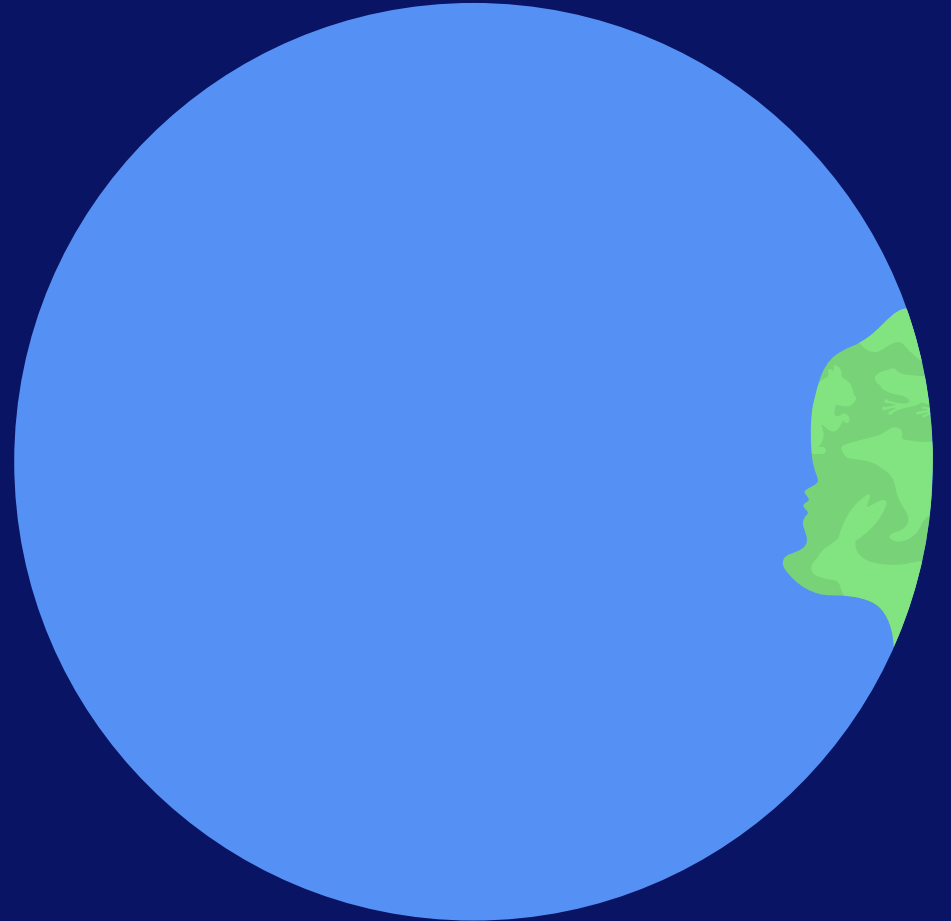


# Drax Group Capital Markets Day

May 2023



drax



**Will Gardiner:**  
Chief Executive Officer



**Andy Skelton:**  
Chief Financial Officer



**Dr Alan Knight:**  
Director of Sustainability



**Jason Shipstone:**  
Chief Innovation Officer



# Strategy Update

Will Gardiner: CEO

drax

## **Our Purpose**

Enabling a zero carbon, lower cost energy future

## **Our People**

Are valued members of a winning team with a worthwhile mission

## **Our Ambition**

To be a carbon negative company by 2030

## Carbon Removals

Objective 1: to be a global leader in carbon removals

## Pellet Production

Objective 2: to be a global leader in sustainable biomass pellets

## Dispatchable, Renewable Power

Objective 3: to be a UK leader in dispatchable, renewable generation

**Underpinned by options over the use of sustainable biomass across all areas of operation**

**Fully integrated biomass supply chain provides opportunities to optimise and create value in multiple markets**

**A sustainable long-term business model leveraging on our biomass expertise and objectives aligned with climate solutions, net zero and energy security**

## **Strategic asset base closely aligned with system needs**

- Dispatchable, renewable electricity
- Security of supply
- A route to carbon removals

## **Proven financial and operational performance**

- A track record of generating strong free cash flows from our strategic asset base

## **Attractive portfolio of investments opportunities aligned with system needs**

- BECCS, biomass supply chain and dispatchable generation

## **Capital allocation policy**

- A policy which supports investment in the existing asset base, growth and additional returns to shareholders



## Drax is UK's largest source of renewable energy by output

- 4% of total annual power generation
- 11% of total annual renewable generation
- Up to 70% of in-day peak renewable generation

## Drax is a UK leader in dispatchable generation – 3.1GW of capacity

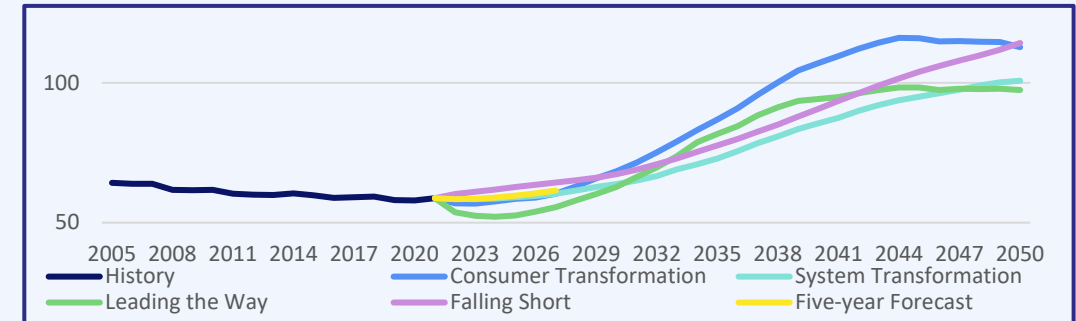
- Growth in wind, solar and nuclear = intermittency, inflexibility and volatility = greater role for dispatchable assets = opportunity for value

## Drax security of supply – underpinned by integrated supply chain

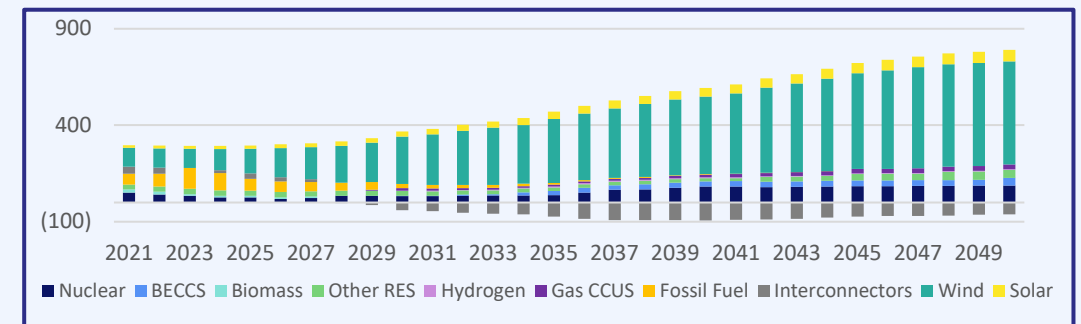
## Multiple earnings opportunities

- Forward power sales up to two years in advance
- Index-linked renewable incentive schemes
- System support services via power markets, balancing mechanism and ancillary services
- Capacity payments

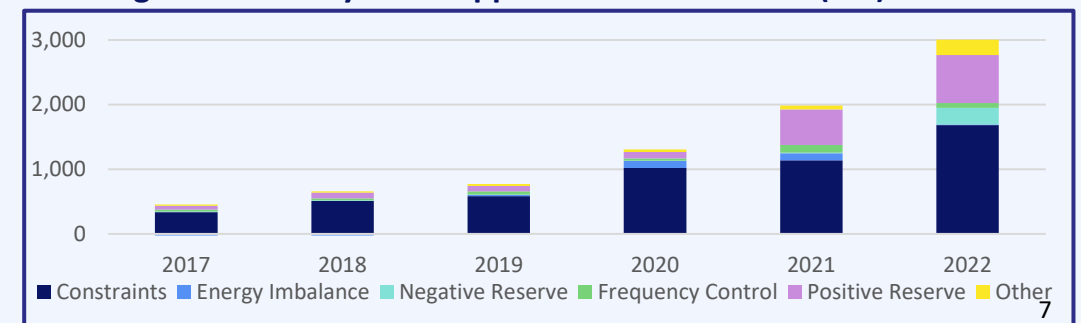
## Significant increase in demand – peaks (TWh)



## Increase in intermittent and inflexible generation capacity (TWh)



## Growing value from system support services – BSUoS (£m)



Sources: National Grid Future Energy Scenarios and system support service data

As a producer, user and supplier of biomass, Drax has multiple sales channels for the biomass in its integrated supply chain, leading to value creation, growth and innovation opportunities, protecting margins and maximising value from biomass

## Growing global demand for sustainable biomass and new markets

- Markets today – generation and heating
- Future growth from BECCS and other industrial processes

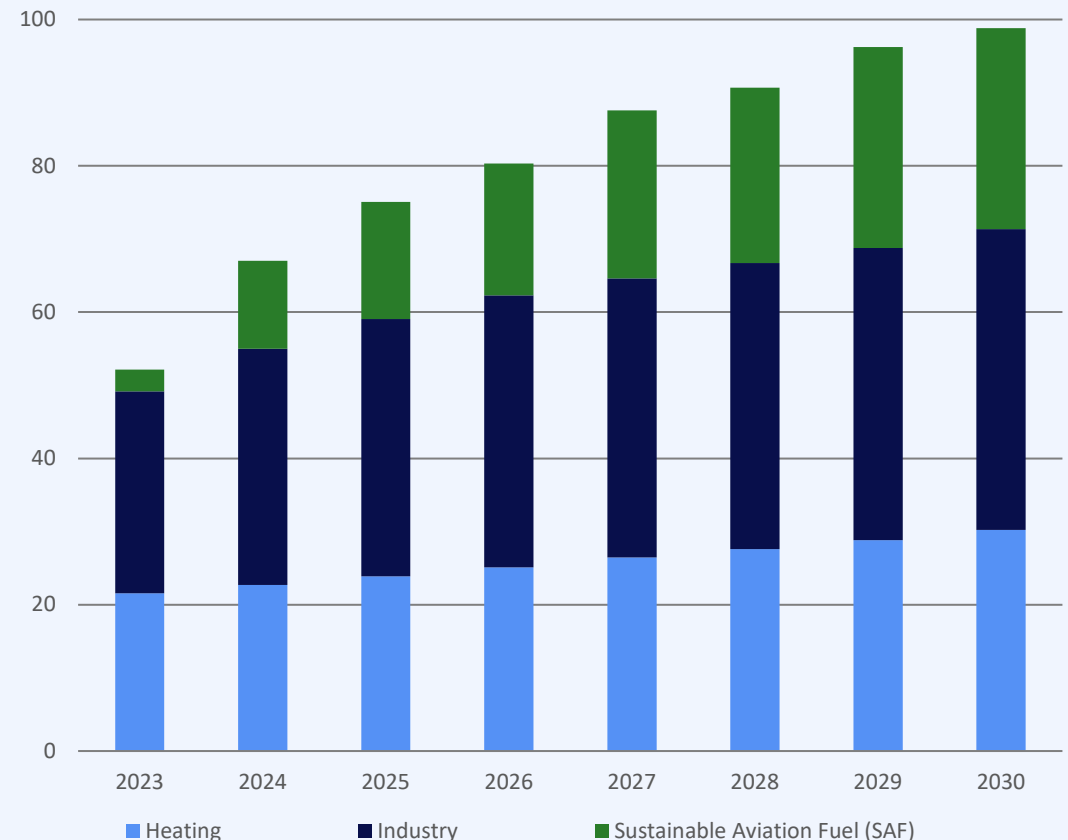
## Use-or-sell options across three biomass models

- Sales to third parties
- Own-use power generation
- Own-use BECCS

## World's second largest producer of biomass

- 5Mt of capacity across 18 operational and development plants with access to 5 deep-water ports and 4 major fibre baskets
- 20 years of biomass innovation and expertise
- Expertise in biomass sourcing, power generation and supply chain operations
- Security of supply – a proven and reliable supply chain
- Backed up by own-use demand in generation

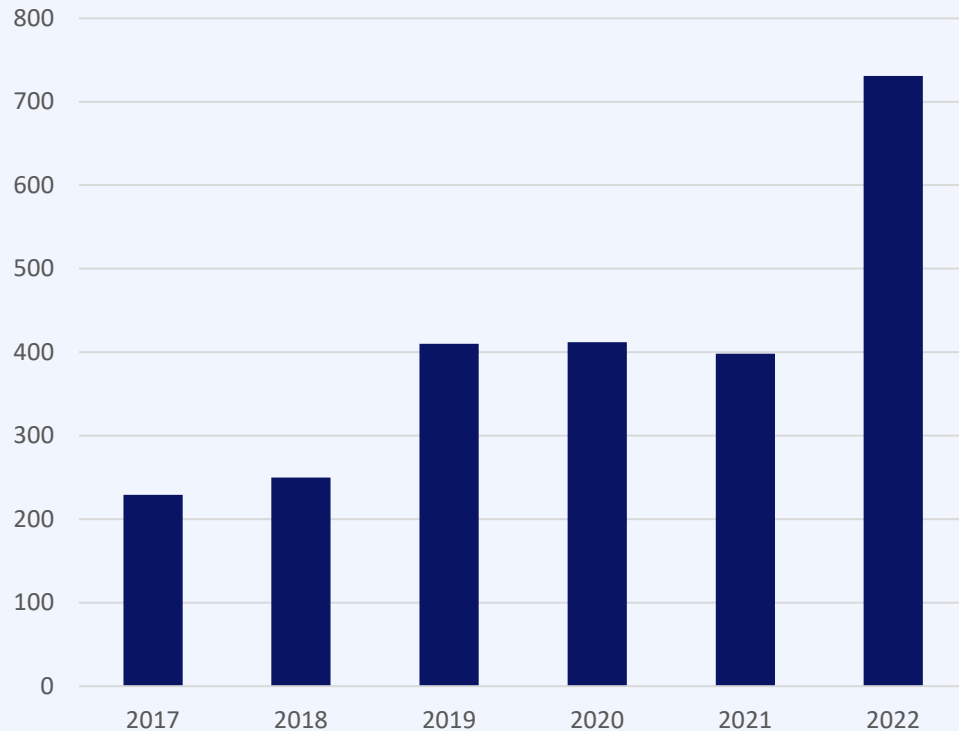
## Potential doubling of growth in global biomass markets through 2030 (Mt)



Sources: Hawkins Wright (Q1 2023), Future Metrics (Aug 2022), Argus (April 2023)



## Adjusted EBITDA<sup>(1)</sup> Growth (£m)



## 11% average annual increase in dividend per share since 2017 (p/share)



**£2.3bn of cash generated from operations 2017 – 2022**

**c.£600m of returns to shareholders 2017 – 2023 – dividends and buybacks<sup>(2)</sup>**

1) Earnings before interest, tax, depreciation, amortisation, excluding the impact of exceptional items and certain remeasurements. Excludes the Electricity Generator Levy.

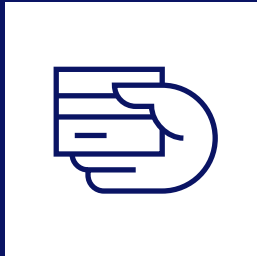
2) Includes £150 million share buyback announced April 2023.

