Biomass Operations and Cost Reduction Initiatives

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Biomass Self-Supply Strategy

Operational excellence

– Safe, reliable and flexible operations

– Deliver good quality pellets at lowest cost to UK Generation business

Cost reduction

– Continuous innovation and improvement to reduce delivered cost of pellets

– Leverage locations and logistics for operational efficiencies

– Further integration of full supply chain from pellet production to power plant

Expansion of North American capacity

– Use existing capacity to support development of 5m tonnes self-supply target

Why We Have Focused on the US Gulf

Leveraging abundant fibre resources and dry bulk infrastructure in US Southeast

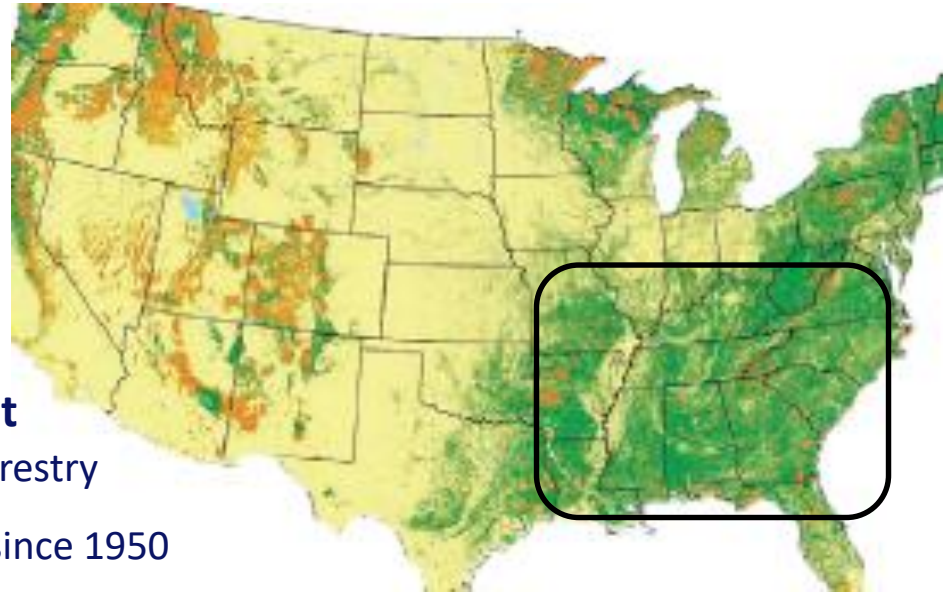
>35% of the landmass and **25%** of global industrial wood production

