National Grid

Grid Guide to: The Future of Gas
21 January 2021

National Grid

Nick Ashworth, Director of Investor Relations

John Pettigrew, Chief Executive Officer

Cordi O'Hara, Chief Operating Officer, US Gas

Sheri Givens, VP, US Regulatory and Customer Strategy

Antony Green, Project Director, Hydrogen

Martin Cook, Business Development Director, National Grid Ventures

Questions

Elchin Mammadov, Bloomberg

Deepa Venkateswaran, Bernstein - via webcast

Mark Freshney, Credit Suisse

Dominic Nash, Barclays

Sam Arie, UBS

Jenny Ping, Citi - via webcast

Verity Mitchell, HSBC - via webcast

Fraser McLaren, Bank of America

Nick Ashworth, Director of Investor Relations
Hello and welcome to our Grid Guide to the Future of Gas Virtual Investor event, the first in our 'Grid Guide to…' ESG series, which will take place every few months through 2021 and beyond.

I'm Nick Ashworth and I head up Investor Relations here at National Grid. We're very pleased to have so many of you joining us today. I hope you're safe and well.

Firstly, I would just like to draw your attention to the cautionary statement at the front of the presentation.

Now, moving on to today's event. It's being filmed remotely and in line with all current lockdown restrictions. I'll shortly hand over to our CEO, John Pettigrew. But before I do, just a few housekeeping points, we want today to be as interactive as possible. And we welcome your questions. After we've heard from John and our four subject matter experts, we'll open up for a live, audio-only, Q&A.

To participate, you have two options. Firstly, you can ask our speakers a question live using the phone numbers on the screen below. The numbers will be shown on the screen again after the presentations. Alternatively, you can use the ask a question text box in your webcast screen at any time during the presentations. Questions submitted through the text box will come to me and I'll read them out during the Q&A. They won't be visible to other participants. Please state if your question is for a specific speaker and also if you'd like me to read out your name or remain anonymous.

All materials, and a recording of today's event, will be available on our website later today. And you'll find a glossary of terms available in the download section of your webcast screen.

As always, myself and the IR team are available to assist you however we can.

So without further delay, I'll now hand you over to our CEO, John Pettigrew, and our panel of experts, John.

. . . . . .

John Pettigrew, Chief Executive Officer
Thank you, Nick, and welcome to our Future of Gas event, the launch of our 'Grid Guide to…' series of investor events. Joining me on the call are leaders and subject experts from our US, UK, and National Grid Ventures businesses.

The purpose of this programme of events is to enable you to learn more from our experts about the areas of work we are undertaking as we advance the Energy Transition.

Today, our objective is to share with you the pivotal role we see for gas and our gas infrastructure assets as we transition towards net zero and meet our environmental commitments.

We see gas as an incredibly important part of the Energy Transition. To give some context, gas delivers around three times the final consumer energy demand of electricity in the UK and across our US regions. And today, over 60% of the homes we serve in the US and over 22 million households in the UK use gas for heating.

This means that, in the UK alone, to switch from gas to electricity by 2050, would require nearly 20,000 homes to be converted each week from 2025. And in the US, with 3.6 million gas accounts, it would mean 2,300 conversions each week, many of which are in dense, urban areas such as Brooklyn.

Given the cost and disruption in doing this, we expect gas to continue to play an important role for decades to come. But it's not just residential heating, we also see gas continuing to play a key role in tackling the challenges of decarbonising industry as well as transport in areas such as heavy goods vehicles and shipping.

Bringing this together, there's a growing amount of research that points towards a balanced approach to net zero. For example, in the UK, the Future Energy Scenarios, work carried out by the Electricity System Operator and work by the Independent Committee on Climate Change shows that a mosaic of solutions can be more cost-effective in the long run rather than just a greater focus on electrification.

In the US, we recognise that work still needs to be done to demonstrate the benefits of gas in the Energy Transition. We serve 3.6 million gas customer accounts across New York, Massachusetts, and Rhode Island and about half of our $26bn rate base is gas distribution, which is why we are working ever more closely with policymakers to underline the role gas networks can play in the future.

To demonstrate this, next month we will publish a piece of research undertaken in collaboration with New York City's Mayor Office and Con Edison. This in-depth analytical assessment, the first of its kind, will focus on the strategies that the city and utilities can use to reach net zero emissions.

It will show that a portfolio of solutions is required to deliver carbon neutrality, from increased energy efficiency through to reducing barriers to solar and storage. But most importantly for today's discussion, the report will show how the gas network in New York can be reimagined to deliver increased of volumes of cleaner low carbon gas in the future.

It will show how existing gas infrastructure has a key role to play in reaching net zero emissions.

I'm proud of the role National Grid played in his ground-breaking work and the shared purpose we have in achieving lower emissions with the city, policymakers, and our peers.

However, whilst we continue to work on long-term solutions across our US gas businesses, near-term focus will remain on balancing the need to invest with safety and reliability. We continue to work with regulators to agree multi-year settlements which will provide longer term visibility for our investments, greater protection against cost pressures and more incentives to innovate and create value for our customers.

So today, you will hear from Cordi O'Hara and Sheri Givens, who will discuss some of our innovative clean gas projects, in particular, renewable natural gas and hydrogen and how we plan to scale these up across our jurisdictions using existing network infrastructure.

In the UK, we own the high-voltage electricity and high-pressure gas transmission networks, with our gas transmission assets making up around 30% of our UK regulated asset base.

Given this, we are pleased that the recent legislative and policy announcements have highlighted the role that gas needs to play across both heat and wider industrial decarbonisation. With most of the detailed policy in this area having been developed in the last 18 months, it shows the pace that positive change can be achieved with collaborative stakeholder alignment.

The Prime Minister's 10-Point plan followed up by the Energy White Paper sets out ambitious targets, recognising gas has a critical role in maintaining energy security and being a major contributor to the economy.

It targets the scaling up of low carbon hydrogen by 2030 as well as moving forward in new carbon capture and storage clusters.

So today, you will hear about how we're supporting the Government with the strategies, from Tony Green on the progress we're making to enable our gas transmission and infrastructure to transport hydrogen and from Martin Cook on the work National Grid Ventures is doing on CCS to enable zero carbon clusters, as well as the potential for the Isle of Grain to become a hydrogen hub.

Again, what's clear within all of these recent policy initiatives is the strong focus on ensuring there is a balance of technologies and the complementary role electricity and decarbonised gas networks need to play long into the future.

We are fully aligned with these goals and continue to work closely with all stakeholders to shape policy.

Whilst the challenges facing our gas transmission assets in the UK and our gas distribution assets in the US do have some differences, we are confident our projects that you'll hear about today are addressing these and there are many learnings we'll be able to share across our businesses as we go along on this journey.

At the end of the presentations, there will be plenty of time to ask our experts any questions that you may have. I'll be happy to answer any overarching Group questions on gas, but please use the time to get a better understanding of our projects from Cordi, Sheri, Tony, and Martin.

So, in summary, I'm excited about the future of gas and the role it will play helping to accelerate progress to net zero. I'm pleased we are working collaboratively with government, regulators, and industry bodies to find the best solutions. And as these government and regulatory policies become clearer, the investment levels needed to deliver them are also becoming more evident.

And finally, I'm proud of the achievements that we've made to date and delighted to showcase these with our technical experts.

With that, I'll hand over to Cordi, who will take you through how our US business has been addressing these challenges.

. . . . . .

Cordi O'Hara, Chief Operating Officer, US Gas
Thank you, John. And welcome, everyone. I'm Cordi O'Hara, Chief Operating Officer of our US gas business and joining me today is Sheri Givens, our Vice President of US Regulatory and Customer Strategy.

Our focus for this session is on our US gas business' decarbonisation agenda. I'm excited to share our progress on transforming our gas network today into the energy network of tomorrow.

But first, let's remind ourselves about the size and scale of the business. We have a diverse customer base of 3.6 million gas customers and a network of over 36,000 miles of pipelines across New York, Massachusetts, and Rhode Island.

We also own and operate 12 LNG supply facilities, delivering peak winter supplies in all three jurisdictions.

