



Outline Decommissioning, Restoration and Aftercare Strategy

Scout Moor II Further Environmental Information

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1. Introduction

This Outline Decommissioning and Restoration Strategy (ODRS), prepared by Cubico UK Development (Wind 1) Limited, sets out the proposed approach to the decommissioning and restoration of the Moor Wind Farm at the end of its operational life.

The ODRS is submitted as part of the Further Environmental Information (FEI) in support of the cross-boundary planning applications for the construction and operation of a wind farm at Scout Moor, alongside a comprehensive moorland restoration scheme (the Proposed Development) on land at Rooley Moor (the Site).

The Site lies within the administrative areas of Rossendale Borough Council and Rochdale Metropolitan Borough Council, which are acting as the determining authorities.

This document updates and refines the previously submitted strategy, taking into account feedback received through statutory and non-statutory consultation, including responses to the submitted Environmental Statement. It should be read as superseding the ODRS submitted in July 2025.

Purpose and Scope

We understand the need for a clear, well-planned strategy and recognise the concerns raised through public consultation about what happens when a wind farm reaches the end of its operational life. Cubico takes this responsibility very seriously. We are committed to putting in place a robust and transparent approach that ensures the site is sensitively restored, that costs are fully covered, and that long-term stewardship is secured.

Our strategy will follow established best practice for onshore wind across the UK, informed by current guidance and lessons learned from previous projects. A key part of this is financial security: we will work with the local planning authorities to agree a mechanism that guarantees decommissioning costs are met by the project itself, not by landowners or local authorities.

In line with circular economy principles, we will also maximise the recovery and recycling of materials and explore opportunities for reuse or repurposing.

This document outlines:

- our proposed decommissioning and restoration approach
- how circular economy principles will be applied
- our commitment to environmental protection and aftercare
- the financial provisions that will be put in place
- proposed planning conditions to secure this strategy

Together, these measures reflect our commitment to responsible asset management, environmental stewardship, and delivering a positive legacy for the local area.

2. Outline Decommissioning and Restoration Plan

Our Approach

Cubico is committed to responsible, long-term site stewardship. A key part of this is ensuring that Scout Moor II is fully decommissioned and appropriately restored at the end of its operational life, or earlier, in the unlikely event the project ceases to operate for any reason. This section sets out the framework for how that will be achieved, drawing on current industry best practice and aligning with the template planning conditions set out in Appendix 2 and explained in further detail in Section 6.

As required by Suggested Condition C, a detailed Decommissioning, Restoration and Aftercare Plan (DRAP) will be prepared and submitted to the Local Planning Authority for written approval no later than one year before the cessation of generation. This final plan will update and expand upon this Outline Strategy, incorporating site-specific data, final infrastructure layouts, and the most up-to-date guidance and standards available at the time.

In addition, we are committing to the submission of an Interim Decommissioning, Restoration and Aftercare Strategy, in accordance with Suggested Condition B, before any development begins. This interim strategy will act as an early safeguard, setting out how the site would be made safe and restored in the event that the development, or any part of it, ceases to operate before the final DRAP is approved. It will include indicative measures for infrastructure removal, ground treatment, and environmental management, ensuring continuity and protection during the early years of operation.

The following sections set out the indicative procedures that would be followed to decommission the proposed development, based on current knowledge and best practice.

Access Tracks and Hardstanding Areas

All access tracks and crane pads constructed specifically for Scout Moor II will, unless otherwise agreed with the Local Planning Authority or landowners, be removed and reinstated to their approximate pre-development condition. Restoration will include:

- Lifting and removing track materials to designated recovery or disposal areas identified in the DRAP
- Regrading and infilling with appropriate inert material
- Replacing stored topsoil and reseeding using an agreed moorland seed mix
- Avoiding unnecessary plant movement over reinstated ground to minimise compaction
- Retaining any upgraded or enhanced tracks (e.g. public rights of way) where agreed as a legacy benefit

Wind Turbines

Wind turbine removal will follow a reverse sequence of construction, using appropriate lifting equipment and haulage vehicles. This will include:

- Disconnecting turbines from the electrical network
- Removing internal components and transporting them off site
- Lowering the nacelle, blades, and tower sections either whole or in manageable parts
- Transporting all components to approved facilities for reuse, recycling, or disposal

Turbine Foundations

Foundations will be partially removed in accordance with good practice. Unless otherwise agreed with the Local Planning Authority, the process will involve:

- Excavating stored topsoil and overburden
- Breaking out reinforced concrete to a depth of 1 to 2 metres below ground level
- Removing materials off site or reusing them in accordance with the DRAP
- Backfilling and reinstating vegetation to restore a natural landform

Substation Compound

The on-site substation will be fully dismantled, including:

- Demolition and removal of all above-ground structures, equipment, and fencing
- Breaking out plinths and underground ducting to an agreed depth
- Removing electrical infrastructure where it can be done safely and without environmental harm
- Regrading and reseeding the compound area to align with surrounding land use

Electrical Infrastructure

All above-ground electrical equipment, such as transformers and switchgear, will be removed using appropriate lifting methods and transported off site for recycling or disposal at licensed facilities.

Cabling

Buried cabling will be removed where it is environmentally acceptable and practical to do so. Where removal could cause unnecessary disturbance to sensitive habitats or hydrological systems, cables may be left in situ with the approval of the Local Planning Authority. Trench backfilling and surface reinstatement will follow best practice.

This restoration work will be supported by a wider suite of environmental measures, as set out in the Environmental Protection and Aftercare section of this strategy. These will include dust and pollution control, surface water and soil management, waste minimisation, and biodiversity protection informed by updated ecological surveys.

Together, the commitments made under Condition B (Interim Strategy) and Condition C (Final Plan) provide a comprehensive and enforceable framework to ensure that Scout Moor II is decommissioned safely, sensitively, and with full environmental and community accountability.

3. Circular Economy and Waste Minimisation

Circular Economy Approach

Cubico is committed to embedding circular economy principles throughout the full lifecycle of its wind energy projects, including decommissioning. Our objective is to minimise waste and maximise the recovery, reuse, and recycling of materials at the end of the project's operational life.

We refer to “circularity” rather than simply “recyclability,” as it better reflects the full range of outcomes that prevent materials from ending up in landfill. Circularity, in this context, includes any process that keeps materials in use or gives them a productive second life. This encompasses:

- **Re-use** – for example, reconditioning or redeploying components
- **Recycling** – processing materials for use in manufacturing new products
- **Recovery** – such as energy recovery through the co-processing of composite materials like turbine blades in cement kilns

Where such recovery routes are viable and available at the time of decommissioning, they will be considered as part of the overall circularity strategy for Scout Moor II. This broader definition ensures that the project's end-of-life plan remains realistic, environmentally responsible, and aligned with industry best practice.

