GENERATE ELECTRICITY (Q6) CORRELATE WITH THE FOLLOWING?:

Uninformed opinion about H2 being used to generate electricity (Q8),

Correlations

		Q8. Opinion on H electricity	Q6. How much knowledge on H electricity
Q8. Opinion on H electricity	Pearson Correlation	1	.339**
	Sig. (2-tailed)		.000
	N	285	284
Q6. How much knowledge on H electricity	Pearson Correlation	.339**	1
	Sig. (2-tailed)	.000	
	N	284	337

**. Correlation is significant at the 0.01 level (2-tailed).

- Significant positive correlation.
- Not overly strong.
- Meaning that with an increasing level of knowledge of H2 being used to generate electricity, there is an increase in uninformed support for Hydrogen produced electricity.

Informed opinion about H2 generators being deployed in the **UK** (Q11)

Correlations

		Q11. Support for H gens	Q6. How much knowledge on H electricity
Q11. Support for H gens	Pearson Correlation	1	.213**
	Sig. (2-tailed)		.000
	N	337	334
Q6. How much knowledge on H electricity	Pearson Correlation	.213**	1
	Sig. (2-tailed)	.000	
	N	334	337

**. Correlation is significant at the 0.01 level (2-tailed).

- Significant positive correlation.
- Not overly strong.
- Meaning that with an increasing level of knowledge of H2 being used to generate electricity, there is an increase in informed support for H2 generators being deployed in the UK.

Informed opinion about H2 generators being used a festivals close to respondents (Q12).

Removed "Don't know" responses for purpose of analysis.

Correlations

		Q12. Want H gen use	Q6. How much knowledge on H electricity
Q12. Want H gen use	Pearson Correlation	1	.003
	Sig. (2-tailed)		.964
	N	262	261
Q6. How much knowledge on H electricity	Pearson Correlation	.003	1
	Sig. (2-tailed)	.964	
	N	261	337

- No significant correlation.
- Level of knowledge does not correlate with informed opinion about H2 generators being used at festivals close to respondents.
- Surprising as "Don't know" responses were removed.

DOES SUPPORT FOR H2 GENS IN THE UK (Q11) CORRELATE WITH HOW PEOPLE **FEEL ABOUT THE BALANCE OF POSITIVES AND NEGATIVES** OF H2 GENS (Q10)?

- Q10:
  - Negatives really outweigh the positives =1
  - Negatives somewhat outweigh the positives =2
  - Negatives and positives are equally balanced = 3
  - Positives somewhat outweigh the negatives = 4
  - Positives far outweigh the negatives = 5

- There is a significant, moderate, positive correlation.
- Meaning that as people increasingly feel like the positives and negatives are balanced, support also increases.

Correlations

		Q10. Feel about balance of pos and neg	Q11. Support for H gens
Q10. Feel about balance of pos and neg	Pearson Correlation	1	.445**
	Sig. (2-tailed)		.000
	N	335	334
Q11. Support for H gens	Pearson Correlation	.445**	1
	Sig. (2-tailed)	.000	
	N	334	337

**. Correlation is significant at the 0.01 level (2-tailed).

DOES SUPPORT FOR H2 GENS AT NEARBY **FESTIVALS**, OVER DIESEL GENERATORS (Q12) CORRELATE WITH HOW PEOPLE **FEEL ABOUT THE BALANCE OF POSITIVES AND NEGATIVES** OF H2 GENS (Q10)?

- Q10:
  - Negatives really outweigh the positives =1
  - Negatives somewhat outweigh the positives =2
  - Negatives and positives are equally balanced = 3
  - Positives somewhat outweigh the negatives = 4
  - Positives far outweigh the negatives = 5

- There is a significant negative correlation.
- Not as strong as the correlation between feeling a balance between positives and negatives and H2 generator use in the wider UK. Symbolised by the smaller Pearson Correlation number.
- This could be due to people preferring the H2 generators to be used but they may be slightly skeptical of them being used close by.

Correlations

		Q12. Want H gen use	Q10. Feel about balance of pos and neg
Q12. Want H gen use	Pearson Correlation	1	-.187**
	Sig. (2-tailed)		.002
	N	262	260
Q10. Feel about balance of pos and neg	Pearson Correlation	-.187**	1
	Sig. (2-tailed)	.002	
	N	260	335

**. Correlation is significant at the 0.01 level (2-tailed).

DOES DESIRE TO HAVE FOR H2 GENERATORS **AT FESTIVALS** NEAR PARTICIPANTS, OVER DIESEL GENERATORS (Q11), CORRELATE WITH SUPPORT FOR H2 GENERATOR USE IN THE UK? (Q12)?

- Q12:
  - Yes = 1
  - No = 2
  - Don't know = 3 (assigned as missing value to allow accurate correlation test)

- More people selected yes; they would like H2 generators used more than diesel generators.
- There is a statistically significant difference in mean level of support for H2 gens in the UK
- Meaning that those who answered No to H2 generators at festivals are less supportive of H2 generators in the wider UK, or more neutral.
- This is supported by a significant negative correlation.
- It is negative and not positive, simply because in the Q11 Likert scale, 1 = less support and 5 = ore support. Whereas in Q12, it's the opposite, 1 represents higher support, while 2, represents less support.