We continue to have strong investment drivers, from pipeline safety and compliance, including leak-prone pipe replacement. We also continue to invest in the network to ensure reliable service as customer demand continues to grow.

Over the next five years, we project a base case compound annual growth rate of 2% per year across our service territories for peak gas demand.

The US gas business is focused, not just on providing safe, reliable, and affordable service to customers today, but also in playing an integral role in planning and delivering a decarbonised future.

Now, at a national level, the US has not yet adopted greenhouse gas emissions reduction goals or clean energy policies comparable to the UK and consistent with deep decarbonisation.

However, our business operates exclusively in three states that each have ambitious long-term decarbonisation goals. The two states that comprise the vast majority of our gas operations, New York, and Massachusetts, have both upped their ambition to net zero targets for 2050, with Rhode Island at an 80% reduction by 2050.

Each state has or is in the process of setting medium-term targets of roughly 40 to 45% reductions in greenhouse gas emissions economy-wide by 2030.

Now, within this context, National Grid has both made a commitment in our Responsible Business Charter and has a set US-specific net zero ambitions consistent with our state's emission reduction goals.

Our published plan outlines the key pillars that support the achievement of net zero. We see our gas network as an energy system that delivers molecules to our customers and, by 2050, the source of those molecules will be very different.

Specifically, our net zero plan focuses on building on our nation-leading energy efficiency efforts, continuing to reduce the fugitive methane emissions from natural gas, both upstream and from our own networks, transitioning away from geological natural gas to low-carbon fuels, in the form of renewable natural gas and hydrogen, and exploring heat electrification in ways that complement the gas network, for example, gas-electric hybrid heating and new geothermal district energy systems.

In terms of preparing the business for the future of gas, we think of gas network decarbonisation as moving along stages of industry maturity. The level of interest and investment in gas network decarbonisation and the scale of green gas technologies grows as the level of maturity in the policy discussion, stakeholder understanding, regulation and the industry progresses.

The US and UK markets are currently at different stages of maturity. However, we are following a similar trajectory, sharing learnings internationally. The UK examples that Tony and Martin will share later show the scale of demonstration projects and future potential in front of us.

So far in the US, our states have focused mostly on emissions reductions in the electricity generation sector. And gas utilities have progressed agendas on both expanding energy efficiency programmes and reducing emissions whilst promoting affordability through oil to gas heating conversions, where ongoing potential remains in our service territory.

However, most recently, attention in our states has pivoted to reducing emissions from building heating and thus from gas networks. This has created momentum in two key areas. Firstly, evolving gas utilities supply planning and second, studying heat decarbonisation pathways to inform policy development.

On supply planning, our regulators and stakeholders are increasingly interested in how we can forecast our gas demand and plan our gas supply network investments in a way that reflects potential departures from business as usual. How we can leverage non-traditional options and demand side solutions as non-pipe alternatives to new gas infrastructure.

We have made strides in the past year both in downstate New York and Rhode Island, in advancing our capabilities and internal processes to accommodate multiple future gas demand scenarios and to look holistically across a wide range of options to meet future customer requirements.

As for studying heat decarbonisation pathways, there is significant interest, from both academia, environmental groups, and other key stakeholders. With varying views on most pathways now starting to be published, it is still early days and different long-term decarbonisation pathways remain open.

So, at present, we have tremendous opportunity to shape this debate. For example, with the future of gas proceeding in Massachusetts in its early stages now.

Our efforts here, that Sheri will share in detail, are intended to help better align our stakeholders on preferred pathways and to create a supportive policy and regulator commitments that will enable us to scale up investments in gas network decarbonisation and leverage new internal capabilities.

Getting to net zero is a fundamental transformation of our entire economy. And we believe we can leverage our existing infrastructure to make the transition to a net zero economy a cost-effective pathway.

Let me now hand over to Sheri, who will take you through our activities related to gas network decarbonisation focused on renewable natural gas and hydrogen.

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
Thank you, Cordi. At National Grid, we see our gas network as an energy system that delivers molecules to our customers. And by 2050, the source of those molecules will be very different.

Our network is an existing infrastructure that is already connected and delivering energy to millions of homes and businesses across our three states and we need to focus on our customers, their bills, and their concerns.

We want to decarbonise our gas network by scaling existing and commercially available technology to produce renewable natural gas or RNG from sustainable biomass feedstock and further lay the foundation to add hydrogen as part of our energy supply.

First, I'll touch on our efforts related to RNG. Building on our 40 plus years of experience and adding RNG to our network and working through our public-private partnership with New York City Department of Environmental Protection, we will soon be injecting RNG produced from the largest wastewater treatment facility in the city, Newtown Creek, adding additional feedstock from food waste, which will boost the biogas production.

The project will produce enough energy to heat approximately 5,000 homes and reduce CO_2 emissions by approximately 90,000 tonnes annually, equalling the removal of about 19,000 cars from our roads.

We are also working to eliminate one of the biggest technical barriers, interconnection, for RNG project developers that want to attach to our network. A few years ago, we started working with key industry stakeholders and other utilities in New York to develop guidelines based on good science and common sense.

Now, let's take a look at our hydrogen efforts. RNG from biomass will not be enough to get us to net zero and that's where hydrogen comes in. We see hydrogen as the low carbon molecule of the 21st century and we are laying the foundation over the next several years to advance its deployment.

We have many partners on this journey, we will be working with them on demonstrations, research, development, and stakeholder engagement. Were currently working with the New York State Energy Research and Development Authority, NYSERDA, and New York's Stony Brook University on a first-of-its-kind demonstration in the US that will include the production of hydrogen by zero or negative carbon means to be utilised for storage and powered gas.

It will produce RNG for use in the company's gas distribution system and any excess hydrogen produced will be used to generate revenues to offset the cost incurred. Up to 10% of the hydrogen can be blended with RNG for use as well.

We are also partnering with the Centre on Global Energy Policy at Columbia University in New York on a new hydrogen programme that will tackle three core aspects of hydrogen development and deployment, technology, and economics, use cases, and applications, and policy design.

The programme will engage business, industry, and government leaders by creating a new technology lab and developing various hydrogen roadmaps.

And we are pleased to announce we recently joined the Low Carbon Resources Initiative, being led by the Gas Technology Institute and the Electric Power Research Institute. This five-year initiative is intended to focus on the large-scale deployment of technologies, including those associated with hydrogen and RNG that will get us to 2030 and beyond with the 25 plus utility industry partners.

Many of our stakeholders are not yet aware of these technologies or how they can play a role in a net zero world. Therefore we will continue to actively engage with them and work with them to ensure that appropriate policy and regulatory frameworks are developed to support these technologies.

Next, I'm going to provide you with an overview of what we proposed in our states and what we intend to do in the coming months to support a net zero ambition.

Internally, we are ensuring that we are building our business capabilities and streamlining our processes to support scaling of these initiatives. We have built internal teams to support the project interconnections, design, scoping and feasibility assessments that our partners will need. We've made a number of proposals which are currently pending before our state regulators.

In Massachusetts, we are looking at a hydrogen production blending campus, the programme will include the identification and securing of one customer-owned energy system, serving a campus environment, such as a university or industrial park, with the campus being adjacent to a portion of the company's service area with residential or light commercial neighbourhoods.

In New York, we are seeking incentives to support the integration of RNG projects into our network. Based on feedback from RNG developers, we think that lowering interconnection cost will encourage the development of third-party projects in our service territory. This incentive will help with the installation of interconnection equipment, such as meters, analysers and odorisation equipment at individual RNG facilities.

We also proposed a hydrogen demonstration project for our multiuse hydrogen facility in upstate New York. The project will be in partnership with Standard Hydrogen Corporation, located at an industrial site along with a carbon capture utilisation sequestration pilot.

In Rhode Island, we've recently filed an amendment to the Advanced Gas Technology Programme that will broaden the use of the programme to support future decarbonisation projects, including hydrogen.

So, what are we doing next? We want to begin procuring RNG to serve our customers. With this in mind, we are asking our state regulators to allow us to include RNG as part of our supply portfolio.

This programme would start with very small volumes of RNG to ensure that we can manage the costs associated by introducing a source of energy that is currently at a premium to natural gas. We expect these volumes to increase over time as costs decline.