Further information on this approach is also provided in the **Sustainability, Energy & Climate Change Statement** submitted as part of the planning application.

Circularity Assessment and Material Forecast

For Scout Moor II, we have undertaken a circularity assessment using **DNV's ReWind** software, a tool designed to support low-cost, high-circularity outcomes for wind farm decommissioning. The assessment was based on a 5.7 MW Nordex N149 candidate turbine and includes the full balance of plant, covering turbine foundations, access tracks, cables, and other infrastructure.

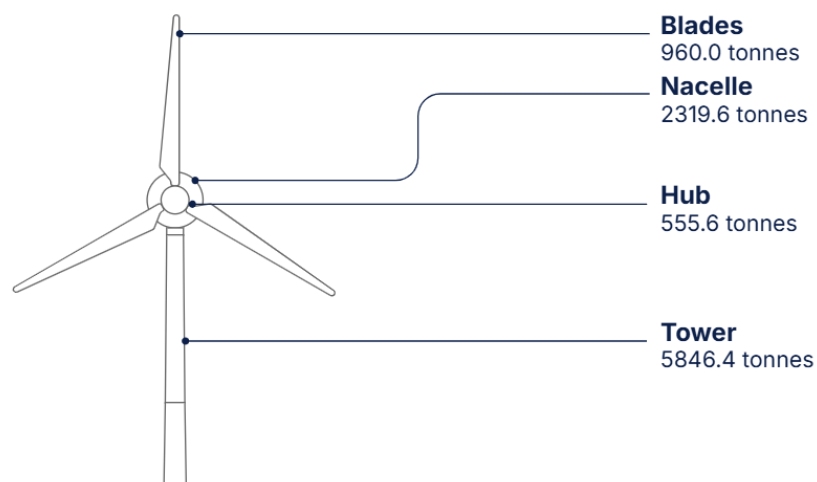


Figure 1: Forecast Turbine Material Weights

ReWind estimates that decommissioning the proposed 12 turbines will generate approximately **9,682 tonnes** of material. This is expected to comprise around:

- 75% steel
- 11% cast iron
- 6% glass fibre
- 4% other metals and materials
- 3% epoxy resin
- <1% remaining materials by weight

For the foundations, an additional 19,530 tonnes of concrete, 1,596 tonnes of other materials, and 972 tonnes of steel are expected.

Array and export cables are forecast to generate a combined 763 tonnes of material, comprising roughly 32% copper, 38% steel 29% insulation (other non-metal materials) and >1% aluminium.

Based on DNV's definition, where circularity includes any activity that prevents material going to landfill, such as reuse, recycling, and energy recovery; the overall project circularity is forecast at approximately 912%:

- ~**90%** of wind turbine materials (blades, hub, nacelle, & towers) are recoverable
- ~**93%** of foundation materials are recoverable
- ~**69%** of cable materials are recoverable
- ~**92%** of the substation is recoverable

This reinforces our commitment to responsible decommissioning and resource efficiency.

Planning for End-of-Life Solutions

To support this, there are currently several waste processing facilities with the capacity to manage key material streams at the end of the project's life. These include:

- EMR Group, Rochdale – ferrous and non-ferrous metals
- Enva, Ayrshire – composite turbine blades
- Enva, Manchester – metals and mixed construction waste

Final decisions on material destinations will be made closer to the point of decommissioning, based on the facilities and technologies available at that time and in line with best practice in waste handling.

Given the growth of the wind energy sector in the UK and globally, the recycling and recovery industry (particularly for specialist components such as turbine blades) is already advancing at pace. Technologies and commercial suppliers capable of processing and recycling blades are available today, and significant investment is being made to scale up and improve these solutions.

Over the next 40 years, this progress is expected to mature. By the time Scout Moor II reaches the end of its operational life, it is highly likely that decommissioning will be supported by an established, efficient, and cost-effective recycling infrastructure, capable of handling all major components of a modern wind farm to high environmental standards.

Through this forward-looking approach, Cubico will ensure that decommissioning at Scout Moor II is not only compliant and well-managed, but also contributes to the growth of a more circular, sustainable energy system.

4. Environmental Protection and Aftercare

Our approach to decommissioning is not simply about dismantling infrastructure—it is about restoring, protecting, and, where possible, enhancing the landscape as part of a long-term vision for the site. The detailed decommissioning, restoration and aftercare plan, to be submitted at least one year before the wind farm ceases generation, will provide a comprehensive, up-to-date strategy in line with best practice and relevant guidance at that time.

The plan will cover the physical removal of infrastructure as well as a suite of environmental and site management measures to ensure the works are delivered safely and to a high standard. These will include:

- **Pollution prevention and dust management** – setting out controls to avoid contamination of soil and water, manage oil and fuel storage, and minimise dust emissions during dismantling and site works.
- **Waste management and recycling strategies** – including a detailed site waste management plan to maximise recycling and recovery of materials and reduce overall waste generation.
- **Surface water, drainage, and soil management** – including plans to protect watercourses, manage runoff, store and reuse topsoil, and ensure effective separation of clean and dirty water during works.
- **Access, traffic and temporary infrastructure** – detailing any temporary access arrangements, visibility splays, wheel-washing facilities, and on-site traffic controls to prevent disruption to the local road network.
- **Temporary site setup** – including location and management of construction compounds, welfare facilities, storage areas, stockpiles, lighting, and fencing.
- **Ecological protection and biodiversity safeguards** – informed by up-to-date surveys (no older than 18 months), the plan will include a species protection plan for birds and other protected species, and outline how sensitive habitats will be managed or enhanced.
- **Aftercare and restoration measures** – including a programme of works to support natural regeneration or transition to agreed land uses, backed by ongoing monitoring and maintenance where needed.

This integrated approach ensures that decommissioning at Scout Moor II is carried out in a well-managed, environmentally acceptable, and transparent manner; meeting the expectations of the local planning authority, landowners, and local communities.

5. Financial Security

We recognise that both the Council and local communities need certainty that Scout Moor II will be properly decommissioned at the end of its operational life, or earlier if the project ceases to operate. That includes confidence that the necessary funds will be available to remove infrastructure and restore the site, regardless of who owns the project in future or how market conditions may change.

To provide this assurance, we propose that a financial bond (or other suitable form of security) is agreed with the Council and put in place prior to the commencement of development. This approach is in line with established best practice across the UK, including in Scotland, where financial security is typically secured once detailed design work is complete and accurate cost estimates for decommissioning are available. Requiring the bond at this stage, rather than earlier in the planning process, is a practical and proportionate measure that ensures the value is based on real, project-specific data.