Group Statistics

	Q12. Want H gen use	N	Mean	Std. Deviation	Std. Error Mean
Q11. Support for H gens	Yes	251	4.08	.791	.050
	No	10	3.10	.994	.314

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Q11. Support for H gens	Equal variances assumed	1.187	.277	3.803	259	.000	.980	.258	.472	1.487
	Equal variances not assumed			3.077	9.459	.012	.980	.318	.265	1.695

Correlations

		Q12. Want H gen use	Q11. Support for H gens
Q12. Want H gen use	Pearson Correlation	1	-.230**
	Sig. (2-tailed)		.000
	N	262	261
Q11. Support for H gens	Pearson Correlation	-.230**	1
	Sig. (2-tailed)	.000	
	N	261	337

**. Correlation is significant at the 0.01 level (2-tailed).

MULTIPLE REGRESSION ANALYSIS OF POSITIVE AND NEGATIVES

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.390[a]	.152	.135	.768

a. Predictors: (Constant), Q9.6, Q9.2, Q9.3, Q9.4, Q9.5, Q9.1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	5.043	.192		26.240	.000	4.664	5.421
	Q9.1	-.384	.102	-.284	-3.769	.000	-.585	-.184
	Q9.2	.033	.108	.024	.304	.761	-.180	.246
	Q9.3	-.067	.063	-.067	-1.054	.293	-.191	.058
	Q9.4	-.080	.057	-.098	-1.409	.160	-.192	.032
	Q9.5	.010	.056	.013	.182	.855	-.099	.120
	Q9.6	-.104	.054	-.136	-1.919	.056	-.210	.003

a. Dependent Variable: Q11. Support for H gens

- Multiple regression analysis was run to predict support for H2 generators from the positive and negative impacts.
- Only 13.5% of the dependent variable (Q11) is dependent upon the independent variables (the positive and negative impacts). This is very low.

The only impact that is statistically significantly added to the prediction was 9.1 – "Hydrogen generators could significantly reduce greenhouse gas emissions being emitted from UK festivals"

TRUST – I trust that Hydrogen generators are less negatively impactful on our health than diesel generators (Q15.1) against Q11 (H2 generators in UK)

- Q15.1:
  - Strongly Agree = 1
  - Somewhat Agree = 2
  - Don't Know = 3
  - Somewhat Disagree = 4
  - Strongly Disagree = 5
- Q11
  - Strongly oppose (1)
    - Somewhat oppose (2)
    - Neutral (3)
    - Somewhat support (4)
    - Strongly support (5)

- Most participants answered strongly or somewhat agree.
- Significant, moderate, negative correlation.
- Meaning that as **distrust** in health benefit increases, support for H2 generators decreases.

Q15.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	106	31.2	43.6	43.6
	2	112	32.9	46.1	89.7
	3	21	6.2	8.6	98.4
	4	3	.9	1.2	99.6
	5	1	.3	.4	100.0
	Total	243	71.5	100.0	
Missing	System	97	28.5		
Total		340	100.0		

Correlations

		Q11. Support for H gens	Q15.1
Q11. Support for H gens	Pearson Correlation	1	-.439**
	Sig. (2-tailed)		.000
	N	337	240
Q15.1	Pearson Correlation	-.439**	1
	Sig. (2-tailed)	.000	
	N	240	243

**. Correlation is significant at the 0.01 level (2-tailed).

TRUST – I trust that Hydrogen generators are less negatively impactful on our health than diesel generators (Q15.1) against Q12 (H2 generators at nearby festivals)

- Significant positive correlation.
- Not overly strong.
- Meaning that as **distrust** in health benefit increases, support demand for H2 generators at nearby festivals decreases.

Correlations

		Q12. Want H gen use	Q15.1 Trust - Health
Q12. Want H gen use	Pearson Correlation	1	.341**
	Sig. (2-tailed)		.000
	N	262	186
Q15.1 Trust - Health	Pearson Correlation	.341**	1
	Sig. (2-tailed)	.000	
	N	186	243

**. Correlation is significant at the 0.01 level (2-tailed).

TRUST – I trust that Hydrogen generators are less negatively impactful on the environment than diesel generators (Q15.2) against Q11 (H2 generators in UK)

- Q15.2:
  - Strongly Agree = 1
  - Somewhat Agree = 2
  - Don't Know = 3
  - Somewhat Disagree = 4
  - Strongly Disagree = 5

- Most participants answered Somewhat agree, then strongly agree.
- Significant negative correlation.
- Meaning that as **distrust** in environmental benefit increases, support for H2 generators decreases.

Q15.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	92	27.1	38.7	38.7
	2	108	31.8	45.4	84.0
	3	28	8.2	11.8	95.8
	4	10	2.9	4.2	100.0
	Total	238	70.0	100.0	
Missing	System	102	30.0		
Total		340	100.0		

Correlations

		Q11. Support for H gens	Q15.2
Q11. Support for H gens	Pearson Correlation	1	-.473**
	Sig. (2-tailed)		.000
	N	337	235
Q15.2	Pearson Correlation	-.473**	1
	Sig. (2-tailed)	.000	
	N	235	238

**. Correlation is significant at the 0.01 level (2-tailed).

TRUST – I trust that Hydrogen generators are less negatively impactful on the environment than diesel generators (Q15.2) against Q12 (H2 generators at nearby festivals)

- Significant positive correlation
- Weak
- Meaning that as **distrust** in environmental benefit increases, the demand for H2 generators at nearby festivals decreases.

