AUTOMEDI

Circularity, Anywhere, Everywhere

LNER FUTURE WASTE REPORT

LNER
LONDON NORTH EASTERN RAILWAY

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CEO Automedi
Climate Technology | Industrial mathematics | Doughnut Economics

Project Stakeholders:
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Contents

In the heavily regulated rail industry, plastics pose a unique challenge to mother nature. The already significant footprint of routine plastic waste is coupled with significant transportation and disposal emissions, which are highly reliant on consumer behaviour to segregate plastic waste before it is processed in rail systems, to conventional commercial recyclers.

The role of rail as a public service is starting to be restored. With the introduction of state enterprises in the east coast mainline, and establishment of London North Eastern Railway (LNER) as the operator of last resort, with Transpennine Express and Northern Rail also joining the family, this offers a unique opportunity to magnify the social value associated with the delivery of rail services to passengers, and social value to communities.

Circular economies provide a unique opportunity to resolve both emissions and waste problems. Careful engineering and deployment can provide circular products cheaper than either conventional buying or waste processing alone and amplifies the social good. Our closed loop circular microeconomies create magnify that benefit, by ensuring more revenue is kept within LNER and used to improve sustainable development and enterprise, for the same cost, at the same time.

Ethar Alali

Ethar Alali
CEO & Founder

AUTOMEDI

Automedi’s closed-loop circular plastic microeconomies help LNER deliver Carbon neutral stations while saving money with sustainable maintenance products made from LNER’s plastic trash. Saving emissions & nurturing new local economics. Unlike conventional waste recycling which incinerated almost everything!