Pellet industry **less than 3%** of annual harvest

Forest **growing annually** since 1950s

Protected by statutes, regulation and certification

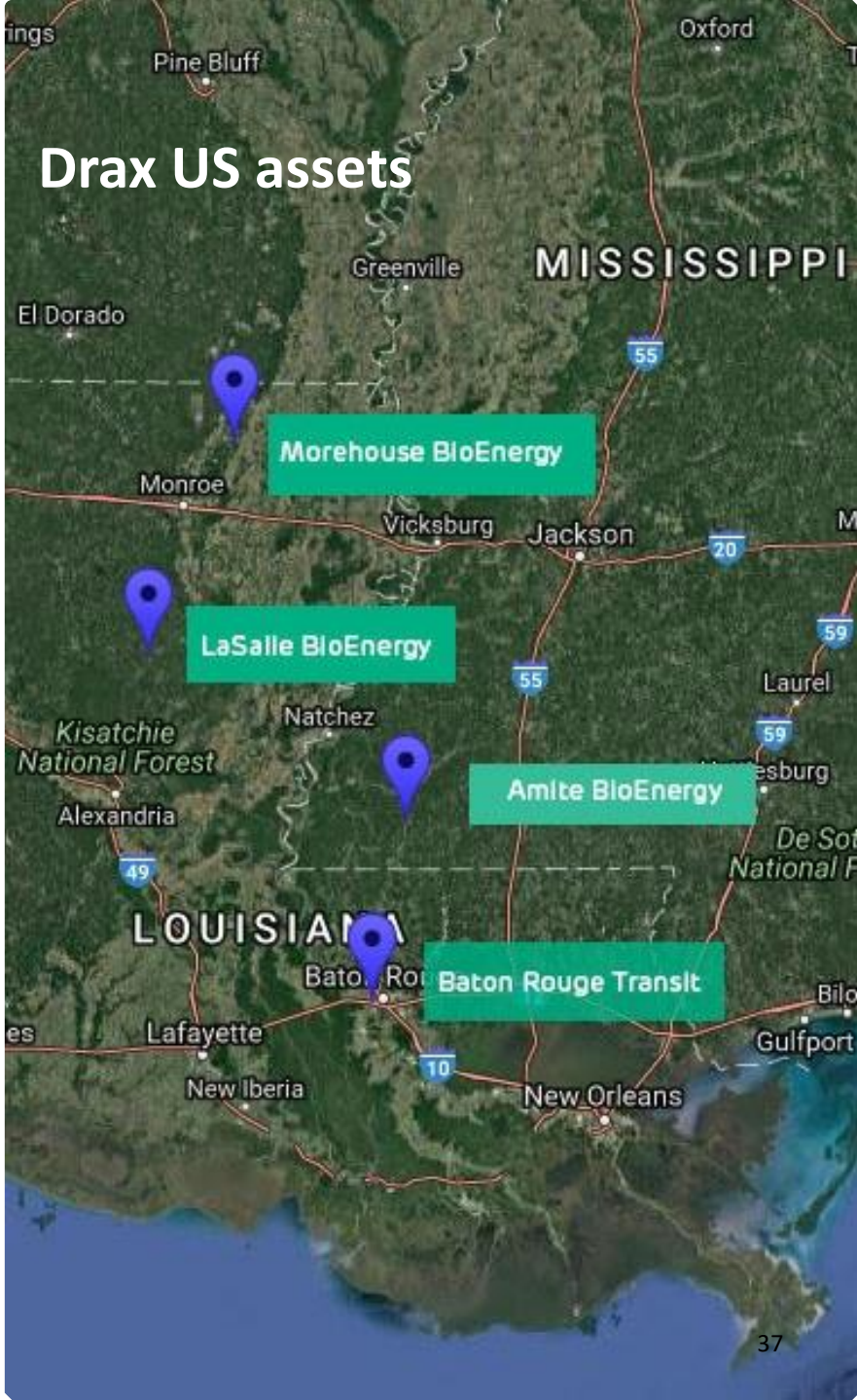
Best practices in **forest management** and sustainability