The goal is to expand these recruitment programmes to all of our operating customers in each of the state that we operate in.

We are also looking at the policy frameworks that can support the scaling of RNG and hydrogen investment. We need to look at how market-based programmes, like a renewable portfolio standard can be used to build the supply and demand of these low-carbon fuels.

We need to consider standardisation and streamlining of interconnection procedures. We need to think of other policies that can help address the unique challenges of our cold weather climate.

Finally, we are looking at progressing our research through partnerships. Notably, the recently announced US Department of Energy-approved HyBlend Project, which I'll go into further detail about.

We realise the need to begin advancing hydrogen in the US, to see the same kind of development that we have seen in Europe and other countries globally.

Recently, we shared the news that the US DoE had allocated $12.5m to stand up a new industry collaborative, the HyBlend Project, to support accelerated research on blending hydrogen into natural gas distribution systems. The funds will primarily be allocated to six national laboratories, each with its own area of focus, and will all directly support our future of gas activity. Others involved include Pacific Gas and Electric, Southern Co and Shell.

The project high-level objectives include evaluation of hydrogen compatibility of pipeline materials, life-cycle emissions, analysis of technologies and a techno-economic analysis to quantify cost.

To summarise, we believe that we can evolve our energy networks, including a gas networks, to serve a net zero future. What we've talked about here is how we want to build the experiences around the world to look at new technologies, adapt them for what we need in our region and continue to serve our customers safely, affordably, and reliably.

I will now hand it over to Tony Green, our Project Director for hydrogen in the UK.

. . . . . .

Tony Green, Project Director, Hydrogen
Many thanks, Sheri. And good afternoon, everybody. My name is Tony Green, I'm the Project Director for Hydrogen for gas transmission in the UK.

As John referenced in his introduction, we've been making some significant advances on hydrogen here in the UK, particularly with some very key messages from the UK Government in recent months.

Here at National Grid Gas Transmission, we are really playing our part in the HyNTS programme has been in process now for around three years and we are making some terrific advances as we look at the options for repurposing our gas network as we move towards net zero.

We are working very extensively with Government and we're collaborating with a wide range of stakeholders, both here in the UK and in Europe, to find the right solutions and maximise the opportunities and to share knowledge and research as we work our way through the various options as we look towards hydrogen.

So, in this presentation, I'm going to focus on two key projects that we are kicking off in 2021. That's the Future Grid Project and Project Union.

But I'd like to start just by setting the scene, looking at some of the key questions around repurposing of the UK gas assets.

On the left-hand side of the screen here, there's a few notes around the studies we've been doing around network capacity. Hydrogen has a third of the calorific value of natural gas, so we need more volume in order to carry the same energy load. So we've been looking at the 2050 energy demands in terms of hydrogen and we've been modelling those in our current network to see if we've got the right capacity.

And the good news is, we can carry the capacities that we are anticipating in 2050. We will require some reinforcement and obviously, as demand for hydrogen increases, we will probably have to put more investment in and provide more reinforcement in the network. But it's very positive that we can broadly carry the levels that we need already.

The other key question is really looking at how ready are our current assets for carrying hydrogen. So we've been doing a survey with our key suppliers, looking at all of our equipment that's out there on our network today and really looking in detail, can those assets carry hydrogen today? Could they carry the hydrogen with some retrofit? Or do we have to do some fundamental research?

And, in a typical red, amber, green display, green being good, you can see that, broadly, we've got a very good picture of our assets already from our first cut. From that, we've now got to build up our research base, build up our risk models so that we fully understand any potential risk.

All of this has really culminated, then, in developing Future Grid. This is a hugely exciting project that we're kicking off this year.

We've just received, in December last year, funding from Ofgem, for £9.1m
for us to build Future Grid. Now, in Future Grid, we're going to decommission some of our assets this year from around the UK. And we're going to reconstruct them in an off-line test environment, at DNV GL's test site up at Spadeadam in Cumbria. This will allow us to connect with H21, which is Northern Gas' distribution network. And also the HY Street houses, which are being used by the BEIS programme for HY4Heat to research the use of hydrogen within a home.

So, within the Future Grid network, we're going to be able to demonstrate transmission through to distribution, all the way down to hydrogen within a home.

We've got a number of partners on this project that you can see across the bottom of the screen. We're going to be working over the next two years to develop this programme, it's going to take is about a year to build the construction.

And what I'd like to do is just focus in, first of all, on the HY Street houses that you can see. And when I bring that image up, that could be any terraced street anywhere in the UK. If I just change the image again and move forward you can now start to see that this is quite a unique set of terraced houses. It's on a test site in a very unique area. And from this, we will then build the distribution network and the transmission network around it.

If I just move the image on again, we'll look at an aerial view of the site. If I just bring up the other piece of animation, you can see where the HY Street houses are, where the H21 distribution network will be and then that shaded red area is where we are going to construct Future Grid.

That, hopefully, gives you an idea of the sheer scale of what we are proposing to build here.

What I'd like to do now is to zoom in a bit more on a schematic on the next slide because it will allow me to explain the facility in a bit more detail. Essentially, it's a loop. It's a loop of large diameter, 36-inch diameter, a steel main. It's going to have assets that represent our national transmission network. So, we are decommissioning assets from around the country.

As I cycle through the animation here, first of all, the entry point. We've got a couple of choices of which entry point we might decommission and bring into the site.

Just to give you an idea, again, of the scale. One of the potential entry points is from Billingham, a former ICI site near Middlesbrough. To bring that site in will be 10 to 12 heavy goods vehicle movements. So, it's an incredible piece of equipment that we are bringing in just for the entry point. So it will be filters, it will be flow meters, all the equipment that we need to demonstrate a representative sample of the assets.

So, as I cycle now through the animation, block valves will come from around the country, pipelines will come from around the country and we'll select a suitable exit point.

So, we'll be able to create a complete loop, we'll be able to run gas around the network and what we plan to do is start with 2% hydrogen, then work up to 20% hydrogen and 20% is really important because we believe that is the level that domestic suppliers can go to in the UK without changing any boilers or burners.

We'll then take the network all the way up to 100 percent and trial it at those levels.

So, this programme's going to take us around two years. We will be going through the testing processes in the latter year and then we've got two later phases, which I'll show you on the next slide.

We will look at the potential of the deblending of hydrogen. If we put a blend in of, say, 10%, can we actually de-blend it and protect particular suppliers? For example, a power station that couldn't take hydrogen in the early years.

In the later phases, we're going to open up the site to third-party testing. There's a lot of development going on in the hydrogen world and all of that equipment is going to require testing, so opening up our site to be able to use the test facility to bring forward that new technology will be very key.

All of that then feeds into the online trials. And ultimately, we want to start putting hydrogen into our live network in a safe way such that we can evaluate the options for moving forward and converting the assets.

And that's where the next project comes in. That's Project Union. Now, Project Union is to identify a potential hydrogen backbone for the UK. The benefit of a hydrogen backbone is that we can start to look at where the current industrial clusters are, which is where we will see blue hydrogen production start and decarbonise the industrial loads.

By looking at a hydrogen backbone that joins those networks together, we can then start to flesh out what a wider hydrogen network would look like the UK.

On the next slide, I've got a map here of the European hydrogen backbone. This was published by Guidehouse back in July last year. I bring it up because it's quite interesting because it's a parallel piece of work to our own work. And they've made some interesting conclusions.

They've shown that by - 2040 they can have a 23,000-kilometre network and they reckon they'll be able to convert around 75% of the existing network to carry hydrogen. So, that means only 25% of new build pipeline. That's heavily biased, actually, by some very large pipelines across the north of Spain and the south of France. I anticipate we will probably need less new build, but we'll wait and see.

They have also analysed the fact that a repurposing cost is around half the cost of a new build.

So, those are some really interesting numbers as we start to explore what our hydrogen backbone could look like.

We've actually now joined this project. I was working on Project Union, which I can bring up now on the next slide. You'll see on the next slide here that the backbone runs largely down the east coast of the UK, picking up Grangemouth, Teesside and Humberside clusters and then works its way across the country to pick up the North West and the South Wales clusters.