Strategic investments aligned with climate solutions, net zero and energy security

Attractive opportunities for long-term growth and positive climate, nature and people outcomes

<b>Carbon removals</b>	<p><b>Ambition for &gt;20Mt of carbon removals via BECCS – 14Mt pa by 2030</b></p> <ul style="list-style-type: none"><li>• 2 sites selected and moving to option in US South – targeting c.6Mt by 2030</li><li>• Evaluating 9 additional sites in US for greenfield and brownfield BECCS</li><li>• Development of option for CCS on a pellet plant – targeting FID in 2024/25, commissioning in 2026</li><li>• MoUs agreed for sale of &gt;2Mt</li><li>• 8Mt of carbon removals at Drax Power Station by 2030</li></ul>
<b>Biomass pellet supply</b>	<p><b>Targeting 8Mt of production capacity by 2030</b></p> <ul style="list-style-type: none"><li>• c.5Mt of current production capacity</li><li>• 18 fully operational pellet plants plus developments across three major fibre baskets and five ports</li><li>• c.2.5Mt of new capacity, plus 0.6Mt in development</li><li>• Continue to target 4Mt of sales to third parties by 2030</li></ul>
<b>Dispatchable, renewable generation</b>	<p><b>Increased value from pumped storage and option for 600MW expansion of Cruachan by 2030</b></p> <ul style="list-style-type: none"><li>• Multiple earnings sources aligned with system needs</li><li>• Underpinned by long-term earnings stability via a cap and floor mechanism</li></ul> <p><b>Construction of 3 new 299MW Open Cycle Gas Turbine plants at sites in England and Wales</b></p>

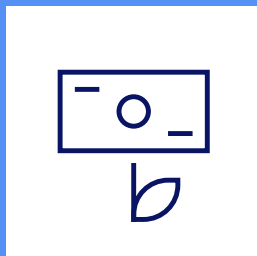
Implemented in 2017, designed to support strategy



1. Maintain credit rating



2. Invest in core business



3. Sustainable and growing dividend



4. Return surplus capital beyond investment requirements

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# A global leader in carbon removals

Global net zero and 1.5°C strategies will require carbon removal technologies  
**BECCS, DACS and afforestation**

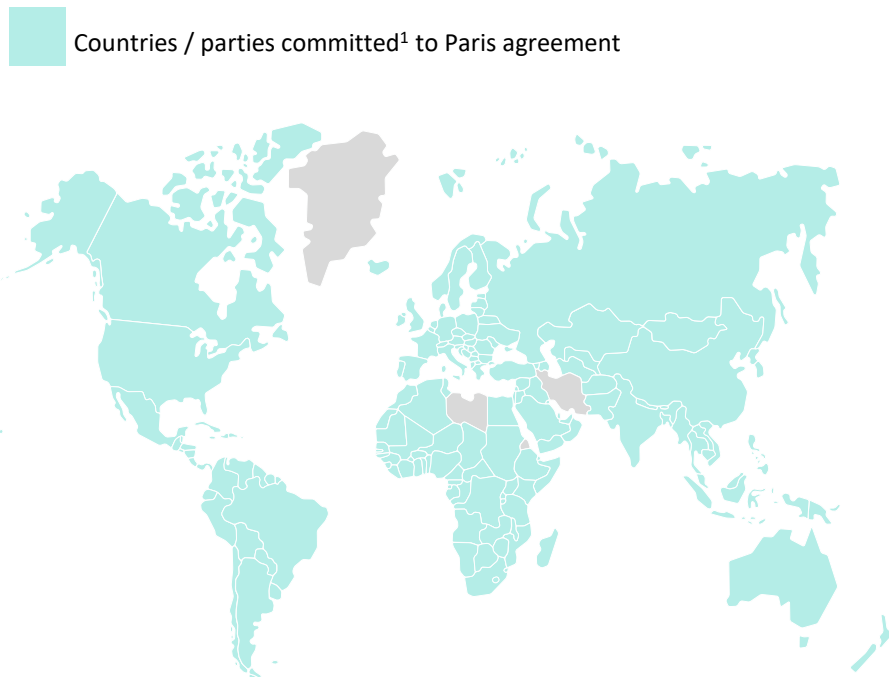
Drax is developing a pipeline of project options in North America and the UK to provide long-term, large-scale carbon removals and create attractive investment opportunities for the Group

**Ambition for >20Mt of carbon removals via BECCS**

US Inflation Reduction Act is creating an enlarged investment opportunity for BECCS



Over 190 countries have confirmed their commitment to a 1.5°C pathway, to avoid the disproportionate impacts of a 2°C world



## Examples of impact of 2°C vs. 1.5°C



**56%**  
higher sea level rise



**50%**  
decrease in crop yields



**Probability of permanent irreversible warming** due to risk of collapse of Greenland Glacier and loss of Arctic summer sea ice



Every extra bit of warming matters, especially since warming of 1.5°C or higher increases the risk associated with long-lasting or irreversible changes, such as the loss of some ecosystems

**Hans-Otto Pörtner**  
Co-Chair of IPCC Working Group II



Limiting global warming to 1.5°C compared with 2°C would reduce challenging impacts on ecosystems, human health and well-being, making it easier to achieve the United Nations Sustainable Development Goals

**Priyadarshi Shukla**  
Co-Chair of IPCC Working Group III

1) Countries that have either ratified, accepted, or acceded the Paris agreement (April 2022).

## Reputable scientific and industry groups agree that significant levels of removals are required



All pathways that limit warming to 1.5°C or 2°C involve substantial levels of carbon removal (Carbon Dioxide Removal – CDR) between 2020 and 2100, ranging from **450 to 1,100bn tonnes of CO<sub>2</sub>**

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Urgent and ambitious action is needed for deep GHG emissions cuts

CDR will be necessary to achieve net-negative CO<sub>2</sub> emissions for mitigating climate change. **Globally between 0.5-9.5bn tonnes of CDRs via BECCS will be required**

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Even with rapid investment in emission reductions, the **United States could need to remove about 2bn tonnes of CO<sub>2</sub> per year by midcentury to reach net zero**

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**10–20bn tonnes of CO<sub>2</sub> removals needed every year** if we are to keep warming below Paris Agreement thresholds

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Sustainable Development Scenario **requires BECCS and DAC to remove c.3bn tonnes of CO<sub>2</sub> in 2070**



## **Inflation Reduction Act (IRA) and Bipartisan Infrastructure Bill – \$369bn funding package for climate and green energy policies**

- 45Q tax credit valued at \$85/t of CO<sub>2</sub> captured through BECCS
- Other tax credits aimed at renewable power generation, Sustainable Aviation Fuel (SAF) and hydrogen
- \$40bn loan fund for projects which utilise innovative technology to reduce, avoid or sequester carbon
- \$26bn Greenhouse Gas Reduction fund
- \$3.5bn DAC Hub funding
- \$140m – competitive purchasing programme for carbon removals
- Local incentives for clean energy technologies – including Louisiana, Massachusetts and California



## **C\$80bn in clean technology over next 10 years, including C\$25bn for clean electricity investment**

- Clean Electricity Investment tax credit – 15% refundable tax credit for eligible investments
- 50% for BECCS investment tax credit for capital invested in CCUS projects
- Carbon price to reach C\$170/t CO<sub>2</sub> in 2030
- Clean Energy Standard being developed
- Carbon removal goal – at least 15Mt annually



## **Green Deal Industrial Plan and Member State support for BECCS**

- €250bn for clean energy manufacturing and investment support schemes for production of strategic net zero technologies
- EU carbon removal certification proposal and CCS strategy being discussed
- Sweden – new BECCS support scheme, c.£90-150/t
- Germany – €120m per year funding for CDR development
- France, Belgium, Hungary and Denmark all include BECCS as part of their net zero strategies



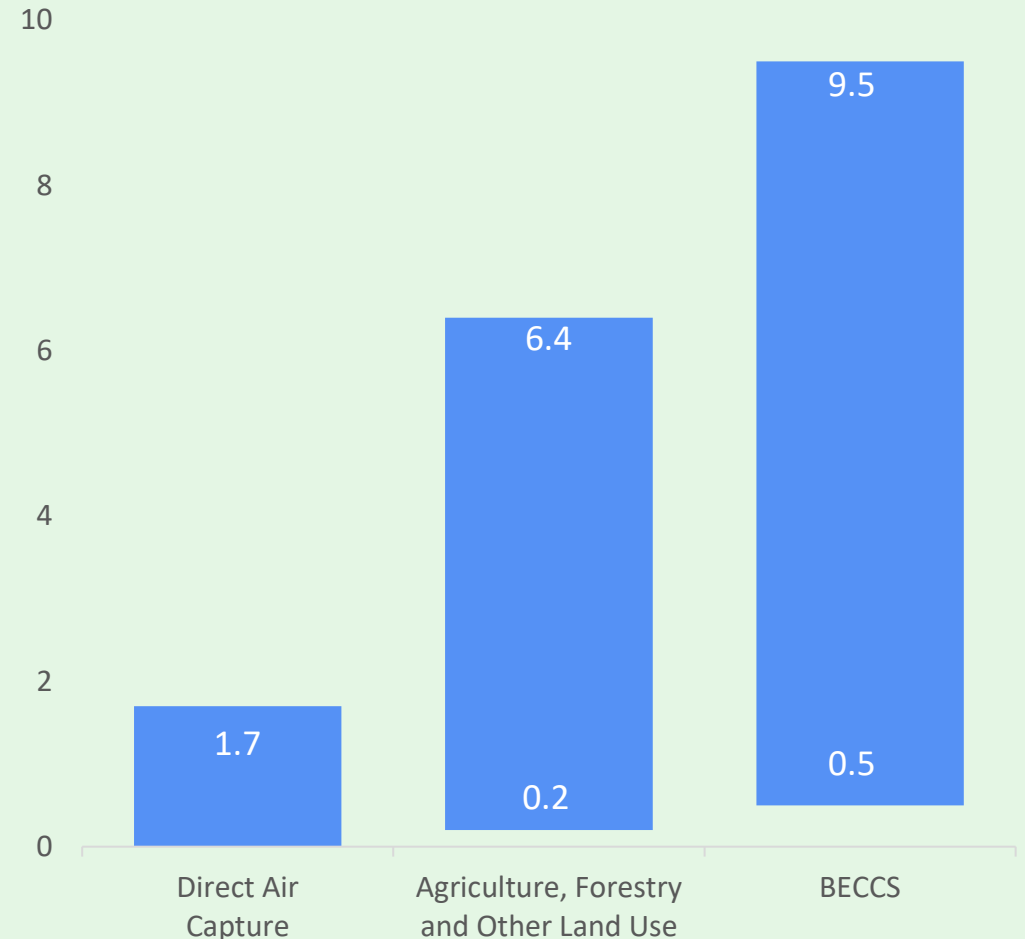
## **Rest of world**

- UK – £20bn CCS investment programme over 20 years
- Japan – Green Transformation Programme to mobilise \$1.1trillion in public-private investment over next ten years, including a carbon pricing mechanism, committed to 6-12Mt of CCS per year by 2030
- Indonesia – target to deliver 23GW of BECCS by 2050
- Asia Zero Emission Community, 11 countries including Australia, Indonesia and Japan, formed to create pathways to enable decarbonisation

## Up to 9.5bn billion tonnes of carbon removals per year from BECCS by 2050 required to maintain a 1.5°C pathway

- Reaching net zero requires reductions in CO<sub>2</sub>, methane, and other GHG emissions, and implies net-negative CO<sub>2</sub> emissions
- CDR will be necessary to achieve net-negative CO<sub>2</sub> emissions
- If warming exceeds 1.5°C, it could gradually be reduced by achieving and sustaining net negative global CO<sub>2</sub> emissions
- The larger the overshoot, the more net negative CO<sub>2</sub> emissions would be needed to return to 1.5°C

Global annual CDR volumes range in 2050 (billion tonnes)



Sources: IPCC Sixth Assessment Report, Coalition for Negative Emissions website



# BECCS is Happening Now But More Supply is Required to Meet Climate Need

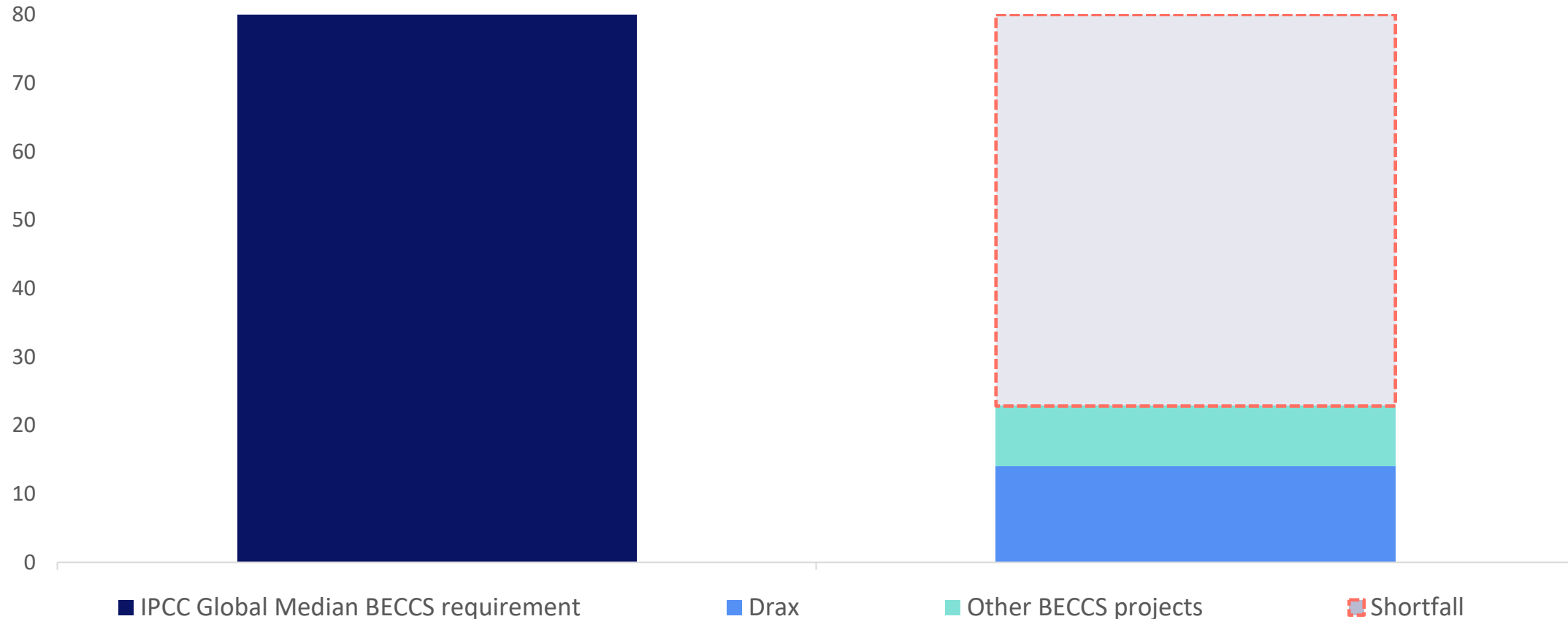
## IPCC – annual median BECCS requirement of 80Mt by 2030

- Rising to 2,750Mt by 2050

## Over 20Mt of global BECCS capacity in development for 2030

- Including 14Mt from Drax

IPCC annual median BECCS requirements vs. projects in development for 2030 (Mt)



Source: IPCC

Source: Company announcements, annual reports, news articles, public databases

**Public prices of high-quality, permanent engineered CDRs are significantly higher than Natural Climate Solutions**

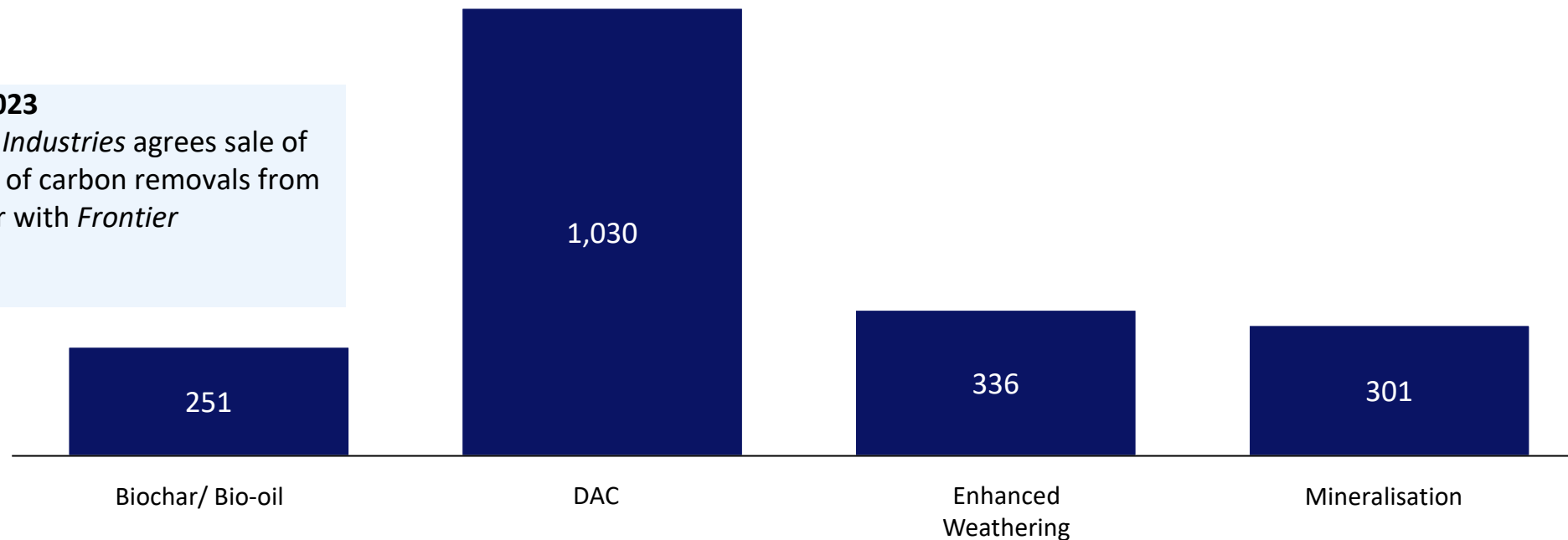
**Characteristics of permanent engineered CDRs support robust pricing**