Correlations

		Q12. Want H gen use	Q15.2 Trust - Environment
Q12. Want H gen use	Pearson Correlation	1	.276**
	Sig. (2-tailed)		.000
	N	262	182
Q15.2 Trust - Environment	Pearson Correlation	.276**	1
	Sig. (2-tailed)	.000	
	N	182	238

**. Correlation is significant at the 0.01 level (2-tailed).

ENVIRONMENTAL VIEWS – CONCERN ABOUT GLOBAL CLIMATE CHANGE

Uninformed opinion about H2 being used to generate electricity (Q8),

Correlations

		Q8. Opinion on H electricity	Q18. Concern about global climate change
Q8. Opinion on H electricity	Pearson Correlation	1	.118
	Sig. (2-tailed)		.100
	N	285	196
Q18. Concern about global climate change	Pearson Correlation	.118	1
	Sig. (2-tailed)	.100	
	N	196	237

- No statistically significant correlation

Q18 – To what extent are you concerned or unconcerned about global climate change
- Very concerned (1)
- Somewhat unconcerned (2)
- Neutral (3)
- Somewhat concerned (4)
- Very concerned (5)

Informed opinion about H2 generators being deployed in the **UK** (Q11)

Correlations

		Q18. Concern about global climate change	Q11. Support for H gens
Q18. Concern about global climate change	Pearson Correlation	1	.265**
	Sig. (2-tailed)		.000
	N	237	234
Q11. Support for H gens	Pearson Correlation	.265**	1
	Sig. (2-tailed)	.000	
	N	234	337

**. Correlation is significant at the 0.01 level (2-tailed).

- Significant positive correlation.
- Weak.
- As concern about global climate change increases, support for H2 generators in the UK increases.

Informed opinion about H2 generators being used a festivals close to respondents (Q12).

Correlations

		Q18. Concern about global climate change	Q12. Want H gen use
Q18. Concern about global climate change	Pearson Correlation	1	-.134
	Sig. (2-tailed)		.070
	N	237	184
Q12. Want H gen use	Pearson Correlation	-.134	1
	Sig. (2-tailed)	.070	
	N	184	262

- No statistically significant correlation
- No statistical difference in support between yes and no 'voters' when conducting independent t-test

ENVIRONMENTAL VIEWS – LOCAL ENVIRONMENTAL ISSUES

Uninformed opinion about H2 being used to generate electricity (Q8),

Correlations

		Q19. Concern about local environmental issues	Q8. Opinion on H electricity
Q19. Concern about local environmental issues	Pearson Correlation	1	.133
	Sig. (2-tailed)		.064
	N	237	196
Q8. Opinion on H electricity	Pearson Correlation	.133	1
	Sig. (2-tailed)	.064	
	N	196	285

- No statistically significant correlation

Q19 – To what extent are you concerned or unconcerned about local environmental issues (e.g., fly tipping, air pollution)?

- Very concerned (1)
- Somewhat unconcerned (2)
- Neutral (3)
- Somewhat concerned (4)
- Very concerned (5)

Informed opinion about H2 generators being deployed in the **UK** (Q11)

Correlations

		Q19. Concern about local environmental issues	Q11. Support for H gens
Q19. Concern about local environmental issues	Pearson Correlation	1	.218**
	Sig. (2-tailed)		.001
	N	237	234
Q11. Support for H gens	Pearson Correlation	.218**	1
	Sig. (2-tailed)	.001	
	N	234	337

**. Correlation is significant at the 0.01 level (2-tailed).

- Significant positive correlation.
- Weak.
- As concern about local environmental issues increases, support for H2 generators in the UK increases.

Informed opinion about H2 generators being used a festivals close to respondents (Q12).

Correlations

		Q19. Concern about local environmental issues	Q12. Want H gen use
Q19. Concern about local environmental issues	Pearson Correlation	1	-.089
	Sig. (2-tailed)		.230
	N	237	184
Q12. Want H gen use	Pearson Correlation	-.089	1
	Sig. (2-tailed)	.230	
	N	184	262

- No statistically significant correlation
- No statistical difference in support between yes and no 'voters' when conducting independent t-test

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Making Hydrogen Happen

THE UNIVERSITY of EDINBURGH

School of GeoSciences

"EDINBURGH FESTIVALS' CLEAN POWER DEMONSTRATION PROJECT"

2 - FOCUS GROUPS

FOCUS GROUPS - CONTENTS

2.1) KEY FINDINGS: PRODUCTION

- Pre-existing knowledge of varying Hydrogen production methods was extremely limited
- Support for grey Hydrogen was low with no participants suggesting this was their preferential production method
- Support for blue Hydrogen was also low with no participants suggesting this was their preferential production method. Several participants specifically expressed concerns regarding CCS technology
- Support for green Hydrogen was very high with the majority of participants suggesting that this was their preferential Hydrogen production method

2.1) KEY FINDINGS: OWNERSHIP

- Investigation sought to gain insight into whether or not audience members attitudes and perceptions are influenced by the production ownership model, i.e. does the identity of the actors that operate and ultimately profit from the production and sale of Hydrogen influence audience members attitudes and perceptions
- Community-led was by far the most supported ownership model. The return of revenue to local communities was an influential factor promoting support. Some concerns still existed regarding the practicalities of delivery. However, concerns decreased when participants were informed that community-led Hydrogen production already exists, as opposed to being purely conceptual
- Industry-led ownership models were supported by a minority of participants. For most of these participants, the reason for this support was more to do with the perceived practicalities of delivery, rather than a normative or ideological pro-industry stance
- With regards to municipal ownership, a minority of participants suggested that they liked the idea in theory, but had reservations about how this may materialise in practice. Whilst some participants suggested that they were tentatively in favour, a handful objected to the model outright

2.1) KEY FINDINGS: WILLINGNESS TO PAY & WIDER VALUE PROPOSITION

- To begin with, most participants expressed concern about any additional costs that may result from displacing diesel generators with Hydrogen counterparts at festivals and outdoor events . However, some suggested that they would be willing to pay a little more (~5-10%), even if they were not particularly happy about it.
- After taking more time to consider this theme and discuss it with one another, opinion within groups shifted somewhat with an increase in the overall number of participants who suggested they would be willing to pay a little more . Nevertheless, it should be noted that the majority of those participants who suggested that they would be willing to pay a little extra were, by and large, unimpressed with the notion
- Thinking about support as part of a wider value proposition (i.e. trying to take money out of the equation), all 25 participants expressed support for the displacement of incumbent diesel generators with Hydrogen powered counterparts. This could be interpreted as suggesting that an important factor limiting support for Hydrogen generators in festival/ outdoor event contexts is the potential price increase implications associated with new technology implementation.

