

SUMMARY REPORT:

TOWARDS INDUSTRIAL CLUSTER
DECARBONISATION IN THE BLACK COUNTRY:
THE ALUMINIUM RE-PROCESSING OPPORTUNITY



The Black Country Industrial Cluster

The World's first zero-carbon industrial cluster

This report presents the role WMG's Supply Chain Research Group is undertaking as part of a consortium of partners to deliver a bold vision for the world's first zero-carbon industrial cluster in the Black Country.

WMG made an important and distinctive contribution to this first phase of our Industrial Cluster Decarbonisation Project. They brought important supply chain and circular economy expertise to the team and delivered a comprehensive report which really helped move our thinking forward and complemented the wider work we're doing on low carbon energy infrastructure and business support. We're delighted to be continuing to work with WMG on phase 2 of the project.

Matthew Rhodes, Programme Director Repowering the Black Country.

The Vision

The Black Country saw the growth of the world's first industrial cluster. The proposition being developed by the consortium presents an exciting and realistic opportunity to secure substantial regional economic growth and develop a leading position as the home of zero-carbon industrial clusters.

- ▶ Clean GVA Growth of £16bn by 2030
- ▶ 20,000 skilled jobs
- ▶ Supporting the reduction of carbon emissions by up to 50%

The Plan

To deliver the vision, a series of new energy production hubs will act as a catalyst for the development of more circular, regionally self-sufficient supply chains focused on the industries that have made the Black Country world renowned for its application of new technology and innovative thinking. The plan comprises four key elements:

- ▶ Reconfigure supply chains for the circular economy - Reconfigure supply chains for foundation industries to reduce carbon emissions by between 40% and 50%.
- ▶ Establish zero carbon Sustainable Energy Centres (SECs) - Design five sources of zero-carbon power to provide variations of energy provision depending on the industries and populations they serve.
- ▶ Optimise processes across hubs and supply chains - Foster a culture of innovation and continuous improvement supported by a range of aligned financial mechanisms and academic institutions.
- ▶ Align with national decarbonisation strategy - Lead with multiple smaller, lower cost projects that offer a faster, low-risk approach and dovetail with broader national and international decarbonisation strategies.

Consortium Members



Black Country Power Hubs

From Vision to Deployment

The consortium's first step towards realising this vision has been to undertake a feasibility study into the development of four demonstrator clusters. Each cluster will comprise a Sustainable Energy Centre providing a power source tailored to a specific industry within the region.

A catalyst for zero-carbon growth

The WMG Supply Chain Research Group (SCRG) was selected to undertake the first feasibility study into the creation of a power hub based on aluminium re-processing at the Phoenix 10 site in Walsall.

The Phoenix 10 Power Hub aims to establish mini clusters of aluminium processing and manufacturing businesses, optimised for energy consumption, integrated into the local circular economy and supplying two main regional industries; automotive and construction.

Future Regional Demand and Supply Chain Opportunities for Aluminium

Secondary Aluminium Processing

The SCRG assessed the global market and regional markets for aluminium as the basis for building the power hub cluster. In Europe the growth in demand for semi-finished aluminium is forecast to grow between 28% and 55% in both of the two main markets; transport (automotive) and construction. Metal manufacturing operations represent the largest local industrial employment sector.

- ▶ **£428m regional GVA**
- ▶ **23,850 employees**
- ▶ **1,345 businesses**

Automotive

The automotive market for aluminium is especially relevant for the UK and in particular, the Black Country. Research indicated that the growth in the electric vehicle (EV) market suggested the UK could potentially produce nearly 1.6 million EVs per year by 2040. This presents an opportunity for new emerging supply chains to develop and produce new and innovative components, leveraging an SEC power hub and disrupt existing market incumbents.

Construction

The construction industry consumes approximately 150,000T of the UK's aluminium production. 43% of this is in the form of extruded products and 20% as sheet metal products. Imports of structural aluminium extrusions add an additional 81,000T annually, which suggest some potential to increase production here in the UK. The construction industry supply chain utilising aluminium is diffuse, however there are clear opportunities for developing industrial clusters around SME fabrication in areas of market growth, i.e. windows and door frames.