- Additional, permanent, quantifiable and sustainable

**Average price of CDR deals announced publicly, \$/tCO<sub>2</sub><sup>(1/2)</sup>**

**May 2023**

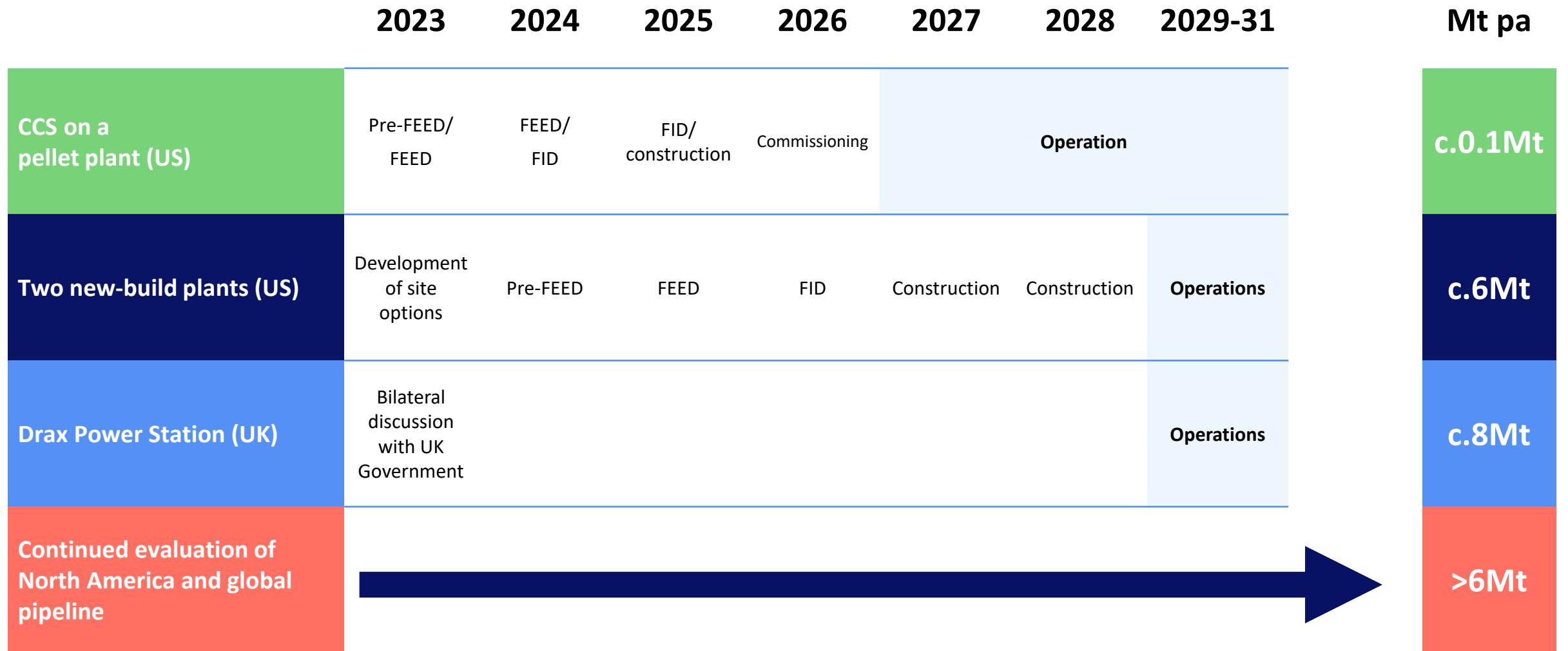
*Charm Industries* agrees sale of >112kt of carbon removals from biochar with *Frontier*  
**\$53m**



1. Based on all deals publicly announced (2020 – 2023).

2. Average price calculated based on number of deals with price per tonnes disclosed. Volumes are summed across all deals with volume disclosed. Some deals disclose volume and not price.

# Drax Current Ambition for >20Mt pa of Carbon Removals



## UK Government

### Supportive of deployment of Power-BECCS by 2030

#### 5MtCO<sub>2</sub> of carbon removals by 2030 (and 23MtCO<sub>2</sub> in 2035)

- Business model to support Power-BECCS under development

#### Powering-Up Britain announcement (March 2023)

- Drax one of two successful BECCS projects shortlisted
- Track-1 expansion process announced
- Track-2 process launched for projects expected to commission by 2030
- Work closely with biomass generators to facilitate transition to BECCS

#### Further announcements in 2023

- Biomass Strategy – expected to outline the role of power-BECCS, deployment ambitions, and sustainability criteria (June 2023)
- Track-1 Expansion detail
- Track-1 Expansion and Track-2 funding envelope
- Carbon removals consultation response

## Drax

### Committed to deployment of two BECCS units at Drax Power Station between 2027 and 2030

#### Targeting clarity on UK BECCS programme in 2023

- Formal bilateral engagement with UK Government commenced

#### ‘Bridging mechanism’

- Engage with Government on the need for a mechanism to support Drax Power Station from 2027 and the commissioning of BECCS

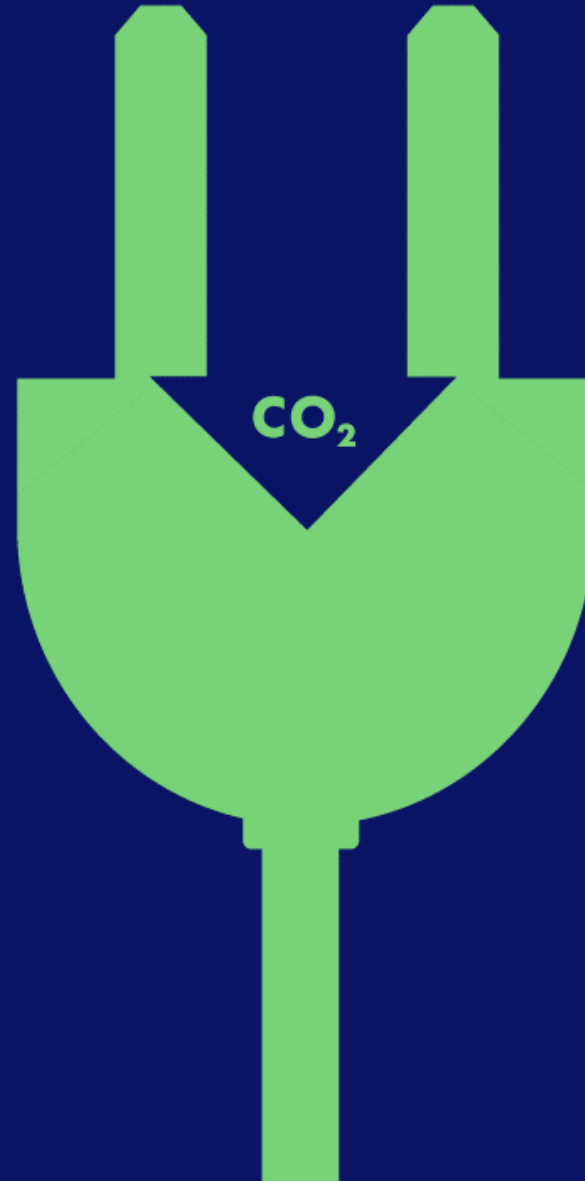
#### Power-BECCS business model

- Develop heads of terms for the model in 2023 and aim to enter contract negotiations following this

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# Carbon Dioxide Removals

Jason Shipstone: Chief Innovation Officer  
& Global BECCS Program Director



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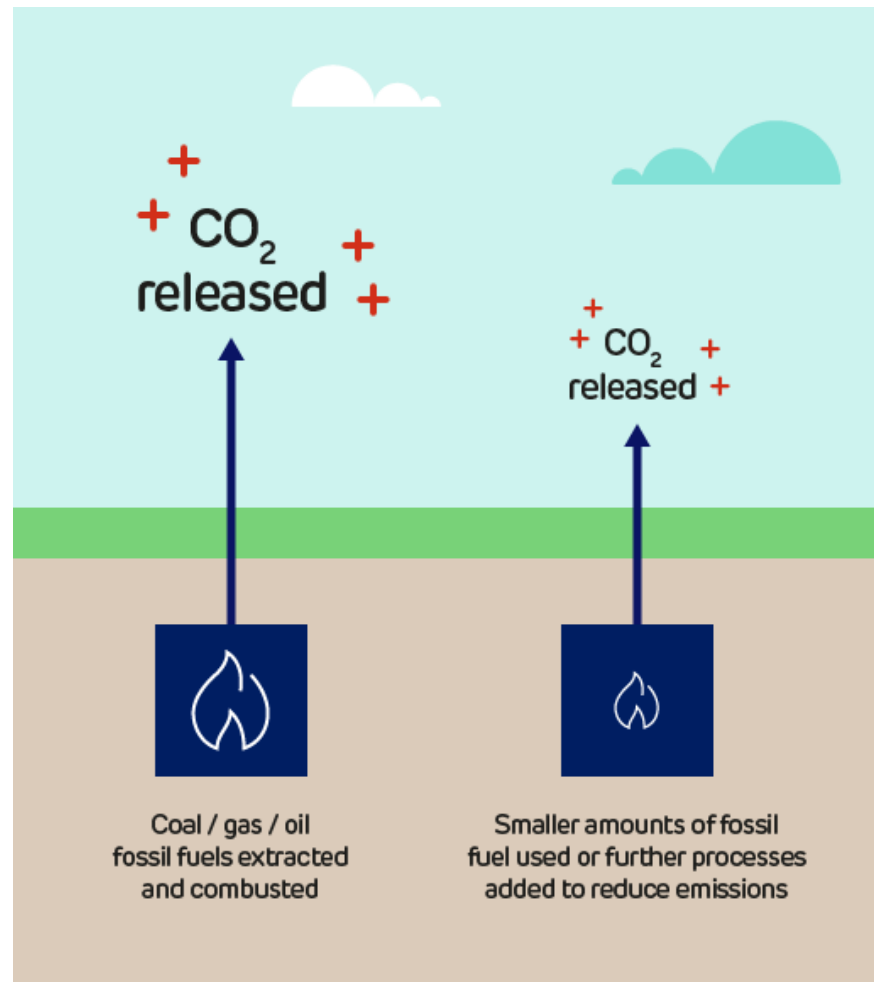
# Compelling science-led case on the need for carbon removals now

IPCC and other science-led organisations informing policy and the investment case

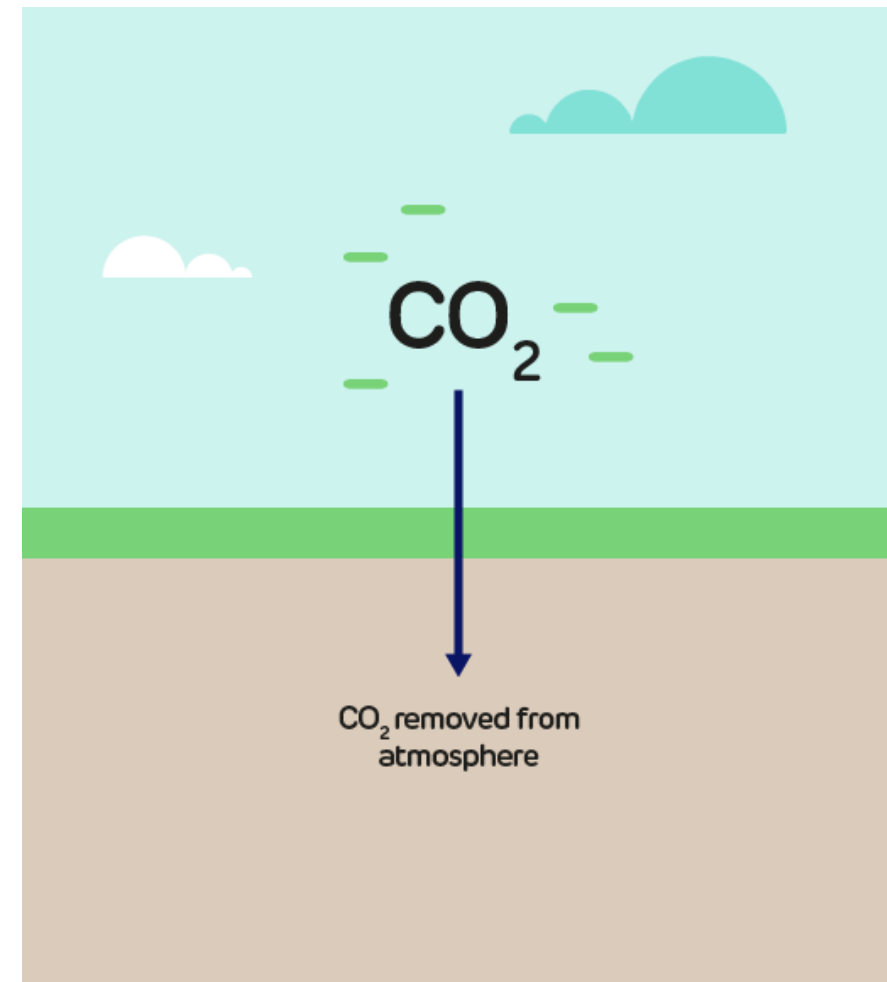


Early deployment of CO<sub>2</sub> removals required to achieve net zero by 2050

## Carbon reduction



## Carbon removal



CO<sub>2</sub> is absorbed from the atmosphere as tree grows

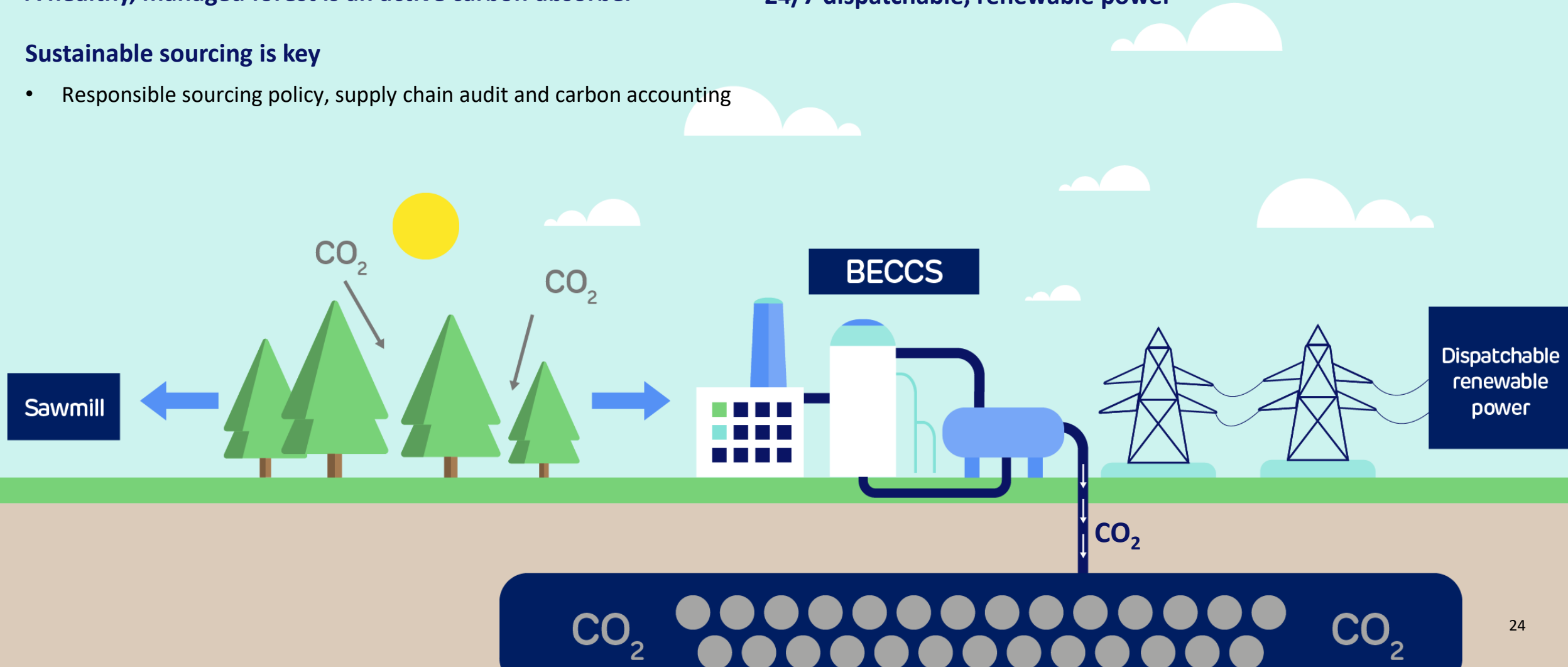
A healthy, managed forest is an active carbon absorber

