drax

# Delivering for the UK

Foreword

# The challenge ahead

**Across the globe, countries and organisations are facing an era-defining challenge to hit net zero targets. Many are also facing a tough balancing act between emissions cuts and energy security.**

The UN's Intergovernmental Panel on Climate Change (IPCC) has warned that the globe is set to pass a dangerous temperature threshold within the next 10 years. There is a real urgency to the action we must collectively take to address the climate crisis.

At the same time, countries including the UK are acutely aware of the importance of energy security as a result of the ongoing war in Ukraine.

Throughout this turbulent period, Drax has continued to play a vital role in preserving the UK's energy security. Our power station in Selby, North Yorkshire provides 11% of the country's renewable power, the largest single source of renewable power in the UK. The introduction of bioenergy with carbon capture and storage (BECCS) at the power station, as well as the expansion of our Pumped Storage Hydro facility in Scotland, will further strengthen the UK's energy security. They will also help the country achieve its net zero ambitions in a balanced and affordable way.

Our BECCS project could remove 8Mt (million tonnes) of $CO_2$ from the atmosphere every year while simultaneously producing renewable and flexible power. BECCS is not simply a 'nice to have'; it's a net zero necessity, and organisations including the IPCC, the UK's Climate Change Committee (CCC), National Grid ESO, and the UK Government, all agree.

£735m

**Oxford Economics data has shown that Drax Power Station contributes £735m to UK GDP, whilst supporting over 7,000 jobs across the UK.**

BECCS at Drax could contribute a significant amount to the UK economy. Not only could BECCS create and support 10,000 jobs and deliver £670m of economic benefit to the UK during peak construction, we're also aiming to source 80% of materials and services for the project from British businesses – a public ambition which shows significant opportunity for companies of all sizes across the UK.

But our ambition doesn't stop there. We're progressing with our planned £500m expansion of our Cruachan Pumped Storage Hydro station in Argyll and Bute, Scotland. This expansion will add 600MW to our current generation capacity, bringing it to over 1GW – enough to power over two million homes.

Through the expansion, almost 1,000 new jobs will be created and supported during development, bringing significant benefits to the local community.

We are delighted that the Scottish Government has backed the project, awarding planning consent for expansion in 2023. With the right support from the UK Government, we can get spades in the ground on these two vital projects, continue to deliver energy security for the UK and help the UK accelerate ahead as a leader in climate-saving technology. If Government matches our ambition, we will move together towards a fair, and prosperous, net zero future achieved at least cost.

# From coal to biomass to BECCS

Here's a timeline of our progress so far in making BECCS at Drax a reality, and a look ahead at what's still to come.


[5] https://www.nationalgrideso.com/document/263951/download (slide 25)

Drax Power Station

# Looking to the future

**Drax Power Station is the UK's largest single source of renewable power, providing 11% of the country's total. Our next chapter will ensure that Drax plays a crucial role in reaching net zero, boosting energy security and supporting jobs and industries nationwide.**

Every day our power station in Selby, North Yorkshire provides a secure, reliable and flexible source of electricity to five million homes across the country, playing an important role in supporting the UK's energy security.

We're proud to be the largest decarbonisation project in Europe. In 2012, Drax invested to transition away from the use of coal to sustainable biomass. In doing so, we protected local jobs while reducing the carbon intensity of power generation at our site by over 90%.

But we're not stopping there. We have set ourselves the ambition to be a carbon negative company by 2030 – a company that removes more carbon dioxide ($CO_2$) from the atmosphere than we emit.

This will be achieved through the installation of the cutting-edge carbon removal technology that is bioenergy with carbon capture and storage (BECCS) at our plant in Selby.

We have already trialled and proven BECCS at our site and now we're ready to scale it up.

Our planned £2bn investment will remove up to 8Mt of $CO_2$ from the atmosphere every year and permanently store it under the North Sea, all while generating renewable power for the nation.

Our investment in BECCS will mean that Yorkshire and the Humber is home to the largest single site carbon removal project in the world. Through BECCS, we'll bring jobs and green industries to the North and make the Humber a global hub for climate-saving technology, all while strengthening UK energy security.

