

INTRODUCTION

Thank you for your participation in this anonymous questionnaire

Only an **adult (+18) living in the UK** should complete this questionnaire.

It consists of a series of questions about climate change and new energy technologies. **Please tick the box that best describes your opinion for each question.** Please answer the questions in order.

There are **30 questions** in total and it should take around 15 min to complete. It is **entirely voluntary** so you can withdraw from the study at any time without giving a reason.

No special knowledge is required. **There are no right or wrong answers! All points of views are welcome! Your views count!**

The research is completely independent and is not linked to any industry, government or interest group.

The information you provide here will be **held totally anonymously** so that it is impossible to trace this information back to you individually. This information may be retained indefinitely or published.

Please direct any questions you have to the researcher using the contact details at the end of the questionnaire.

If you consent to participate in the study, please proceed by pressing the 'continue' button below.

Important: please do not use your browser 'back' button as this will result in your data being lost.

DEMOGRAPHICS

Gender

- ☐ Male
- ☐ Female
- ☐ Other
- ☐ Prefer not to say

Age

- ☐ 18 - 24
- ☐ 25 - 34
- ☐ 35 - 44
- ☐ 45 - 54
- ☐ 55 - 64
- ☐ 65 +

What is the highest qualification you have obtained?

- ☐ Postgraduate degree (MSc, PhD, etc)
- ☐ University degree (BA, BSc, etc)
- ☐ Professional qualification
- ☐ Trade School
- ☐ GCSE O-level
- ☐ A-level or equivalent
- ☐ Still studying
- ☐ No academic or professional qualifications

Working status

- ☐ Employed full time
- ☐ Employed part time
- ☐ Unemployed
- ☐ Looking after house/children

- ☐ Retired
- ☐ Student
- ☐ Other

In politics, people sometimes talk of "left" and "right". Using a scale from 0 to 10, where 0 means the left and 10 means the right, where would you place yourself on this scale?



What region of the UK do you live in?

FIRST ASSOCIATIONS

What are the first thoughts or images that come to mind when you hear the term 'ammonia':

☐ 1.-

PERCEPTIONS OF CLIMATE CHANGE

This set of questions will ask you about your thoughts and opinions on climate change (sometimes referred to as global warming)

You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing?

- ☐ Definitely changing
- ☐ Probably changing
- ☐ Probably not changing
- ☐ Definitely not changing

☐ Don't know

How worried, if at all, are you about climate change?

- ☐ Not at all worried
- ☐ Not very worried
- ☐ Fairly worried
- ☐ Very worried
- ☐ Extremely worried

Do you think that climate change is caused by natural processes, human activity, or both?

- ☐ Entirely by natural processes
- ☐ Mainly by natural processes
- ☐ About equally by natural processes and human activity
- ☐ Mainly by human activity
- ☐ Entirely by human activity
- ☐ I don't think climate change is happening
- ☐ Don't know

How serious of a threat, if at all, is climate change to each of the following?

	Not at all serious	Not very serious	Fairly serious	Very serious	Extremely serious
You and your family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
UK as a whole	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People in developing countries (e.g. South Africa, Thailand, Ecuador)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People in developed countries (e.g. Japan, USA, Germany)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How much do you think climate change will harm you personally?

- ☐ A great deal
- ☐ A moderate amount

- ☐ A little
- ☐ None at all

Which one, if any, of these do you feel should be mainly responsible for taking action against climate change?

- ☐ Industry
- ☐ National Government
- ☐ Society
- ☐ Local Government
- ☐ Individuals and their families
- ☐ Environmental groups
- ☐ The international community
- ☐ None of these

In the next **month**, how often do you plan to:

	Never	Sometimes	About half the time	Most of the time	Always	Not relevant to me (e.g if you don't drive)
Turn off lights when you're not using them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drive economically (e.g., braking or accelerating gently)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walk, cycle or take public transport for short journeys (i.e., trips of less than 3 miles)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share a car journey with someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cut down on the amount you fly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy environmentally-friendly products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy food which is organic, locally-grown or in season	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoid eating meat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Sometimes	About half the time	Most of the time	Always	Not relevant to me (e.g if you don't drive)
Buy products with less packaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reuse or repair items instead of throwing them away	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compost your kitchen waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Save water by taking shorter showers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Turn off the tap while you brush your teeth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

A study published in 2017 by the Universities of Lund and British Columbia, suggested that the single most effective measure an individual in the developed world could take to cut their carbon emissions over the long term, could be having smaller families (one fewer child per family)

What do you think about limiting the number of children per family as a measure to tackle climate change?