Sustainable sourcing is key

- Responsible sourcing policy, supply chain audit and carbon accounting

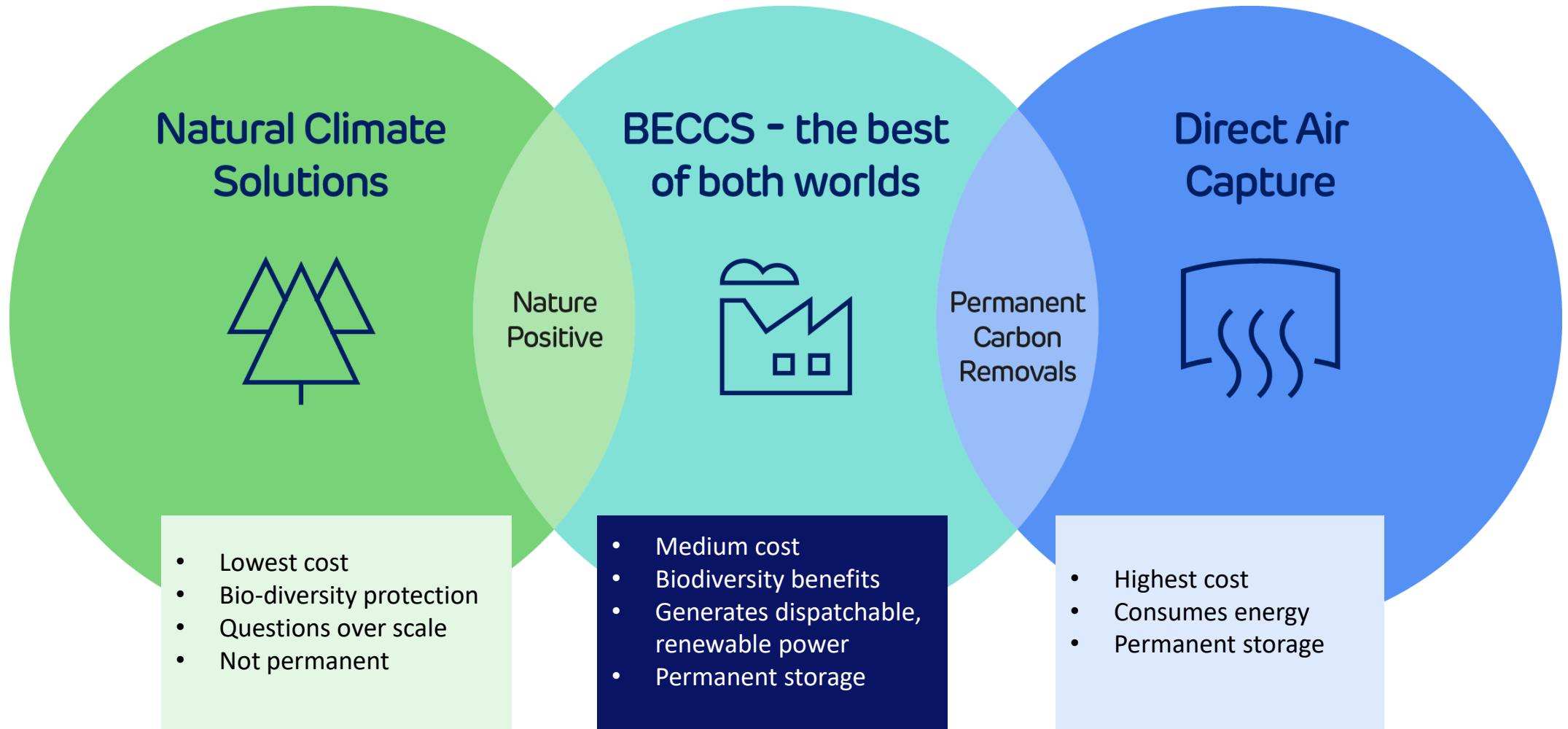
The BECCS process separates and permanently stores CO<sub>2</sub> underground

24/7 dispatchable, renewable power



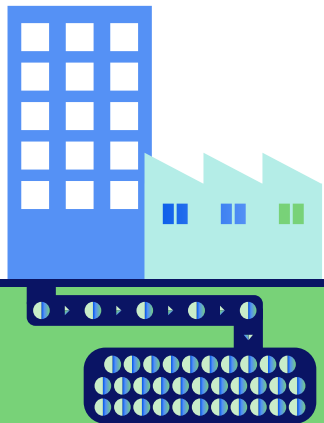


Achieving net zero will require the deployment of a full range of technologies



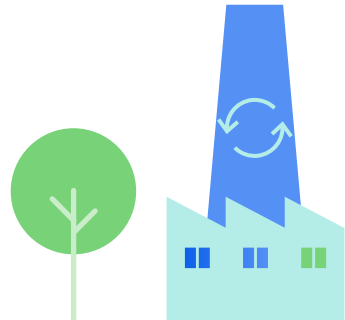
## Permanent

**Permanently stores CO<sub>2</sub> in geological sites**



## Impact

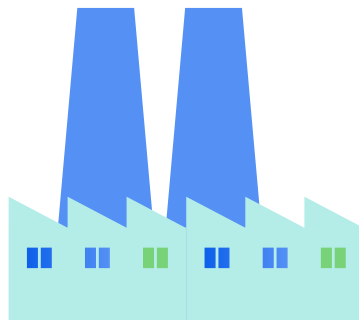
**Efficient removal of CO<sub>2</sub>**  
Active management reduces risk of disease and wildfire losses and economic returns incentivise forest retention and investment



## Scalable

**Gigatonne scalability**

Sustainable biomass available to support BECCS globally  
New-build  
Repurpose existing industrial assets



## Cost-competitive

**Lower cost versus other engineered solutions**

Even at scale, BECCS should remain cheaper than other engineered removals



## Tech-ready

**Proven technology**

Proven technology both in terms of biomass usage as a sustainable resource for power generation, and permanent carbon capture and storage



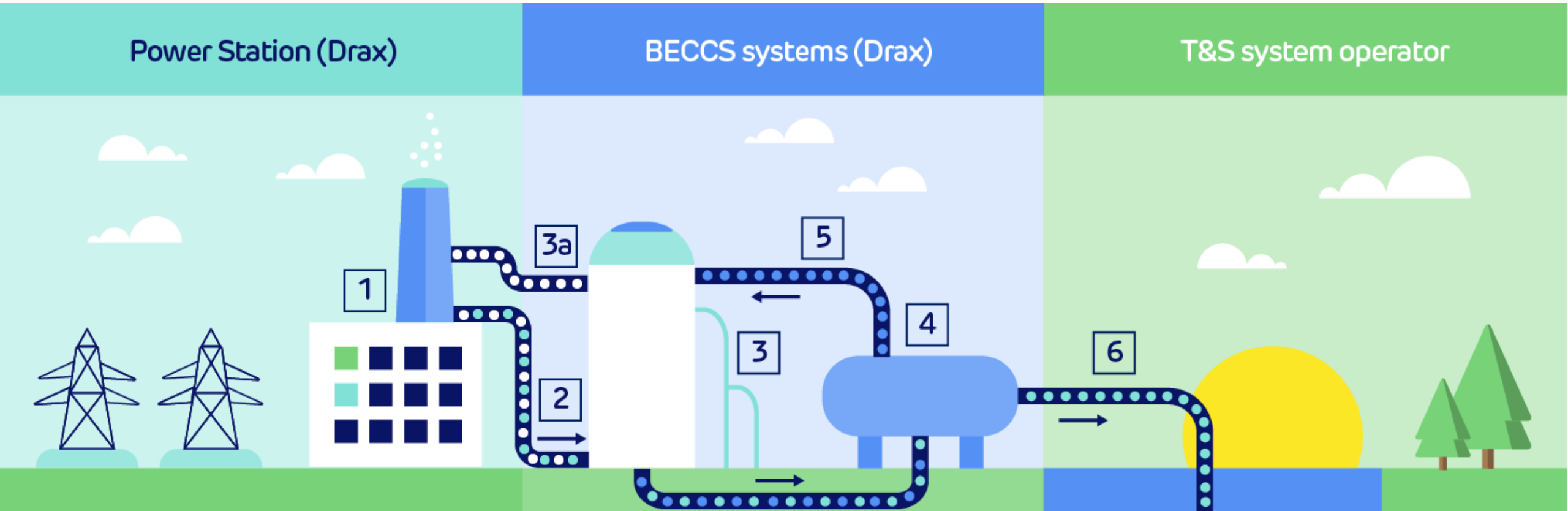
## Green co-products

**Meet demand for baseload renewables and zero carbon products**

Power-BECCS generates renewable baseload electricity to meet the rising demand for renewable power; BECCS on industry also enables third-party co-products



## Post-combustion capture on existing biomass generation units and solvent treatment of CO<sub>2</sub>



### KEY

- Flue gas
- CO<sub>2</sub>
- Solvent

1. Flue gas containing CO<sub>2</sub> leaves 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 which extracts CO<sub>2</sub> from the flue gas. CO<sub>2</sub>-depleted flue gas is released into the atmosphere (3a)
4. The solvent containing the CO<sub>2</sub> is heated in a re-boiler, which reverses the chemical reaction separating the CO<sub>2</sub> from the solvent
5. The solvent is then re-circulated back into the carbon capture system
6. The now pure stream of CO<sub>2</sub> is transported via pipeline for permanent storage underground, under the ocean or sea

**BECCS is the only non-fossil technology to offer the full suite of system services – enabling the integration of intermittent renewables while dispatchable fossil plant diminishes**

SYSTEM SERVICES	BECCS	GAS CCS	NUCLEAR	WIND	SOLAR	BATTERIES	INTER-CONNECTOR
Carbon removals	YES	NO	NO	NO	NO	NO	NO
Clean electricity	YES	PARTIAL	YES	YES	YES	PARTIAL	PARTIAL
Controllable / Dispatchable	YES	YES	NO	PARTIAL	PARTIAL	YES	YES
Inertia	YES	YES	YES	NO	NO	NO	NO
Dynamic response	YES	YES	NO	PARTIAL	NO	YES	YES
Reserve	YES	YES	NO	PARTIAL	NO	YES	YES
Reactive Power	YES	YES	YES	PARTIAL	NO	YES	YES
Black Start	YES	YES	PARTIAL	NO	NO	NO	YES

## Proven technologies and a biomass supply chain demonstrated over c.20 years

### Bioenergy (BE)

- Use of biomass for generation since 2004
- Operator of world's largest biomass power station
- Operator of world's second largest pellet production business
- New-build BECCS can simplify supply chain even further

### Carbon Capture (CC)

- Multiple reference plants capturing CO<sub>2</sub> globally, including reference plants at >1Mt capture pa
- Drax Power Station project will utilise Mitsubishi Heavy Industries (MHI) advanced amine technology
- >6,000 hours of testing has proven the chemistry

### Storage (S)

- Targeting areas with well-mapped geologies



## **Is BECCS an efficient capture process?**

- BECCS is one of the most efficient technologies for large scale carbon removals
- Advanced amine technology – capture rate of around 95%

## **Retrofitting BECCS means the loss of thermal efficiency?**

- The energy consumed in a BECCS plant is used for the production of two products (1) renewable power and (2) carbon removals – it is not lost

## **Does BECCS lead to a higher level of SOx and NOx emissions?**

- Biomass is already a low sulphur
- SOx in the flue gas is treated and removed in the quench column before the flue gas is passed through the CO<sub>2</sub> absorber
- NOx is controlled in the power island and reduced further as part of the carbon capture cycle

## **BECCS is unproven?**

- The post combustion technology we plan to use has been proven at scale and is deployed on numerous sites globally
- >6,000 hours of testing of solvent on live flue gas at Drax Power Station over the last two years

## **BECCS will lead to unsustainable fibre consumption?**

- We have a responsible sourcing policy, which supplements national and regional regulations mitigating this risk

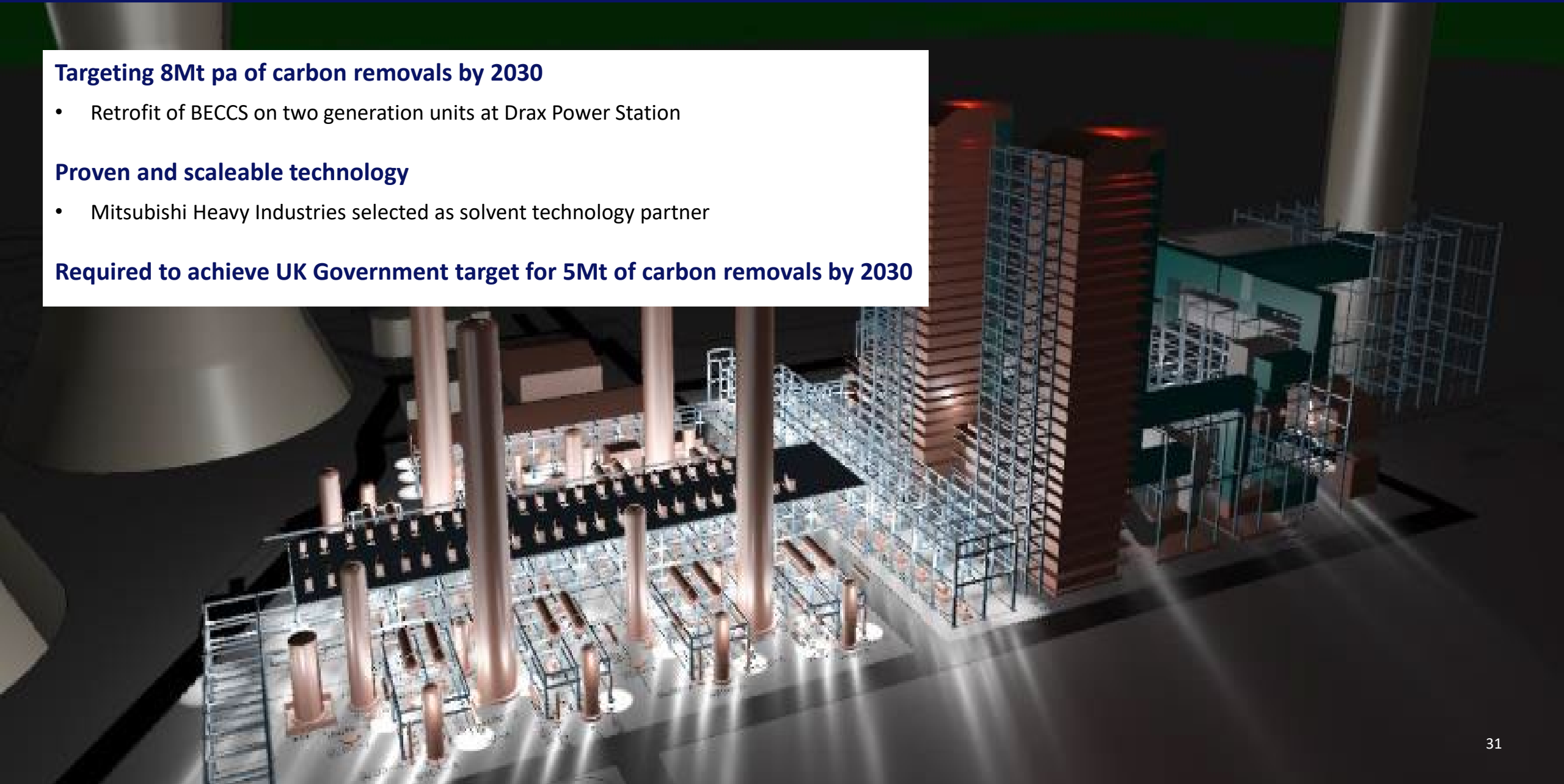
## Targeting 8Mt pa of carbon removals by 2030

- Retrofit of BECCS on two generation units at Drax Power Station

## Proven and scalable technology

- Mitsubishi Heavy Industries selected as solvent technology partner

## Required to achieve UK Government target for 5Mt of carbon removals by 2030



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# CCS on a pellet plant

Early deployment on BECCS technology on existing supply chain assets to demonstrate technology at smaller scale, stimulate CDR market and reduce supply chain emissions

Targeting FID in 2024/25 and commissioning in 2026





Drax is pursuing a project to capture and permanently store the CO<sub>2</sub> produced from an existing pellet plant

## Why install CCS on a pellet plant?

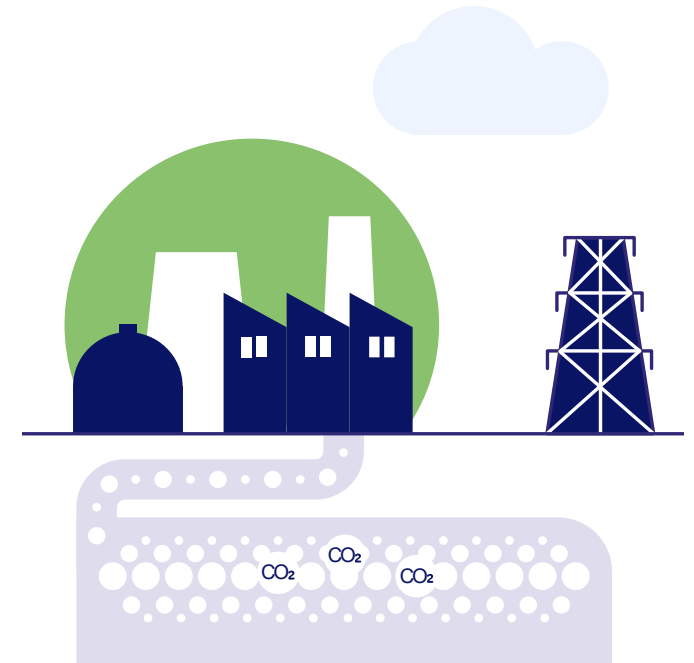
- Early deployment and demonstration of CCS with biomass
- Access to early CDR to help stimulate the market
- Utilisation of existing infrastructure and expertise from work on BECCS
- Removal of CO<sub>2</sub> emissions from pellet manufacturing process
- Lower capital investment