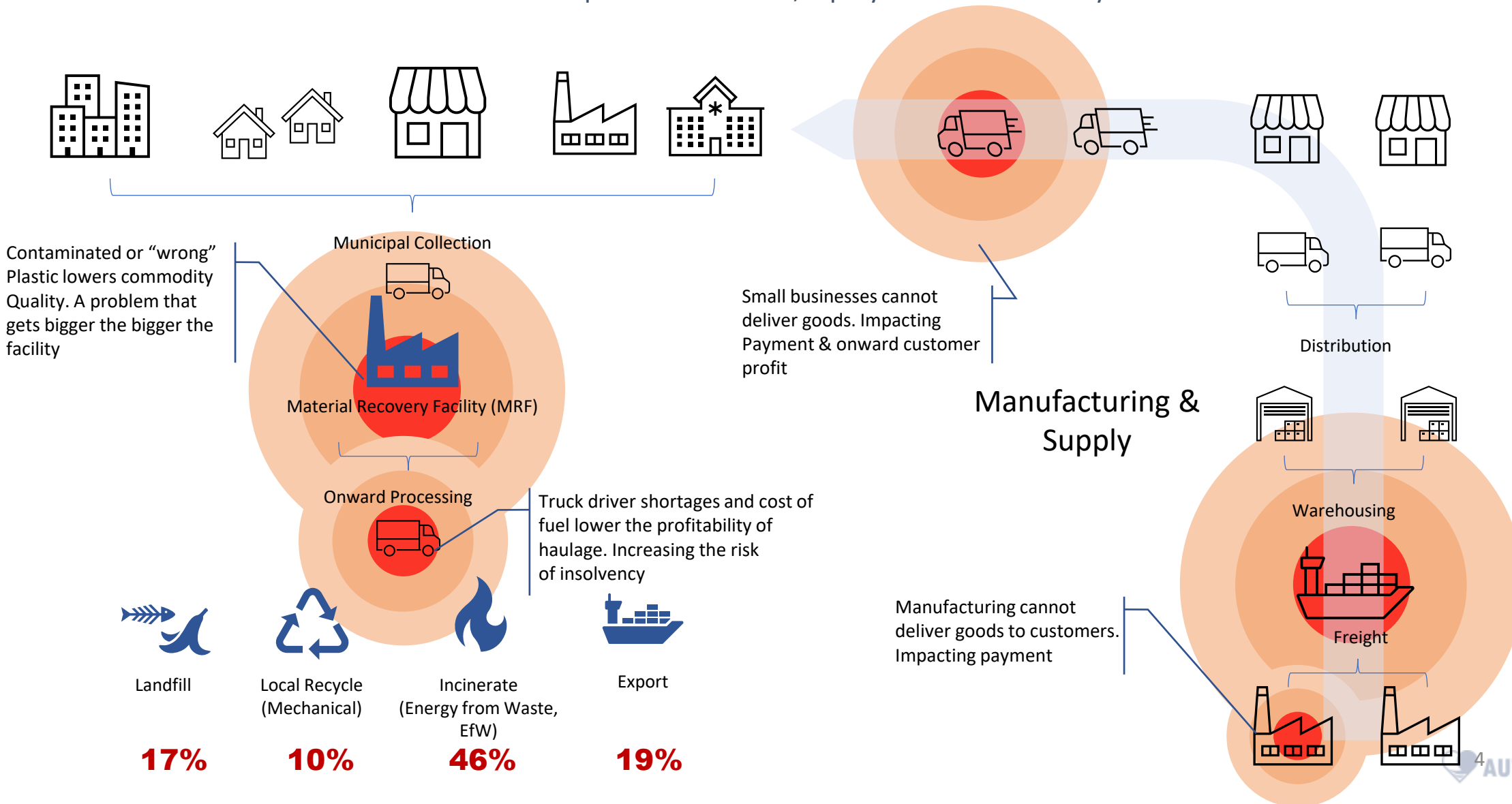
£52 million
Economic Value

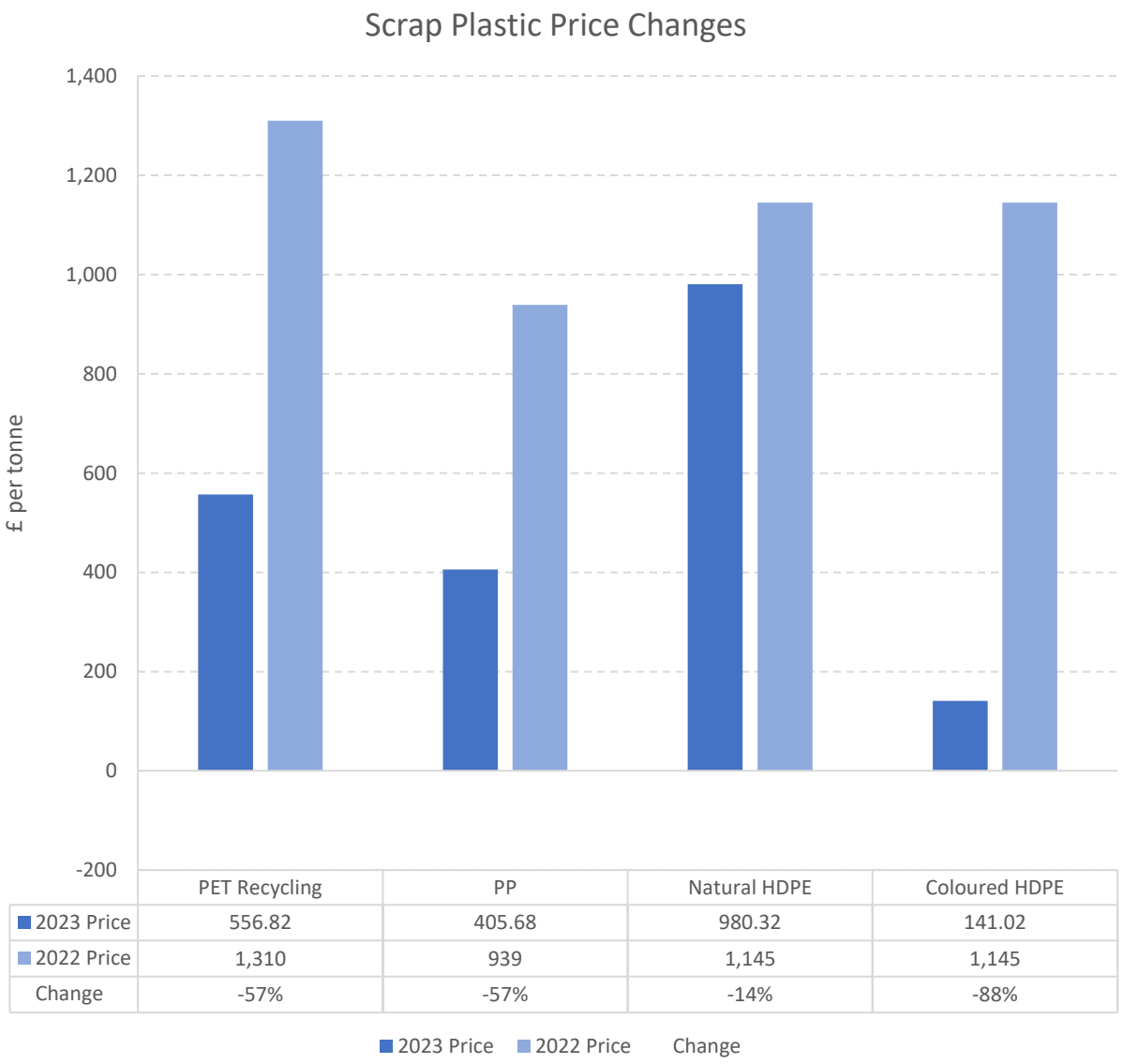
724 tonnes
Diverted from EfW

11,000 tonne
Greater Carbon Saving

Waste + Manufacturing + Supply = Combined Problems

Municipalities must reduce consumption of natural resources, shorten supply chains AND minimise what is not reclaimed to deliver sustainable development. Resilience, Equity and Climate Safety





	PET Recycling	PP	Natural HDPE	Coloured HDPE
2023 Price	556.82	405.68	980.32	141.02
2022 Price	1,310	939	1,145	1,145
Change	-57%	-57%	-14%	-88%

The China Effect

China boycotted western waste plastics in 2021. Creating a much lower economic yield and dropping plastic commodity prices by up to 80%;

- Decimating secondary plastic market
- Prices dropping > 50%
- Low margin recycling becomes uneconomical
- Reduces rebates & *real* recycling rates.
- Waste recyclers raise prices & become fussier.
- Stricter penalties to maintain revenue against increased landfill gate fees.

Financially, many recyclers ask if there a point collecting it? Those that do, become fussier and raise collection prices to their customers.

Mixed Source Products

Reusable Lanyard

Classical Buy
Cost: £1.34
(inc delivery & VAT)
Embodied CO_2: 222g
Disposal CO_2: 36.8g
Gen 2 CO_2 : 517.6g

via Automedi
Cost: £0.07
(delivery not required)
Embodied CO_2: 3g
Recycle CO_2: 1g
Gen 2 CO_2: 5g

Circular "Microeconomies"

Decentralising a single system of waste recycling, manufacturing and supply.

Our system collects waste, recycles it and makes products as one system and does for these industries, what the internet did for mainframes in the 1980s. By combining the three, it cuts out all intermediary transportation. Turning these industries into final-mile sectors.

Plus, using smart bin tracking, collection and processing can be optimised to run only when bins are full. Making the best use of resources.

Together with low energy manufacturing in our 3D vending machines, this cuts emissions by over 97% compared to disparate competitors.

Automedi LNER MVP

Filament follows the train

LNER Access to Automedi Cloud (Quartic)

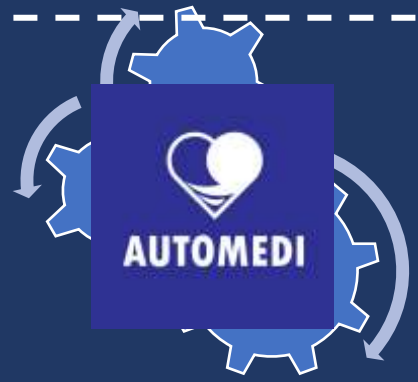
Access open train & maintenance schedules (optional)

WASTE PLASTIC

Throw Away in…

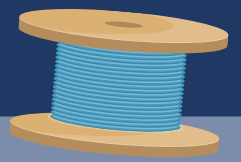
SMART BINS

Transported for…



RECONSTITUTION

Made into…



CONSUMABLE SPOOL

To Refill…

MAKE & TRACK REMANUFACTURED PRODUCTS

Obtain orders

CIRCULAR MICRO-ECONOMY PLATFORM

Grind

Grind is the first step in recycling plastics it is granulated plastic in chunks of 5 mm x 5 mm.