The bond will:

- Be set by an independent, qualified expert, based on the full scope of decommissioning, restoration, and aftercare obligations
- Be reviewed at least every five years throughout the life of the project and adjusted if needed to reflect updated cost estimates
- Remain in place for the full duration of the planning permission, and only be released once decommissioning and site restoration are fully complete

Importantly, the funds will be ring-fenced and cannot be used for any other purpose. This gives the Council confidence that decommissioning will be carried out in full and to a high standard, regardless of future ownership or economic circumstances.

This is a fair and responsible approach that balances the need for financial assurance with the practical realities of project development, and reflects Cubico's long-term commitment to responsible asset management.

6. Ensuring Certainty Through Planning Conditions

We understand that local authorities and residents want confidence that Scout Moor II will be properly decommissioned at the end of its life, and that this process will be well-managed, fully funded, and environmentally responsible. Planning conditions offer the most effective and enforceable mechanism to secure that outcome.

To give this certainty, we are proposing the inclusion of three robust and clearly worded conditions within any planning permission. These are based on template conditions used in recent wind farm approvals by the Scottish Government's Energy Consents Unit¹, where they have been tested and refined through the consenting process. They are widely accepted as providing a strong and reliable framework to manage decommissioning and site restoration over the long term.

We are not seeking to rely on goodwill or informal commitments. The proposed conditions are as follows:

1. Financial Guarantee Condition

Requires a financial bond (or equivalent security) to be agreed with the Council and put in place *before development begins*. The value will be reviewed every five years by an independent expert to ensure it reflects up-to-date decommissioning, restoration and aftercare costs.

2. Interim Decommissioning Strategy

Provides early protection by requiring a fallback strategy to be in place from the outset. This sets out how the site would be made safe and managed if operations were to cease unexpectedly—such as due to construction delays or early closure.

3. Final Decommissioning Plan

Requires a full and detailed decommissioning, restoration and aftercare plan to be submitted for approval *at least one year before the project shuts down* (or earlier if generation stops). The site must then be fully restored within three years of closure.

Together, these conditions provide a comprehensive and enforceable framework for long-term environmental protection, responsible asset management, and financial assurance. They reflect best practice in wind farm planning and ensure that decommissioning will not be left to chance.

The full wording of the proposed conditions is provided in **Appendix 2**.

¹ ECU References: ECU00001999 (Ourack Wind Farm); ECU00002103 (Clachaig Glen Wind Farm); ECU00002221 (Lethans Wind Farm Extension); ECU00003246 (Strath Oykel Wind Farm); ECU00003251 (Garvary Wind Farm)

7. Conclusion

Decommissioning is a critical part of responsible wind farm development. It is not an afterthought, but an integral part of project planning—one that gives confidence to local authorities, landowners, and communities that the site will be restored to a high standard once operations come to an end.

This ODRS demonstrates Cubico’s commitment to long-term stewardship. It sets out how we will minimise environmental impacts, recover and recycle valuable materials, and ensure that the necessary funds are secured in advance. It also outlines how enforceable planning conditions can provide legal certainty and peace of mind that these commitments will be upheld—regardless of future ownership or market conditions.

We believe this approach is proportionate, practical, and in line with best practice across the UK. It reflects the scale of the proposed development, the sensitivity of the surrounding moorland environment, and the expectations of local communities.

By planning for the full lifecycle of the project, from construction through to decommissioning, Cubico is committed to ensuring that Scout Moor II leaves a positive legacy, both in how it operates and in how it ultimately concludes.

Appendix 1: ReWind Report

Decommissioning Report

PROJECT

Scout Moor II Wind Farm

CUSTOMER

Cubico

SCENARIO

Scout Moor II Wind Farm FEI

REPORT GENERATED

1 May 2026



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1. Executive Summary

Cubico (the “Customer”), has used ReWind's software to generate this decommissioning report. The Customer has used the ReWind model to determine the material breakdown, circularity and decommissioning costs for the Scout Moor II Wind Farm wind farm (the “Project”).

The Project is located in the United Kingdom and comprises of 12 (5.7 MW of capacity) turbines with a total capacity of 68.4 MW.

The study estimates the material breakdown, circularity and costs associated with the dismantling and removal, of all equipment and site infrastructure. All costs in this study are presented in British Pound Sterling, £.

The Customer has provided site specific turbine and project inputs to ReWind, which is a fully independent, third party software. ReWind assumes that there are strong parallels between wind power project construction and decommissioning programs and consequently bases the estimates for circularity and decommissioning costs on its broad experience of wind power project construction programs and the associated costs of labour, plant, and materials.

ReWind defines circularity percentage as the ratio of the recoverable material mass to the total material mass of the Project. The Project Circularity percentage is presented below in Project Circularity Percentage Table.

A further detailed circularity breakdown is provided in Section 6.

Project Circularity Percentage			Project Circularity
Name	Total Material Mass	Total Recovered Material	Project Circularity
Scout Moor II Wind Farm	32542.7 tonnes	29729.8 tonnes	91.36%

2. Introduction

Cubico (the "Customer") has used ReWind's software to generate this decommissioning report. The Customer has used the ReWind model to determine the material breakdown, circularity and decommissioning costs for the Scout Moor II Wind Farm wind farm (the "Project").

2.1 Objective

The following report is based on ReWind's proprietary models and has been generated by the Customer using the ReWind software. The Customer has provided site specific turbine and project inputs to the model and ReWind has generated the material breakdown and circularity costs independently. Independent calculations of the following items are presented in the report below:

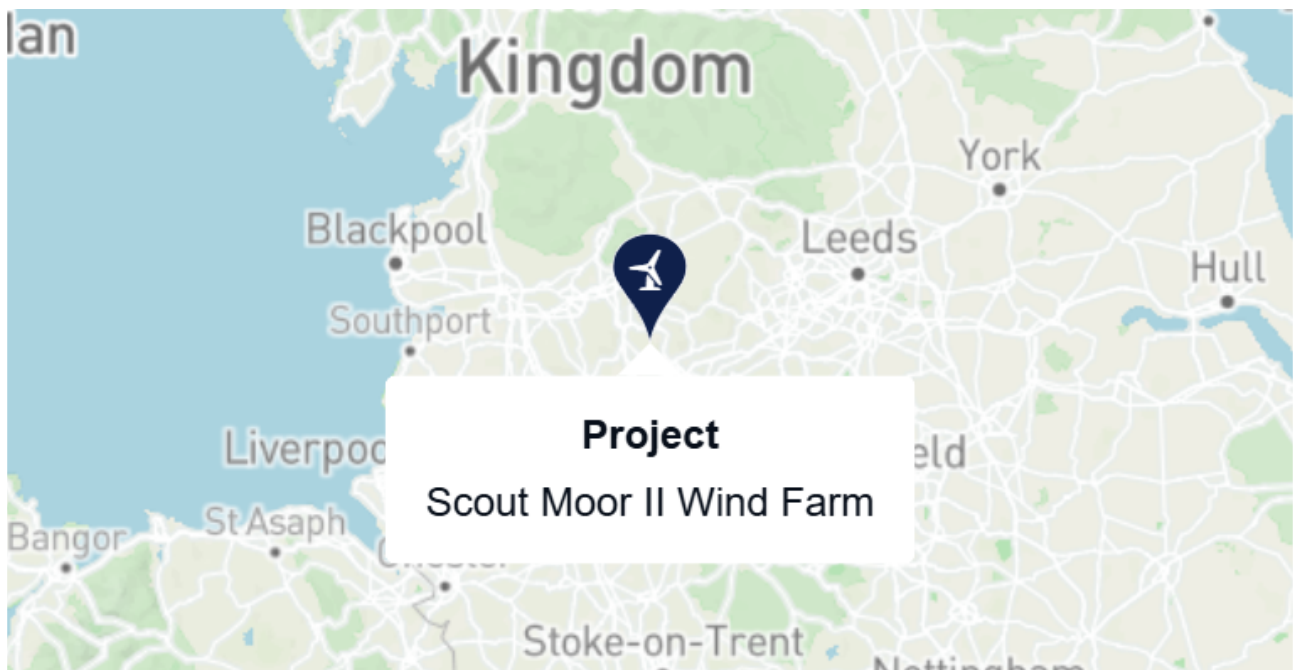
- The material composition of the wind farm
- The circularity of the wind farm

Details for each are shown in the following sections of this report.

2.2 Project site

The following project site and turbine details have been provided by the user.

Site Details	
Coordinates	53.668°N, -2.2246°E
Country	United Kingdom
Number of turbines	12
Installation date	31/12/2028
Date of commissioning	31/12/2029
Type	Onshore
Address	Scout Moor and Rooley Moor, near Manchester
Turbines	
Turbine name	Nordex n149
Turbine instalation date	31/12/2028
Number of turbines	12
Foundation weight (tonnes)	1841.50
Foundation steel weight (tonnes)	81.00
Foundation concrete weight (tonnes)	1627.50
Foundation other weight (tonnes)	133.00
Infrastructure	
Access road length (km)	10
Access road width (m)	4
Crane pad length (m)	25
Crane pad width (m)	45
Crane pad depth (m)	0.7
On-site substations	1
Met mast number	0
Cables	
Array cable length (km)	14
Array cable size (kV)	33
Array cable core material	Copper
Export cable length (km)	9.2
Export cable size (kV)	132
Export cable core material	Copper

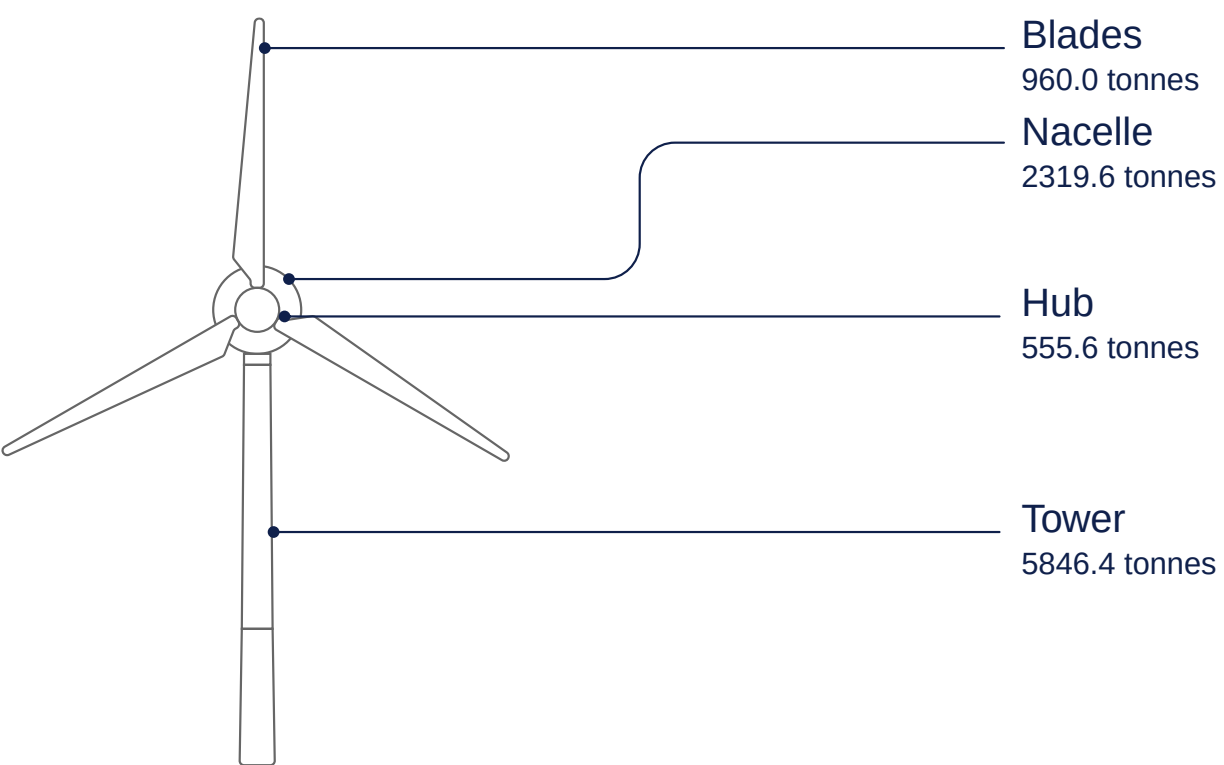


3. Material composition

ReWind has modelled the material composition of the wind farm including the turbines and balance of plant based on the inputs provided by the user shown above. ReWind has modelled the turbines characteristics using DNV's advanced concept design model library Renewables.Architect (RA).

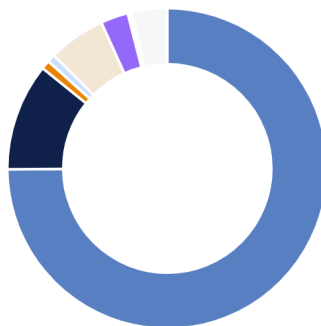
RA uses a mixture of load analysis, geometry optimisation and scaling law models to design and optimise a representative turbine according to the input specifications. The software is heavily benchmarked against DNV's expansive expertise within wind turbine design.