US Southeast – key fibre basket

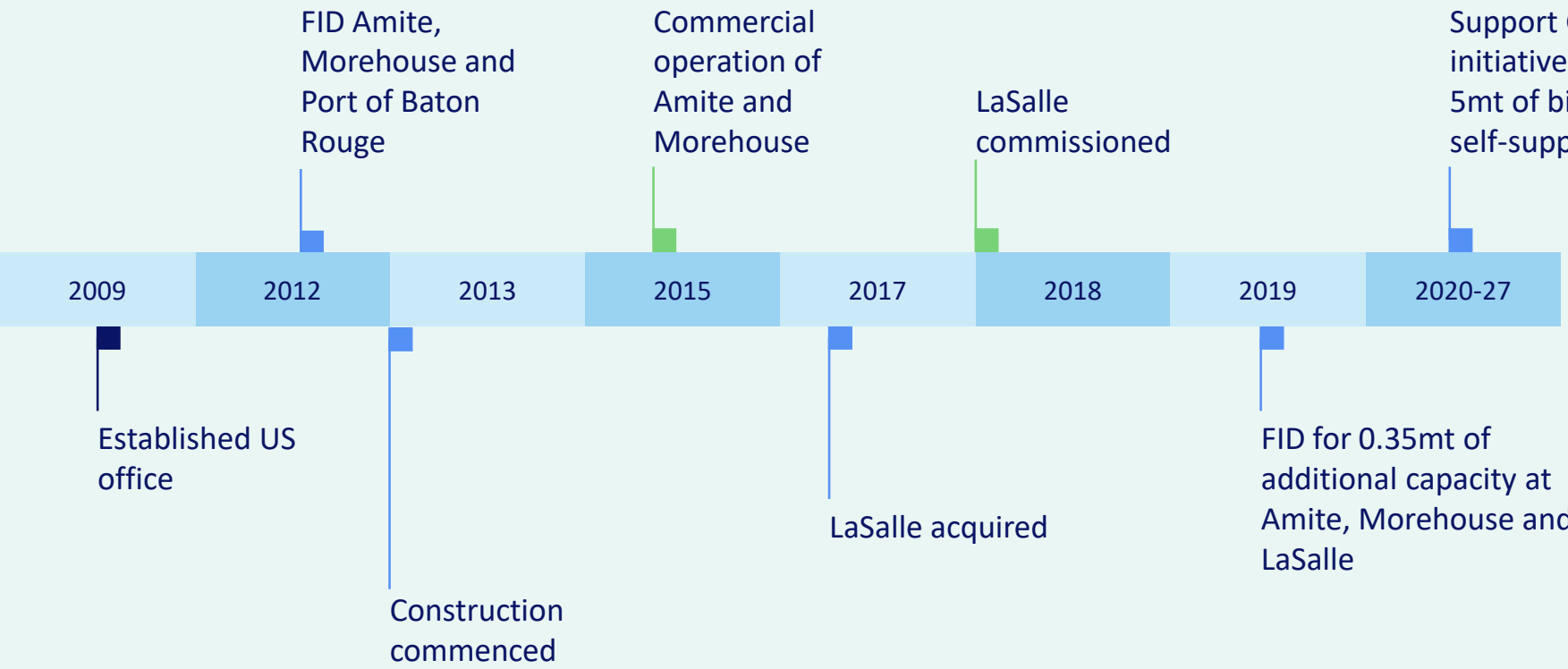
- Vast resources of sustainable forestry
- Carbon stocks increased >90% since 1950
- Well established commercial forestry industry and infrastructure
- Structural decline in incumbent users of low value fibre
- Opportunity for pellet producers

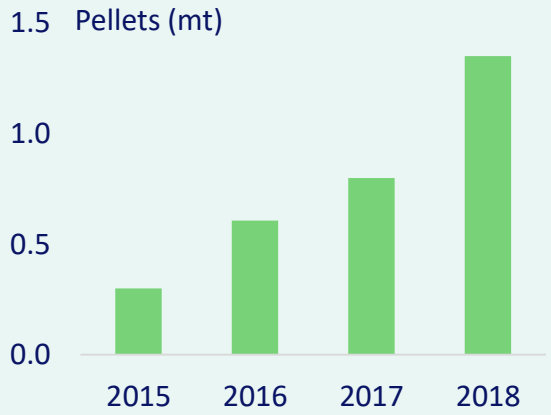
Stable commercial and regulatory environment

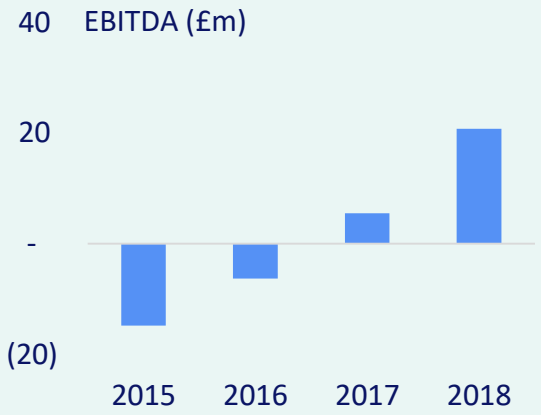


A History of Development and Improvement

Earnings growth driven by production increases, expansion and cost reduction







Pellet Plant Economics

Multi-stage immature self-supply chain provides significant opportunities for savings