## £2bn

**Our investment will put the Humber at the forefront of net zero.**

# Capturing a positive opportunity

BECCS at Drax

# The prize to be won

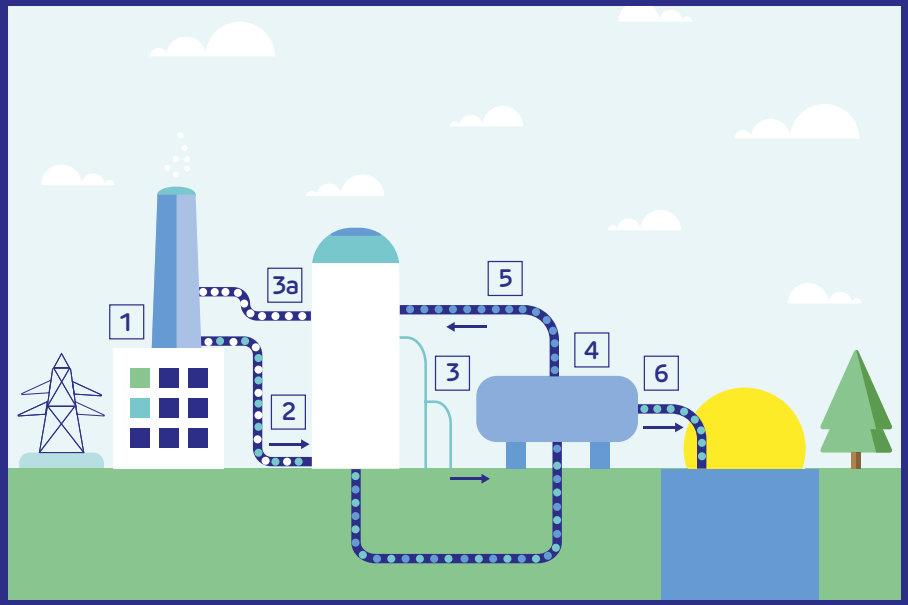
- BECCS at Drax Power Station is expected to be the world's biggest, engineered carbon removal project, permanently removing 8Mt of $CO_2$ from the atmosphere once fully operational.
- Vivid Economics research shows that BECCS could deliver £670 million of economic benefit for the UK during construction, creating and supporting more than 10,000 jobs during peak construction.
- Recent Baringa research demonstrates that if we don't deploy BECCS at Drax Power Station, the UK won't be able to deliver this important carbon removals technology until at least the 2030s.
- Deploying BECCS at Drax could save the UK over £26bn to reach its net zero target.
- Drax aims to source 80% of materials and services for the project from British businesses and is also working with British Steel to explore opportunities for its UK production facilities to supply a proportion of the steel needed for BECCS.

BECCS at Drax

# How it works

Our £2bn BECCS project would see the addition of carbon capture technology by Mitsubishi Heavy Industries to two of the power station's existing biomass units. Captured $CO_2$ would then be transported and permanently stored under the North Sea.

## How carbon is captured from an emissions source




KEY ● Flue gas ● $CO_2$ ● Solvent

1. Flue gas containing $CO_2$ is captured during the power production process
2. The flue gas is cooled and treated before entering an absorber tower
3. Inside the absorber tower, a chemical reaction takes place when a solvent is used to extract $CO_2$ from the flue gas
3a. $CO_2$ depleted flue gas is released into the atmosphere
4. The solvent containing the $CO_2$ is heated in a re-boiler, which reverses the chemical reaction separating the $CO_2$ from the solvent
5. The solvent is then re-circulated back into the carbon capture system
6. The now pure stream of $CO_2$ is transported via pipeline for permanent storage underground, under the ocean or sea

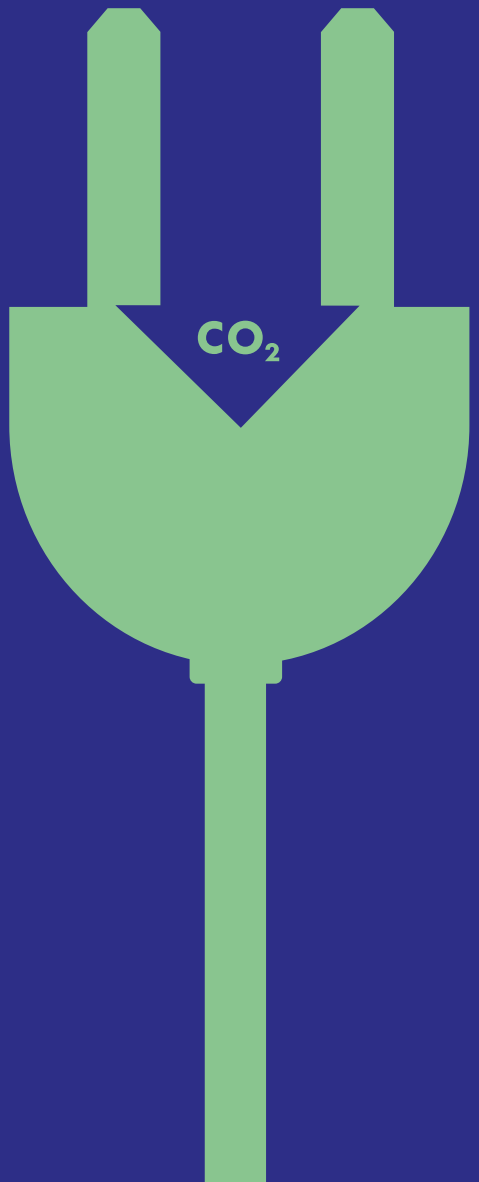
### Safe and permanent storage

Captured $CO_2$ is pressurised and turned into a liquid, which can then be safely and permanently injected into naturally-occurring, porous rock formations (such as unused natural gas reservoirs, coal beds or saline aquifers) in a process known as sequestration. The UK has the capacity to hold up to 70 billion tonnes of $CO_2$ in this way under its seabed.