Component weights



Turbine details	
Turbine name	Nordex n149
Nominal power	5.7 MW
Wind class (IEC)	IB
Rotor diameter	150 m
Hub height	105 m
Generator type	Geared Double Fed Induction Generator
Blade spar material	Glass Fibre
Number of turbines	12
Tower	
Steel	5846.4 tonnes
Component mass	5846.4 tonnes
Blades	
Glass fibre	556.8 tonnes
Epoxy resin	268.8 tonnes
PUR/PVC foam	24.0 tonnes
Balsa wood	33.6 tonnes
Aluminium	38.4 tonnes
Steel	19.2 tonnes
Epoxy gelcoat	19.2 tonnes
Component mass	960.0 tonnes
Hub	
Cast iron	555.6 tonnes
Component mass	555.6 tonnes
Nacelle	
Cast iron	490.8 tonnes
Steel	1362.0 tonnes
Copper	86.4 tonnes
Rare earth magnets	0 tonnes
Aluminium	39.6 tonnes
Silicon	1.2 tonne
Other	339.6 tonnes
Component mass	2319.6 tonnes
Total	
Total turbine	9681.6 tonnes
Total turbines	9681.6 tonnes

Material composition		Nordex n149
Steel	7227.6 tonnes	74.65%
Cast Iron	1046.4 tonnes	10.81%
Copper	86.4 tonnes	0.89%
Aluminium	78.0 tonnes	0.81%
Rare earths	0 tonnes	0%
Glass fibre	556.8 tonnes	5.75%
Epoxy Resin	268.8 tonnes	2.78%
PUR/PVC Foam	24.0 tonnes	0.25%
Balsa Wood	33.6 tonnes	0.35%
Epoxy Gelcoat	19.2 tonnes	0.20%
Silicon	1.2 tonne	0.01%
Other	339.6 tonnes	3.51%
Total	9681.6 tonnes	100.00%



● Steel
 ● Cast Iron
 ● Copper
 ● Aluminium
 ● Glass fibre
 ● Epoxy Resin
 ● PUR/PVC Foam
 ● Epoxy Gelcoat
 ● Silicon
 ● Other

4. Balance of plant

ReWind defines the balance of plant components for an onshore wind farm as the foundations, array cables and export cables. The balance of plant has been modeled based on the inputs provided by the user. Any assumptions used to estimate the material breakdown have been described in the following section.

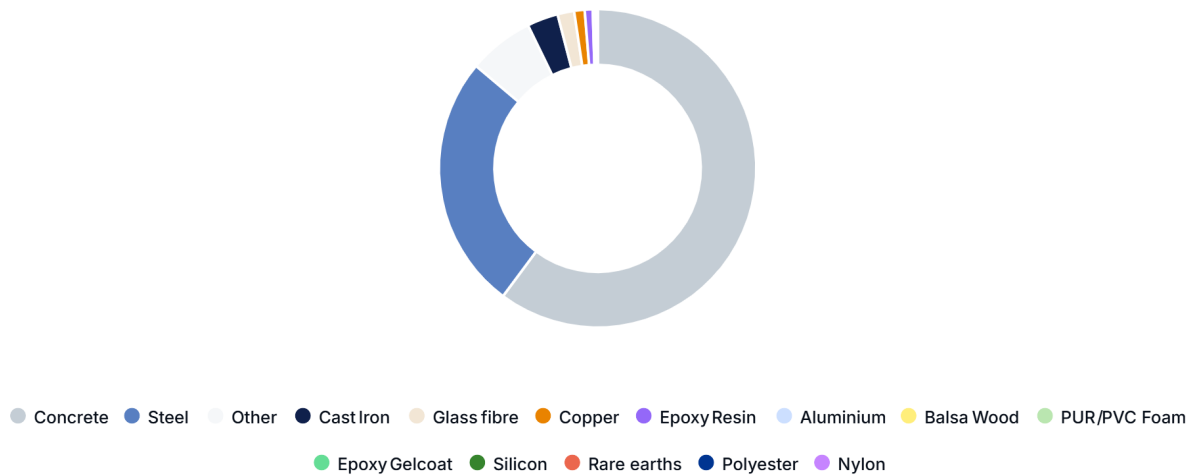
Balance of plant		
Foundations		
Steel	972.0 tonnes	4.40%
Concrete	19530.0 tonnes	88.38%
Other	1596.0 tonnes	7.22%
Total	22098.0 tonnes	100%
Array cables		
Copper	42.7 tonnes	59.33%
Aluminium	5.1 tonnes	7.04%
Steel	0 tonnes	0%
Others	24.2 tonnes	33.63%
Total	71.9 tonnes	100%
Export cables		
Copper	203.7 tonnes	29.47%
Aluminium	0 tonnes	0%
Steel	287.1 tonnes	41.54%
Others	200.3 tonnes	28.99%
Total	691.2 tonnes	100%
Onshore Substation		
Steel	89.1 tonnes	17.86%
Concrete	348.8 tonnes	69.90%
Copper	21.3 tonnes	4.27%
Aluminium	1.0 tonne	0.19%
Other	38.8 tonnes	7.77%
Total	499.0 tonnes	100%

Array and export cable weights have been estimated based on the cable size (kV), material, and length as provided by the user. ReWind has a database of cable weights and material compositions and has selected an appropriate weight factor based on the inputs.

Wind farm total material breakdown		
Concrete	19878.8 tonnes	60.16%
Steel	8575.9 tonnes	25.95%
Other	2198.9 tonnes	6.65%
Cast Iron	1046.4 tonnes	3.17%
Glass fibre	556.8 tonnes	1.69%

Copper	354.1 tonnes	1.07%
Epoxy Resin	268.8 tonnes	0.81%
Aluminium	84.0 tonnes	0.25%
Balsa Wood	33.6 tonnes	0.10%
PUR/PVC Foam	24.0 tonnes	0.07%
Epoxy Gelcoat	19.2 tonnes	0.06%
Silicon	1.2 tonne	0.00%
Total	33041.7 tonnes	100.00%

The total wind farm material breakdown has been calculated based on the component material breakdown shown above and the number of turbines as provided by the user.



5. Critical Raw Materials

The enormous appetite for resources (energy, food and raw materials) is putting extreme pressure on the planet, accounting for half of greenhouse gas emissions and more than 90% of biodiversity loss and water stress. Scaling up the circular economy is vital to achieving climate neutrality [1]. A transition to a fully circular economy is important in all industries but is essential in some that rely heavily on inherently scarce resources, particularly those that are locally scarce. Wind energy generation is one such industry which is heavily reliant on inherently scarce materials. The European Union has defined a list of Critical Raw Materials (CRMs) which are of significant special importance and the scaling up of the reuse and recycling of these materials will be essentially to meeting the emissions reduction and biodiversity promotion targets set for 2050.