## Location

- Evaluating options for development at existing Drax plants at Morehouse or LaSalle (Louisiana)

## Technology and innovation

- Evaluation of multiple technology options



Carbon removal capacity:  
**>100kt/year**



Investment:  
**c.\$150m**



Targeted commissioning:  
**2026**

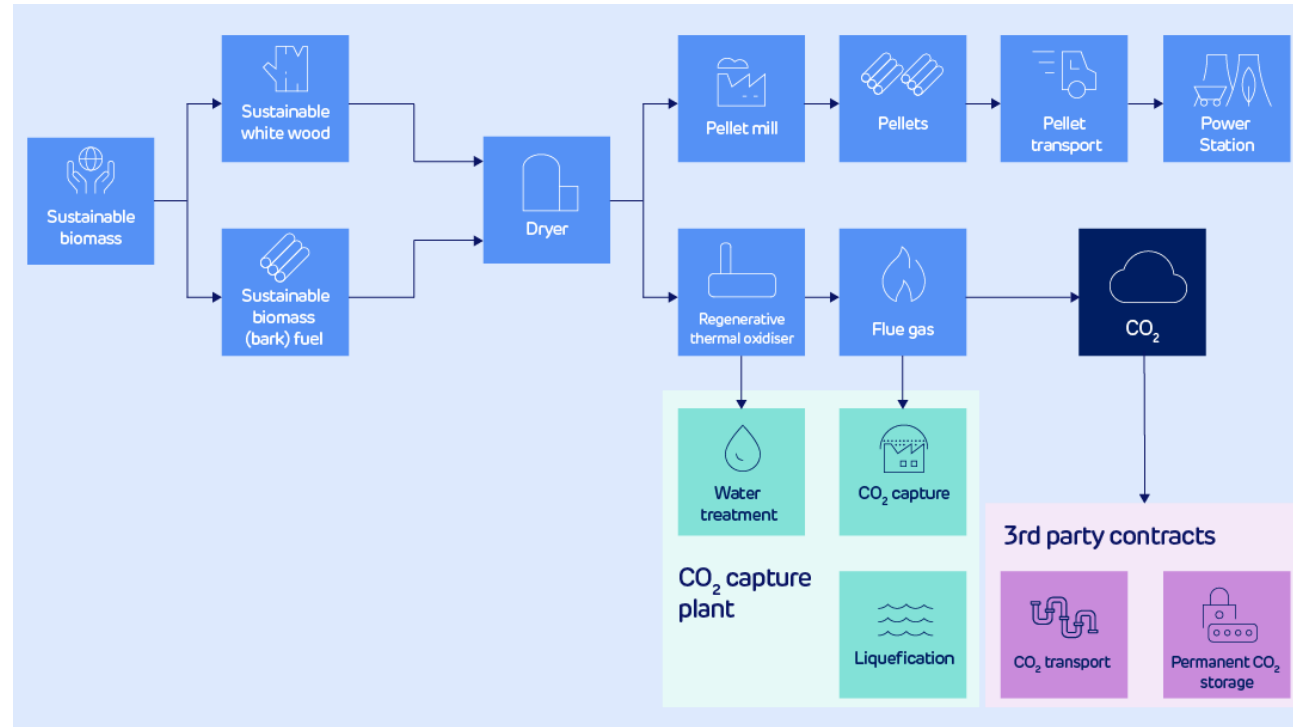


Permanent jobs  
**20+**

# Carbon Capture & Storage on a Pellet Plant – How it Works and Timetable

The key components of the CO<sub>2</sub> capture plant include CO<sub>2</sub> capture, liquefaction, water management, offloading and transport, balance of plant, and pellet plant brownfield components

Operational process



Development timetable



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# Development of Global BECCS

**Drax is developing a pipeline of project options in North America to provide long-term, large-scale carbon removals opportunities and create attractive investment opportunities**

**US Inflation Reduction Act is creating an enlarged investment opportunity for BECCS**

**Developing options in Europe and Australasia**



## Multiple options for deployment

### New-build BECCS

- Site the plant near the fibre basket and Transportation & Storage
- Design the plant with modern boiler technology to use wood chip and / or wood pellets, depending on location

### Coal-to-biomass-to-BECCS

- Retrofit of existing plants
- Likely to use wood pellets
- Similar model to Drax Power Station

### Co-located or integrated BECCS

- Use BECCS knowhow to integrate into other processes
- Sustainable Aviation Fuel – attractive host site for BECCS – multiple synergies
- Other advantages of being ‘inside the fence’



**Sited on or next to suitable CO<sub>2</sub> storage, reducing distance transported**

**Proximity to fibre baskets reduces transportation**

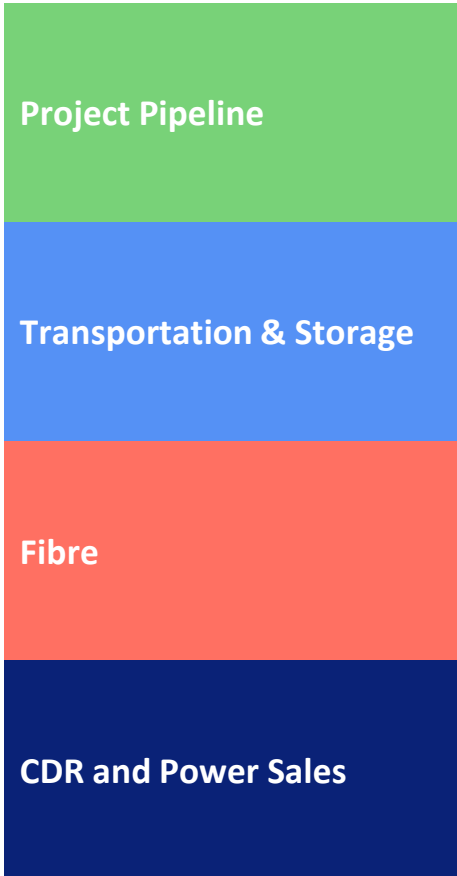
**Potential for lower fuel cost and wider fuel diet**

**Bottom-up design for biomass, not coal-to-biomass conversion**

**Efficiency through design – bottom-up design for biomass with optimised operational efficiency**

**Higher capital cost vs. retrofit – construction of new power generation and CCS units**

**Long-term supportive investment environment with national and local support**



**2 sites selected and progressing to option in US South, targeting c.6Mt by 2030**

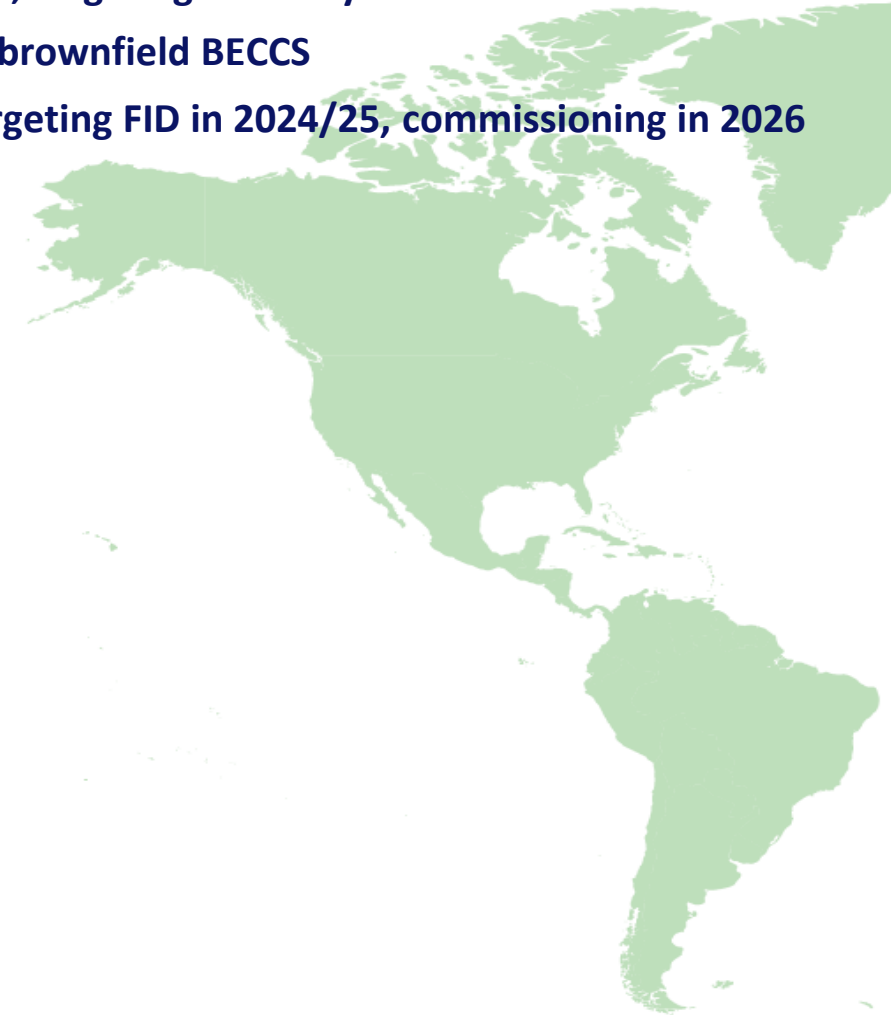
**Evaluating 9 additional sites in US for greenfield and brownfield BECCS**

**Development of option for CCS on a pellet plant – targeting FID in 2024/25, commissioning in 2026**

**MoUs in place with T&S providers**

**MoUs in place with three leading forestry companies**

**MoU for sales >2Mt of CDRs**





**US: targeting carbon-free power grid by 2035; net zero target by 2050; long-term strategy recognises the need for biomass**

**Inflation Reduction Act provides incentives for CCS**

**Canada: coal phase-out by 2030; net zero electricity system by 2035 and federal carbon price plan to increase C\$15/t per year from 2023 to reach CA\$170/t by 2030**

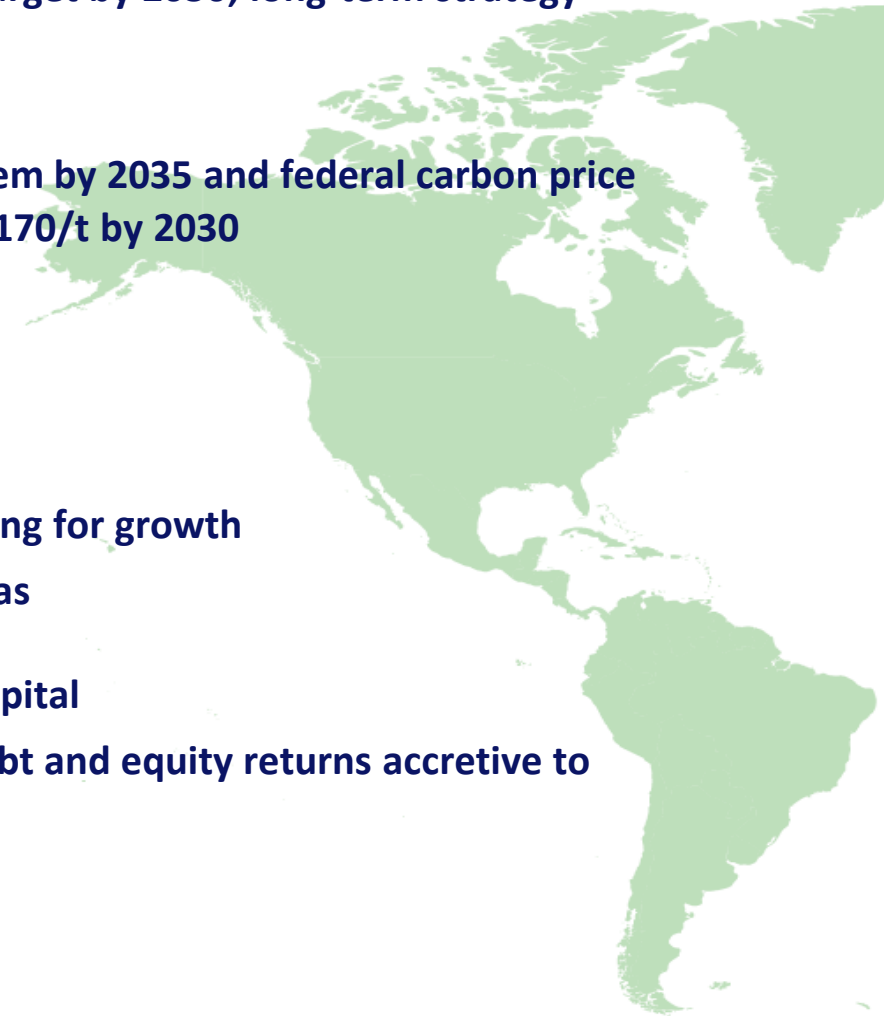
**Screening of long-term fibre supply**

**80 hires into Global BECCS – investing in people, resourcing for growth**

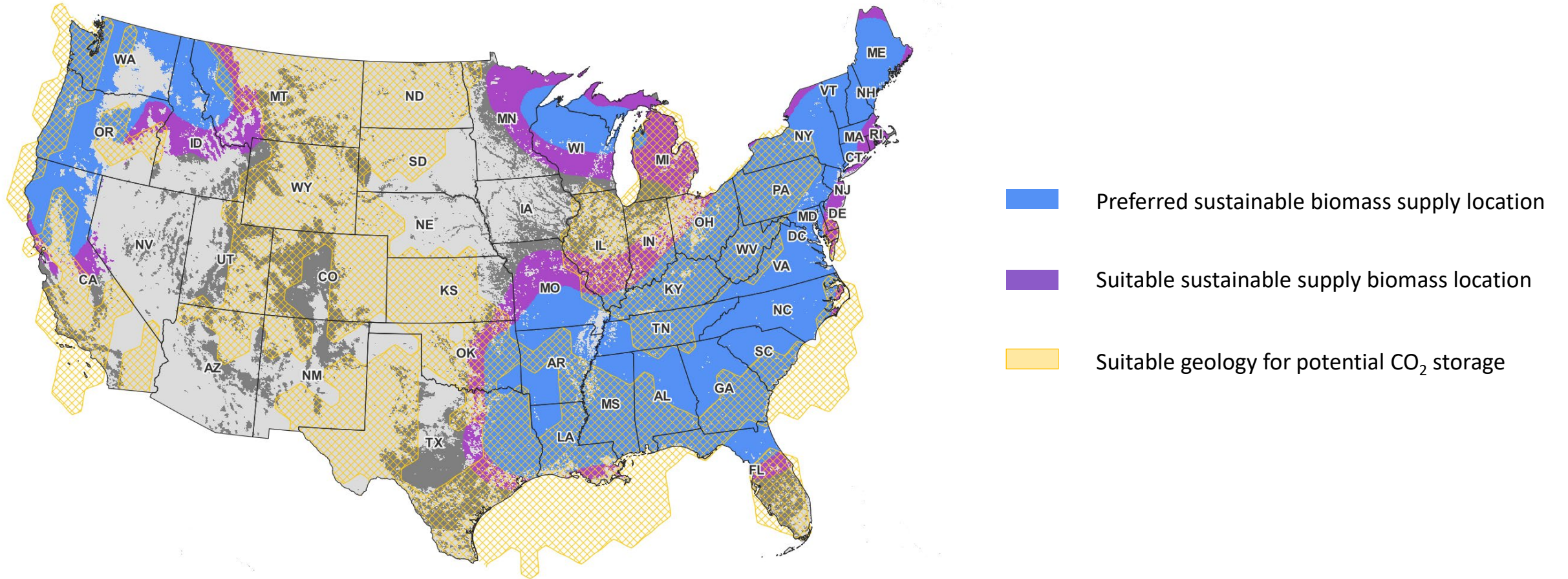
**New Global BECCS HQ being established in Houston, Texas**

**Targeting attractive returns significantly above cost of capital**

**Developing a range of funding options with attractive debt and equity returns accretive to existing shareholder equity**

