

### Sustainably Sourced Rare Earths for the Green Transition

### Mkango Resources Ltd.

Corporate Presentation July 2025



### Spearheading Rare Earth Magnet Recycling

Overview



HyProMag has been spearheading short-loop rare earth magnet recycling and manufacturing since 2018, underpinned by the patented **Hydrogen Processing of Scrap (HPMS) Technology**, developed at the University of Birmingham and exclusively licenced to HyProMag, a 79.4% subsidiary of Mkango

### Scalable Technology Solution for Rare Earth Magnet Recycling

HPMS solves the separation challenge - economic and energy efficient separation of rare earth magnets from waste streams

### US\$100m of R&D Expenditure with University of Birmingham & Partners

Underpins new rare earth hub currently being commissioned at Tyseley Energy Park, Birmingham and global roll-out









magnet manufacturing



### **Recycled Magnet Production with** 95% Reduction in CO<sub>2</sub> Footprint

HPMS enables short-loop production of recycled rare earth magnets and alloys with an exceptionally low CO2 footprint

### First UK Production in July 2025 Kicks off Global Growth Pipeline

Ongoing commercialisation of HPMS in UK (underway), Germany (by end 2025) and USA (2027)

### **Recycling Technology Roll-Out & Growth Pipeline**

Overview



### **Rare Earth Magnet Recycling & Manufacturing**

### **Group Structure**



- Focus on shortloop recycling in UK
- Commissioning underway with first production runs July 2025
- Initial production 20-25tpa recycled NdFeB scaling up to targeted 100-350tpa
- Further expansion options being evaluated

**HYPR®MAG** HYPRAMAG

in Germany

taraeted by

production of

100-350tpa

expansion

evaluated

options being

recycled

**NdFeB** 

Further

end 2025

Taraeted

First production

- Focus on short-Focus on shortloop recycling in loop recycling USA
  - Taraeted production of 1.000tpa startina H1 2027
  - NPV US\$262m, IRR 23% at current prices
  - NPV U\$\$503m. IRR 31% at
    - forecast prices
  - Detailed engineering underway



- Collaboration with Envipro in Japan & UK
- Joint marketina of recycling solutions in Japan
- **Recycling trials in UK** and Japan
- Analysis of scrap feed and offtake opportunities in Japan
- Potential HyProMag recycling technology development in Japan

- $\searrow \mathbb{Z}$  $\ge$ MKANGO Mkango RE UK
- Focus on lonaloop recycling
- Complementary process to shortloop
- Pilot plant being commissioned in UK
- Production of Nd/Pr and Dv/Tb carbonates and oxides
- Strategic options being evaluated



<sup>1</sup>Maginito's interest in HyProMag GmbH will increase to 90% once convertible loan note is converted

Mkango will also hold an interest in a new Nasdag listed company holding the Songwe mining & Pulawy separation assets

First production runs in UK announced July 2025, first production in Germany targeted by end 2025

### Mkango's Upstream Assets to be Listed on Nasdaq

- Business Combination Agreement (BCA) signed for a SPAC merger with Crown Proptech Acquisitions.
- Mkango's Songwe Hill and Pulawy Projects to be listed on NASDAQ, under the name Mkango Rare Earths Limited (MKAR)
- Post transaction, Mkango will be focused on rare earth magnet recycling and manufacturing via its 79.4% in Maginito, whilst retaining a majority interest in MKAR, focused on rare earth mining and separation, and continued opportunities for synergies
- Proforma valuation for Mkango's share of MKAR of \$400M
- Transaction proceeds will support MKAR's strategic growth plan including development of Songwe and Pulawy.
- Proposed Business Combination and Nasdaq listing is expected to be completed in the Q4 2025



- Awarded Strategic Project status by European Commission
- Definitive Feasibility Study completed in July 2022, currenty being updated
- Targeting 5,954tpa TREO in mixed rare earth carbonate (MREC)
- ESHIA approval received in Jan 2023
- Mining Development Agreement signed with Government of Malawi in July 2024
- Significant opportunities to reduce OPEX

Awarded Strategic Project status by European Commission

Overview

- Underpinned by sustainablysourced, mixed rare earth carbonate from Songwe and other potential sources
- Site adjacent to Grupa Azoty Pulawy fertiliser and chemical plant
- Pre-feasibility currently being updated
- Production of 2,000 tpa Nd / Pr oxides and 50 tpa Dy / Tb oxides (in SEGH carbonate)