There's two key points on this backbone. The first one is the link over to Bacton. I don't know whether you notice, but on the European hydrogen backbone, they highlighted the fact that the two interconnectors that come into Bacton are options for future conversion to hydrogen, so our hydrogen backbone is connecting with that.

And the second one is the link down to the Isle of Grain and project Cavendish, which we've been working on over the last couple of years and my colleague, Martin, will talk to you more about Project Cavendish in a few minutes.

So, we are now working on some of the routing options, some of the pipeline options as we develop Project Union. And that's going to be a piece of work that we now do over the next couple years.

So, just to summarise overall, our outlook is looking really, really interesting. We've got an awful lot of work to do over the next few years as we develop the technical evidence, and we develop the market around the move to hydrogen.

The UK government has been really clear, it wants to make a decision around the future of heat circa 2025. So it really does emphasise the amount of work that we've got to do so that the off-line facility that we are building now is incredibly important so that we can then start to look at what the options are for the live network.

We are not doing this on our own. Other countries, particularly around Europe, are all on the same journey. We've formed the H2GARG, the Hydrogen Gas Asset Readiness Group, with seven other TSOs around Europe. We are actually collaborating very heavily, bringing research in, and sharing knowledge as we are on this journey together.

The good news is that the NTS, as it exists today, has largely got the capacity we need, but we are going to see the need for more reinforcement as the demand for hydrogen grows and we're really looking at the options overall as we develop the readiness of the network.

So I do anticipate that the conversion will begin with a backbone, joining the industrial clusters really makes sense. And then we can look at how we might convert domestic use of gas and link the gas distribution networks at a later date.

So lots to do over the next few years. We are very ready to play our part as we work towards net zero.

At this point, I'll hand over to my colleague, Martin, who will take you through the work that National Grid Ventures have been doing.

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Hello. My name is Martin Cook and I'm the Business Development Director for National Grid Ventures.

I'd like to tell you about a couple of projects we're developing in National Grid Ventures.

Firstly, some context and background. I think it's fair to say that it's now widely agreed there is no credible means of the UK delivering net zero by 2050, without hydrogen and without CCUS. And the Government's

recently published its 10 Point Plan and subsequently the Energy White Paper, which includes, amongst many other things, the political ambition for these two technologies.

For CCUS, there is the aspiration to see ten million tonnes of CO2 being captured and stored safely per annum by 2030. And for hydrogen, it's to have five gigawatts of low carbon hydrogen being produced by 2030, plus the installation of 100% hydrogen network to displace gas for heating and cooking across a whole town also by the end of the decade.

The government has made a commitment to develop business models for both CCUS and hydrogen over the next year and significant development funding, £1bn for CCUS and £240m for hydrogen has been promised.

National Grid ventures are involved in a lot of work to support decarbonisation of electricity supplies, but I'm going to focus on a couple of projects that we are involved in in the UK around CCUS and hydrogen which have the potential to make a material impact on the UK's road to net zero.

The first is Project Cavendish, where we brought together a consortium of energy companies that have an interest in developing at-scale hydrogen production and can provide a base load demand for the hydrogen.

It's based on the Isle of Grain in Kent and will initially look to build up to one gigawatt of blue hydrogen production capacity. So, that is hydrogen produced through breaking the carbon atom with natural gas, which is called methane reformation.

The hydrogen will initially be used by the local CCGT power stations as a fuel. Then the trials taking place by Tony and his team into hydrogen and methane blending will hopefully mean that we can blend any surplus hydrogen produced not needed by the power stations into the NTS or LTS gas networks.

And then, the plan is that this demand will anchor at scale hydrogen production in this area.

And then, looking longer term, as demand grows, there is the potential to build 100% hydrogen pipelines along the Thames Estuary and on to London.

One of the advantages for Project Cavendish is its location and its combination of assets. From a strategic perspective and its location on the network, but also from a geographic perspective in that it is the only hydrogen project of any significant size or scale currently being developed in the South East.

For those not familiar, the Isle of Grain is in Kent and it's about 35 miles from the centre of London. This is an aerial view of the peninsula. As you can see, there's already a huge amount of energy infrastructure on the peninsula, much of it owned by National Grid.

As well as robust gas and electricity networks, the Peninsula is also home to an LNG storage facility, which is the largest in Europe, three major gas fired power stations, which will provide an initial demand for the hydrogen that will be produced and it also has the electricity transmission infrastructure required to allow offshore wind to connect, providing a potential source of power for green hydrogen in the future.

We also own a large amount of land and we've earmarked around 90 acres to the project, which includes access to the waterfront and the jetty.

Key to the production of blue hydrogen is the ability to remove CO2 that is captured as part of the process and the deep-water port and jetty allows the CO2 to be transported away from site by boat to one of several permanent sub-sea carbon storage facilities being developed by other projects, such as the Humber region that I will come on to talk about in a minute.

The second project I'd like to talk about is Zero Carbon Humber, which does include hydrogen, but is more significantly focused on carbon capture and storage and the ambition to create the UK's first net zero industrial cluster.

A bit about the Humber. The Humber region contributes £18bn to the UK economy, supports 55,000 manufacturing jobs and is home to 25% of the country's refinery production. It also hosts over 100 chemical and refinery companies.

As a result, the Yorkshire and Humber region is the most carbon-intensive region in the whole of the UK, emitting over 10 million tonnes of CO2 each year.

So, the government had identified the need to incentivise the development of solutions to decarbonise hard to obey areas of industry and launched the process in the second half of 2019.

As part of that process, we've been leading the development of the largest CCUS infrastructure project in the UK, centred on the Humber, which is more latterly combined to also include Teesside.

Now this is part of a Government supported initiative to bring forward schemes to decarbonise industrial clusters in the UK and you can see the other clusters on this map.

In order to support what is essentially a new industry, the government has earmarked a £1bn fund to develop these initiatives. It's a competitive process, but with strong indications that at least four of these clusters will be supported through to the next phase. Announcements should be made shortly confirming which regions will be supported.

Again, similar to Cavendish, we've brought together a strong consortium of industry players. With the main players in our initiatives being ourselves, BP and Equinor.

Turning to the Humber in a bit more detail, we are focused primarily on the onshore systems for transporting carbon and the backbone is a CO2 and potentially a co-located hydrogen pipeline.

The route of the pipelines we intend to build will run close to the major industrial businesses that are likely to want to connect. In the West, it starts at Drax, the UK's largest power station, passing by Keadby power station, British Steel and onto Immingham, which is home to a third of the UK's refinery capacity. And then over to the estuary to Salt End.

Then at Salt End, Equinor's ambition is to build a 600-megawatt blue hydrogen production facility that will support the decarbonisation of Salt End Chemicals Park.

The onshore CO2 pipeline will reach the coast at Easington and then travel out to sea to store carbon in a sub-sea reservoir.

If we zoom out a bit, you can see that once the pipeline reaches Easington on the coast, the CO2 will then be pressurised to dense form and piped out to the sub-sea store known as Northern Endurance.

The Endurance store was appraised by National Grid as part of a previous project known as White Rose and the store licence is now jointly held by ourselves, BP and Equinor.

In recent months, we've also come together with the Teesside industrial cluster, so together with our partners in that project, we are proposing to deliver a solution for both the Humber and Teesside industrial clusters.

The combined Humber and Teesside abatement of carbon would represent more than a third of the total industrial emissions in the UK. So this is going to make a material difference to the UK achieving climate change targets and will also protect and create thousands of jobs in the North East of England.

So, in summary, we have seen a real step change in the last six months in the appetite and ambition being shown in the hydrogen and CCUS space in the UK. 2021 is a very important year to continue the momentum on these projects and a critical milestone will be the finalisation of business models that underpin both carbon capture and hydrogen so that we can assess the investment opportunity.

And with that, I will now hand back to Nick.

. . . . . .

Questions and Answers

Nick Ashworth, Director of Investor Relations
Thanks Martin and welcome to the Q&A part of the event.

So as a reminder and for those who may have been a little bit late onto the call there are two ways in which you can ask our speakers a question. Firstly through the ask a question box at the bottom of your webcast screen. If you use this option, please state if the question is directed towards a particular speaker and whether you'd like to be attributed or not and we will read it out before answering it.