Market value: £600/tonne

Filament

Filament is used both in 3D printing and to pelletise.

Market value: £17,000/tonne

Product

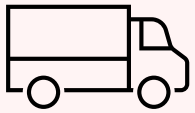
Product is the most valuable output. Optimised for plastic use and price.

Market value: £96,000/tonne

LNER BUSINESS CASE

LONDON NORTH EASTERN RAILWAY

LNER 2023*



(£900,000)

Waste collection contract

959 tonnes of plastics

Station, pass-through, depot and train waste

(10,932) t CO2e

Embodied emissions

(manufacture, transport, collection & incineration or landfill)

LNER 2025

£52million

Economic Value

724 tonnes

Diverted from EfW

11,000 tonne

Greater Carbon Saving

Optimised Revenue

Mixing and expanding outlets, to maximise revenue and savings.

Our cradle-to-cradle circular economy generates revenue can be made anywhere in the circle. Unlike conventional recyclers, our system makes products directly. Expanding our direct outlet network and partnerships to include end-product distribution and keeping the economic value that is normally distributed across multiple economic actors, like recyclers, brokers, transporters and manufacturers, in-house.

As well as our in-house capability, we use a vetted comprehensive outlet partner network we can deploy spare intermediate products to maximise revenue made from waste while we also take care of product manufacture, service provision, sustainability and social value aims.

**Source: LNER Sustainability report 2022. Embodied emissions calculated using BEIS conversion factors*

CANDIDATE PRODUCT CATALOGUE


Key Ring


Washer Bottle Cap


Shim


Tag Seal


Tamper Seal


Flare Box


Ice Scraper

Tag Holder

RAIL-PURPOSED CATALOGUE

Live Catalogues

Updated at any time, in real-time, using products co-produced by in-house and local partners, develop supply self-sufficiency within the LNER network

We work with you to develop products that can withstand older heterogenous plastic inclusion using our unique recipe books.

Co-producing products between us, LNER, partners and the community make them perfect for longer term-maintenance and refurbishment. Consumables, parts and accessories are ideal candidate products. They are quick to create and replace, and as conventional commodity supplies, travel the furthest with the highest carbon footprint. Meaning replacing them saves higher amounts of CO2e per kg of product.

WASTE COMPOSITION ANALYSIS: BRADFORD INTERCHANGE

(segregated by ISS)

NORTHERN

Inconsistent segregation for each station. Some use Hitachi and Northern segregation facilities, some use ISS and others have no segregation at all.

Plastic recycling rates are also going backwards for some TOCs. 63% (2020/21) to 47% (2021/22)

Important note
Consumer waste is the only thing segregated. Some “random” station or engineering waste appears in skip-bin waste streams post-segregation.

RAIL FAMILY WASTE COMPARISON

LNER

LONDON NORTH EASTERN RAILWAY

Overview

959 **tonnes of plastics**

Station, pass-through, depot and train waste

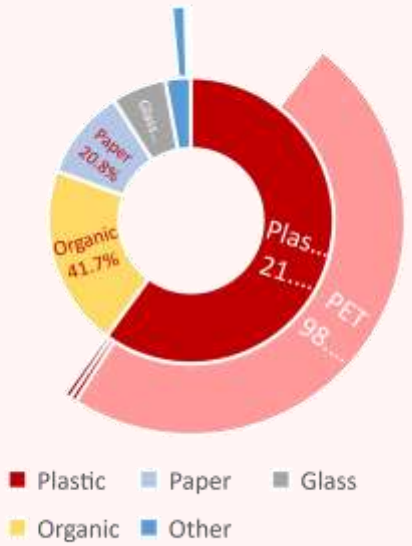
235 **tonnes** Recycled

724 **tonnes** incinerated (EfW)

10,932 **t CO2e**

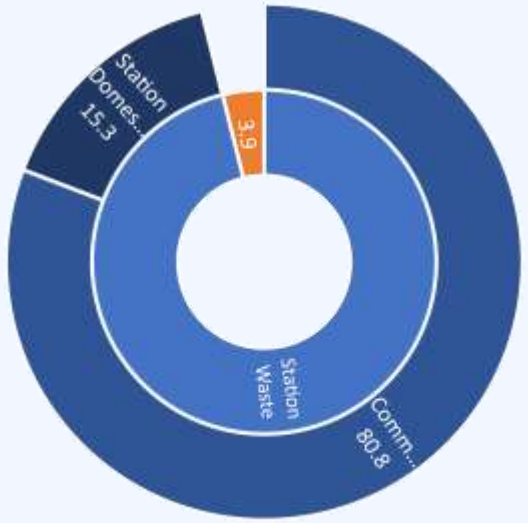
Embodied emissions
(manufacture, transport, collection & incineration or landfill)

Waste Composition (York Station)



NORTHERN — Bredbury Station

Waste Sources (% by mass)



Unsegregated Waste

4 Bins used in station.

1 Weekly Collection

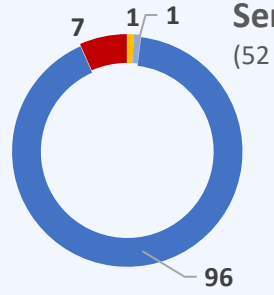
3 Mixed waste

1 Paper (inc newspapers)

NORTHERN — Bradford Interchange

Service Composition

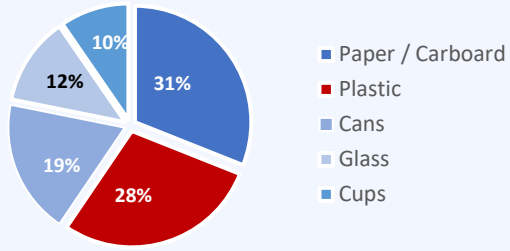
(52 weeks, 2x per week)



Waste Composition

Average weight of bag 2.1kg.

Error percentage: 4.7%



RECYCLING UPLIFT ACTIVITIES

NORTHERN
Bradford Interchange

Segregated Waste

32% Percentage point Recycling uplift

526 Stations (most small)

£938 Cost per 1% recycling uplift

£5,800 Revenue per 1% recycling uplift across Northern Rail

Savings equivalent of £5,890 on Bradford Interchange ALONE
This does returns on the investment in segregation. Such as Bradford Interchange, which performs much better.