Continuous innovation, increased capacity, operational synergies, lower cost fibres and *viable fuels*

PELLET PRODUCTION **GENERATION**

Forest | Harvesting | Transport to pellet plant | Processing | Transport to port | Port storage and handling | Ocean freight | Port storage and handling | Transport to power station | Generation

40% delivered fibre **40% processed pellets to port** **20% transport to Drax**

2019: c.£75-80/MWh

Total Group deliver cost

c.30% saving across supply chain

2027: c.£50/MWh

Target total Group deliver cost

US Initiatives

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Pellet Manufacturing Process

Specific US Cost Saving Initiatives

Some benefits delivered in 2019, more to follow in 2020-2022

$35/tonne saving (c.£13/MWh(1)) cost reduction

on 1.85mt pa (c.3.5TWh)

(1) At constant FX rate of $1.45/£

Forestry and Harvesting – Examples of Savings

Sawmill co-location

LaSalle sawmill co-location

- Investment: nil
- Long-term sawdust agreement with Hunt Forest Products
- Lower cost fibre
- Reduced fuel handling / transport
- Improved process efficiency
- Reduced energy consumption
- Fully operational

Completed in H1 2019, fully operational H2 2019

>$10/t saving
on 0.45mt pa
(Replicate at other sites)

Forestry and Harvesting – Examples of Savings

Improvement in wood mix; Increase in in-woods chips and mill residuals

Lower fibre cost

- Reduced use of forest thinnings
- Greater utilisation of bark, branches, wood chips and sawmill residues (including dry shavings)

Improved process efficiency

- Lower moisture content
- Reduced processing steps
- Reduced power consumption

c.$4/t saving
on 1.1mt pa
(Amite & Morehouse)

Operations – Examples of Savings

Decommissioning of woodyard facility at LaSalle

Reduced use of forest thinnings

Investment in truck dumps and mills

- Greater utilisation of low-cost residues
- Bark, branches, wood chips and sawmill residues

Cost and operational benefits

- Improved process efficiency and lower cost
- Lower fibre cost
- Wider fuel diet
- Greater operational resilience

c.$5/t saving
on 0.45mt pa
(replicate at other sites)

Die and roll life extension

Used to press fibre at high temperature into pellets

- Significant wear and tear

Installation of new pellet dies

- Increases hours of operation
- Lighter, easier installation
- Operational efficiency

c.<$1/t saving
on 1.5mt pa

Operations – Examples of Savings

Expansion of existing three pellet plants – process more low-cost residues

350kt capacity expansion

- LaSalle 150kt
- Amite 100kt
- Morehouse 100kt

Investment

- £50m[(1)] (2019 to 2021), payback pre 2027
- Returns significantly in excess of cost of capital

Benefits

- Increased capacity and throughput
- Pellet and hammermill upgrades
- Greater utilisation of low-cost sawmill residues and dry shavings
- Pellet screening to improve quality
- Improved process efficiency

Commissioning 2020/21

c.$50/t saving
on additional 0.35mt pa

(1) At constant FX rate of $1.45/£

Logistics – Examples of Savings

LaSalle

New rail spur

- Investment: $15m, three year payback
- Reduced cost versus road haulage
- 450kt throughput, plus expansion
- Fully operational

c.$15/t saving
on 0.45mt pa

Port of Baton Rouge

Rail chambering yard

- Use of 80-car rail wagons (currently 45)
- Reduced rail cost for LaSalle and Morehouse
- Interim solution to allow 80 car sets

c.$3/t saving
on 1mt pa

Amite

Trailer drop programme

- Optimised used of trailers between Amite and Baton Rouge
- Scaleable with increased volume

c.$2/t saving
on 0.5mt pa

Other US Self-Supply Development Opportunities – Satellite Plants

Smaller scale facilities strategically located in the southeast US

Wood pellet plants

- c.40kt tonnes sites, c.$10-15m per site
- Evaluate opportunity for up to 0.5mt
- Potential to replicate in other geographies