Transaction streamlines Mkango to focus on downstream technologies, whilst unlocking significant value and facilitating development of its mining and separation assets through access to US capital markets

# Mkango - Capital Structure

Mkango Resources	AIM/TSXV: MKA				
Share Price	GBP0.313 /C\$0.56				
Shares Outstanding	332.7m				
Market Cap.	£103.9m / C\$186.3m				

Major Shareholders	
Talaxis	20.87 %
Stewart Newton	3.55 %
Michael Geoghegan	2.91 %
Leo Mining & Exploration	2.57 %
Derek Linfield	2.42 %

#### Major upcoming milestones targeted for 2025

- Production scale-up for HyProMag UK recycling and magnet manufacturing plant following first production runs in July 2025
- First production for HyProMag Germany recycling and magnet manufacturing plant, targeted by end of 2025
- Completion of detailed engineering and development decision for HyProMag USA by end 2025
- Listing of Songwe mining and Pulawy separation projects on NASDAQ via SPAC transaction

#### 3-year share price p (AIM)



Corporate Information

# Mkango - Board and Management



#### William Dawes, CEO & Co-founder

- BSc in Geology, MSc in Mineral Exploration
- 30 years' experience in exploration, business development, investment banking at Rio Tinto, Robert Fleming, Chase Manhattan and JP Morgan



#### Alexander Lemon, President & Co-founder

- BSc in Geological Sciences, MSc in Mineral Exploration
- 30 years' experience in exploration, business development, operations management at Allied Commercial, Consolidated Contractors Company



#### Robert Sewell, Chief Financial Officer

- B Comm Hons (Accounting) Chartered Accountant (SA)
- 20 years' experience in commercial accounting, debt and equity finance, and cash management at Deloitte and AfriTin Mining

#### Derek Linfield, Non-Executive Chairman

Former Managing Partner of Stikeman Elliott (London) LLP, over 18 years' experience in London with African mining and oil & gas sectors, Former Chairman of Cornish Lithium

#### Susan Muir, NED

Over 25 years of capital markets experience in senior investor relations roles and equity research with major Canadian banks. Formerly Vice President, IR, at Barrick Gold and Arizona Mining.

#### Shaun Treacy, NED

Strategic and Financial Adviser, 25 years' experience in corporate finance and investment banking. Former MD of J.P. Morgan, Lehman Brothers, Nomura and UBS. Associate of the Institute of Chartered Accountants.

#### Philipa Varris, NED

NED of EnviroGold, over 25 years' experience globally in ESG and H&S management globally with an MSc in Natural Resources. AusIMM Chartered Environmental Professional and UK Committee member. Formerly Head of Sustainability at Horizonte Minerals.

- Implemented early-mover recycling strategy
- Track record of growth via partnerships
- Advanced rare earth project from exploration to DFS
- Significant rare earth expertise

### **Rare Earth Magnet Recycling and Manufacturing**



# HyProMag – Introduction

- Major opportunity for growth in recycling less than 5% of rare earth magnets are currently recycled from end-of-life products
- Key challenge is separation how do you liberate embedded NdFeB magnets for recycling in a cost effective and energy efficient way?
- HyProMag has the solution via its patented Hydrogen Processing of Magnet Scrap (HPMS) technology
- The resulting recycled NdFeB can be fed back into multiple points of the supply chain including:
  - o short-loop magnet manufacturing to produce magnets with a significantly reduced carbon footprint
  - o long-loop chemical processing to produce rare earth carbonates and oxides
- Commercial production for UK and Germany in 2025, USA in H1 2027
- Supported by the Minerals Security Partnership and aligned with the Critical Raw Materials Act

- Founded in 2018 by leading experts in magnetic materials, recycling and hydrogen technologies
- Highly-experienced team

   Directors with extensive experience in rare earths, alloys and magnets
- HyProMag GmbH was established in 2021 to commercialise in Germany
- HyProMag USA joint venture formed to commercialise HPMS in USA, fully funded by CoTec