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Awareness Campaigns

3% Percentage points recycling uplift (not statistically significant)

11 Co-managed Station Estate (most large)

£9,000 Cost per 1% recycling uplift

£5,800 Revenue per 1% recycling uplift across LNER

Saving equivalent of £27,000 on LNER waste contract
This doesn't not return on the investment in awareness campaigns. Newcastle segregation is a better alternative

Different Strategies, Different Results

Various options were deployed by Train Operating Companies to increase recycling rates. From customer awareness to segregation at station, each has its own advantages.

Northern Rail segregate plastics from other waste at stations. This has proven to be significantly more effective at recycling plastic than consumer awareness in stations such as York by almost 1,000%.

With a 4.7% error rate, it is not perfect and this can negate savings from passenger driven segregation. Given waste collection contracts are worth £900,000 for LNER, consumer awareness makes a difference of £27,000 to recycle 3% more (£9,000 per percent increase).

In contrast, Northern Rail segregation performed by ISS costs **£938*** for every percent increase.

** Comparative methodology uses total lifetime cost minus without value returned through typical rebates on plastic commodity market. Note, this has reduced by up to 80% between 2020 and 2023.*

BRADFORD INTERCHANGE ANALYSIS: PERFORMANCE

Segregated Waste

1
Northern Stations with waste segregated at source

32
Percentage point increase in recycling from **segregation**

8.7 tonnes
Total waste mass collection

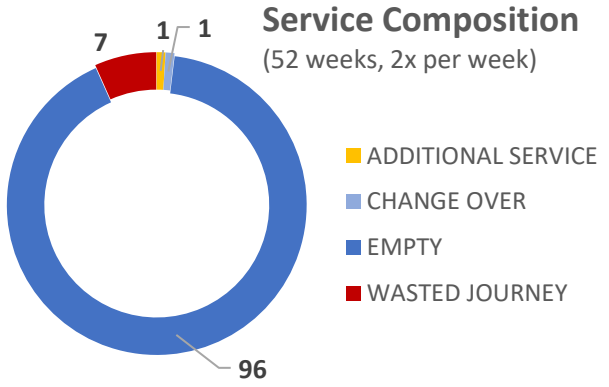
6.7%
Wasted collection/ emission rate

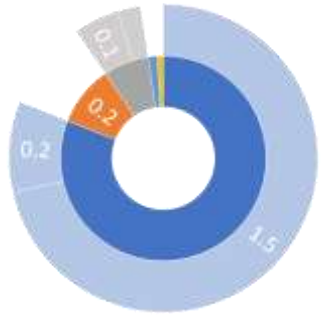
621 bins
Across **105** collections

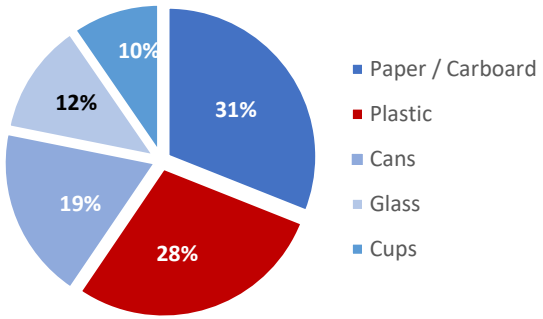
256.03kg
Mass per collection (mean)

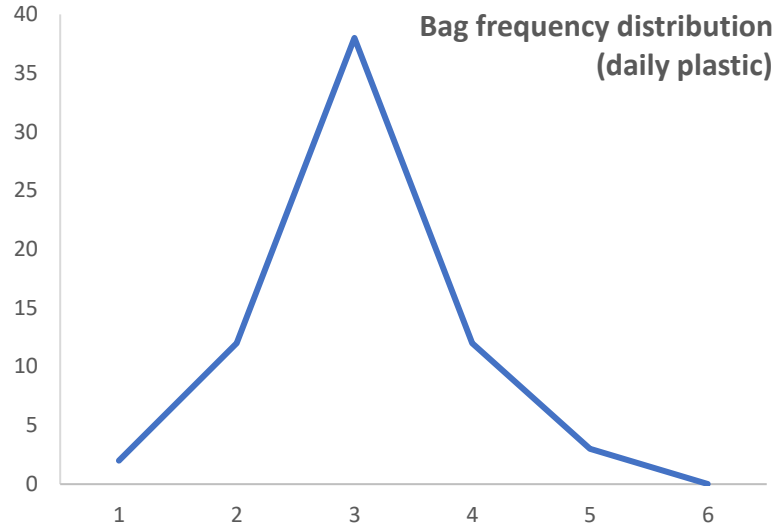
15
Bins worth of waste segregated by ISS in 3 days

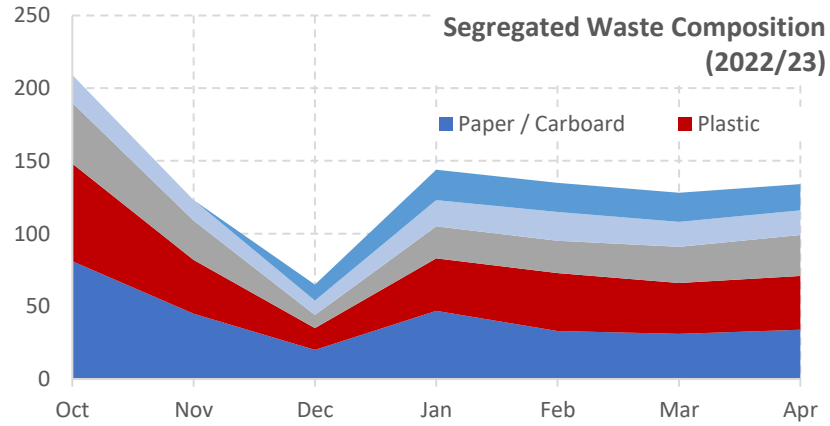
12%
unsegregated waste as recyclable PET by mass