EU Critical Raw Materials List 2023 [2]		
Aluminium/bauxite	Gallium	Phosphate Rock
Antimony	Germanium	Phosphorus
Arsenic	Hafnium	Platinum Group Metals
Baryte	Heavy Rare Earth Elements	Scandium
Beryllium	Helium	Silicon metal
Bismuth	Light Rare Earth Elements	Strontium
Boron/Borate	Lithium	Tantalum
Cobalt	Magnesium	Titanium metal
Coking Coal	Manganese	Tungsten
Copper*	Natural Graphite	Vanadium
Feldspar	Nickel*	
Fluorspar	Niobium	

CRMs used by the wind industry shown in orange.

*Copper and Nickel do not meet the CRM threshold but are included as strategic raw materials

Within the supply chain for wind generators, the highest risks exist at the raw materials stage. The EU only provides 1% of the raw materials for wind energy. In contrast over 12% of manufactured components and more than 50% of the assembly of wind turbines takes place within Europe [3]. Of those critical raw materials, it is the supply of both light and heavy rare earth elements (REEs) which are of highest concern. These materials are critical for direct drive permanent magnet generators which currently dominate the offshore wind turbine market. As turbines become larger and larger the need for strong permanent magnet generators which boast a relatively low weight are essential to the growth of the wind industry. At present China plays a quasi-monopolistic role with almost 100% of all REEs coming directly from China.

The REEs, i.e. neodymium, praseodymium and dysprosium, are key ingredients in the most powerful magnet material, namely neodymium-iron-boron (NdFeB). This magnet is used to manufacture Permanent Magnet Synchronous Generators (PMSG), which are used in the major wind turbine configurations. Of these REEs dysprosium is at a higher supply risk due to the higher rate of demand growth and lower proportion in rare earth ores.

Cobalt, manganese, and niobium are key alloying elements used to enhance the performance of steels applied throughout wind energy infrastructure including turbine towers, foundations, cables, and substations. Boron, dysprosium, neodymium, and praseodymium occur in wind turbines both as micro-alloying additions in certain steels and, more importantly, as functional materials in electromagnetic and energy-storage subsystems. Neodymium, praseodymium, and dysprosium are critical constituents of high-coercivity NdFeB

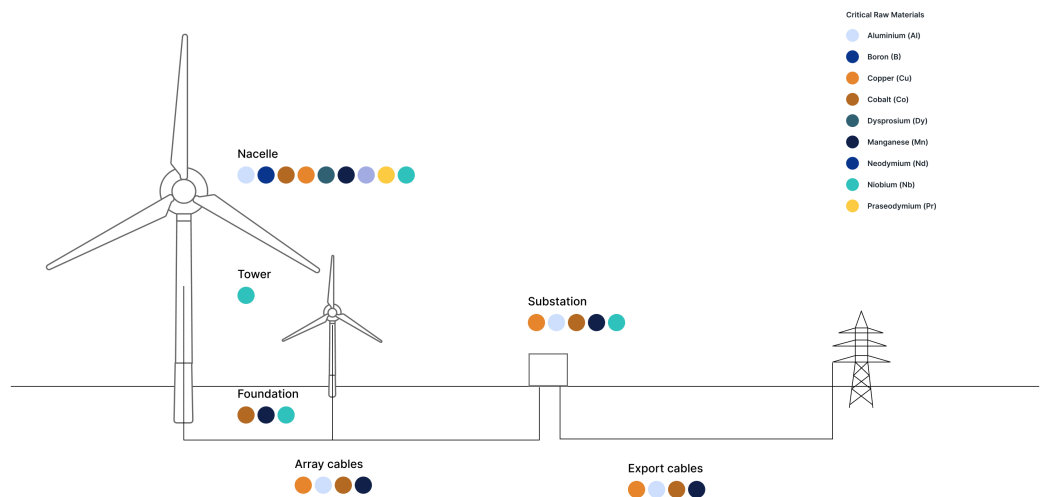
permanent magnets used in direct-drive and medium-speed generators, while boron contributes to magnet chemistries and also appears in selected battery and power-electronic components.

ReWind has been used to model the material breakdown of the wind farm including the wind turbine and balance of plant elements. It is essential to understand the location and quantity of CRMs in the wind farm in order to effectively plan for and maximise the re-use and recycling of these materials at the end of the wind farm’s usable life. ReWind has mapped the location and quantity of these materials in the diagram and table below.

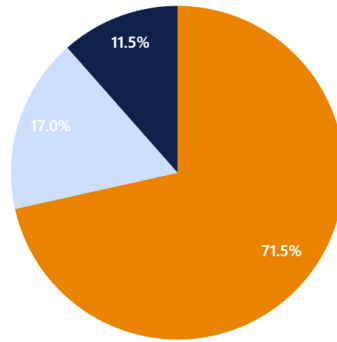
[1] <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474>

[2] <https://www.rtlnieuws.nl/sites/default/files/content/documents/2023/07/04/Study%202023%20CRM%20Assessment%20%281%29.pdf>

[3] https://rmis.jrc.ec.europa.eu/uploads/CRMs_for_Strategic_Technologies_and_Sectors_in_the_EU_2020.pdf



Critical Raw Materials breakdown	
Material	Weight (tonnes)
Aluminium (Al)	84.03
Boron (B)	0.00
Copper (Cu)	354.07
Cobalt (Co)	0.03
Dysprosium (Dy)	0.00
Manganese (Mn)	56.95
Neodymium (Nd)	0.00
Niobium (Nb)	0.02
Praseodymium (Pr)	0.00
Total Critical Raw Materials	495.11



● Copper (Cu) ● Aluminium (Al) ● Manganese (Mn) ● Cobalt (Co) ● Niobium (Nb) ● Boron (B) ● Dysprosium (Dy) ● Neodymium (Nd)
● Praseodymium (Pr)

6. Circularity

6.1. Wind farm circularity

Calculating the circularity percentage of a wind farm gives a measure of the proportion of the project that can be usefully recycled, re-used or recovered at the end-of-life and that will not end up in landfill.

The term “circularity” has been intentionally used here in the place of “recyclability” as ReWind considers the definition of recyclability to be too narrow. ReWind defines circularity as any material processing activity which avoids waste material from the wind farm going to landfill. When defined in terms of the waste hierarchy this means that the following activities are considered circular:

- Re-use
- Recycling
- Recovery

Recovery in the context of processing of materials from wind farms includes energy recovery through the cement co-processing of wind turbine blades. If a cement co-processing facility has been selected for blade processing this has been reflected in the circularity calculation shown below.