**8Mt**

of $CO_2$ could be captured and stored every year using BECCS carbon removals at Drax.

# Power up, carbon down






BECCS at Drax

# Capturing the opportunity of carbon removals

**The high integrity carbon removals which BECCS technology delivers will offer a permanent solution to lock away carbon dioxide. This can complement organisations' actions to cut emissions and help them to meet their net zero goals.**

Carbon removals will be especially important for sectors which will take longer to decarbonise, such as aviation, agriculture, and heavy industry. Alongside ongoing emissions reductions, carbon removals will help these sectors map out a journey to net zero which is balanced and affordable. Drax is committed to leading industry in developing the standards that will govern the carbon removals of the future.

The carbon removals market will help drive economic growth and opportunity while helping countries and organisations to reach net zero. Unsurprisingly, there is a global race for countries to lead in this emerging technology. The US, with the Inflation Reduction Act, has thrown their support behind technologies including BECCS, with the EU progressing their own plans.

With a clear plan and support for BECCS, the UK can still take the lead and be a trailblazer in carbon removals internationally.

# Carbon removals at a glance

- The market for carbon dioxide removals (CDRs) is projected to be worth $1 trillion in the future
- IPCC and CCC both predict that the 1.5°c target won't be achieved without carbon removals technologies
- The CDRs market is growing, and will be at the forefront of the race to net zero

**Respira Memorandum of Understanding (MoU):**

Our MoU agreement will allow Respira to purchase 2 million metric tonnes of carbon dioxide removals (CDRs) from our first BECCS international project over a five year period.

# Moving mountains to provide energy security

Cruachan Expansion

## Harnessing the power of pumped storage hydro

**Today, 'The Hollow Mountain', located in Argyll and Bute, Scotland, has a capacity of 440 megawatts (MW) – enough to power almost 1 million homes.**

At present, as one of just four UK pumped storage hydro stations, Cruachan Power Station – 'The Hollow Mountain' – is playing an important role in protecting UK energy security, offering clean and dispatchable power in just 30 seconds.

As the UK energy system decarbonises there will be a growing need for increased energy storage capacity. We're committed to meeting this increased demand. That is why we are progressing our ambitious £500m expansion project for Cruachan to construct a second underground power station. The expansion will add 600 MW to the site's generation capacity, bringing it to over 1 gigawatt (GW) – enough to power over two million homes.

This increased capacity will further facilitate the integration of more wind and solar power onto the energy grid, enhancing the nation's energy security and grid stability, all while tackling climate change.

In July 2023, we came one step closer to making this a reality when Drax gained planning consent from the Scottish Government for the expansion project. This acknowledged the important role of pumped storage hydro power in reaching net zero, strengthening energy resilience, and growing the economy.

**Over +1GW**

**The generation capacity of 'The Hollow Mountain' after expansion, which is enough to power over two million homes.**

The expansion of Cruachan will be a landmark milestone. No new pumped storage hydro power plants have been constructed in the UK since 1984, despite their critical role in supporting a safe and secure electricity grid, and their ability to support the decarbonisation of the power sector.

Fully delivering the expansion of Cruachan requires the UK Government to provide an updated financial stabilisation mechanism.

The current absence of a framework like this for large-scale, long-duration storage technologies has been the barrier to expanding capacity.

With the right support from the UK Government, the new facility could be operational as soon as 2030, with almost 1,000 jobs created and supported during development.