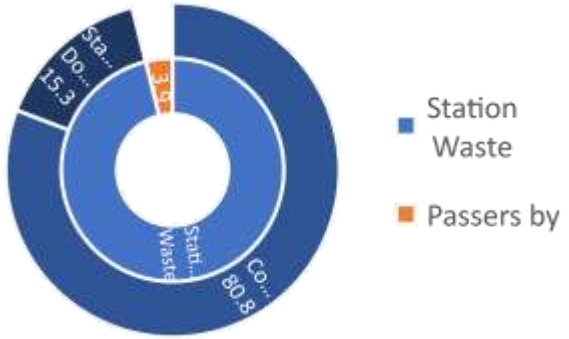




WASTE COMPOSITION ANALYSIS: BREDBURY STATION

(segregated by ISS)

Waste Sources (% by mass)



Unsegregated Waste

4 Bins used in station.

1 Weekly Collection

1 Paper (inc newspapers)

3 Mixed waste

NORTHERN *Bredbury*

Bredbury station is typical of a mid-sized suburban station with no station segregation. 4 Biffa bins plus ISS intercepted skip for collection and segregation elsewhere.

Important note

"Passer by" and station waste appears in the Bredbury waste stream. These are not consumer.

Also, imported waste consistently appears in the waste stream. Commuters buy refreshments elsewhere on the line and deposit this in station bins in the journey from their starting point or destination

LNER YORK ANALYSIS: COMPOSITION

Quasi-Segregated Waste

2

Types of waste.
General & mixed recycling

9 percentage point

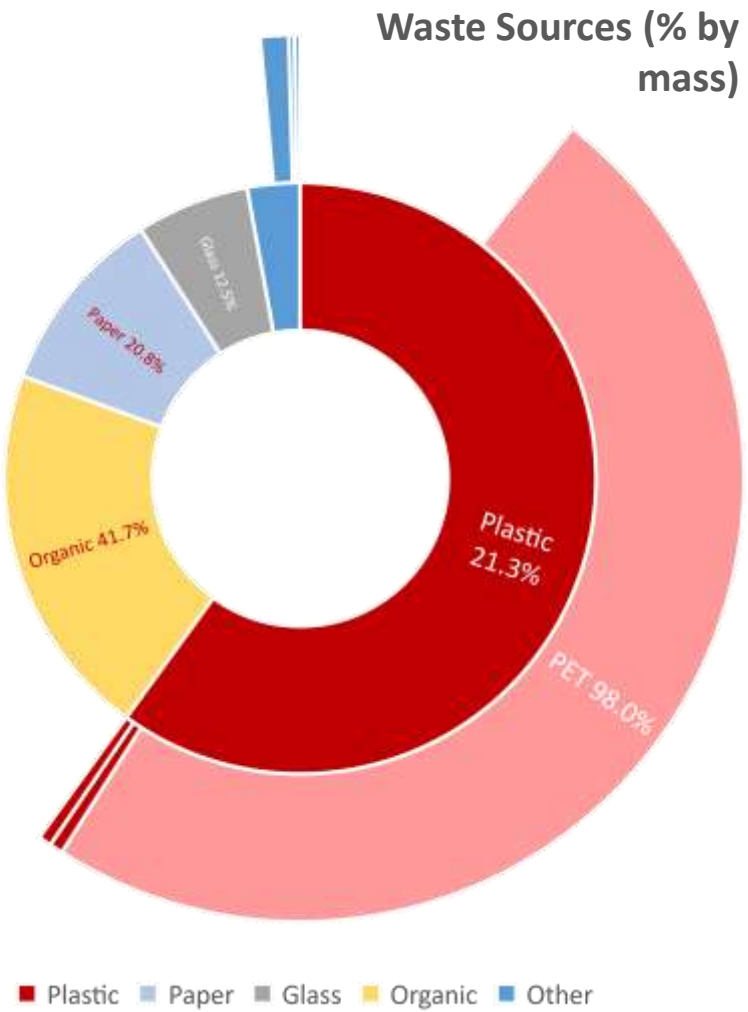
Difference from awareness raising (to date)

21%

unsegregated waste as recyclable PET by mass

21.6kg

Mass per bin (mean)



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York station is typical of a central urban railway station. A significant number of Veolia bins collect segregated waste from general and mixed recycling.

Important note
Despite the best efforts of station and facilities staff in nurturing behaviour change amongst passengers, and a significant awareness campaign, the composition of station waste is technically unsegregated, despite the existence of two bins.

Waste is collected from both set of bins but is often deposited in a single collection scheme due to the significant overlap. Veolia cannot segregate that contaminated waste stream.