Lower capital cost

- Less material handling and preparation equipment

Low operating costs

- Emphasis on residual feedstocks

Minimal transport cost

- Utilisation of Drax infrastructure to deliver economies of scale

Opportunity for further savings from optimisation

Timescales

- Subject to investment decision, development in 2020

An additional opportunity for cost reduction and expansion in addition to $35/t identified from existing projects

>$40/t saving on up to 0.5mt of new capacity

UK Initiatives

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UK Supply Chain Cost Saving Initiatives

A number of improvements now being undertaken

Logistics	— **Port:** working in partnership to structure contracts post-2027 — **Storage:** additional on-dock storage under negotiation – avoiding inland store requirement — **Rail routes:** increase paths, rotations per rail set – increased tonnage
Efficiency Improvement Projects	— **Combustion:** on-site processing to reduce unburned material, fouling and heat transfer optimisation — **Process modifications:** reburning unburned biomass material — **Turbine upgrades:** barrel turbine
Biomass Fuel Purchasing	— **Agricultural residues:** maximising against technical limit, improving flexibility — **Biomass trading capability:** optimisation and risk management — **Targeting locations:** where fibre demand is in decline
Operational Excellence	— **Driving excellence throughout operations, trading and optimisation** — **Focused improvement initiatives:** safety, cost and commercial efficiency, integrated operational planning

UK Generation – Example of Savings

High Pressure Turbine Upgrade

Upgrade of biomass units 1-3

- Improved thermal efficiency – c.39%
- Reduced maintenance requirement
- Lower cost operations

Investment

- Capital investment c.£40m
- Payback pre 2027
- Payment post completion of programme

1st upgrade completed summer 2019

- 2nd summer 2020
- 3rd summer 2021

£1/MWh saving and lower opex

(3 biomass units from 2022)

drax

Viable Fuels

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Viable Fuels

Sustainable biomass material which is not white wood pellets

***Viable fuels* development lifecycle**

Identification	— Broad and continual feedstock identification - **new fuels, new forms & new geographies**
Prioritisation	— Opportunity **screening and prioritisation** based on **Drax criteria** (HSE, plant integrity, sustainability, compliance & complexity)
Feasibility	— Appraising viable volumes and **technical feasibility** with piloting, testing & trialling to **reduce risk**
Selection	— Selection of the **optimal development scheme, strategy & counterparties** – balance of risk and reward
Definition	— Technical definition, securing consents and negotiation of third-party contracts to **underpin investment case & capital efficiency**
Execution	— Execution dependent on scale and complexity

Examples of opportunities currently being evaluated:

1. Woodchips
2. Sugarcane bagasse
3. Nutshells

Generation Enabling Projects

Low-cost initiatives in 2020/21 to support operational efficiency and wider fuel envelope