2.1) KEY FINDINGS: HYDROGEN AND GENERATORS

- Prior to being given information concerning the pros and cons of replacing diesel generators with Hydrogen counterparts , just over half of the participants were aware that Hydrogen can be used as a sustainable fuel, e.g. in Hydrogen powered cars or buses, whilst others claimed no pre-existing knowledge
- At this early stage in group discussions, potential ticket price increases and safety issues were both raised as concerns by a small minority of participants. However, no participants expressed safety concerns after being provided with additional information (specifically that H2 technology would have to adhere to strict health and safety regulations and/or that H2 does not inherently offer risks over and above other flammable gases, e.g., natural gas). But the number of participants expressing concern regarding the potential price increase implications did increase.
- After being provided with information concerning the pros and cons of replacing incumbent diesel generators with Hydrogen counterparts, the majority of participants across all 5 focus groups (n=19) thought that the pros of displacement outweighed the cons

2.1) KEY FINDINGS: FESTIVALS AND ELECTRICITY GENERATION

- Waste and general pollution (e.g. plastic food and beverage waste; tents) were the first things that came to the majority of participants minds when they considered the negative environmental impacts of festivals
- Transport to festival sites was also raised as an issue by multiple participants. So too was land degradation (e.g. compression from foot traffic) and on-site build production (e.g. building of temporary stages and other structures), but to a lesser extent
- Although the impacts of electricity generation were raised by some participants, this issue was largely an afterthought and not one of the first things that came to participants minds
- Some participants were aware that diesel generators are often used to supply power, whilst others claimed no pre-existing knowledge or suggested that they had never really thought about it before

2.2) AIMS

Primary research aims:

- *"Explore festival audience members perceptions of, and attitudes towards, different Hydrogen production methods and ownership models"*
- including willingness to pay and value proposition in relation to Hydrogen powered outdoor events and festivals

Secondary aims to explore:

- *perceptions of environmental challenges in outdoor event context (particularly festivals)*
- *perceptions of Hydrogen as a fuel*
- *attitudes concerning displacement of incumbent diesel generators with Hydrogen counterparts*

2.3) METHODS: DATA COLLECTION

- 5 focus groups
- Ranging from 4 to 7 participants in each group
- 25 participants in total
- All participants frequent festivals as audience members on a regular basis
- Relatively young UK based cohort* (average age 29 years old – ranging from 22yo to 40yo**)

- Each session lasted between 80 to 120 minutes
- Totaling around 500 mins qualitative audio data in total

2.3) THE PARTICIPANTS

	Gender	Age	Occupation	Attendance frequency
Stuart	M	33	Sales assistant	➢ Once a year
Christopher	M	60+	Councillor	Once a year
Lisa	F	34	Nurse	➢ Once a year
Danny	M	35	Business analyst	Once every 2 years
Jules	F	24	Coroner's office	➢ Once a year
Lucy	F	23	Studio manager	➢ Once a year
Alex	M	31	Lettings negotiator	➢ Once a year
Rachel	F	23	Wellbeing assistant	➢ Once a year
Teresa	F	30	Research associate	➢ Once a year
Deb	F	34	Community care officer	➢ Once a year
Giovanni	M	23	Estate agent	➢ Once a year
Jordan	M	40	Fleet manager	➢ Once a year
Oli	M	27	Label manager	➢ Once a year
Cathy	F	35	Social worker	➢ Once a year
Nicola	F	32	Social worker	➢ Once a year
James	M	34	Customer engagement executive	➢ Once a year
Claire	F	28	Finance business partner	➢ Once a year
Paloma	F	22	Student	➢ Once a year
Saphire	F	33	HR business partner	➢ Once a year
Steve	M	34	Security supervisor	➢ Once a year
Hannah	F	28	Local business owner	➢ Once a year
Matt	M	26	Paralegal	➢ Once a year
Patricia	F	34	n/a	➢ Once a year
Ryan	M	27	Account	➢ Once a year
Jean	F	26	n/a	➢ Once a year

2.3) METHODS: DATA COLLECTION

Discussions focused on researcher-led themes, namely:

- negative environmental impacts of festivals
- electricity generation and diesel generators in festival contexts
- Hydrogen as a fuel and Hydrogen generators
- Hydrogen production methods (grey, blue, and green)
- Hydrogen ownership models (industry, community, and municipal)
- willingness to pay/ value proposition in relation to H2 powered outdoor events and festivals

2.3) METHODS: DATA ANALYSIS

1) Transcribe the data

2) Apply pseudonyms and remove any personal information that could be used to identify participants

3) Break the data down into high-level themes (researcher-led questions)

2.3) DATA ANALYSIS CONTINUED…

4) Create tables for each of the 6 identified themes and populate with relevant qualitative data (see sample image below)