Then secondly, if you want to ask a live question you can dial in using the number on the screen in front of you.

Finally, I just want to flag that at the end of the Q&A session we will be announcing the next Grid Guide To event.

So without further delay I'll now hand over to our operator Nadia, who will go through the audio call instructions before we take our first question.

. . . . . .

Telephone Operator
Hi there, we have our first question from Elchin Mammadov, from Bloomberg. So Elchin, please go ahead.

. . . . . .

Elchin Mammadov, Bloomberg
Hi there. Thanks for taking my questions, I have three, but if it's too much just answer the two that you want. General questions to nobody in particular.

The first one is on the uses of hydrogen, I mean the current focus seems to be on industrial processes like refineries which you mentioned, metal smelters and what not. How about decarbonising heat and transport, do you think we're talking about like 10 or 15 years from now, or is it going to start around the same time as the industrial demand?

The second question on a similar use of hydrogen. You've talked a lot about blending and 20% being probably the threshold for household, but there's lots of other utilities that aren't in hydrogen from a power generation side that are saying that hydrogen blending into the grid, including hydrogen to power is too expensive. Do you think the economics will stack up, because again the other utilities are mostly focusing on decarbonising industrial processes at this stage?

And the final question is on green versus non-green hydrogen, I mean do you think non-green hydrogen will play a big role. I mean you mentioned the Humber Cluster for example, but where do you think the split is going to be in ten years' time or so? That would be quite interesting to hear. Thanks a lot.

. . . . . .

John Pettigrew, Chief Executive Officer
Thank you Elchin, it's John Pettigrew here. Let me answer the second question and then I'm going to ask Tony if he could pick up the first question on use of hydrogen, industrial versus heat and transport and then I'll ask Martin to pick up on green hydrogen.

In terms of your second question, as you heard from Tony, you know there is an awful lot of research and evidence that now points to the fact that we believe we could safely blend hydrogen to provide to domestic customers up to 20% and of course the benefit of that is the avoidance of having to do appliance changes.

In terms of industrial and power generation, I think our view is that there's an awful lot of work that needs to be done over the next couple of years and hopefully you picked that up from the presentation in that there's an awful lot of pilots and technology development that is needed. And our expectation is that as that technology develops and as those pilots come through and as we see an increase in utilisation as we've seen with solar and as we've seen with storage, we would expect technology prices to come down and therefore hydrogen to become more competitive.

You're right, today it is not as competitive as the alternatives and that is one of the challenges that of course we're gong to have to face as we work out what the right road map is gong forward.

So with that, let me hand over to Tony to talk about the first question.

. . . . . .

Antony Green, Project Director, Hydrogen
Yes, thanks Elchin. I mean the question, yes, we're absolutely starting with industry, because that's where obviously the greatest opportunity to decarbonise most quickly lies. But we do use an awful lot of energy across the heat landscape and clearly hydrogen has an opportunity there.

That will very much come once we start to see larger quantities of green hydrogen flowing through. And I think it's where green hydrogen starts - it's actually around the transport sector. So I think there are a number of threads that need to be pulled here. I think we're going to see a focus on industry first. We're working through the heat decarbonisation piece. But decarbonisation of transport, utilising green hydrogen in the early days.

When I say transport, I'm thinking here particular of heavy goods vehicles, large fleet vehicles where electric vehicles don't really scale very well. So I think there's quite a bespoke unique use there.

So as for green and non-green hydrogen I'll pass over to Martin to pick up on that one.

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Thank you, Tony. Yes, so there was a lot of debate in the market and industry about blue versus green hydrogen and I think our government has been involved in that and clearly has recognised actually, blue hydrogen is going to be an important step. Will we see green hydrogen in the future? Of course I think we will.

There is a gap in the technical development of green hydrogen, so, you know, it's probably towards the end of this decade before we'll see at scale technical deployment of hydrogen at economic costs, I think. And also that will actually marry quite nicely I think with the ambitions of the UK in terms of the amount of offshore wind we're going to deploy. So by 2030 if we've added another 30 gigawatts of offshore wind, that will couple quite nicely I think properly with the development of green hydrogen technology.

So that's the way we see it and I think that's why you're seeing actually quite a lot of support for blue hydrogen and carbon capture and storage by the UK Government.

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
And this is Sheri I'd like to ...

. . . . . .

John Pettigrew, Chief Executive Officer
Go on Sheri why don't you give a US perspective on it.

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
Thank you so much John. So from the US perspective I think it's important that we point out that we're early days in the maturity curve on hydrogen. We are very seriously considering hydrogen for heating. It's important that we look at partnerships. Some of the partnerships that I referenced like the Low Carbon Resources Initiative, our work with Columbia University Centre for Global Energy Policy and other entities that are looking at these areas.

Right now we're thinking though different projects that we can do, demonstrations that we can do, working with our stakeholders and our government entities. Working with the US Department of Energy's Hydrogen at Scale, looking at different initiatives where we can really analyse what is the level of capacity of hydrogen that we can actually accept in our current pipeline network.

So I just wanted to make sure that we added that in that we are very seriously considering hydrogen for heat in the US.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Sheri. I'm going to take a question that's come through on the web. This is from Deepa at Bernstein.

Can you talk about the various UK Government timelines relevant to the future gas heat strategy in 2021, what percentage of the NTS is H2 ready per the heat map in Tony's slide?

Thank you for that Deepa, as we all know the government recently published its White Paper, which set out and I think put a bit more flesh on the bones to the statements that the Prime Minster made with his 10 Point Plan a couple of weeks before that. And in that there is a host of consultations. One of the things that we're very much looking forward to is the heat strategy with BEIS told me is due to come out in the very near future.

But Tony if you could pick up and perhaps provide some more detail?

. . . . . .

Antony Green, Project Director, Hydrogen
Yeah, the other piece of government timeline we're expecting in the future actually is the hydrogen strategy which will obviously inform an awful lot as we go forward. So we're very much in the proof phase of what the options are as regarding rolling out hydrogen and I mentioned 2025, that's the timeframes that they're looking to make that decision.

So just picking up on the second part of that question, what percentage of the NTS is hydrogen ready today? That's actually quite a difficult question to answer. We have got to work through the specifics of each individual feeder, so we've done that broad high-level assessment and we've now got to drill down into the detail of some of the individual lengths of feeder that we run. And it's largely down to the materials that we've got, the control systems we've got, we've got to get into that level of detail.

So I'm not comfortable saying the percentage at this point, but that's really my job over the next few years to work out which feeders we will focus on first. I'll pass back to John.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Tony. Again, I've got another question that's come through on the web, I'll ask Sheri if she could answer this from a US perspective. So can you give me a sense of the potential scale of RNG from waste biomass in terms of percentage share of gas demand? Are you looking at other sources for RNG, such as biofuels?

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
Thank you, John, I'd be delighted to answer. So regarding RNG we've actually been injecting it into our system from a landfill since the early 1980s. As I mentioned we're going to be injecting from a wastewater treatment facility in a couple of months that will also incorporate food waste.

We also have quite a few dairy farms in Upstate New York who have contacted us, I think we have about ten projects in the queue, developers with interest with various feedstocks. So we're looking at a variety of developers, a variety of feedstocks to really introduce into our system.

Some of the main factors of course are going to be the cost of the actual feedstock and the cost of the interconnections, we're really trying to work with our developers on these issues and take it up with our regulators and our policy makers are well.

We participated in a study in 2019 with The American Gas Foundation and they found that across the nation about 88% of residential heating could be met with biomethane resources. In our region, the US North East, we think about 10 to 15% could be met by RNG resources and that's really what we're looking to further understand and study in the coming years.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Sheri. Nadia we've got some incoming calls, can we take the call from Mark Freshney at Credit Suisse?

. . . . . .

Telephone Operator
Yes, Mark Freshney, your line is now open.

. . . . . .

Mark Freshney, Credit Suisse
Hello, thanks for taking my questions. Two questions. Firstly, regarding the regulations, I mean ideally, I guess for you, it would be putting the investment into the NG regulated asset base, but are there any other models for remunerating your investments, for example commercial discussions with other parties that are outside of the regulation?