"Metal manufacturing operations represent the largest local industrial employment sector."

Reconfiguring the Supply Chain

Supply Chain Design Principles

To underpin the core principles driving the vision, SCRG developed a set of supply chain design principles that refocus planning and activity on creating a cohesive and collaborative supply chain as the basis for competition. The premise is that supply chains compete and not individual firms.

Flexibility within the supply chain is the aim, with an intent to develop economies of scope rather than economies of scale. This enables the development of more localised supply chains able to operate using circular principles and more resilient to external shocks.

Challenge	Approach	Investment Rationale
Local vs. Global sourcing	Investigate 'local-for-local' alternative to global sourcing and centralised manufacturing	From a global perspective, investing in a smaller scale UK plant would create a 'distributed' approach, improving supply chain resilience and flexibility
Economies of Scope vs. Scale	Focus on the 'economies of scope' rather than the 'economies of scale'	A smaller scale plant but a great bandwidth of capabilities. This is inherent to the plant design through the integrated ability to recycle AND manufacture products.
Wide vs. Narrow bandwidth	Create 'bandwidth' through asset sharing, e.g. capacity and inventory	Creating an eco-system with other energy users to create closed loop system would enable efficiency savings Opportunities for network based competition such as joint ownership models
Multiple vs. Single options	Adopt a 'real options' approach to supply chain decision making	Mitigate future risk of availability of processed aluminium (due to Chinese controls and demand increases) by investing in additional secondary processing
Old vs new sustainable business models	Adopting circular economy principles and embracing new technology to create new market offerings	Exploring different service offerings such as life cycle management for automotive OEMs would also support profitability Green site offers opportunities to exploit new technology (for effective plant running).

Table: New supply chain thinking and impact on investment decisions

Six Pillars for investment

As the basis for determining feasibility, the SCRG concluded that there were 6 key drivers that need to be satisfied for investment in the development of power hubs at each of the shortlisted locations to be viable. These drivers were used to assess the viability of the power hub based on aluminium re-processing at the Phoenix 10 site in Walsall via further research and interviews with industry stakeholders.

Pillar One

Strategic Opportunity - The investment must present a clear strategic opportunity for supporting zero-carbon economic growth for target industries in Black Country region.

- ▶ **Combining** the re-melting and casting operations could create significant energy and cost savings. This disrupts the traditional supply chain structure thus providing a significant competitive advantage.
- ▶ **Co-locating** different aspects of aluminium re-processing creates the opportunity for 'network-based competitive' and more innovative ownership models and supports net zero carbon objectives.
- ▶ **On-Shoring** strategies allow for the UK and Balck Country region to take advantage of restrictions in imports of scrap to China and growing global demand for aluminium.
- ▶ **Innovating** business and service models to help manage end-of-life for aluminium products. This supports both circular supply chain approaches but also provides a further revenue stream.

Pillar Two

Circular Supply Chain - The investment must allow for the development of a primarily self-sufficient circular supply chain to reinforce positive inter-relationships, and the skills and expertise base in the region.

- ▶ **Fuel sourcing** for the SEC is possible within the region via Refuse Derived Fuel (RDF) and biomass feedstocks. This presents the foundations of the circular supply chain created for the project.
- ▶ **Aluminium sourcing** is possible due to a wide network of scrap collectors and sorters within the West Midlands. Sorting operations should be strategically placed to ensure effective selection and segregation.
- ▶ **Product fabrication** can be undertaken by a large number of companies already located in the region. Metal manufacturing companies already contribute £438m GVA p.a. and employ 23,450 people.
- ▶ **Customer development** is deemed viable due to the high volume of automotive and construction activity in the region. Customers would comprise established OEMs (e.g. JLR) and smaller, more niche players.

Pillar Three

Cost Competitiveness - The investment must present an opportunity to reduce the overall cost of energy to companies in the power hub cluster which will reduce operating costs and allow for increased price competitiveness.