5) Attitudes towards various hydrogen production ownership models

FG 1	Industry-led	Community-led	Other (e.g. Municipal)
1.1 (Stuart)	("For me, it makes sense if it's just produced in one central kind of location and then distributed outwards because, although you'll have these small islands or people involved in distributing it on a smaller scale, like it sounds weird but like bigger is almost better")	("For me, it makes sense if it's just produced in one central kind of location and then distributed outwards because, although you'll have these small islands or people involved in distributing it on a smaller scale, like it sounds weird but like bigger is almost better")	("yeah I'd have to agree with Danny on that, like as much as like there are certain things that I think your Council should be involved in supplying me with power slash energy is not one of them")
1.2 (Christopher)	Depends on local conditions, e.g. ("laying power lines from the Orkneys to where the power needs to be used is very expensive and difficult thing to do so, it makes sense in those terms to produce the hydrogen there and then transport the hydrogen")	Depends on local conditions, e.g. ("laying power lines from the Orkneys to where the power needs to be used is very expensive and difficult thing to do so, it makes sense in those terms to produce the hydrogen there and then transport the hydrogen"); but not against in principal ("of course it will be great to say that it could be done in a sensible economic way. With cooperative ownership of it if it can be done")	Good in principal, risky in practice ("It is a risky business the council's to get into but I mean, in principle, if it can be done, then, is a great thing for communities to generate their own power")
1.3 (Lisa)	Prefers money not to go to corporations ("Oh well, that two quid went towards that", "okay saved a few fish, whatever, I'm happy, it didn't end up in a corporate pocket"	n/a	("[Council should] help people make best choices and so still doing their bit, but without throwing loads of money into it where it should be a larger government and energy supplier responsibility as well")

5) Attitudes towards various ownership structures

Group 1

- 1 out of 5 participants expressed support for an industry-led ownership structure. Meanwhile, 3 out of 5 participants suggested that they would rather not see more profits going to corporations or industry. The remaining participant suggested that the most appropriate ownership model depends on context, as opposed to one rule for all situations

- 3 out of 5 participants expressed support for a community-led ownership model. However, 1 of these participants suggested that it depends on context, as opposed to one rule for all situations (see above). 1 participant explicitly stated preference for an industry-led approach over other ownership-models (including community-led). The remaining participant did not explicitly comment on this subtheme.

- With regards to municipal ownership, 2 participants expressed support, however, 2 other participants explicitly stated that they do not think it is within councils remits. The remaining participant suggested that councils do have a role to play in aiding transition, but that this has more to do with information/ helping people make good choices as opposed to energy supply

Sample quote: **"I think that surely it makes sense to and let these communities utilize the fact that they have so much kind of green energy available to them and that's surely the best place to do it" (Jules)**

Sample quote: **"It is a risky business the council's to get into but I mean, in principle, if it can be done, then, is a great thing for communities to generate their own power" (Christopher)**

2.3) DATA ANALYSIS CONTINUED…

5) Tally up responses to themes group by group, include sample quotations (see left hand image)

2.3) DATA ANALYSIS CONTINUED…

6) Tally up responses to themes by individual (independent of the grouping)

7) Provide an overall narrative for each theme including sample quotations (see right hand image)

Overall

- A handful of participants expressed support for Industry-led ownership structures (n=5). However, for most of these participants, the reason for this preference was more to do with the perceived practicalities of delivery, rather than a normative or ideological stance (n=3).

- Community-led was by far the most supported ownership structure (n=16). However, some concerns existed regarding the practicalities of delivery (n=4). Interestingly, this concern decreased when participants were informed that community-led hydrogen production already exists, as opposed to being purely conceptual (n=2)

- With regards to municipal ownership, numerous participants suggested that they liked the idea in theory, but had reservations about how this may materialise in practice (n=6). Other participants suggested that they were tentatively in favour (n=4). Whilst a handful of participants objected (n=4).

Sample quote: **"I guess I'm thinking if there were bigger companies involved, essentially green hydrogen you hope one day might become like the gold standard. And I feel like the only way that that would happen sadly, is if the big companies get involved" (Nicola)**

Sample quote: **"I love the sound of the potential community ownership. I think that sounds really, really good. And just kind of generally the direction we should be trying to move in, in terms of not only thinking about the planet, but then thinking about our societies as well and how to keep that going simultaneously and helping each other out" (Jean)**

Sample quote: **"There's no reason why it can't be done. It's just, the main thing is, like we say the resources and stuff, councils just don't have the money to do it" (Ryan)**

2.3) DATA ANALYSIS CONTINUED…

8) Create tables to aid with visulisation of findings (see sample below)

Attitudes towards various ownership models

	Industry support	Community support	Municipal support
Group 1	1 out of 5	2 out of 5	2 out of 5
Group 2	0 out of 4	4 out of 4	n/a
Group 3	n/a	2 out of 5	2 out of 5
Group 4	2 out of 4	2 out of 4	0 out of 4
Group 5	2 out of 7	6 out of 7	0 out of 7

2.3) HEAT MAP TO AID VISULISATION

9) Utilise heatmaps where useful to aid visulisation of the findings

<34%	34% – 66%	67% - 100%

Attitudes towards various ownership models

	Industry support	Community support	Municipal support
Group 1	1 out of 5	3 out of 5	2 out of 5
Group 2	0 out of 4	4 out of 4	n/a
Group 3	n/a	2 out of 5	2 out of 5
Group 4	2 out of 4	2 out of 4	0 out of 4
Group 5	2 out of 7	6 out of 7	0 out of 7

2.3) METHODS: ANALYSIS RECAP

1) Transcribe data
2) Apply pseudonyms and remove any personal info that could be used to identify ppts
3) Break the data down into high-level themes (researcher-led questions)
4) Create tables for each of the 6 identified themes and populate with relevant qualitative data.
5) Tally up responses to themes group by group, include sample quotations.
6) Tally up responses to themes by individual (independent of the grouping)
7) Weave together an overall narrative.
8) Create tables to aid with visulisation of findings and 9) utilise heatmaps where useful to aid visulisation

2.4) PERCEPTIONS CONCERNING NEGATIVE ENVIRONMENTAL IMPACTS OF OUTDOOR EVENTS (PARTICULARLY FESTIVALS)

- For all groups, waste and general pollution was the first thing that came to the majority of participants minds when they considered the negative environmental impacts of festivals (n=15). Specifically, there was significant reference to litter and waste (e.g. plastic, belongings, tents).