And just secondly, I know John, this was an area that you used to look at, but the gas distribution businesses, some of them more than others have gone through substantial mains replacement programmes. Would that 2030 mains replacement programme have to be complete first before you can risk putting hydrogen into the system? Can you talk about technical capabilities on the distribution end? Thank you.

. . . . . .

John Pettigrew, Chief Executive Officer
Yes, so thank you Mark. Let me just talk a little bit about a sort of broader perspective in terms of business models and then I'll ask Martin perhaps to talk about our views on the CCS industrial clusters and the business models there, and perhaps Tony can talk a little bit about gas distribution and the replacement programme, because you were referencing the UK replacement programme Mark.

I mean certainly from our perspective, you know, as a regulated utility if we are to invest in any form of reimagination or repurposing of the gas transmission system then clearly our preference would be that it would be part of the regulated asset base. As you saw from the presentations, we are at such an early stage of thinking about that that it's too early to talk about what the levels of capex will be. I think it's going to take two or three years before we're in a position where we've got a clear road map as Tony indicated which will then give us some sense of what the investment will be.

What I would say is you know I'm very confident that the longevity of the gas networks is going to go forward for many decades to come, you know when you look at the practicalities and the engineering issues associated with decarbonisation then it's clear that gas has got an important role. And of course the UK network was built in the 1970s, so you're going to see investment for asset replacement as the networks go on. But you're also likely to see investment for repurposing as well.

So with that why don't I ask Martin perhaps to talk about our CCUS work that we're doing on the industrial clusters and the business models associated with that.

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Thank you, John. Yes, for CCUS and the industrial clusters that you were looking at on the charts BEIS consulted on the business model towards the end of last year and just before Christmas came out with a first draft of a regulated business model for CCUS.

So lots of relatively familiar things in there that we're familiar with. There is a clear distinction between onshore and offshore though of course. And the phase that we're in now is continuing in those discussions with BEIS. But yeah, a regulated asset business models that we're relatively familiar with, which we hope will be developed further this year.

. . . . . .

John Pettigrew, Chief Executive Officer

Thank you, Martin. Tony, could you pick up on the gas distribution and the replacement programme?

. . . . . .

Antony Green, Project Director, Hydrogen
Yeah sure. Thanks for the question Mark, I mean you're absolutely right, the mains replacement programme makes a significant contribution towards this, because plastic is a more resilient asset against hydrogen. It gives us a leak free network that we can work with. And the amount of metallics left in the network is one of the key questions. So at the moment the distribution networks are really working through finishing off that mains replacement programme, but they are also looking at any residual metallics in the network.

Northern Gas Networks in particular have been doing quite a bit of testing through their H21 project. There has been a test facility constructed at the HSE's facility up at Buxton, where they've actually been lifting whole sections and whole joins of metallic main and leak testing those to see how resilient those are. So it really does help if we've got more plastic in the network. But they're working through any residual risk of any of the metallics there. But I know my DM colleagues would like to see that whole programme complete.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Tony. Nadia, we've got a question in from Dominic Nash from Barclays, if I could take that on the line please?

. . . . . .

Telephone Operator
Of course, Dominic your line is now open.

. . . . . .

Dominic Nash, Barclays
Good afternoon and thank you very much. A couple of questions from me please. Firstly, on the infrastructure itself around storage, does the increase in hydrogen need different storage to the way that we store natural gas? And does that mean that in both the US and the UK we've got to look at different ways or develop new assets around there to keep our security of supply on hydrogen?

And coming back to the CCS pipeline that you're building between Teesside and Humberside going out, am I correct in thinking - your response to Mark Freshney's question was that that's likely to be on at RAV basis and if so, is that then liable to be caught by the competition clause in the regulation? And if it isn't on the RAV basis how do you get it so that the early adopters of it don't sort of pay too much for the later users of it, because you're obviously going to be building it to be sort of future proof, which I think is a classic issue with infrastructure? Thank you.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Dominic. I'm going to ask Sheri if she could pick up the first question but let me just take the second question first. So in terms of the industrial cluster up in the Humber Dominic, I mean at this stage there isn't clarity in terms of what is the business model for making that investment, which I think Martin was referencing earlier on.

From our perspective with regards to the pipeline we think you know a RAV based model makes a lot of sense and that is what we're feeding into BEIS as part of the ongoing discussions on that. Inevitably, as with all

infrastructure I think as we go forward in the UK there will probably be a debate around whether actually building and owning that asset should be something that's put out to competition.

I think given the work that the consortium has done over the last few years and continues to do I think that you know ourselves and the other members of the consortium would feel that we're very well placed to actually get on with that and deliver it in the timescales that the UK Government has set out. And therefore, it puts us at somewhat of an advantage and somewhat of an advantage for Government as well, because they do want to get on with this as you know because they want to get to significant levels of production of hydrogen by 2030 and they want to move forward with industrial clusters as we saw in the White Paper.

In terms of the first question around storage, perhaps Sheri, could you pick that one up for me?

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
I'd be happy to John, thank you for the question. Regarding infrastructure related to hydrogen and storage I think, again, it's important to stress that we're early days in the US and that is why it's so essential that we work with the US Department of Energy, it's labs, NYSERDA, academic institutions like Columbia and Stony Brook University to really understand the capability of our network and what we need going forward.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Sheri. I'm going to take one more on the line and then I'm going to go back to the web. So there's a question from Sam from UBS.

. . . . . .

Telephone Operator
Sam, your line is now open.

. . . . . .

Sam Arie, UBS
Thank you very much. Good afternoon everyone. Thanks first of all for this excellent presentation today, it's a huge topic and really interesting slides. I feel we're getting educated. So I wanted to say thank you to all the speakers for that.

I also want to try a sort of high-level questions, because I must say still wrestling with these topics it's quite hard from the outside to see how this really plays out over the next sort of decades. Obviously, we're all kind of talking about net zero, but I think, if I take the UK, I think gas supply according to some of your reports was what 80 BCMs in 2019, that's the data I have in front of me, a bit less than 1,000-terawatt hours.

So I'm just wondering, factoring all of this in, going forwards to 2030, 2040, 2050, what do you think the actual usage of natural gas, i.e. old-fashioned fossil fuel gas is going to be on those timeframes? Because I get a bit lost, there's so many good things we could talk about here, hydrogen, CCS, green gas and so on, I get a bit lost actually - what size it's going to be and whether we're really going to succeed in reduce that baseline gas consumption.

So that's my big question for today. And then secondly, I apologise John, but forgive me for throwing this in, we haven't seen you at an event like this since we had the detail of the Ofgem package. So I just wondered if having had time to sort of chew over RIIO 2 in detail you can share any colour with us on how you're looking at

that and whether it feels like a package you're going to be able to accept, or that you need to challenge at the CMA? I know that's a bit off topic, but I can't resist putting the question. Thank you.

. . . . . .

John Pettigrew, Chief Executive Officer
Thank you, Sam, I'll take a couple off topic, but I'll try and keep us all on topic is I can. But I'll take the RIIO 2 one, it doesn't surprise me that it would come up.

Let me start with your first question and the sort of big question around gas. Let me give you a sort of macro answer and then again, I'll ask Tony I think, given it was a UK focused question, to give me his perspective in terms of perhaps the trajectory.

You know I started off in the last question by saying, you know, whichever way I look at it gas has got a really important role going forwards for many decades to done. And I apply sort of an engineering and a practicalities tool to what, which is you know we all know that volumes of energy which goes through our gas networks in the UK is three times that which goes through our electricity network. And therefore is you consider an alternative such as full electrification then the size and the scale of the renewable generation you'd need to build and the network that you'd need to build would be a massive engineering undertaking and that's before you even get to the practicalities of converting 20,000 households per week for the next 25 years and the cost to consumers.

So all of that from a practical person who's been running networks for many years suggest that whatever way you look at it gas has got an incredibly important role to play, both in terms of providing heat and I think as you saw from Tony's presentation in terms of potentially through the blending or through hydrogen providing support to industries, while, particular given the size and scale of the carbon emissions we see in the industrial clusters in the UK.

To give an external perspective on it, I think it was the Committee on Climate Change that said based on their best estimates by 2050 I think they said about 68% of the current throughput of gas in the networks would continue to be there in 2050. It is just a point estimate, but you know they're pretty smart people and do a lot of work in this area. So that gives you can indication of what they're thinking.