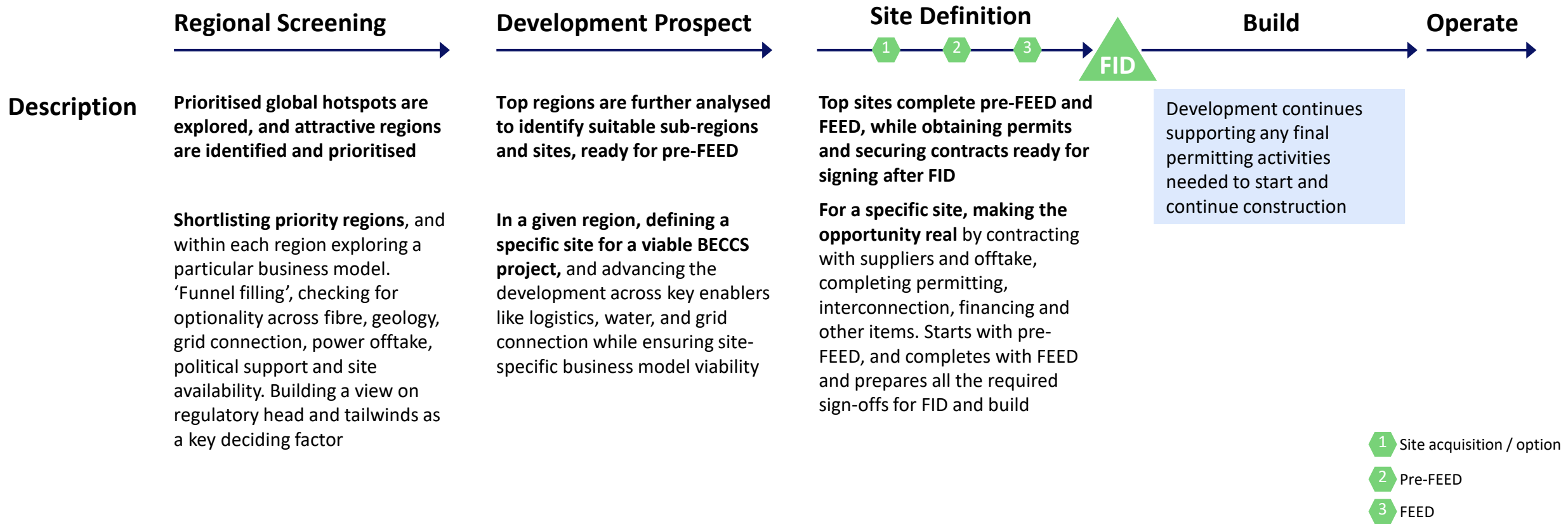


Focus on regions with a sustainable supply of biomass and favourable geology for CO<sub>2</sub> storage

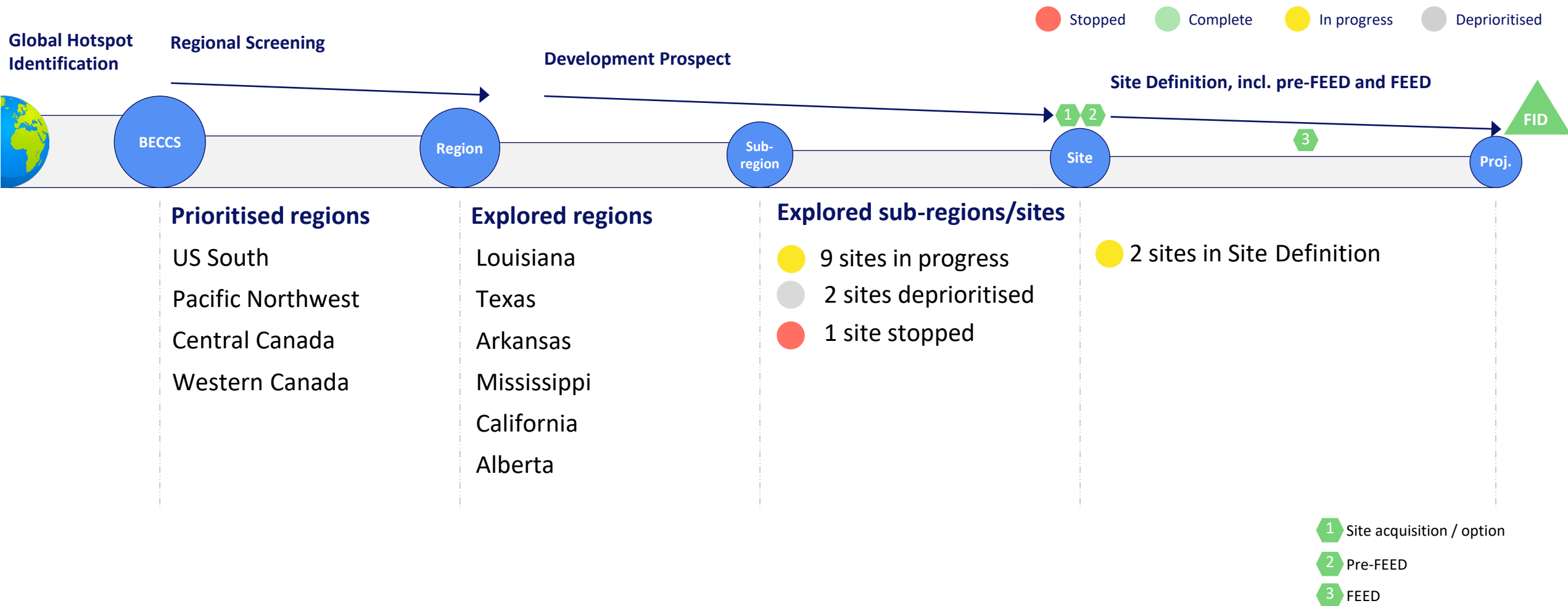




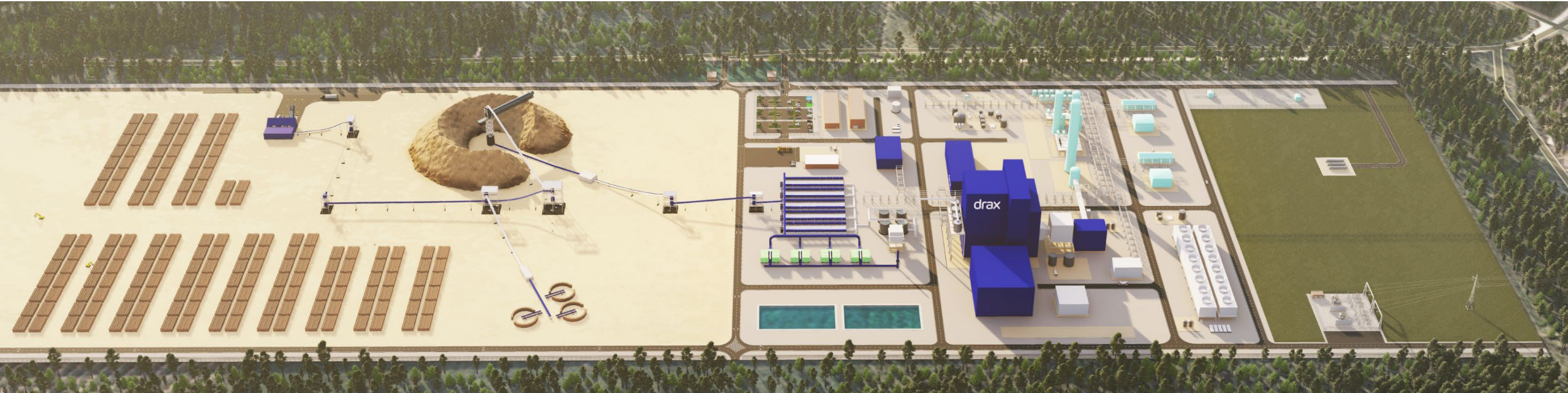
## Targeting FID on first two projects in 2025 and commissioning by 2030



## North American funnelling



Feasibility studies conducted with Bechtel and Worley – optimal size identified for new-build BECCS facility



Generation capacity:  
**c.270MW net**  
c.400MW gross



Renewable power generated:  
**c.2.0 TWh**  
of 24/7 renewable baseload power



Carbon dioxide captured:  
**c.3Mt**  
of carbon sequestered annually



Investment:  
**c.\$2bn**  
initial capital investment from Drax



Healthy forests:  
**c.3Mt**  
green tonnes of low-grade fibre



Job creation:  
**1,000+**  
permanent jobs supported by plant operations and across supply chain

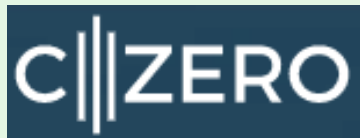


## CDR sales

- MoU for sale of 2Mt of CDR with Respira



- MoU with C-zero



## Fibre sourcing

- MOUs in place with three leading forestry companies



## Transportation and storage

- MoUs in place with T&S providers



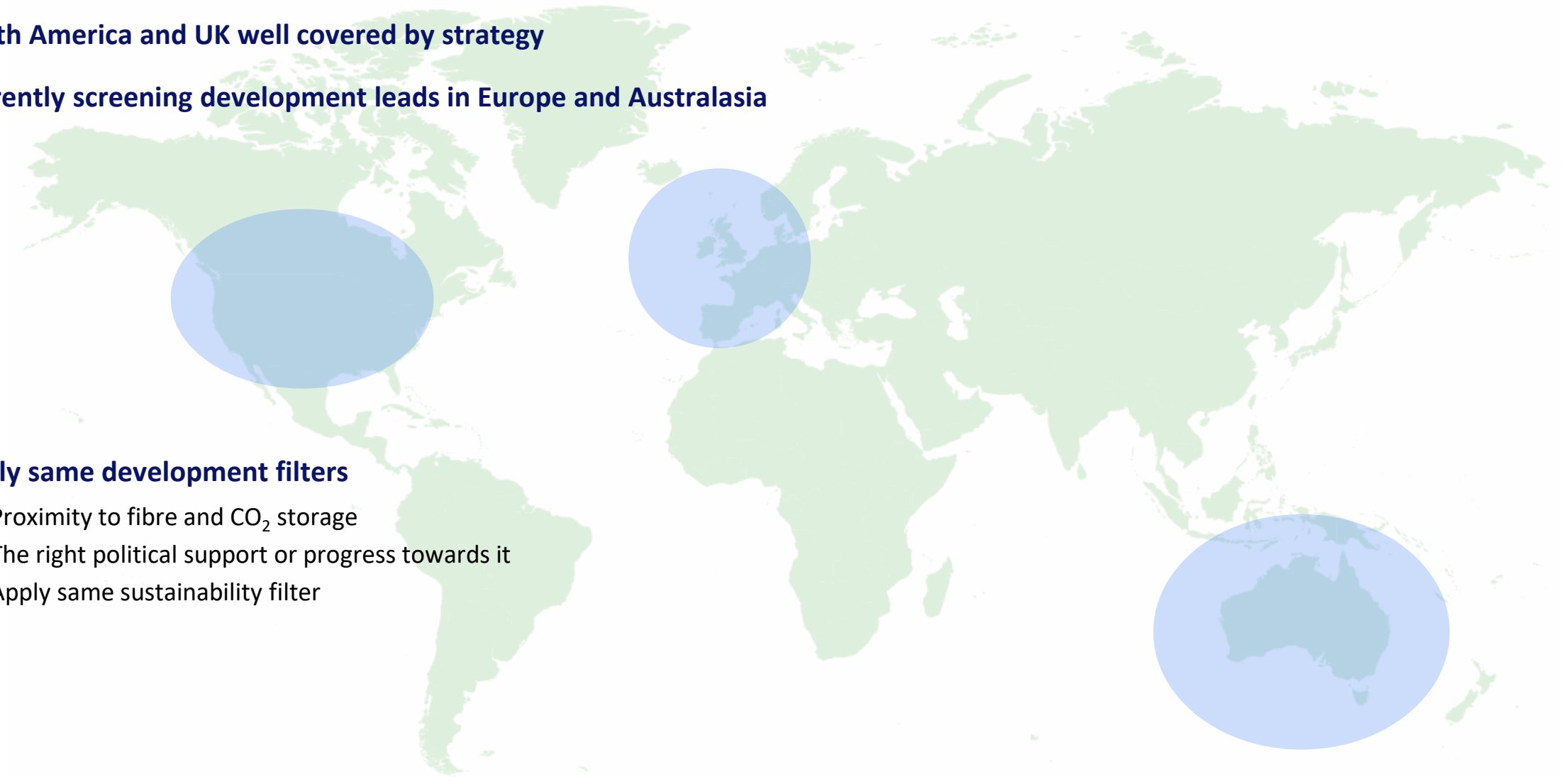
## Flexible technology deployment – BECCS as a service

- Open to bespoke solutions to particular industries
- SAF, chemicals, retrofit

## Developing options for BECCS beyond North America and UK

North America and UK well covered by strategy

Currently screening development leads in Europe and Australasia



### Apply same development filters

- Proximity to fibre and CO<sub>2</sub> storage
- The right political support or progress towards it
- Apply same sustainability filter

## **Ambition for >20Mt pa of carbon removals via BECCS – 14Mt pa by 2030**

### **North America**

- 2 sites selected and moving to option in US South – targeting FID in 2026 and operation by 2030, c.6Mt pa of carbon removals
- Pipeline of options for potential future development – screening 9 additional sites (greenfield and brownfield)
- Development of option for CCS on a pellet plant – targeting FID in 2024/25, commissioning in 2026

### **UK**

- 8Mt of carbon removals at Drax Power Station by 2030

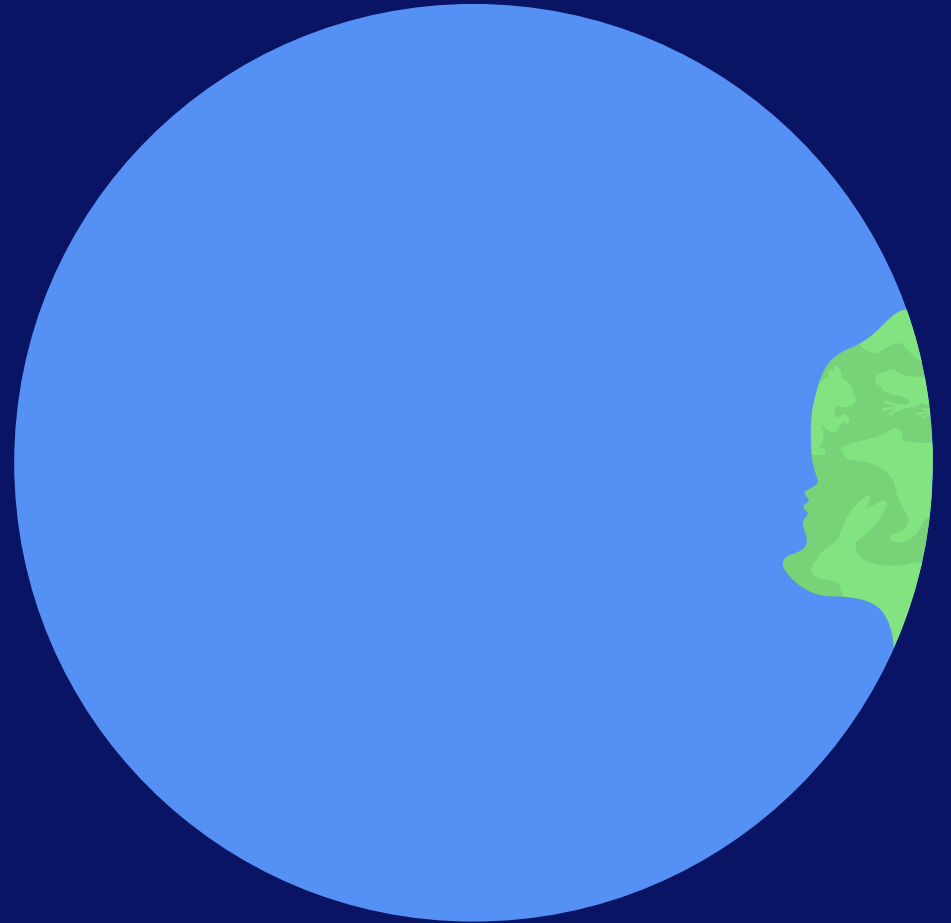
### **Global**

- Currently screening development leads in Europe and Australasia

# Sustainable Business

Alan Knight:

Director of Sustainability



drax

## Financial, climate, nature and people positive outcomes

### Countries, businesses and individuals are increasingly conscious of sustainability

- But behavioural changes are being offset by growth and new consumption

### Drax – long-term financial performance with positive climate, nature and people outcomes

- Supporting more renewable energy
- Helping to restore the climate by removing CO<sub>2</sub>
- Supporting the quality and growth of nature systems like forests
- Creating green jobs and supporting communities





**Our business is based on what the scientific consensus is telling us**

**Independent Advisory Board continues to scrutinise our use of science**

**Creation of a central science function**

- Enhance use of existing science
- New research
- Share thinking with stakeholders

**Development of BECCS Evidence Book**

## The Case for BECCS: An Evidence Book

The need and ability to scale up BECCS at an accelerated pace, true to sustainability



2023

## **‘BECCS Done Well’ report – *Forum for the Future* (November 2022)**

- Independent report commissioned by Drax
- Panel of four experts – Jonathon Porritt chair
- Seventy-plus expert stakeholders interviewed
- Supportive of BECCS
- Thirty conditions to ensure BECCS is done well

## **Since publication**

- Extensive internal consideration chaired by Will Gardiner
- Preliminary response due to be published shortly
- Full commitments and policies to follow
- Continue to work with Jonathon Porritt