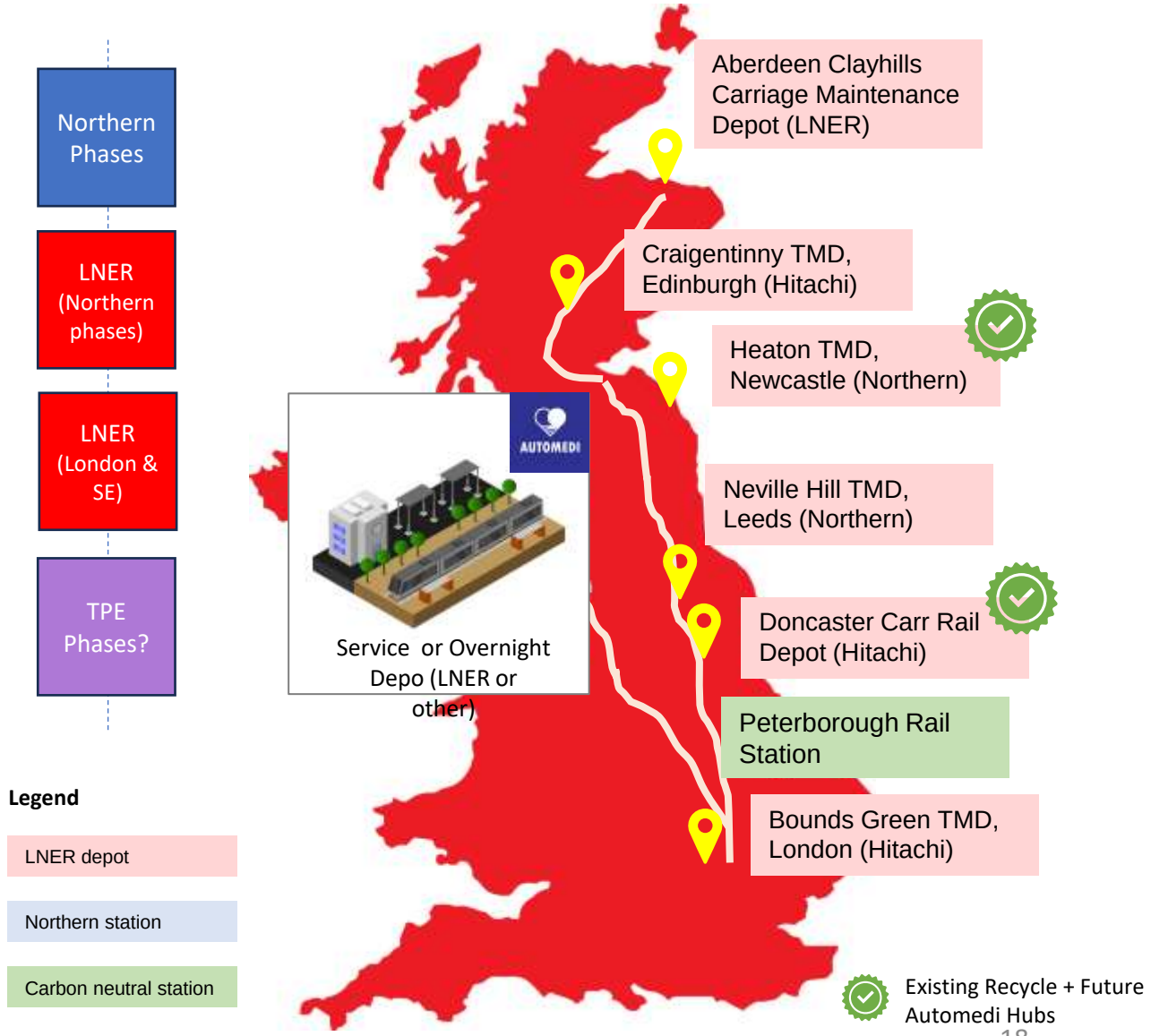
2025 NET ZERO STATIONS

Net Zero Station Programme

The LNER network aims to have deployed two Net Zero stations by 2025 as part of their sustainability and social value journey. Peterborough is one such station that has been recommended by the LNER Sustainability team as a host for pilot clusters.

When disaggregating services to station level, corporate optimisations cannot offset emissions in lower, finer grained entities like stations. Building self-sufficient station systems is a more rigorous test of organisational sustainable development aims.

In LNER's journey to Net Zero operations, the town of Peterborough has been recommended as a candidate location for the first Automedi cluster for the Peterborough city region. There is also an established Net Zero community, which our service can market to and engage with to co-create that station of the future.



PETERBOROUGH CIRCULARITY CLUSTER (PILOT)

Environmental, Social and Governance

80 **tonnes of plastics**
Average station content (East coast mainline)