In terms of the trajectory, I think it's really hard, but Tony I'll just see if you've got anything to add in terms of the sort of pathway between here and 2050?

. . . . . .

Antony Green, Project Director, Hydrogen
Yeah, I wish I had a crystal ball, it's particularly challenging because I think there are a few effects here. One is there has got to be an energy efficiency effect, which will reduce demand over time. But then the second trajectory is how much blue and how much green hydrogen do we start to generate. Because obviously we need natural gas to create the blue hydrogen. So it comes down really to the volumes of those two aspects and what the cross over is.

So it's very difficult to sort of try and put numbers on it at this point. But I would anticipate that we see natural gas used in blue hydrogen production in the early years with then green hydrogen production coming through later on. So the future for natural gas, whether it's used directly or indirectly to product blue hydrogen I think is going to sit pretty solid for quite some time to come.

. . . . . .

John Pettigrew, Chief Executive Officer

Thanks Tony. So if I could just cover off RIIO T2 and I think a few people on the web have asked a similar question as well Sam.

I mean from our perspective you'll recall that when the draft determination came out there were three key areas that we raised. The first was whether there was sufficient capex for us to be able to deliver a resilient and reliable network, particularly in the context of all the changes we're expecting to see over the next decade.

The second issue was whether the framework itself was really supportive of delivering the investment that was going to be required to align with Government policy and net zero.

And then thirdly of course was the financial package.

Since then of course we've seen the final determination and Ofgem have made some significant moves. We are currently, as you can imagine, working through all of that detail to make sure we understand the implications and consequences for each of those three areas.

On top of that as well, obviously there's the relevance of PR 19 and the latest information that came up from the CMA. So obviously we need to consider that as well because there's some relevance around the financial package their views on that.

But where we are at the moment is, we're working through that. And you know we wouldn't expect to make a final decision until the back end of February early March, so we're not in a position yet to have done that. But we will hopefully make a decision by that sort of timeframe.

Okay, I'm going to go to a question on the web. There's a question from Jenny from Citi. So can you talk about Project Union and Cavendish in the context of RAV growth, or the level of investments and if this is included in RIIO T2?

So why don't I ask Martin to talk about Project Union and Cavendish. Actually Martin you do Cavendish and I'll go back to Tony for Project Union.

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Right thank you John, Cavendish at the moment, no there's no plans for that to be a RAV based investment. Essentially it is a hydrogen production and carbon capture facility down at the Isle of Grain, which would not fall normally into the remit of the regulated asset base. So that would be development probably at this point in time we pursue in National Grid Ventures and not within the regulated business.

So I'll hand over definitely to Tony on Union.

. . . . . .

Antony Green, Project Director, Hydrogen
Thanks Martin. Project Union, we're very much at the concept phase, so the work in T2 is about developing the modelling, the strategy, and the engineering aspects behind it. Where I anticipate to get to is in the latter part of T2, to be looking at pre-feed and feed, potentially on the first section of the network we'd be interested in.

So from a capex point of view in T2 I don't see anything happening. It's more likely to be right at the end of T2 into T3, that's the earliest I would anticipate we'd be looking for any capex. And that's just for the first phase.

These are going to be a number of phases. As I showed on my slide there's five phases there, so it's over a period of time.

. . . . . .

John Pettigrew, Chief Executive Officer
Okay, thank you Tony. There are a couple of questions that have come in on the web, which I'm going to sort of aggregate together, which is really what's the impact of all these initiatives on customer bills.

So perhaps I could ask Cordi perhaps to give a US perspective on how we see customer bill impacts given the investments we talked about today?

. . . . . .

Cordi O'Hara, Chief Operating Officer, US Gas
That's John. I mean it's early days, as I think Sheri has laid out, clearly the cost of RNG and hydrogen production depend on the feedstocks used to create these fuels, including the cost of electricity. And we also know from key stakeholders that there are other considerations we need to consider in terms of bill impact, including cost of connecting products to I guest network. And as you know impact on customer bills is something we've got to be particularly mindful of, particularly in the recent context of COVID.

So we are working through the details of how we can better understand the cost profiles, build, and work through that with regulators into our rate cases and also consider how we can create different market mechanisms which drive down the costs to the customers in terms of integrating these low carbon fuels.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Cordi. One for Martin here, so I'll go straight to you Martin. The Government said they'll provide £1bn to CCUS infrastructure, could you update on this support and how NG benefit from it and the timeline for it?

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Thank you, John. In relation not one of the questions we had earlier actually. In the early drafts of the business models there is the concept that the development and growth of the carbon capture networks in the UK will need to be supported, because obviously from day one, not all customers will be connected.

So there's a variety of ways that £1bn can be used I think to support the carbon capture sector. Firstly, a) to prop up the start of the carbon capture networks that are going to be built, and also maybe to earmark some funding for let's say risk of a first kind in this market, especially with offshore technology. So I mean that £1bn fund and the availability of it is very welcome in the CCUS sector.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Martin. There's a question here which I'll start with Tony in the UK. But I'd also like to get a US distribution perspective, so I'll ask Sheri as well.

The question is, as we targets are fully decarbonised by 2050, will our UK gas transmission network only transmit hydrogen by 2050 instead of 20% max? If yes, how would the gas distribution network manage a progressive increase of that blend?

And then similarly ask the same question in terms of managing that progressive increase in the US gas distribution. So Tony perhaps you could take the UK part of that.

. . . . . .

Antony Green, Project Director, Hydrogen
Okay thanks John. So I think the key thing here is what does a system transformation look like at an overall UK level. And this is where I think we've got to consider a mosaic of solutions as regards to the future of heat where there's a role for some electrification, there's a role for some gas, the future of gas, district heating for example and other sources.

So I think from a conversion point of view where our current thinking is, we'll start with the backbone and then gradually convert out from that. That will allow us to do a phased conversion of distribution networks among the piece. I would anticipate we all start at blends and then work in certain pipelines to 100% and do that in both transmission and distribution.

So we've got to choreograph how we do this because as we move up to the network to hydrogen, we've got to retain network resilience on both the natural gas network and the hydrogen network. So we've got to be very careful how we do the crossover and we're working with BEIS at the moment regarding this whole system transformation piece as to what it needs to look like and all the various components. So a work in progress John.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Tony. A question that I'll throw over to Cordi and Sheri actually. What's your outlook for unifying hydrogen policies, federal over in the US? Is it manageable to generate bipartisan support for policy commensurate to the UK and EU policy? Perhaps at a unifying federal policy what sort of skills do we achieve at a state level? Cordi, would you like to start and then Sheri if you would like to add anything that would be great.

. . . . . .

Cordi O'Hara, Chief Operating Officer, US Gas
Yes, thanks John. So we've been doing a lot of work with all of the relevant regulatory bodies in order to progress different decarbonisation pathways, and then how we can advance the thinking and funding around that. I know Sheri wanted to share some of the detail on that.

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
Absolutely, thank you. So President Biden was just sworn in yesterday as we all know, he has a very aggressive climate change agenda ahead of him. And he actually re-entered us into the Paris Climate Accord which will be effective on February 19th. So we're working with some of his advisors and some of the administration people to talk about decarbonisation at that higher level.

We're also working with our federal congressional members, talking with them about decarbonisation from the gas network, talking to them about hydrogen, making sure they understand where we are along this pathway along our journey. And we're likewise talking with our state regulators helping them understand why is the capacity for hydrogen in our network and in our systems.

And as we work through these different demonstrations, these different research projects with the partners that I've mentioned, we'll be providing results and information on all of the work that we're doing to really, so our stakeholders can be educated and informed on where we're progressing with hydrogen going forward.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Cordi and Sheri. I've got another question on the web here. So what do we see is the biggest source of energy for green hydrogen production in Europe? Perhaps Martin could you take that one?

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Thank you, John. Yes, referencing back I think to an earlier question. The ambitions of the UK in terms of growing its offshore wind penetration in the next ten years will mean that by 2030 we're likely to see quite a lot of excess wind at times in the UK attached to the system.