"At the end of the festival, when you're leaving and you can just see tents everywhere and rubbish everywhere. That's pretty damning. It's quite visual, we just destroy everything" (Lucy)

2.4) CONTINUED…

- Transport to festival sites was also raised as an issue by multiple participants (n=5), whilst land degradation (n=1) and on-site build production (n=1) were also highlighted.

- Although electricity generation was raised (n=7), it was only a primary concern for a couple of participants (n=2), whilst being an afterthought for most who highlighted it (n=5)

	Primary concern	Secondary concern	Electricity Generation (y/n)
Group 1	Waste/ general pollution	Transport	Y (1/5)
Group 2	Waste/ general pollution	Electricity Generation	Y (2/4)
Group 3	Waste/ general pollution	Transport, On-site Build	N (0/5)
Group 4	Waste/ general pollution	Electricity Generation	Y (3/4)
Group 5	Waste/ general pollution	Transport, Land Degradation	Y (1/7)

2.5) KNOWLEDGE/ AWARENESS OF ELECTRICITY GENERATION AT FESTIVALS & PERCEPTIONS OF INCUMBENT DIESEL GENERATORS

- Awareness of electricity generation at festivals was split within groups. Some participants were aware that diesel generators are often used to supply power (n=10), whilst others claimed no pre-existing knowledge or suggested that they had never really thought about it before (n=9)*.

- Participants from only 2 groups commented explicitly on either the negative environmental or health impacts of diesel generators before these issues were raised by the researcher (n=6).

- Upon being informed about the negative environmental and health ramifications of diesel generator use at UK festivals, participants across the 3 groups expressed shock (n=7).

2.5) CONTINUED…

- 10 out of 25 participants were aware that diesel generators are used at many festivals and outdoor events to supply electricity

"It's just really random thought that came to my head, but it was like, Jesus, it is all diesel generated because I can't think of any way to get power to this festival otherwise" (Steve)

- 9 out of 25 participants suggested that they had no pre-existing knowledge of diesel generators in relation to festival energy supply or had otherwise never really thought about it

"I haven't got a clue. I've never thought about that" (Jules)

- 7 out of 25 participants expressed shock upon being informed about the negative environmental and health ramifications of diesel generator use at UK festivals

"I think it was definitely shock. Nowhere near did I think it was as much as that. It seems wasteful, the amount, it's crazy" (James)

- Only 6 out of 25 participants explicitly commented on either the negative environmental or health impacts of diesel generators before these issues were raised by the researcher

"all the festivals seem to use diesel generators which [are] incredibly wasteful and dirty and noisy so to get away from that would be a very good thing" (Christopher)

2.6) HYDROGEN AS A FUEL (BEFORE INFO) AND HYDROGEN GENERATORS (AFTER INFO)

- Awareness of potential for Hydrogen as a low carbon or sustainable fuel was split within groups. Some participants were aware that Hydrogen can be used as a sustainable fuel (n=13), e.g. in Hydrogen powered cars or buses, whilst others claimed no pre-existing knowledge (n=5)

- Prior to being given information concerning the pros and cons of replacing diesel generators with Hydrogen counterparts (see next slide), participants in 1 group expressed potential price increase implications as a concern (n=2), whilst participants across another 2 groups expressed safety concerns (n=2)

"I guess there has to be an alternative [to diesel]… if that's Hydrogen then great, but I don't know enough about it to make my decision. I don't know anything about Hydrogen" (Nicola)

2.6) CONTINUED…

Researcher Supplied Information

- Diesel generators = bad for public health, bad for the environment, noisy operation
- H2 generators (+) = no nasty particulates, no tail pipe GHG emissions, quieter operation
- H2 generators (-) = h2 is flammable, technology likely to be more expensive, supply chains of RE tech involves mining

2.6) CONTINUED…

- After being provided with additional information, the majority of participants across all 5 groups thought that the pros of Hydrogen generators outweighed the cons (n=19). No participants suggested that the cons outweighed the pros (n=0).

- No participants expressed safety concerns after being provided with additional information, however, the number of participants across groups expressing concern regarding the potential price increase implications increased (n=8)

	Low-carbon or sustainable	Price implication concerns before info (y/n)	Safety concerns before info (y/n)	Price implication concerns after info (y/n)	Safety concerns after info (y/n)	Pros outweigh cons
Group 1	4 out of 5	N	N	Y (4 out of 5)	N	4 out of 5
Group 2	1 out of 4	N	N	Y (1 out of 4)	N	3 out of 4
Group 3	1 out of 5	Y (2 out of 5)	N	Y (3 out of 5)	N	3 out of 5
Group 4	3 out of 4	N	Y (1 out of 5)	N	N	4 out of 4
Group 5	4 out of 7	N	Y (1 out of 7)	N	N	5 out of 7

“Apart from the cost of the tickets, I think the pros outweigh the cons and the other negative issues you described”
(Jordan)

“While you mentioned some of the negatives, it sounds like overall it would be a better alternative. So I think I'd probably be in favour of it”
(Paloma)

2.7) ATTITUDES TOWARDS VARIOUS HYDROGEN PRODUCTION METHODS

- Pre-existing knowledge of varying Hydrogen production methods was extremely limited (n=1)

- Support for grey Hydrogen was low with no participants suggesting this was their preferential production method. Nevertheless, some participants did suggest that it would not put them off going to a festival (n=4), whilst others thought it was reasonable to utilise as a stepping stone on the way to green h2 (n=4)

"Ideally we all want green, but if it's the stage, if it's down the evolutionary chain, if we end up bringing it, brilliant, but at the end of the day, it's a step in the right direction, and it can't be faulted for that really" (Steve)

2.7) CONTINUED…

- Support for blue Hydrogen was also low with no participants suggesting this was their preferential production method. In addition, several participants specifically expressed concerns regarding CCS technology (n=6). Nevertheless, some participants did suggest that it was "alright" (n=5), would not put them off going to a festival (n=2), or that it was reasonable to utilise as a stepping stone on the way to green h2 (n=2).