The circularity percentage is calculated based on the wind farm material breakdown and the selected material processing facilities as presented above. Circularity percentage is calculated using the following equation:

$$\text{Circularity} = \sum_{i=1}^{\text{all wind farm components}} \frac{\text{material recovery rate} \times \text{material mass (kg)}}{\text{total materials mass (kg)}}$$

Where:

- Material mass is the mass of each material in the wind farm, including both the turbine and Balance of Plant (BoP), as shown in the “Wind farm total material breakdown” figure above
- Material recovery rate is defined as the amount of material that is recovered and re-usable after the dismantling and recycling, re-use or recovery processes
- Total materials mass is the mass of all materials in the wind farm, including both the turbine and BoP and can be seen in the “Wind farm total material breakdown” figure above

The material recovery rate for metals, blades and concrete as shown below is dependent on whether the chosen processing facility provides re-use, recycling or recovery services. Where landfill has been chosen the recovery rate for this material has been set as 0%. In addition, all non-recyclable materials have an assumed recovery rate of 0%.

Circularity			
Material	Wind Farm material mass (t)	Material recovery rate	Recovered material mass (t)
Wind Turbines			
Steel	7227.6 tonnes	96.85%	7000.2 tonnes
Cast Iron	1046.4 tonnes	98.00%	1025.5 tonnes
Copper	86.4 tonnes	92.00%	79.5 tonnes
Aluminium	78.0 tonnes	92.00%	71.8 tonnes
Rare Earths	0 tonnes	95.00%	0 tonnes
Glass Fibre	556.8 tonnes	60.00%	334.1 tonnes
Epoxy Resin	268.8 tonnes	60.00%	161.3 tonnes
PUR/PVC foam	24.0 tonnes	60.00%	14.4 tonnes
Balsa wood	33.6 tonnes	60.00%	20.2 tonnes
Epoxy gelcoat	19.2 tonnes	60.00%	11.5 tonnes
Silicon	1.2 tonne	95.00%	1.1 tonne
Other	339.6 tonnes	0%	0 tonnes
Total Turbine Recyclability		90.06%	
Blades			
Steel	19.2 tonnes	92.00%	17.7 tonnes
Aluminium	38.4 tonnes	92.00%	35.3 tonnes
Glass Fibre	556.8 tonnes	60.00%	334.1 tonnes
Epoxy Resin	268.8 tonnes	60.00%	161.3 tonnes
PUR/PVC foam	24.0 tonnes	60.00%	14.4 tonnes
Balsa wood	33.6 tonnes	60.00%	20.2 tonnes
Epoxy gelcoat	19.2 tonnes	60.00%	11.5 tonnes
Total Blades Recyclability		61.92%	
Hub			
Cast Iron	555.6 tonnes	98.00%	544.5 tonnes
Total Hub Recyclability		98.00%	
Nacelle			
Steel	1362.0 tonnes	92.00%	1253.0 tonnes
Cast Iron	490.8 tonnes	98.00%	481.0 tonnes
Copper	86.4 tonnes	92.00%	79.5 tonnes
Aluminium	39.6 tonnes	92.00%	36.4 tonnes
Silicon	1.2 tonne	95.00%	1.1 tonne
Other	339.6 tonnes	0%	0 tonnes
Total Nacelle Recyclability		79.80%	
Tower			

Steel	5846.4 tonnes	98.00%	5729.5 tonnes
Total Tower Recyclability		98.00%	
Foundations			
Steel	972.0 tonnes	98.00%	952.6 tonnes
Concrete	19530.0 tonnes	100.00%	19530.0 tonnes
Other	1596.0 tonnes	0%	0 tonnes
Total Foundation Recyclability		92.69%	
Array Cables			
Copper	42.7 tonnes	98.00%	41.8 tonnes
Aluminium	5.1 tonnes	98.00%	5.0 tonnes
Steel	0 tonnes	0%	0 tonnes
Others	24.2 tonnes	0%	0 tonnes
Total Array Cables Recyclability		65.04%	
Export Cables			
Copper	203.7 tonnes	98.00%	199.6 tonnes
Aluminium	0 tonnes	0%	0 tonnes
Steel	287.1 tonnes	98.00%	281.4 tonnes
Others	200.3 tonnes	0%	0 tonnes
Total Export Cables Recyclability		69.59%	
Onshore Substation			
Steel	89.1 tonnes	98.00%	87.4 tonnes
Concrete	348.8 tonnes	100.00%	348.8 tonnes
Copper	21.3 tonnes	98.00%	20.9 tonnes
Aluminium	1.0 tonne	98.00%	0.9 tonne
Other	38.8 tonnes	0%	0 tonnes
Total Onshore Substation Recyclability		91.79%	
Project Circularity Calculation			
Total Material Mass		32542.7 tonnes	
Total Recovered Material		29729.8 tonnes	
Project Circularity		91.36%	

6.2. Material processing

ReWind defines three primary material waste streams generated during wind farm decommissioning: Metals, Blades and Concrete. The following material processing facilities have been defined as part of the decommissioning scenario to handle these waste streams at end of life.

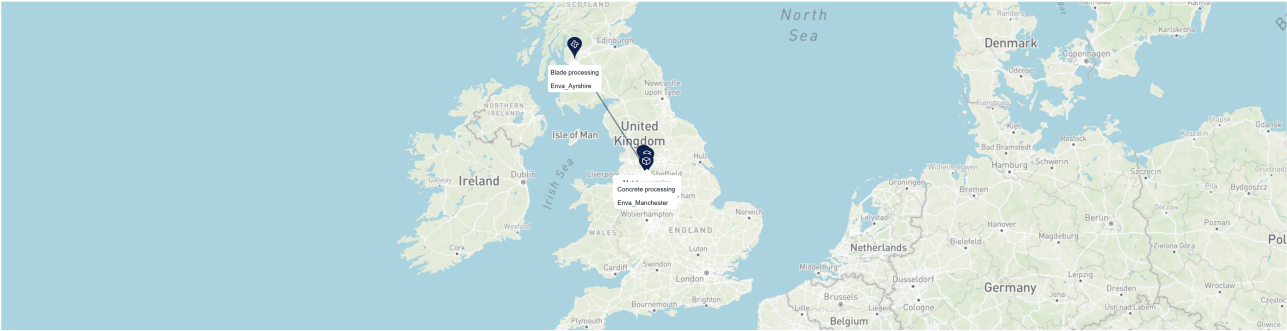
Metal processing		EMR Group_Rochdale
Location and contact details		
Company	EMR Group_Rochdale	
Location	United Kingdom	
Facility address	Uncouth Rd, Rochdale OL16 3DD	
Coordinates	53.61870510315024°N, -2.1201458134912325°E	
HQ address	–	
HQ country	United Kingdom	
Phone number	01706 341623	
Website	https://uk.emrlocal.com/yards/emr-rochdale-scrap-metal	
Email address	ukinfo@emrgroup.com	
Details		
Operation status	Operating	
Operational since	2000	
Process description	The firm buys both ferrous and non-ferrous metals that will be recycled.	
Certifications	ISO 9001 ISO 14001 ISO 27001 ISO 45001	
Facility type	Material Processing	
Materials processes	Metals	
Services	Recycling	
Commercial partners	0	
Recovery Rate	92% - 98%	