- ☐ Strongly agree
- ☐ Tend to agree
- ☐ Neither agree nor disagree
- ☐ Tend to disagree
- ☐ Strongly disagree

FUELS

Do you believe the following fuels/energy sources contribute to climate change?

	It contributes	It does not contribute	Don't know	I've never heard of it
Biomass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diesel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	It contributes	It does not contribute	Don't know	I've never heard of it
Gasoline	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydrogen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
LP Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nuclear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biofuels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydroelectric energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tidal energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

To what extent, do you support or oppose the use of...

	Strongly support	Support	Neither support nor oppose	Oppose	Strongly oppose	I've never heard of it
Biomass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diesel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gasoline	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydrogen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
LP Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nuclear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biofuels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydroelectric energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tidal energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

To what extent do you think the following statements are correct or incorrect

	Correct	Incorrect	Don't know
Burning oil produces CO ₂	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Correct	Incorrect	Don't know
Nuclear power plants emit CO2 during operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The global CO2 concentration in the atmosphere has increased during the past 250 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The last century's global increase in temperature was the largest during the past 1,000 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For the next decades, the majority of climate scientists expect...

	Correct	Incorrect	Don't Know
...an increase in extreme events, such as droughts, floods and storms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the climate to change evenly all over the world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

GREEN AMMONIA

Please read the following information carefully:

Traditionally, fossil fuels have been used to rapidly match electricity supply with demand.

By burning fossil fuels (fuels containing carbon), cutting down rainforests and farming livestock, humans are increasingly influencing the climate and the earth's temperature, causing what we know as *global warming*.

This is why the need for a carbon-free fuel. But this is not easy, currently, just a few fuels exist with no carbon (i.e. hydrazine, hydrogen sulphide, ammonium nitrate, ammonia etc.). Research indicates that amongst these, **hydrogen** and **ammonia** are the simplest and most promising.

Hydrogen is an excellent zero-carbon fuel to help reduce greenhouse gas emissions. However, due to its chemical composition, shipment for long distances and storage for long times present a

lot of challenges. Another way to use hydrogen is through ammonia.

Below we are going to present information about how ammonia fuel could be produced and utilised as an energy carrier and for energy storage:

From ammonia to green ammonia

Ammonia (NH₃)

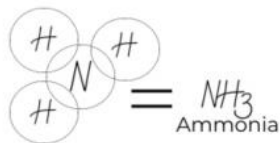
It is mainly used as a fertilizer all around the world



2nd

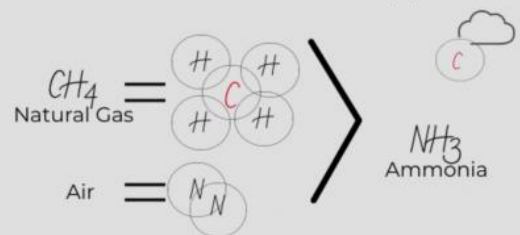
most produced industrial chemical around the world

Is a compound of **nitrogen (N)** and **hydrogen (H)**



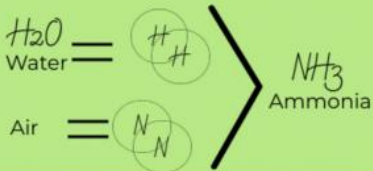
CURRENT PRODUCTION OF AMMONIA

To create ammonia, **hydrogen (H)** is obtained from natural gas. However, this process contributes to climate change because it contains carbon (C)

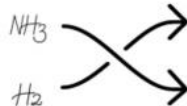


Green Ammonia

A way to produce zero-carbon ammonia is to instead obtain **hydrogen (H)** from water



Using electricity from renewables it can be split again into hydrogen or keep it as ammonia



ENERGY POWER

The hydrogen in ammonia is used directly as a fuel

ENERGY STORAGE

The ammonia generated can be stored in tanks as a liquid and used as when needed, such as an electric battery

Applications

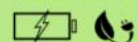
CHEMICAL

Fertilizer
Refrigerant

FUEL



BATTERY



Please tell us what thoughts or images came to mind when reading this information about green ammonia?

In general, how do you feel about green ammonia?