	Pre-existing knowledge re Hydrogen production methods	Support for grey h2	Support for blue h2	Support for green h2	No preference
Group 1	1 out of 5	2 out of 5	0 out of 5	5 out of 5	0 out of 5
Group 2	0 out of 4	0 out of 4	0 out of 4	2 out of 4	2 out of 4
Group 3	0 out of 5	0 out of 5	0 out of 5*	5 out of 5	0 out of 5
Group 4	0 out of 4	0 out of 4	0 out of 4	2 out of 4	0 out of 4
Group 5	0 out of 7	4 out of 7	4 out of 7	7 out of 7	0 out of 7

* All 5 participants in "Group 3" suggested that blue Hydrogen was "alright", i.e., better than grey, worse than green. This has not been recorded as overt support

- Support for green Hydrogen was very high with the majority of participants suggesting that this was their preferential Hydrogen production method (n=21). However, whilst some participants suggested that green h2 was the only viable production method (n=17), other stated that, although green was their preference, they would not be put off attending a festival that used grey or blue h2 (n=4)

“Just do it the proper way from the very first time and while you're developing hydrogen-based energy, make it with a renewable source instead of a non-renewable and consumable source” (Hannah)

2.8) ATTITUDES TOWARDS VARIOUS OWNERSHIP MODELS

- Industry-led ownership models were supported by a handful of participants (n=5). However, for most of these participants (n=3), the reason for this support was more to do with the perceived practicalities of delivery, rather than a normative or ideological pro-industry stance. The sample quote below demonstrates this position well.

"I guess I'm thinking if there were bigger companies involved, essentially green Hydrogen you hope one day might become like the gold standard. And I feel like the only way that that would happen sadly, is if the big companies get involved" (Nicola)

2.8) CONTINUED…

- Community-led was by far the most supported ownership model (n=17). Participants cited reinvestment of profits back into local communities as a key motivation for support (n=8) . However, some concerns still existed regarding the practicalities of delivery (n=4). This concern decreased when participants were informed that community-led Hydrogen production already exists, as opposed to being purely conceptual (n=2)

"I love the sound of the potential community ownership. I think that sounds really, really good. And just kind of generally the direction we should be trying to move in, in terms of not only thinking about the planet, but then thinking about our societies as well and how to keep that going simultaneously and helping each other out" (Jean)

2.8) CONTINUED…

- With regards to municipal ownership, numerous participants suggested that they liked the idea in theory, but had reservations about how this may materialise in practice (n=6). For example, lack of resources and expertise was cited. Meanwhile, other participants suggested that they were tentatively in favour (n=4). Whilst a handful of participants objected outright (n=4).

	Industry support	Community support	Municipal support
Group 1	1 out of 5	3 out of 5	2 out of 5
Group 2	0 out of 4	4 out of 4	n/a
Group 3	n/a	2 out of 5	2 out of 5
Group 4	2 out of 4	2 out of 4	0 out of 4
Group 5	2 out of 7	6 out of 7	0 out of 7

"There's no reason why it can't be done. It's just, the main thing is, like we say the resources and stuff, councils just don't have the money to do it" (Ryan)

2.9) WILLINGNESS TO PAY/ WIDER VALUE PROPOSITION

- To begin with, most participants expressed concern about any additional costs that may result from displacing diesel generators with Hydrogen counterparts at festivals and outdoor events (n=13). However, others suggested that they would be willing to pay a little more, even if they were not particularly happy about it (n=9)

"I guess I do worry about accessibility to festivals for people with disabilities, and they are already expensive. And I guess I worry about a group of people not being able to go if prices go up even more" (Nicola)

"I'm cool to pay for it if it's a bit, if it's a fraction of the ticket, not if it becomes like... Festivals are expensive, aren't they? (Lucy)

2.9) CONTINUED…

- After talking more time to consider this issue and talk it through with one another, opinion within groups shifted somewhat with an increase in the overall number of participants who suggested they would be willing to pay a little more (from n=13 to n=17). This demonstrates that attitudes are not necessarily static or fixed and that group consultation and deliberation can impact upon individuals thinking.

- However, it should be noted that even participants who suggested that they would be willing to pay a little extra were very far from impressed with the notion.