1 **Repurposed brownfield site**
North of Peterborough station

16 **tonnes of plastics**
Usable without affecting existing contracts

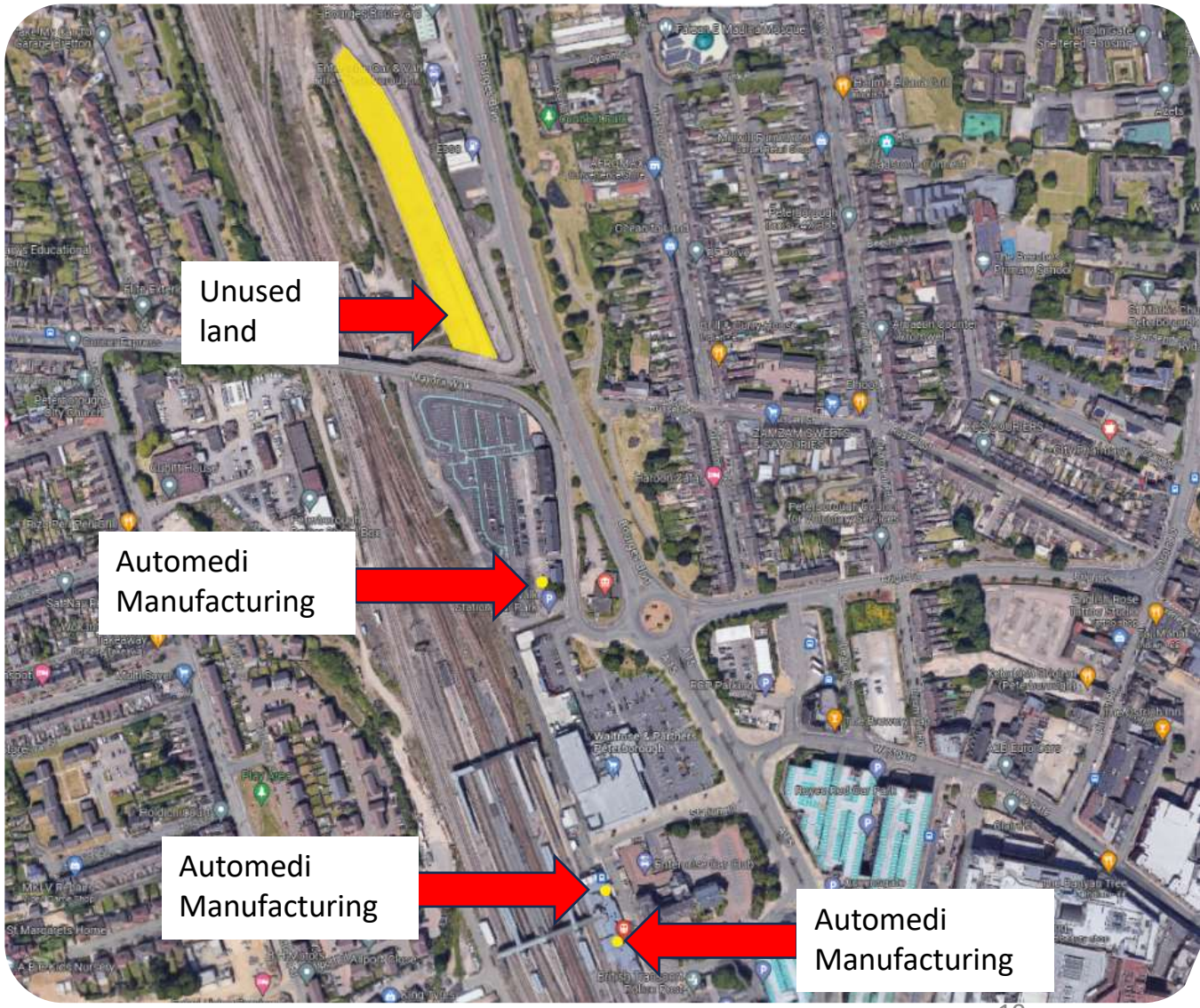
£1.16 million
Maximal revenue value add

2 **New jobs**
Created from the local population

£192,000
Minimal revenue value add

92.8 **tonnes CO2e**
Avoided lifecycle emissions (gen 1)

464 **tonnes CO2e**
Avoided lifecycle emissions (gen 8)



Community Co-Creation

Engaging community and civic society in the creation of a station adapted and suited to the community that uses it is an essential part of both public engagement and utilisation. Adapting societies need adapting services and Automedi helps deploy that through faster product and accessory turnaround.

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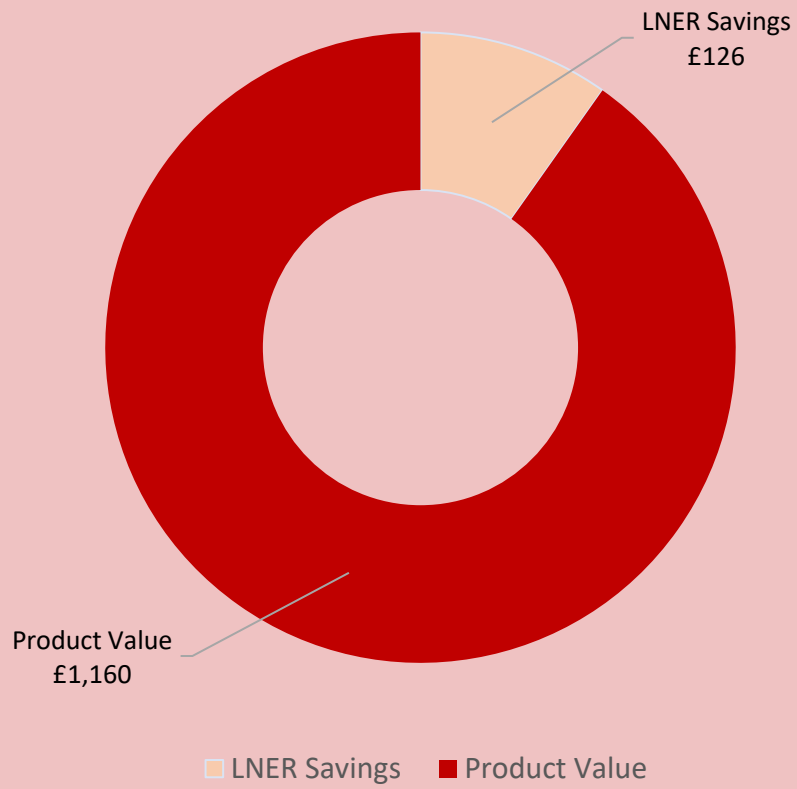
In contrast, Northern Rail segregation performed by ISS costs £938 for every percent increase.

SUMMARY ECONOMIC CASE (PILOT)

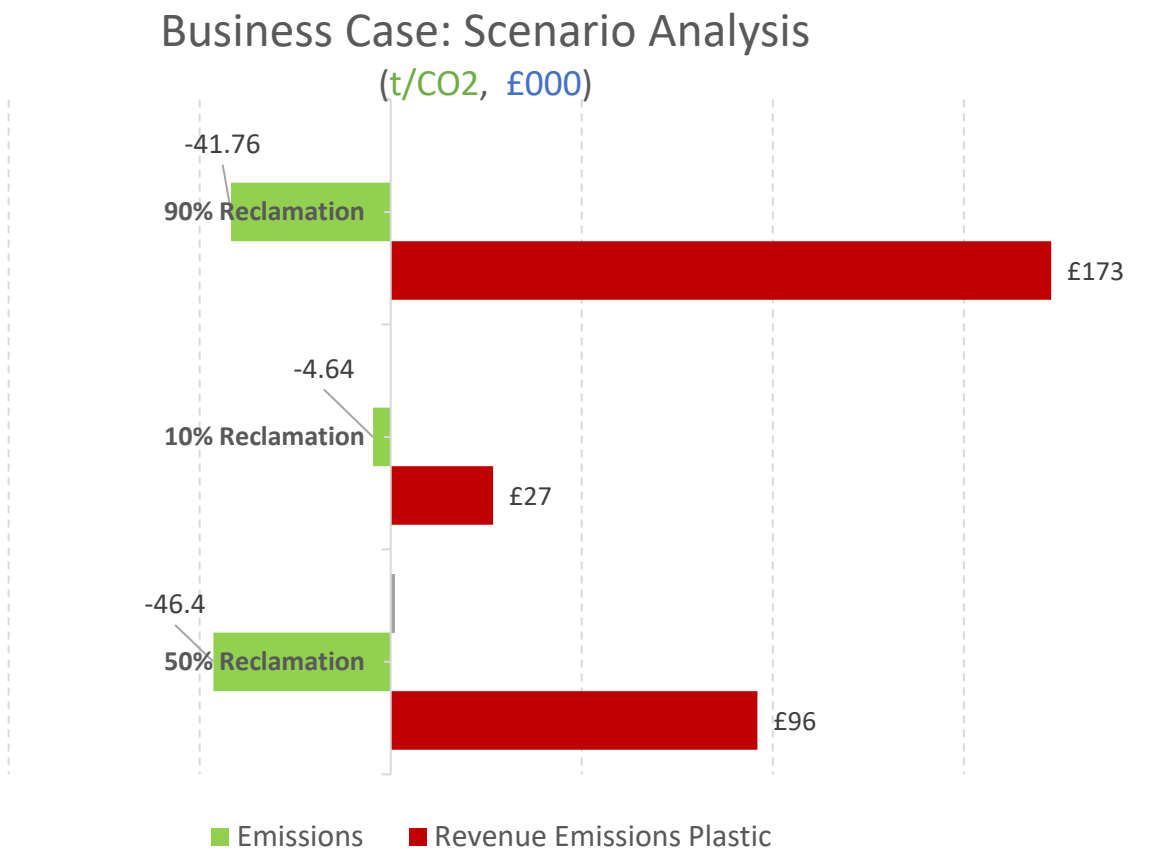
LONDON NORTH EASTERN RAILWAY

Overview

GROSS VALUE ADD AT SCALE (£ 000)