- ☐ Extremely positive
- ☐ Moderately positive
- ☐ Slightly positive
- ☐ Neither positive nor negative

- ☐ Slightly negative
- ☐ Moderately negative
- ☐ Extremely negative

RISKS AND BENEFITS

The use of ammonia can have both **risks** and **benefits**:

How positive do you feel about the following benefits...

	Not at all positive	Not very positive	Somewhat positive	Very positive	Extremely Positive	Don't Know
When ammonia is used to generate energy, it is converted into water and air so it would not contaminate the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure to use ammonia is already in place around the world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The penetrating smell of ammonia is a useful way to detect any gas leak	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal waste, which contains ammonia, could be utilized to create energy instead of polluting soil and water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

To what extent are you worried about the following risks...

	Not at all worried	Not very worried	Somewhat worried	Very worried	Extremely worried	Don't Know
Ammonia is a toxic gas that when inhaled in large concentrations can cause burns in eyes and mouth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As a fuel, if ammonia is not burned properly, NOx particles (a type of greenhouse gas) can be released, contributing to climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Not at all worried	Not very worried	Somewhat worried	Very worried	Extremely worried	Don't Know
Ammonia technology to store and generate energy would need large investments to commercialize, this might imply higher prices in electricity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ammonia has a very unpleasant smell	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ammonia technology is water intensive so it would need to be developed in areas with easy access to water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

On the whole, how acceptable or unacceptable are the risks of green ammonia to you?

- ☐ Very acceptable
- ☐ Acceptable
- ☐ Neither acceptable nor unacceptable
- ☐ Unacceptable
- ☐ Very unacceptable

Do you think there are more risks or benefits for green ammonia?

- ☐ The risks outweigh the benefits
- ☐ The risks and benefits are about the same
- ☐ The benefits outweigh the risks

Do you have any other concerns about ammonia?

AMMONIA IN THE UK

Would you support or oppose the use and development of green ammonia technologies in your country as a way to reduce carbon emissions?

- ☐ Strongly support
- ☐ Somewhat support
- ☐ Neither support nor oppose
- ☐ Somewhat oppose
- ☐ Strongly oppose

How feasible do you think the development of this kind of project (e.g. ammonia technologies) might be in the UK?

- ☐ Definitely feasible
- ☐ Probably feasible
- ☐ Not sure
- ☐ Probably not feasible
- ☐ Definitely not feasible

If we use this technology in the UK, who would you trust to regulate it?

- ☐ Government
- ☐ Industry
- ☐ Both
- ☐ None

Is there anything we've missed - anything you'd like to tell us that would help us to understand your opinions about climate change and green ammonia?

PRIVACY NOTE

IMPORTANT: PLEASE PRESS SUBMIT TO COMPLETE THE SURVEY

Thank you for completing our survey!

This survey is part of a cross-national comparison of public perceptions of climate change and new energy technologies. In this survey, you were asked about your personal attitudes towards the use of

ammonia as an energy vector, for power distribution and storage in order to help mitigate climate change. We want to find out how supportive people would be about research in this area, and ultimately deployment in the future.

This survey was designed to identify how public perceptions of climate change and ammonia-based technologies differ between Mexico and the UK. All data will be held totally anonymously, so that it is impossible to trace this information back to you individually. This information may be retained indefinitely and will be made available for research purposes.

For more details or concerns about the wider project you can contact:

Researcher: Andrea Guati Rojo MercadoGuatiRojoA1@cardiff.ac.uk

Supervisor (School of Psychology): Dr. Christina Demski DemskiCC@cardiff.ac.uk

Supervisor (School of Engineering): Dr. Agustin Valera- Medina: valeramedinaA1@cardiff.ac.uk

Who is funding the research? The Research is funded by the National Council of Science and Technology in Mexico (abbreviated CONACYT). This entity is in charge of the promotion of scientific and technological activities, setting government policies for these matters and granting scholarships for postgraduate studies.

If you would like more information about ammonia-based systems you can access the following link:

<https://www.youtube.com/watch?v=eLMfRZGagfE>

Please contact the School of Psychology Ethics Committee if you have any concerns regarding this research: Secretary of the Ethics Committee, School of Psychology, Cardiff University, Tower Building, Park Place, Cardiff, CF10 3AT, Email: psychethics@cardiff.ac.uk Privacy notice: The information provided on the consent form will be held in compliance with GDPR regulations. Cardiff University is the data controller and Matt Cooper is the data protection officer (inforequest@cardiff.ac.uk).

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