Blade processing		Enva_Ayrshire
Location and contact details		
Company	Enva_Ayrshire	
Location	United Kingdom	
Facility address	North Ayrshire Council, UK	
Coordinates	55.7405°N, -4.5443°E	
HQ address	–	
HQ country	United Kingdom	
Phone number	+44 (0) 1294 315 200	
Website	https://enva.com/news-pr/enva-launches-wind-turbine-blade-recycling-service	
Email address	0	
Details		
Operation status	Operating	
Operational since	2000	
Process description	Enva offers a solution which crushes and shredded wind turbine blades to enable the recovery of recyclable materials such as steel. The residual material is then used as a replacement for traditional fossil fuels in EfW (energy from waste) facilities. To aid processing and transportation specialist equipment is used to cut down the blades into three 50 metre lengths prior to them being delivered to Enva’s recycling facility.	
Certifications	–	
Facility type	Material Processing	
Materials processes	Blades	
Services	Recycling	
Commercial partners	–	
Recovery Method	Energy recovery	
Recovery Rate	60%	

Concrete processing		Enva_Manchester
Location and contact details		
Company	Enva_Manchester	
Location	United Kingdom	
Facility address	Lumm Farm, Enva, Lumb Ln, Droylsden, Manchester M43 7LB, United Kingdom	
Coordinates	53.49106458555433°N, -2.1367518265678065°E	
HQ address	49 Burnbrae Road Linwood Industrial Estate Linwood PA3 3BD	
HQ country	United Kingdom	
Phone number	0161 370 2360	
Website	https://enva.com/locations#28	
Email address	0	
Details		
Operation status	Operating	
Operational since	1972	
Process description	The firm offers recycles ferrous and non-ferrous metals. Waste management solutions are available for non-metal waste.	
Certifications	ISO 9001 ISO 14001 ISO 45001	
Facility type	Material Processing	
Materials processes	Concrete, Metals	
Services	Recycling	
Commercial partners	0	
Recovery Rate	100%	

7. Supply chain map

The primary waste streams as defined above have been mapped and are shown in the figure below:



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Appendix 2: Planning Conditions

Condition A – Financial Provision

- (1) There shall be no Commencement of development unless and until the Company has delivered a bond or other form of financial security in terms acceptable to the Planning Authority which secures the cost of performance of all decommissioning, restoration and aftercare obligations contained in **Condition [C]** to the Planning Authority.
- (2) The value of the financial provision shall be determined by a suitably qualified independent professional as being sufficient to meet the costs of all decommissioning, restoration and aftercare obligations contained in **Condition [C]**.
- (3) The value of the financial guarantee shall be reviewed by a suitably qualified independent professional no less than every five years and increased or decreased to take account of any variation in costs of compliance with all decommissioning, restoration and aftercare obligations contained in **Condition [C]**.
- (4) The Company shall ensure:
- (a) that the guarantee, bond or other financial provision is maintained throughout the duration of this permission; and
 - (b) that the guarantee, bond or other financial provision is subject to a review five years (at the expense of the Company) after the Commencement of development and every five years thereafter until such time as the Development is decommissioned and the site restored.

Reason: To ensure that there are sufficient funds to secure performance of the decommissioning, restoration and aftercare condition.

Condition B – Interim Decommissioning, Restoration and Aftercare Strategy

There shall be no Commencement of Development until an Interim decommissioning, restoration and aftercare strategy has been submitted to, and approved in writing by, the Local Planning Authority. The interim decommissioning, restoration and aftercare strategy shall outline measures for the decommissioning of the Development and the restoration and aftercare of the site, and shall provide proposals for the removal of the Development, the treatment of ground surfaces, the management and timing of the works and environmental management provisions in any instance that the site as a whole, or in part, ceases to operate prior to the approval of the Decommissioning, Restoration and Aftercare Plan required under the provisions of **Condition [C]**.

Reason: To ensure the decommissioning and removal of the Development in an appropriate and environmentally acceptable manner and the restoration and aftercare of the site, in the interests of safety, amenity and environmental protection when a detailed Decommissioning, Restoration and Aftercare Plan has not yet been approved.

Condition C – Site Decommissioning, Restoration and Aftercare

- (1) The Development shall cease to generate electricity to the grid network by no later than the date falling 40 years from the Date of Final Commissioning.
- (2) No later than one year prior to the Date of Final Generation or the expiry of the planning permission (whichever is earlier) a decommissioning, restoration and aftercare plan shall be submitted for the written approval of the Local Planning Authority, in consultation with relevant statutory consultees. The detailed decommissioning, restoration and aftercare plan shall provide updated and detailed proposals, in accordance

with relevant guidance at that time, for the removal of the Development, the treatment of ground surfaces, the management and timing of the works and environment management provisions which shall provide:

- (a) a site waste management plan (dealing with all aspects of waste produced during the decommissioning, restoration and aftercare phases and, including details of measures to be taken to minimise waste associated with the Development and promote the recycling of materials and infrastructure components);
- (b) details of the formation of the construction compound, welfare facilities, any areas of hardstanding, turning areas, internal access tracks, car parking, material stockpiles, oil storage, lighting columns, and any construction compound boundary fencing;
- (c) a dust management plan;
- (d) details of measures to be taken to prevent loose or deleterious material being deposited on the local road network, including wheel cleaning measures, lorry sheeting facilities, and measures to clean the site entrances and the adjacent local road network;
- (e) a pollution prevention and control method statement, including arrangements for the storage and management of oil and fuel on the site;
- (f) details of measures for soil storage and management;
- (g) a surface water and groundwater management and treatment plan, including details of the separation of clean and dirty water drains, and location of settlement lagoons for silt laden water;
- (h) details of measures for sewage disposal and treatment;
- (i) temporary site illumination;
- (j) the construction of any temporary access into the site and the creation and maintenance of associated visibility splays; and
- (k) a species protection plan based on surveys for protected species (including birds) carried out no longer than eighteen months prior to submission of the plan.

(3) The Development shall be decommissioned, the site restored, and aftercare undertaken prior to the date falling three years after the Date of Final Generation and in accordance with the approved detailed decommissioning, restoration and aftercare plan.

Reason: To ensure the decommissioning and removal of the Development in an appropriate and environmentally acceptable manner and the restoration and aftercare of the site, in the interests of safety, amenity and environmental protection.