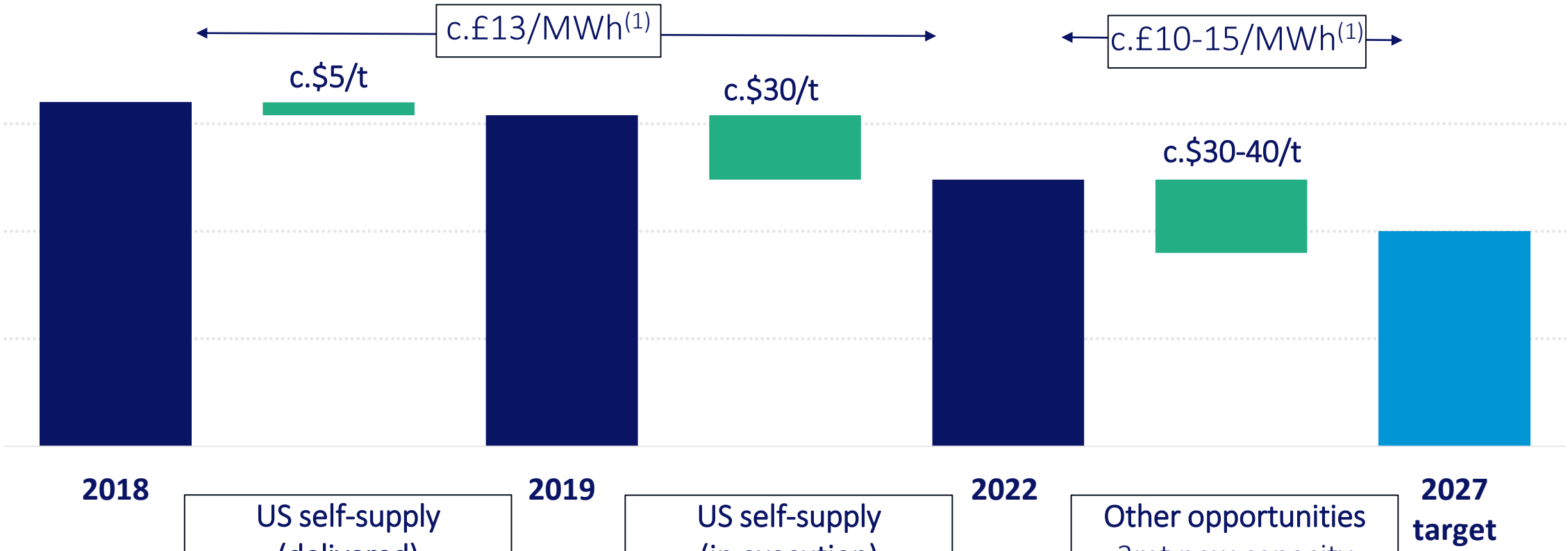
Projects seek to expand the fuel envelope

Scope	Description	Key benefits
Combustion testing	Securing access to a combustion test facility	Ability to verify combustion chemistry of new fuels
Fuel cleaning	Pre-processing to reduce problematic components	Fuel processing such as cleaning to improve fuel parameters
Furnace cleaning	Boiler modifications to increase resilience	Boiler capability to fire new fuels in the long term
Unpelletised biomass	Capability to receive unpelletised materials	Supply chain cost reduction
Densification	Alternative options for densification	Lower cost densification of low moisture biomass, reduced capex
Site processing	Capability to process forms of biomass at site	Upgrade biomass at site
Blending capability	Capability to flexibly manage fuel mix	Capacity to handle a more diverse basket of fuels
Raw material aggregation	Unlocking residues barriered by aggregation costs	Unlock significant residue biomass left in the field

Backward Integration of Supply Chain to Reduce Overall Cost of Biomass to c.£50/MWh

Specific projects to reduce cost in existing US business by £15/MWh over four years

Other opportunities from expansion; *viable fuels*; logistics and operational enhancements; work with 3rd party suppliers



(1) At constant FX rate of $1.45/£

Summary

Progressing and delivering cost reduction, expanding self-supply capacity

Focus on delivery of good quality pellets at lowest cost

– Continued focus on operational efficiency and improvement

Expanding capacity and reducing cost in US Gulf

– Investment in 0.35Mt of capacity

– Reduce cost of current portfolio by $35-40/t (£13-15/MWh) over four year period

Other opportunities across the Group

– Expand capacity to self-supply to 5mt, including satellite plants in US Gulf

– Development of *viable fuel* opportunities

– Other opportunities across supply chain – logistics and operations

On track for c.£50/MWh by 2027