I think most people envisage at that point in time that that electricity can be used to split water basically and generate hydrogen from oxygen. That will become a major source of green hydrogen at that point in ti me. So that I think is the simple answer.

We may see solar coming into play at some point. But at the moment it looks like if we get the system and design right then green hydrogen, the major source of that could be offshore wind in the future.

. . . . . .

John Pettigrew, Chief Executive Officer
Thank you, Martin. I've got a very specific question it's from Mark at Credit Suisse. I'll hand it to you Tony, but it might go back to Martin actually. But are there any surplus gas transmission pipeline assets that could be used for CCUS, e.g. there are four pipes to go through Scotland to St Fergus, can one or two of them be used for CCUS?

. . . . . .

Martin Cook, Business Development Director, National Grid Ventures
Thanks John. I think Tony would you like to; you're involved directly in some of this?

. . . . . .

Antony Green, Project Director, Hydrogen
Yes, we are actually and that's a question we've been asked as part of the Acorn Project which is the cluster based out of St Fergus. And as people will be aware one of our feeders has previously been looked at for potentially carrying of carbon dioxide. And the questions reopened because if you want to decarbonise Grangemouth how do you get hydrogen to it, or how do you get CO2 away from it?

So we've actually submitted as one of the project partners actually on the Acorn Project for ISCF phase 2 funding. And if we're successful with that we will be doing some of the analysis over the next year to provide some more information on that, into the Acorn Project and really look at the feasibility of that. So work in progress.

. . . . . .

John Pettigrew, Chief Executive Officer

Thank you. Question from Verity from HSBC. From the White Paper and the lack of technology specific 2050 outcomes, do you think the Government has a blueprint, or is a case of whoever develops the viable projects relaxes the funding and be part of the plan?

I think I understand the question Verity. I mean I think from my perspective particularly when I look through the white paper you can see the different pieces of the jigsaw in which the government is making a further commitment to various technologies.

So clearly, they set out an ambition for 5 gigawatt I think it was of production for hydrogen by 2030. I mean relative to energy consumption in the UK that's relatively small, but nonetheless there's a commitment and obviously hydrogen's an important part of the future.

Similarly we've seen the commitments in nuclear. And as Martin's talked about today with the £1bn of support to the US. We're starting to see I think where Government is indicating the technology should develop over the next 10, 20, 30 years.

In terms of the blueprint I sort of agree with you that it is likely to be quite a competitive process if that's what you mean. In terms of who wins those projects specifically then it is likely to be the most competitive players in those different technologies.

But I do think that they are starting to indicate what the shape of energy and energy policy looks like for the next few decades.

. . . . . .

Nick Ashworth, Director of Investor Relations
Nadia, I'm just conscious of time, we've only got a few minutes left. Are there any more on the line because we've got plenty coming through on the web, but I just want to make sure we've answered all the live ones as well.

. . . . . .

Telephone Operator
We currently have no telephone questions. Oh wait we've just had one pop up from Fraser Mc Laren from Bank of America. So Fraser please go ahead.

. . . . . .

Fraser McLaren, Bank of America
Good afternoon. Many thanks for the presentation. Just three quick questions if I may. Just to be clear is your view that 20% hydrogen is not an absolute maximum for households, and that 100% maybe possible in time? And are there any clear technical differences between the UK and US distribution networks that you know about at the moment that maybe determine progress?

Number two is that I noted that the Future Grid test is in a very remote area. I assume that's at least partly because of safety issues. So just wondering what are the largest concerns on safety, and what work needs to be done specifically to address these?

And then finally as we're speaking about gas, can I ask when we should expect news on the KEDLI / KEDNY rate case? Thank you.

. . . . . .

John Pettigrew, Chief Executive Officer
Thank you, Fraser. I think that was four questions actually. So I'll take the fourth one and then I'll ask the team to respond to the others. So in terms of KEDLI / KEDNY, we continue to have settlement discussions with the PSE in New York. I think I said at the last set of results, we remain hopeful that we will get to a settlement.

The challenge that we are trying to work with the PSE on is reflect on the fact that COVID has had a significant impact economically on New York. But at the same time the PSE and we would like to do a significant amount of investment, not just for safety and reliability, but also to start to adapt the networks for some of the things that we've been talking about.

So the conversation is really how we shape that capital programme to reflect the fact that customers over certainly this year and next are going to struggle with any significant rate increases. So we're trying to profile that capex and find a way of getting to a sensible settlement. And I'm still hopeful that we will get to that outcome very, very soon.

In terms of your three questions, I'll ask Tony to take the first one which is around whether 20% is a maximum or not. And then perhaps Sheri perhaps you could talk about whether you see any differences in distribution in the UK and the US. And Tony if you could also pick up the safety question when you answer the 20% one, that would be helpful.

. . . . . .

Antony Green, Project Director, Hydrogen
Yes, absolutely will. So the 20% is referencing the blend of hydrogen we believe we could put in today without impacting the burners and swapping out the boiler that's in people's homes. To go higher than that would require some retro fit of boilers within people's homes to be able to go up to that 100%.

The good news is that Baxi and Worcester Bosch both have hydrogen ready boilers already in their labs, they're already in demonstration form at the HY Street houses up at Spadeadam. And where they want to get to is being able to deploy these as soon as possible into the market so you could actually buy a hydrogen ready boiler. And when the switchover occurs you just change the burner or flip the burner and it can move across.

The question around the remote are that we're doing the testing. There's a few good reasons behind it and why we're using that particular site. Spadeadam has actually been used by British Gas research and development going back as far as 1976. It's where all the fundamental gas tests for the UK were done. So it's not atypical that we would actually use that site. It is in the middle of nowhere, it is well used for doing safety related tests. And clearly when we are trialling assets in a new way, we do need to make sure we've got those safety aspects as people have noted on some of the questions. There are safety aspects of working with hydrogen and we need to make sure that we can operate in a safe environment to do that.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Tony. Sherry, could you pick up the technical difference one?

. . . . . .

Sheri Givens, VP, US Regulatory and Customer Strategy
Sure John. So I am not aware of any technical differences between the US and UK infrastructure, I'd have to check with our engineering team on that specifically. But I will say that we are working actively with our many partners to understand what those blending limits are in the US, whether it's 2%, 10% or 20%. And hopefully in the next year or two we'll have information from those studies with those partnerships to be able to produce and share more information on what we think our blend rate might be.

. . . . . .

John Pettigrew, Chief Executive Officer
Thanks Sheri. I'm going to take just one final question because I think we're out of time.

How much capex do we expect to be applied to scale these initiatives?

I think I referenced a little bit the answer to this question earlier on. I think our perspective is that over the next couple of years we've got a huge amount of work to do to understand the technical solutions to run these pilots. And from that we'll get a much better perspective on what capex we need both in our distribution gas business in the US and our transmission business in the UK.

As I said because we see gas having a very long-term future the levels of capex are going to be a mixture of what we then will need to do to renew and replace and to asset health investment as you do with any network. But at the same time depending on the outcome we will need to invest or repurpose for whether it's blended hydrogen, renewable natural gas, or other solutions.

And then outside of that we're very optimistic for investment opportunity particularly in the National Grid Ventures business. Whether it's the CCUS clusters or whether it's the Cavendish Project that Martin talked about. Both of those projects will be in the several hundred million pounds type level of investment, so a significant investment which would add to our investor proposition as we look to grow the Group by 5 to 7% going forward.

So with that Nick I think we'll probably hand it back to you.

. . . . . .

Nick Ashworth, Director of Investor Relations
Thanks John, and thanks to all our speakers today. And thank you all for your questions and interest in today's topic. I recognise it's a massive topic, we received an awful lot of questions online which we've not been able to get through me and the team will work through those questions and get back to you in the coming days.

You'll also shortly receive an email where you can provide feedback on today's events as well as thoughts for future ones.

And with that in mind I'm pleased to say that the next live Grid Guide To event will take place in Q2, with the focus on our role in the decarbonisation of transport in the UK and across the US North East. So we hope you'll be able to join us then.

So as always if you have any questions or queries please reach out to me or any member of the IR team. So that just leaves me to say thanks for listening and we hope to see you soon, goodbye.

. . . . . .

END