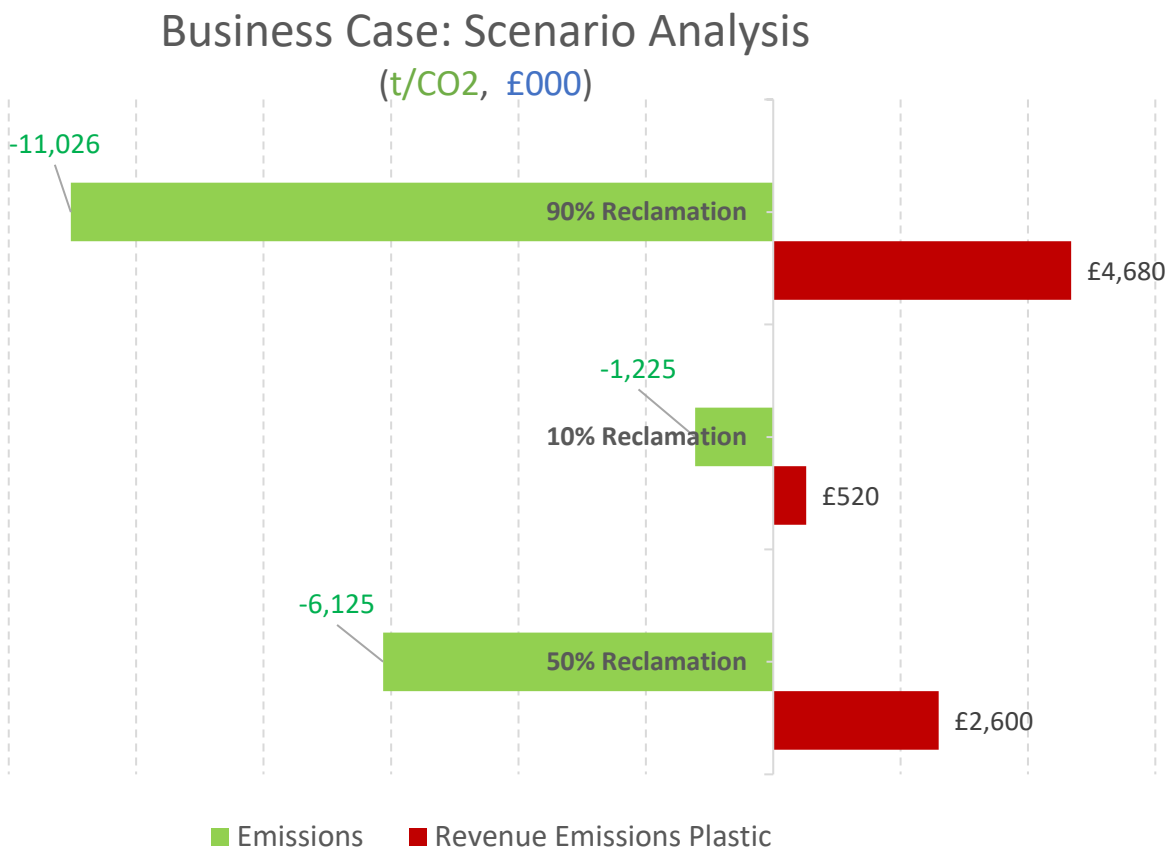
Peterborough Station Pilot



Working Assumptions:
£90/tonne conventional waste collection. Product value = purchase savings + product sales. CO2 emissions savings (Scope 3) waste processing, transport and future product manufacturing, freight & transit. 6x leverage rate (items made from 6kg of conventional plastic, per 1kg collected). "Other hard plastics" and plant pots/trays considered only.

SUMMARY ECONOMIC CASE: AT SCALE

LNER Net Zero Stations Programme



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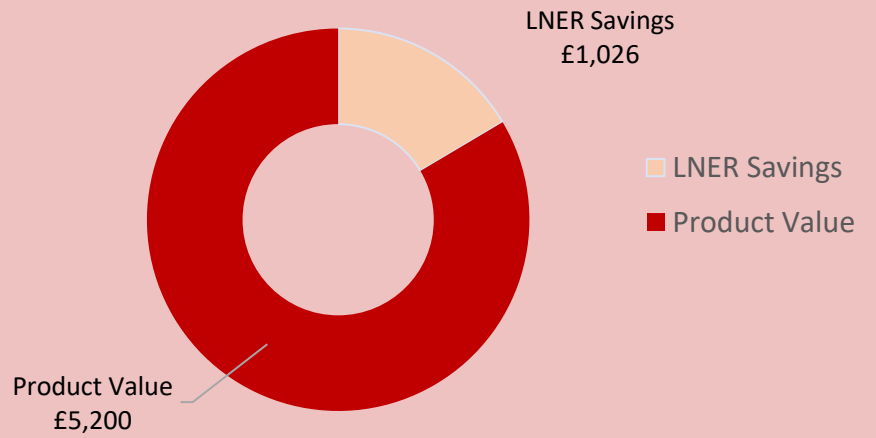
Overview

OVER £6.226 MILLION GROSS VALUE ADD AT SCALE (£ 000)



11 Deployment Phases

Incremental, co-produced offer

32 Community Consultations

Local community & civic engagement activities

Automedi: Trusted Circular Supplier

The UK's biggest infrastructure trust also ready to deliver circular services that transform waste from a cost centre into a revenue stream.

Our international growth has connected us to some of Europe and the USA's biggest organisations. Opening the doors to collaborations, partnerships and connections we help deliver circular economies in organisational niches.

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