"Really depends what numbers we're talking here. And also, I would prefer to see it getting subsidized by government, or other funders rather than the end customer having to pay for it" (Teresa)

2.9) CONTINUED…

- Thinking about support as part of a wider value proposition (i.e. trying to take money out of the equation), all 25 participants expressed support for the displacement of incumbent diesel generators with Hydrogen powered counterparts. This could be interpreted as suggesting that an important factor potentially limiting support for Hydrogen generators in festival settings concerns the potential price increase implications associated with implementation of new technology

	WTP (initial attitudes)	WTP (developed opinions)	Support (wider value proposition)
Group 1	1 out of 5	5 out of 5	5 out of 5
Group 2	2 out of 4	3 out of 4	4 out of 4
Group 3	1 out of 5	3 out of 5	5 out of 5
Group 4	2 out of 4	2 out of 4	4 out of 4
Group 5	3 out of 7	4 out of 7	7 out of 7

"It's a great decision and great route to go down. Thinking about climate change, it will make a big difference. Hydrogen again, I think it's just being mindful of how we're going to be getting those resources" (Cathy)

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School of GeoSciences

"EDINBURGH FESTIVALS' CLEAN POWER DEMONSTRATION PROJECT"

3 - SYNTHESIS

SYNTHESIS (1/4)

- Findings from our descriptive statistics analysis demonstrate that the operational advantages of Hydrogen generators over diesel counterparts (i.e. better for both health and planet at the point of use; quieter operation) are valued by festival and outdoor events audience members
- But our findings from focus groups add additional depth here by highlighting that when audience members become aware that not all H2 is made equal (i.e. grey, blue & green), the majority support production methods involving renewables, but not fossil fuels.
- Furthermore, more value is attributed to production ownership structures that return benefits back to communities than those that do not (i.e. Community-led ownership models are more supported than industry or municipal-led)
- This suggests that an informed public/ audience is more likely to reject the displacement of diesel generators with Hydrogen counterparts if a) they do not run on Green Hydrogen and b) communities are not perceived to be deriving benefit
- However, it should be noted that further research would need to be carried out to determine if these variables alone are strong enough to override what appears to be strong support

SYNTHESIS (2/4)

Other key findings where survey and focus group research inform one another:

- very limited pre-existing knowledge concerning Hydrogen as a fuel and Hydrogen generators
- despite this, there is reasonable support in principle (even before more information has been given)
- when information is received by publics/ audience, it strongly influences perceptions
- however, if this information is balanced (with both pros and cons highlighted), then our findings suggest strong support for the displacement of diesel generators with Hydrogen counterparts

- trust too plays an important role when it comes to information, with industry and the UK Government in particular perceived by many as relatively untrustworthy
- this contrasts with more trust in Scottish Government and significantly more trust in academic and/or research institutions
- it is possible that trust (or lack of trust) is an influential variable with regards to H2 production ownership models (i.e. community-led being the most supported, with a lack of support for industry)

SYNTHESIS (3/4)

- A consistent finding regarding existing Hydrogen perception research centres around a lack of meaningful knowledge on behalf of the general public (Ricci et al., 2008; Scott and Powells, 2020a; Bogel et al., 2018; Flynn, Bellaby and Ricci, 2009)
- Our findings converge with this, suggesting that festival and outdoor event audience members in the UK have very limited pre-existing knowledge regarding Hydrogen as a low-carbon fuel and Hydrogen generators. This was a consistent finding in both surveys and focus groups.

- Although it is often stated that people negatively associate the word Hydrogen with danger or explosion, existing literature suggests that most responses are in fact neutral (Ricci, Bellaby and Flynn, 2008). More recently in fact, research suggests support, for example: a high level of support for the development of Hydrogen energy was found in Taiwan (Chen at al., 2016), whilst overall positive attitudes towards Hydrogen fuel cell technologies were found in seven European countries (Bogel et al., 2018).
- Our findings from both surveys and focus groups support the assertion that most festival and outdoor event audience members do not associate Hydrogen with danger and explosion. Moreover, there is broad support for Hydrogen generator technology deployment in festival and outdoor event settings.

SYNTHESIS (4/4)

- Our literature review revealed very little pre-existing research concerning perceptions of, and attitudes towards, differing Hydrogen production methods.
- However, public support for renewables is often higher than for fossil fuels (Peterson et al, 2015). Meanwhile, public concerns related to carbon capture and storage technology (CCS) have been recorded (Glanz and Schonauer, 2021). Thus, from this information it is reasonable to hypothesise that Green Hydrogen production will likely be supported more than Grey or Blue.
- Our findings that Green Hydrogen production was preferred by participants over Grey and Blue methods goes some way to confirming our hypothesis and adds additional depth to current understandings.

- Our literature review also revealed very little pre-existing research specifically concerning perceptions of, and attitudes towards, various Hydrogen production ownership models.
- However, research exploring low carbon energy technologies more broadly does indicate that when economic benefits do not go to local communities, public perception can shift resulting in less acceptance (Peterson et al, 2015).
- Here, our findings that community-led Hydrogen production ownership models are preferred over industry-led and municipal led structures adds depth to current understandings specific to H2 whilst supporting existing literature with a broader technological focus.

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THE UNIVERSITY of EDINBURGH
School of GeoSciences

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APPENDICES

- Survey: https://uoe.sharepoint.com/:b:/r/sites/EdinburghfestivalscleanpowerdemonstrationprojectattitudesperceptionsresearchAppendices/Shared%20Documents/Survey.pdf?csf=1&web=1&e=okcHaw
- Information pamphlet (for surveys): https://uoe.sharepoint.com/:b:/r/sites/EdinburghfestivalscleanpowerdemonstrationprojectattitudesperceptionsresearchAppendices/Shared%20Documents/Information%20pamphlet.pdf?csf=1&web=1&e=pskyk7
- Focus group analysis working documents: https://uoe.sharepoint.com/:b:/r/sites/EdinburghfestivalscleanpowerdemonstrationprojectattitudesperceptionsresearchAppendices/Shared%20Documents/Focus%20Group%20Analysis%20Working%20Doc.pdf?csf=1&web=1&e=iyHBkG
- Sample lit review: https://uoe.sharepoint.com/:b:/r/sites/EdinburghfestivalscleanpowerdemonstrationprojectattitudesperceptionsresearchAppendices/Shared%20Documents/UoE%20-%20PlusZero%20-%20NEOSI%20-%20Lit%20Review.pdf?csf=1&web=1&e=uKH1HQ