# BECCS DONE WELL

## Conditions for Success for Bioenergy with Carbon Capture and Storage

Prepared by  
The High Level Panel on BECCS Done Well

November 2022

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# Biomass sustainability and standards

## **The world needs more timber for construction, manufacturing and more**

- Timber creates sawdust and shavings
- Harvesting forests creates thinnings, branches, unusable logs
- Good forest management includes removal of material
  - Reduce the risk and intensity of forest fires
  - Restoration from disease
- Drax fibre sources are embedded in the timber industry
  - c.98% from sawmill and other wood industry residues, branches and tops, thinnings, low-grade roundwood
  - c.2% agricultural residues



## We source from forests that are well regulated to ensure positive people, nature and climate outcomes

- Working forests are well managed
- Healthy managed forests deliver sustained ecological, economic and social outcomes
- Working forests for timber encourages regeneration
- Active management of forests reduces risk of disease and wild-fire

## Utilisation of material with limited other uses



Protection of sensitive sites



Forest Fire protection and Restoration from disease



Improved Biodiversity



Increased forest productivity



Local employment



Improved access for recreation



Historically, commercial uses for residues were limited... particularly in British Columbia...  
.....where burning of residues was undertaken

**Biomass provides a better alternative and supports long-term investment in good forest management**

## c.60% of Drax Group fibre comes from USA

- Working forests harvested by landowners for timber and pulp
- Stable / growing carbon stocks
- Engagement with suppliers helps sustain and improve forest management practices
- Working with small and large producers

## c.20% of Drax Group fibre comes from Canada

- 80% – sawdust and sawmill by-products

## Drax Group sources of fibre

	Sawmill and other wood industry residues	Branches and tops	Thinnings	Low-grade round wood	Arbori and agri. residues	Waste	Total
<b>USA</b>	19.7%	3.0%	13.8%	22.0%	1.4%	-	<b>59.9%</b>
<b>Canada</b>	20.2%	3.3%	-	0.8%	-	-	<b>24.3%</b>
<b>Latvia</b>	2.1%	-	-	6.8%	-	-	<b>8.9%</b>
<b>Portugal</b>	0.1%	0.3%	0.3%	1.2%	-	-	<b>1.9%</b>
<b>Brazil</b>	-	-	0.0%	1.8%	-	-	<b>1.8%</b>
<b>Estonia</b>	0.7%	-	0.2%	0.7%	-	-	<b>1.6%</b>
<b>Other European</b>	0.5%	-	-	-	1.1%	0.1%	<b>1.7%</b>
<b>Total</b>	<b>43.3%</b>	<b>6.6%</b>	<b>14.3%</b>	<b>33.3%</b>	<b>2.5%</b>	<b>0.1%</b>	<b>100.0%</b>

## Drax Pellet Production sources of fibre

<b>USA</b>	24.3%	0.0%	16.2%	12.3%	-	-	52.8%
<b>Canada</b>	38.9%	7.1%	0.0%	1.1%	-	-	47.2%
<b>Total</b>	<b>63.3%</b>	<b>7.1%</b>	<b>16.2%</b>	<b>13.4%</b>	<b>-</b>	<b>-</b>	<b>100.0%</b>

## Catchment Area Analysis

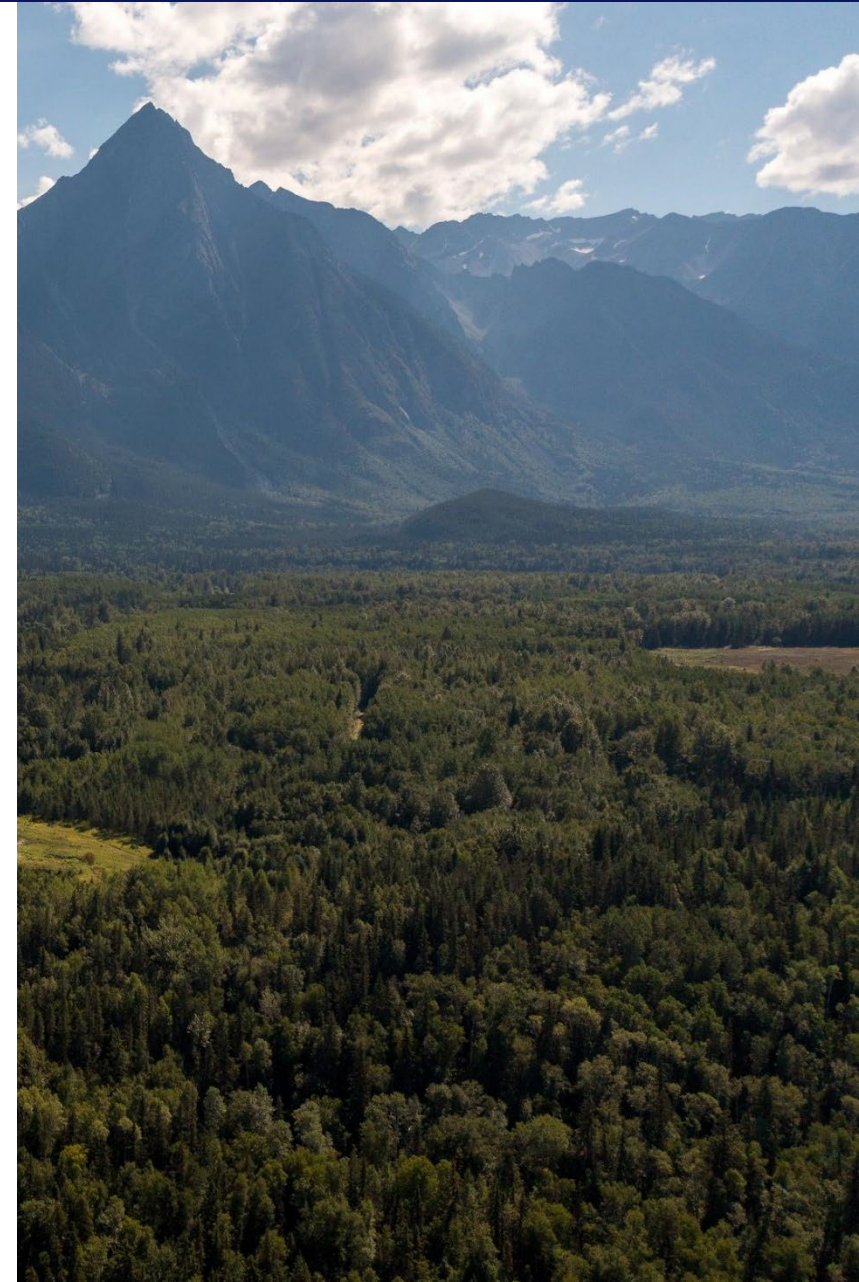
- Tracking of carbon storage and sequestration in regions where we source
- Applied to own-use fibre and third-party suppliers

## Catchment Area Analysis considerations

- Amount of carbon stored on landscape (growing stock)
- Sequestration rate of carbon (productivity of forests)
- Harvesting levels vs. productive capacity of area
- Changes in forest management practice
- Wood prices and other markets that use wood

## Impact

- Source from working forest areas where there is an established forest industry
- Understand forest carbon factors in areas we source from





## Multiple regulations and audits of biomass sources

- In-country forestry regulations for timber sector
- Independent, multi-stakeholder forest standards bodies
  - Forest Stewardship Council® (FSC® C119787), PEFC (PEFC/16-37-1769), SFI (SFI-01578)
- Independent, multi-stakeholder standards for biomass – SBP
- Internal policies and audits



The mark of  
responsible forestry



## Highlight on:

### Sustainable Biomass Program (SBP)

SBP is a certification system designed for woody biomass used in industrial energy production

Originally created by biomass generators, SBP has evolved and has had a multi-stakeholder governance structure since 2019

### Sustainable Forestry Initiative (SFI)

Programme for the Endorsement of Forest Certifications (PEFC)

Forest Stewardship Council® (FSC®)

## Drax – a leading role in the Glasgow Declaration

Lead the industry in setting sustainability standards for biomass

Clear principles

Forum for users and producers, with others stakeholders to agree a common approach to sustainability

Working with World Bioenergy Association and other sector peers to develop sustainability standards for biomass



# Glasgow Declaration on Sustainable Bioenergy



The economics of forestry mean we take low-grade material



We buy from regions where forest regulations are tight



Voluntary certification schemes



Sourcing policy, supported by our compliance procedures



UK regulations and compliance



Post-harvesting studies, to track impact



Independent Advisory Board of leading academics



Work with our sector to create a universal gold standard

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# Towards BECCS and what next?

## Geospatial models with sustainability filters...

## ...exploring three main types of biomass

### Modelled current and potential future biomass production

11 geospatial datasets, 7 scientific references and high-resolution data

#### Criteria



**No high conservation value land:** intact forest landscape; high biodiversity intactness index; key biodiversity area; peatland; wetland; areas with high soil loss



**Leaving enough residue for nature:** protect nutrient cycles, floor biodiversity in forests



**Good practice forestry and logistics:** exclude land steeper than a threshold grade; land far from major infrastructure; containing a low biomass density excluded



**Low-grade and forest and sawmill residuals:** wood residues, primary residues from forest harvests, secondary residues, and low-grade roundwood  
Excludes high-quality roundwood such as sawlogs



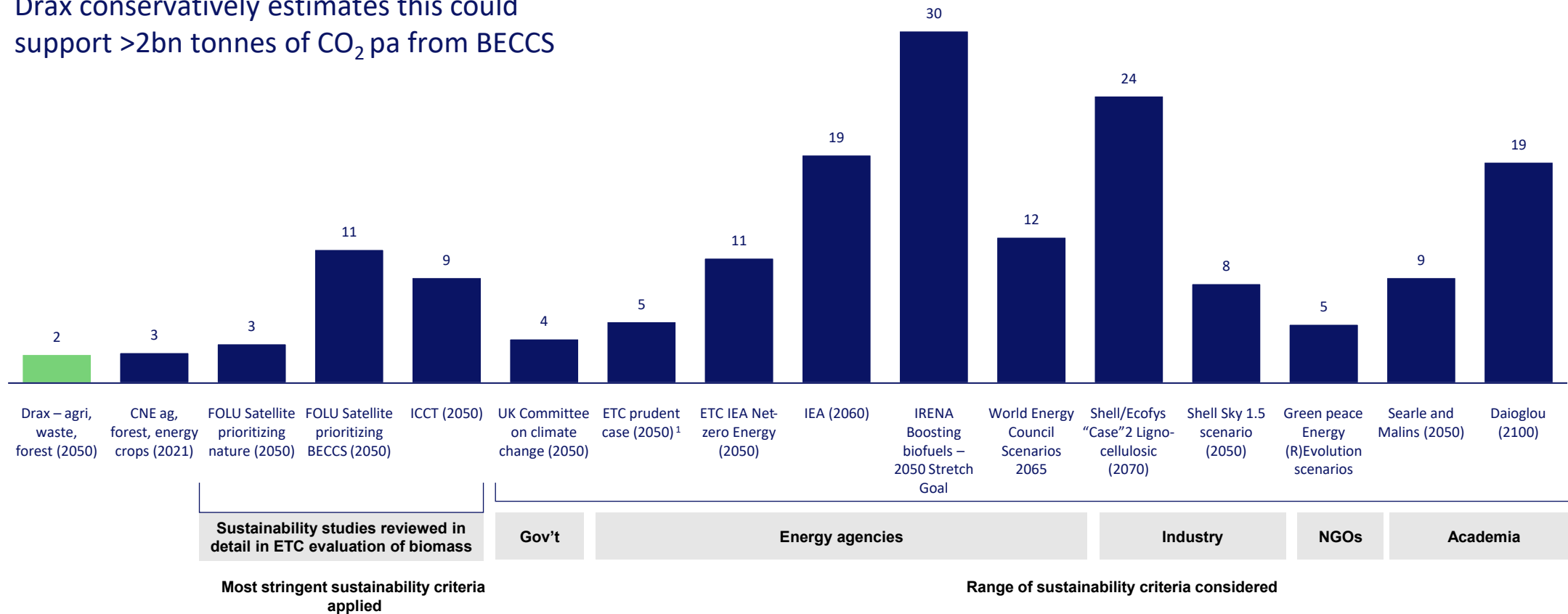
**Agricultural biomass:** primary residues (e.g., stalks, leaves) and secondary residues (e.g., processing residues like bagasse)



**Waste biomass:** woody municipal waste, sludges, cooking oils, animal fats, food processing wastes, and other municipal wastes

## Theoretical maximum of CO<sub>2</sub> that could be captured by BECCS based on global sustainable biomass supply, billion tonnes of CO<sub>2</sub> pa

Drax conservatively estimates this could support >2bn tonnes of CO<sub>2</sub> pa from BECCS

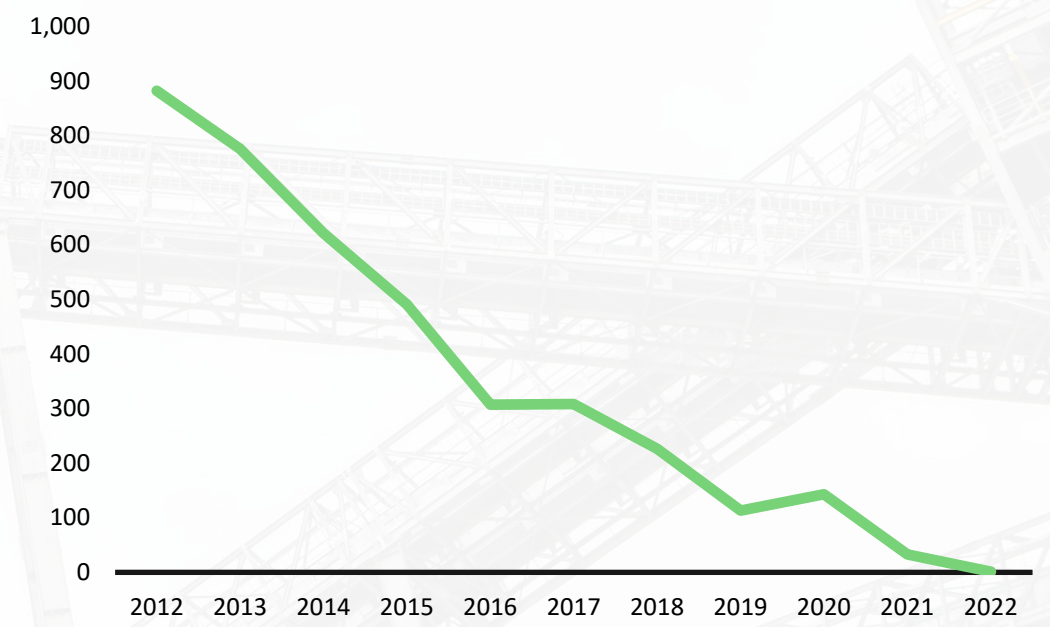


**Coal reduction saw scope 1 emissions fall**

**Targets to reduce remaining Group scope 1, 2 and 3 emissions**

**Targeting net zero by 2030**

## 99% reduction in Generation scope 1 and 2 CO<sub>2</sub> intensity (tCO<sub>2</sub>e/GWh) since 2012



- Transition from coal to biomass
- Sale of combined cycle gas generation
- Closure of remaining coal

## Well-established science and policies underpins biomass sustainability

### **Mapping our impact and dependencies on the natural environment to enable us to have a positive impact**

- Working with World Business Council for Sustainable Development (WBCSD) and others to establish best practice
- Identifying nature metrics specific to our generation assets and forest sources
- Recruiting nature specialists at corporate and operation level
- Policies and projects in place to protect and enhance nature at our many touchpoints
- Developing partnerships throughout our value chain to deliver benefits to nature
- Member of Task Force for Nature Related Financial Disclosure (TNFD) Pilot



c.£1million investment in 2023 in projects and programmes that support our communities



## Drax Foundation

Grant funding for non-profit organizations in the UK, US and Canada



- STEM education and skills development
- Enhancing green spaces and biodiversity in local communities
- Bi-annual grant awards, grants up to £50,000. Supported by employee-led Foundation Committees in each country

## Drax Community Fund

Donations to local projects in the communities where Drax operates



- Focus on STEM education and improving local communities
- Projects with high local visibility
- Quarterly donations of up to £2,000 to local community projects.
- Supported by employee-led Charity Committees in each country

## Drax Communities in Crisis Fund



- Emergency support for natural disasters, conflict and other humanitarian crises
- Overseen by Drax executive committee



## Strengthening governance across the company through a new governance model and ESG reporting

- Sustainability Council
- New executive role for sustainability
- Expert hubs – Climate, Forests, Carbon Reduction, Nature, Biomass
- ESG reporting