- ▶ **Latest technology** has advanced significantly in the last 10 years and therefore presents an opportunity to ensure this process can efficiently segregate the different aluminium grades and alloys.
- ▶ **Effective sourcing** of raw materials for the right scrap feedstock and maximising yields through the plant is the key to viability and profitability. Raw materials make up 85% of the total selling price.
- ▶ **Localised sorting** would increase speed of transfer into the process and reduce transportation costs, thereby improving operating effectiveness and returns on investment.
- ▶ **Internal recycling** of any scrap generated within the plant (i.e. from casting/machining) must be handled using efficient processes to minimise raw material costs and ensure cost effectiveness.

Pillar Four

Operating Effectiveness - The investment must facilitate the introduction of smaller more modular energy solutions capable of delivering the energy required by the cluster.

- ▶ **Smaller modular energy solutions** producing ~35MW of power (compared to ~800MW for a large power station), would provide efficient localised energy fueled by local feedstocks and waste.
- ▶ **Energy efficiencies** would be possible as the hub and energy eco-system is designed to maximise heat exchange and minimise losses to industrial customers based on site or within close proximity.
- ▶ **Sorting processes** present a crucial element to optimising operating effectiveness in addition to its impact on cost competitiveness. The proximity of industrial units designed for this function satisfy this requirement.
- ▶ **Maximising yields** through the plant are vital with the assumed yield through the furnaces being 97% while yield through the casting process/machine shop is of the order of 65%.

Pillar Five

Resilience - The investment must be resilient. SCRG identified the following adjustments to the standard supply chain model that would be required to achieve this.

- ▶ **Local sourcing** of feedstocks for the plant combined with an effective programme for engaging the local supply chain will enable a 'local-for-local' alternative to global sourcing and centralised manufacturing.
- ▶ **Economies of Scope** will increase the resilience of the power hub cluster by expanding the range of products produced and offset the development of single point of failure by focusing solely on scale.
- ▶ **Wide bandwidths** of capability and capacity can be developed through alternative approaches to sharing assets, inventory and other capital intensive fixed assets.
- ▶ **Multiple options** for sourcing, raw material production and product production will mitigate future risk of availability due to Chinese export/import controls and demand increases.
- ▶ **Sustainable business models** should be designed and adopted to support circular economy principles and embrace new technology to create new market offerings.

Pillar Six

Supply Network - The investment must be based on access to an efficient and viable supply of materials; both in terms of fuel sources for the SEC and the businesses comprising the power hub cluster.

- ▶ **Supply of Scrap** industrial and potentially domestic aluminium will need to be established by the plant operator. This is viable through the wide network of scrap collectors and sorters within the West Midlands.
- ▶ **Sorting operations** would need to be strategically placed at these points as well as within the processing plant to ensure that scrap is properly selected and segregated.
- ▶ **Strong customer base** located in the West Midlands is deemed as viable due to the regional UK automotive industry and high volume of commercial and domestic construction fabrication companies.

Viability of Investment

As a result of extensive research and feedback from industry stakeholders, SCRG concludes that establishing a Sustainable Energy Centre with a co-located secondary aluminium processing plant within Phoenix 10 is a viable proposition.

There are many challenges to overcome and questions to answer before a power hub demonstrator at Phoenix 10 comes into operation. However, SCRG believes that it presents a significant opportunity to advance industrial capability and supply chain resilience within the Black Country. As a first step, this feasibility study indicates that the foundational arguments for positioning the Black Country region as the world's first zero-carbon industrial cluster can be satisfied from a technical, operational and financial perspective.

POSSIBLE IMAGE

Excellent transport and road links



1 hour to London by train



Nearest airport -
Birmingham International
(approx 20 minutes by car)



Nearest train stations -
Coventry or Canley
(approx 10-15 minutes by car)



Getting in touch



warwick.ac.uk/fac/sci/wmg/research/scip



SCIP@warwick.ac.uk



@WMGBusiness



WMG Business



University of Warwick
Coventry
CV4 7AL
United Kingdom