**1,000**

**new jobs could be created by the expansion of Cruachan hydro power plant.**

> “Hydro power has real potential to play a greater role in our transition to net zero, and to help ensure a resilient and secure electricity supply across the UK. The expansion of Cruachan will help to strengthen our energy security by providing much needed resilience in the system, supporting hundreds of jobs and providing a real boost to the Scottish economy.”
>
> Humza Yousaf,
> First Minister of Scotland

Pumped Storage Hydro

# How it works

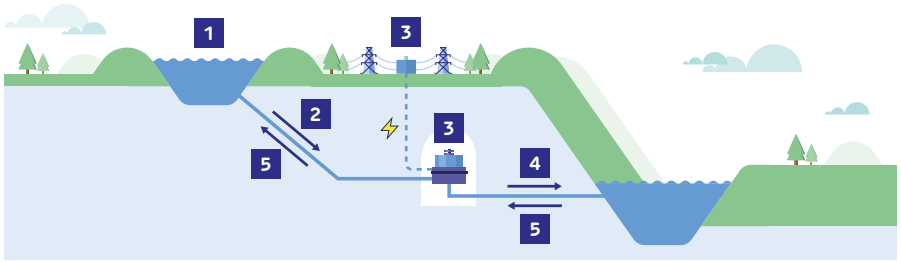
Pumped storage facilities have two water reservoirs at different elevations – the top and the bottom – of a steep slope. When there is excess power on the grid and demand for electricity is low, the power is used to pump water from the lower to the upper reservoir using reversible turbines. When demand is high, the water is released downhill into the lower reservoir, driving the turbines in the other direction to generate electricity.

Renewable energy sources like wind and solar are weather-dependent, resulting in intermittent supply, which poses challenges for grid operators. When output from renewables falls, grid operators often rely on gas-fired power stations to fill the gap. Which in the long term will compromise efforts to reach net zero.

Pumped storage hydro facilities act as vast 'water batteries', offering a flexible way of storing excess energy generated by renewables, cost-effectively and at scale.

> "As the UK increasingly relies on intermittent renewables to keep our lights on, there is a growing need for flexible power sources to plug the gap when the wind doesn't blow, or the sun doesn't shine. With its reversible turbines, Cruachan can also store excess power from Scotland's wind turbines when they are generating more renewable electricity than we need, helping to stop valuable green power from going to waste."
>
> Ian Kinnaird
> Drax's Scottish Assets Director

## Cruachan power generation cycle




1. Cruachan's upper reservoir – nearly 400m above sea level – can store up to 10 million $m^3$ of water, held back by a 316m dam across a 'corrie' (horseshoe-shaped valley).
2. When there's demand for electricity, Cruachan gets ready to generate by using underground pipes to flow water from the upper reservoir to the turbines inside the mountain.
3. The water spins the turbines, activating the generators that produce the electricity. Transformers convert the generated voltage to the transmission voltage, so the pylons above the surface can deliver the power where it's needed.
4. After spinning the turbines, the water goes down a tunnel to Loch Awe, the lower reservoir.
5. To refill the upper reservoir, Cruachan uses power from National Grid to drive the turbines. Acting as pumps, they send water from Loch Awe to the upper reservoir.

# Drax in the community

## Education and skills

The green transition will require new skills. If the UK is to hit its climate targets and help lead the world in tackling climate change, then ensuring our workforce and businesses have the capability to capitalise on opportunities will be vital.

That's why in 2020 we launched a five-year partnership with Selby College designed to help deliver community education programmes, as well as support for retraining, to ensure students are developing the skills needed in innovative technologies which will help to drive a zero carbon economy.

A year later we secured £270,000 in Government funding to develop the UK's first educational programmes in carbon capture. These programmes are helping us to create a workforce fit for the future.

As we progress our plans for bioenergy with carbon capture and storage (BECCS), we'll continue to work with local partners to play our part in bridging the green skills gap.

We're partnering with EngineeringUK, a non-profit organisation, to deliver £15,000 of funding towards their equality, diversity and inclusion (EDI) bursary. Through match-funding the donation will be worth £30,000, and will support schools with high proportions of young people from groups under-represented in engineering, to participate in STEM activities.


## Our role in the community

Drax is committed to people-positive outcomes, which is why we invest in and support communities in the locations where we operate. We run grant-giving programmes for charitable donations to our nearby communities in the UK, as well as in the US and Canada, through the Drax Foundation, Drax Community Fund and Drax Communities in Crisis Fund. These grants support a range of causes including access to STEM education and improving energy efficiency.

For example, in July 2023 we pledged £1.5m for the year to help schools save energy and reduce their carbon footprint. The funding was used for LED lighting schemes, solar panel schemes and an energy saving and education programme.

**Five schools local to Drax operations in England are piloting the installation of energy efficient LED lighting:**

- Barwic Parade Community Primary School in Selby
- Kirk Sandall Junior School in Doncaster
- Selby Abbey Primary School
- Triangle Primary School in Sowerby Bridge
- Great Clacton Junior School in Clacton-on-Sea

In addition to our funding for schools, during the first half of 2023, we have donated c. £225,000 to non-profit organisations in and around the communities where we operate in the UK. This includes £15,000 for Toranj Tuition in Hull and £49,000 for the North Yorkshire Business and Education Partnership (NYBEP).

**1.5m**

**funding pledged for the year in July 2023, to help schools save energy and reduce their carbon footprint.**

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