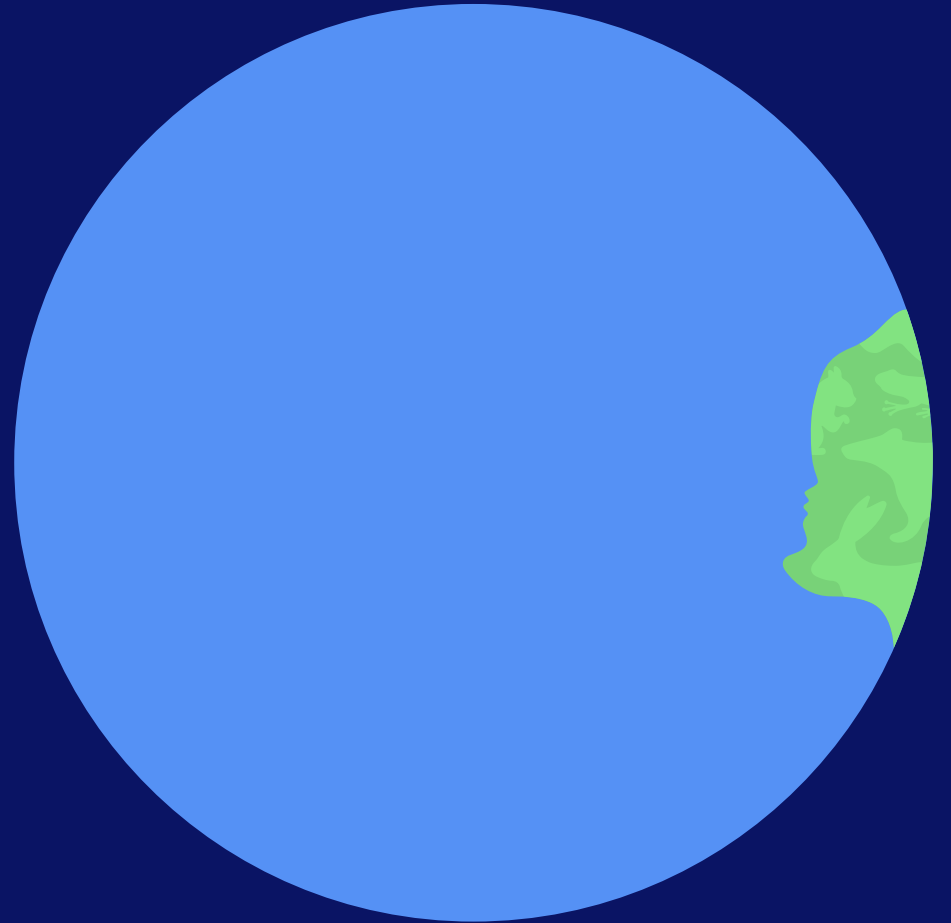
**A business model that links positive long-term financial, climate, nature and people outcomes**

**Underpinned by the science and strong governance**



# Finance Update

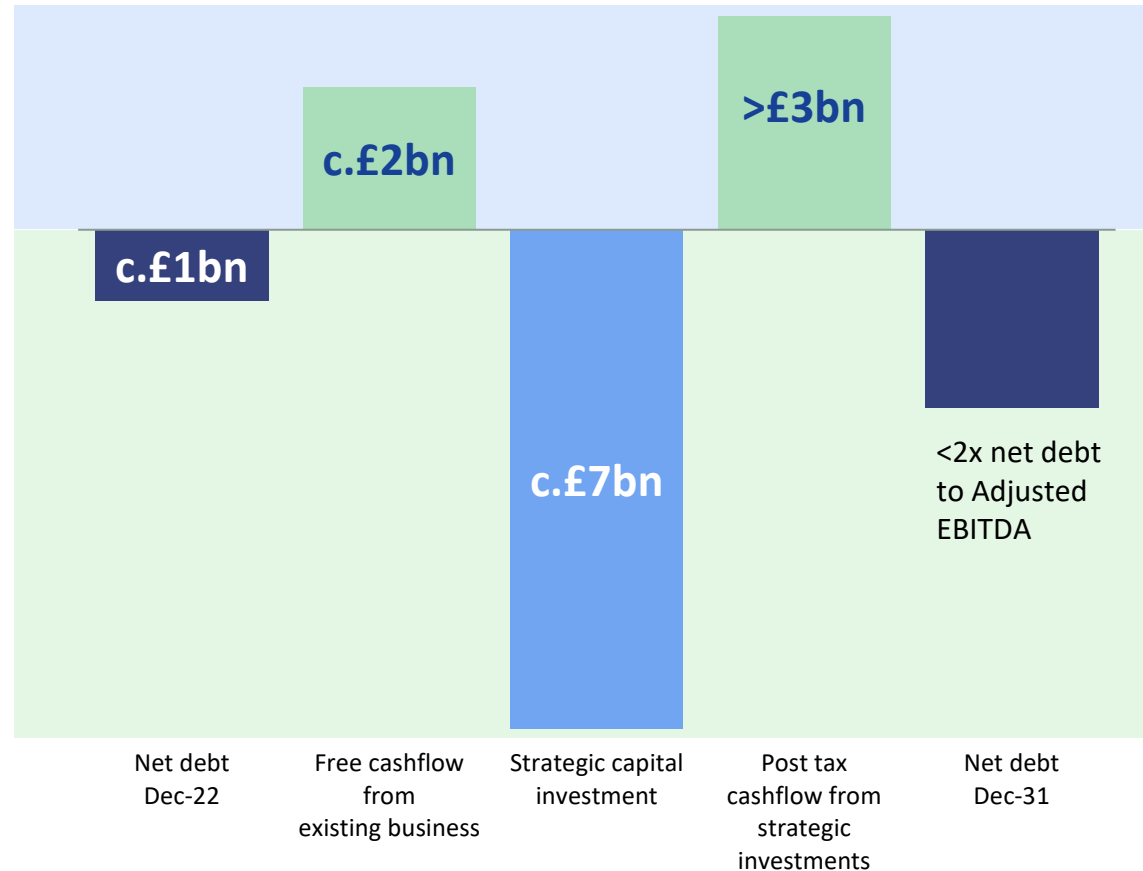
Andy Skelton: CFO



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<p>High-quality, strategic asset base aligned with climate solutions, net zero and energy security</p>	<ul style="list-style-type: none"> <li>• UK – 2.6GW of biomass and 0.5GW of pumped storage / hydro generation</li> <li>• North America – 5Mt of capacity across 18 operational and development plants with access to 5 deep-water ports. Sourcing of sustainable biomass from 4 major fibre baskets</li> <li>• Vertically integrated biomass supply chain and dispatchable UK generation assets support security of supply</li> </ul>
<p>Differentiated position with operations across the biomass value chain</p>	<ul style="list-style-type: none"> <li>• Owner, producer, operator, user and supplier of biomass</li> <li>• c.20 years experience in biomass and long-term relationships with forestry industry</li> <li>• Geographically diversified supply chain with opportunities for trading and optimisation</li> </ul>
<p>Strong operational and financial performance</p>	<ul style="list-style-type: none"> <li>• Adjusted EBITDA underpinned by index-linked revenues extending into the 2030s</li> <li>• £2.3bn of net cash from operating activities since 2017 with strong cash conversion</li> <li>• Strong balance sheet with c.2x net debt to Adjusted EBITDA target</li> </ul>
<p>Significant global growth opportunities aligned with climate solutions and net zero</p>	<ul style="list-style-type: none"> <li>• Attractive investment opportunities in carbon removals, pellet production and dispatchable generation</li> <li>• Investment opportunities aligned with country-level climate policies and rising value of carbon</li> </ul>
<p>Clear capital allocation policy</p>	<ul style="list-style-type: none"> <li>• Longstanding policy which supports investment in the existing asset base, growth and returns to shareholders</li> <li>• 11% average annual growth in dividend per share since 2017 – c.£400m of dividends paid</li> <li>• £200m of additional returns via share buybacks – £50m (2018/2019), £150m in 2023 (in progress)</li> </ul>

**Strong cash generation from existing assets underpins investment for growth**  
**Net debt to Adjusted EBITDA below 2x in 2031**



**c.£7bn of strategic investments**

- 14Mt of BECCS, pellet plants and pumped storage
- Investment high point 2026-2029, de-lever quickly thereafter, below 2x by 2031
- Significant free cashflows from strategic investments supports further investment opportunities

**Investment returns and funding options**

- Targeting double digit returns
- High-quality strategic assets and project portfolio provides range of attractive funding options

**Long standing capital allocation policy**

- Committed to paying a growing and sustainable dividend throughout and return of surplus capital in line with policy

1) Free cashflow from existing business = Adjusted EBITDA less interest, tax, Electricity Generator Levy, dividend and maintenance capex.

2) Free cashflow from strategic investments = Adjusted EBITDA less interest and tax.

Strategic objectives closely aligned with climate solutions, net zero and energy security  
 c.£7bn of attractive opportunities for long-term growth and value creation for stakeholders

	Description	Capital investment	Risk/Return
<b>Carbon Removals</b>	<p><b>14 Mt of carbon removals by 2030</b></p> <ul style="list-style-type: none"> <li>• 2 sites selected and moving to option in US South – targeting c.6Mt by 2030</li> <li>• Evaluating 9 additional sites in US for green and brownfield BECCS</li> <li>• MoUs agreed for sale of &gt;2Mt</li> <li>• 8Mt of carbon removals at Drax Power Station by 2030</li> <li>• Option for CCS on a pellet plant</li> </ul>	<b>c.£5.5-6.0bn</b>	<b>Higher</b>
<b>Pellet Plants</b>	<p><b>Targeting 8Mt of production capacity by 2030</b></p> <ul style="list-style-type: none"> <li>• c.3Mt of new capacity</li> </ul>	<b>c.£0.5-1.0bn</b>	
<b>Pumped storage expansion</b>	<p><b>600MW expansion by 2030</b></p> <ul style="list-style-type: none"> <li>• Multiple earnings sources aligned with growing system need</li> <li>• Underpinned by long-term earnings stability via a cap and floor mechanism</li> </ul>	<b>c.£0.5bn</b>	<b>Lower</b>



Wide range of attractive funding options: reinvestment of cash generated (from existing assets and strategic investments), issuance of new debt in-line with balance sheet targets and other sources of funding including project finance

## New-build BECCS – US



Renewable power generated:  
**c.2TWh**  
of 24/7 renewable baseload power



Carbon captured:  
**c.3Mt**  
of carbon sequestered pa



### Capital investment c.\$2bn

- New build c.300MW power station with BECCS located close to fibre source and access to T&S
- Higher capex than retrofit but lower opex



### Operating costs:

- Use of **wood chip** and proximity to sustainable fibre source reduces transportation costs and removes need for pelletisation
- T&S varies by project and region



### Remuneration:

- Long-term Power Purchase Agreements
- 45Q = \$85/t annual direct pay tax credit for CO<sub>2</sub> permanently removed and stored over 12-year period
- Forward sale of CDRs underpins FID (3m CDRs available per year)



### Risk and return

- Commercial structure supports higher returns but requires forward sale of significant volume of CDRs to underpin FID and support financing options
- Reduced FX risk
- Target long-term fibre agreements before FID

## BECCS in the UK – Drax Power Station



Renewable power generated:  
**c.4TWh**  
of 24/7 renewable baseload power



Carbon dioxide captured:  
**c.4Mt**  
of carbon sequestered pa



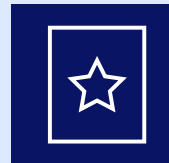
### Capital investment c.£1bn

- Retrofit existing biomass unit
- Lower capex than new build but higher opex



### Operating costs:

- Use of **biomass pellets** increases production and transportation cost
- T&S offtake agreement



### Remuneration:

- Long-term CfD agreement with UK Government with payment for renewable power generated and carbon captured, linked to UK CPI

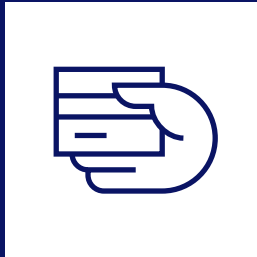


### Risk and return

- Government backed contract with long-term revenue visibility but lower returns
- CfD required to cover market price of biomass and FX risk to underpin project returns



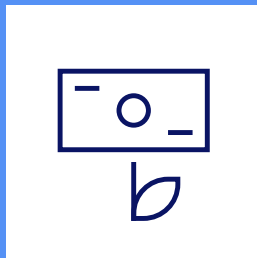
Implemented in 2017, designed to support strategy



1. Maintain credit rating



2. Invest in core business



3. Sustainable and growing dividend



4. Return surplus capital beyond investment requirements

**A sustainable long-term business model leveraging on our biomass expertise and objectives aligned with climate solutions, net zero and energy security**

**A purpose led company**

**A strategy delivering for shareholders as well as climate, nature and people**

**Proven financial performance**

**Attractive portfolio of investments opportunities**

**A disciplined approach to capital allocation**

## Carbon Removals

Objective 1: to be a global leader in carbon removals

## Pellet Production

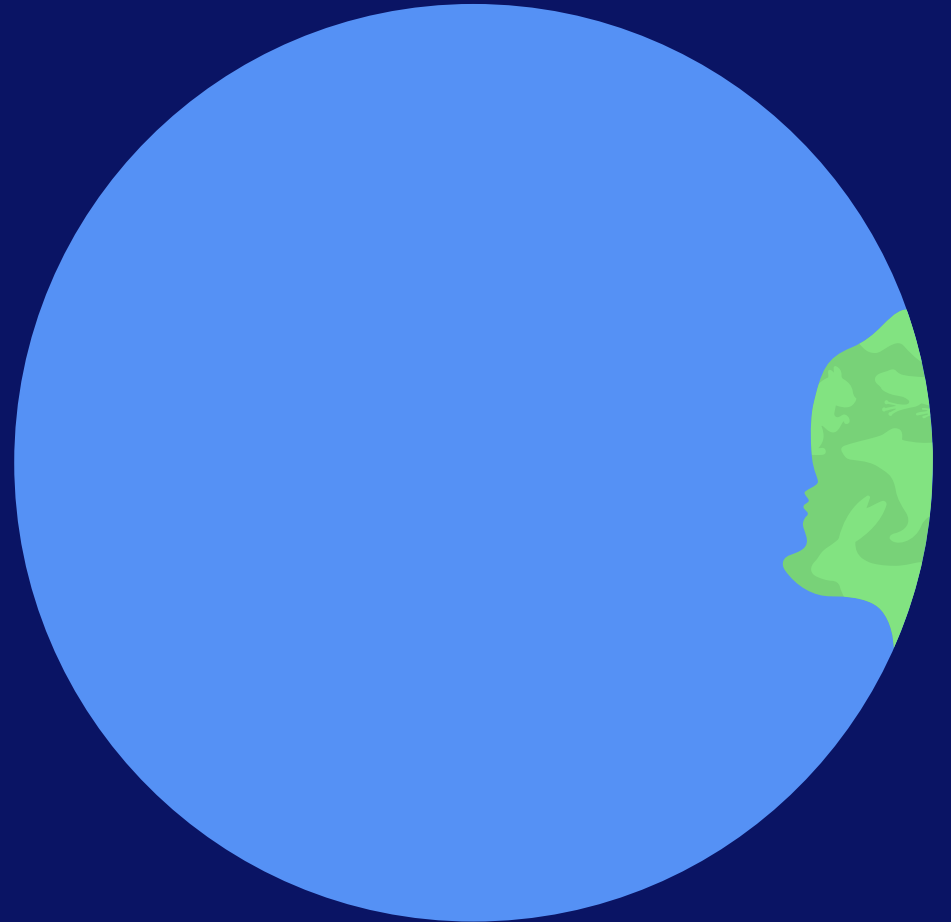
Objective 2: to be a global leader in sustainable biomass pellets

## Dispatchable, Renewable Power

Objective 3: to be a UK leader in dispatchable, renewable generation

# Drax Group Capital Markets Day

May 2023



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This presentation may contain certain statements, expectations, statistics, projections and other information that are, or may be, forward-looking. The accuracy and completeness of all such statements, including, without limitation, statements regarding the future financial position, strategy, projected costs, plans, beliefs, and objectives for the management of future operations of Drax Group plc ("Drax") and its subsidiaries (the "Group"), are not warranted or guaranteed. By their nature, forward-looking statements involve risk and uncertainty because they relate to events and depend on circumstances that may occur in the future. Although Drax believes that the statements, expectations, statistics and projections and other information reflected in such statements are reasonable, they reflect the Company's current view and no assurance can be given that they will prove to be correct. Such events and statements involve risks and uncertainties. Actual results and outcomes may differ materially from those expressed or implied by those forward-looking statements. There are a number of factors, many of which are beyond the control of the Group, which could cause actual results and developments to differ materially from those expressed or implied by such forward-looking statements. These include, but are not limited to, factors such as: future revenues being lower than expected; increasing competitive pressures in the industry; uncertainty as to future investment and support achieved in enabling the realisation of strategic aims and objectives; and/or general economic conditions or conditions affecting the relevant industry, both domestically and internationally, being less favourable than expected, including the impact of prevailing economic and political uncertainty. We do not intend to publicly update or revise these projections or other forward-looking statements to reflect events or circumstances after the date hereof, and we do not assume any responsibility for doing so.