Will Dawes Director HyProMag Ltd, Mkango





**Dr. John Speight** Director HyProMag Ltd



David Kennedy Director HyProMag Ltd



Prof. Carlo Burkhardt Director HyProMag GmbH



Nelson Brito Managing Director HyProMag GmbH

Recycle

# Magnet Recycling Challenges

Recycle

### Most end-of-life rare earth magnets are not currently recycled

- Electronic products are not often designed with end-ofuse recycling in mind
- Current recycling processes are not suitable for NdFeB magnets
- Magnets not recovered during shredding process

<sup>1</sup>University of Birmingham/HyProMag <sup>2</sup>Axion



Hard disk drives



Rotor from an automotive drive motor



Shredded HDDs



[Shredded automotive motor

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#### Defra plots electrical goods recycling reforms to end 'sheer waste of natural resources'



### **The HPMS Solution Explained**

Recycle

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HPMS extracts & demagnetises embedded NdFeB magnets using hydrogen, enabling separation from the scrap stream prior to shredding – the resulting NdFeB powder is then fed back into the supply chain

## The HPMS Solution Explained

Recycle



#### Neodymium oxide powder





Recycle

#### Mixed VCM Feed from HDDs

Commercial Grades N40M - N45M Magnets

# **Recycled Magnets with Low CO<sub>2</sub> Footprint**

Recycle



Over 3,000 finished recycled magnets produced to date by HyProMag and University of Birmingham, currently being tested in multiple automotive, aerospace, electronics applications, with other applications planned







# **Competitive Advantages**

Recycle

### Early mover advantage with strong competitive position

- Significant competitive advantages
- HPMS solves the separation issue how to liberate and demagnetise separated magnets
- Short loop recycling more energy efficient and cost effective than recycling via chemical processes
- Underpinned by c.US\$100m in research and development funding
- Supported by the Minerals Security Partnership
- Ability to manufacture magnets with a reduced carbon footprint
- Minimal carbon footprint vs. primary mining to separation, to metal alloy, to magnet production
- Exclusive agreement with Inserma for automated preprocessing

Over 3,000 commercial grade recycled finished magnets produced from piloting and being tested in various applications





Very strong technical expertise and extensive industry experience with broad network of partnerships and excellent reputation – supported by University of Birmingham Magnetic Materials Group and University of Pforzheim, with specialists in magnet processing in UK and Germany

### Significantly Reduced CO2 Footprint

Recycle





### **Inserma Automated Pre-Processing**

Recycle

Exclusive agreement with Inserma to commercialise automated preprocessing of hard disc drives, loudspeakers and electric motors

- Collaboration with Inserma on the optimisation, commercialisation and roll-out of pre-processing technologies for HyProMag in the UK, Germany and United States
- The latest mobile Inserma unit for hard disc drives (HDD) can be co-located at hyperscale data centres, shredding, recycling or HyProMag facilities
- The technology not only provides a steady pre-processed NdFeB magnet scrap feed to HyProMag, but also has major benefits for sustainable, secure and low cost recycling of HDDs
  - > Expected VCM removal in less than 3 seconds per HDD
  - > Secure data destruction of the remainder of the HDD can remain on site
  - Removal of the rare earth magnet reduces costs and carbon footprint of subsequent shredding
  - Simultaneous removal of centre spindle further facilitates subsequent shredding, and reduces blade breakage, costs and carbon footprint
  - > No heat treatment or dismantling required for magnet recovery
  - Facilitates HyProMag's short loop magnet manufacturing process with minimal carbon footprint
  - Complementary technology for automated Printed Circuit Board Assembly (PCBA) removal under development





### New UK Rare Earths Hub at Tyseley

Recycle

Tyseley Energy Park - delivering low & zero-carbon power, transport, heat, waste and recycling solutions



DER (UK) has provided £4.4 million of predominantly capital funding to scale up the HPMS process and magnet manufacturing

# First Commercial Production Runs Complete

Recycle

### HyProMag – main industrial partner for scale-up and exclusive HPMS licencee



### Equipment at Tyseley Energy park, UK

- HPMS reactor
- Powder processing (sieving, milling, blending)
- Pellet press
- Axial aligning press(commissioned)
- Inert sintering system
- Transverse aligning press (commissioned)
- Analytical equipment
- Chemical processing



- Pilot HPMS vessel at University of Birmingham commissioned in 2022
- 50 100kg per batch
- Over 3,000 finished magnets produced and being tested in various applications



- Scaled-up HPMS vessel being commissioned with first production runs complete
- Minimum 350kg per batch
- Presses previously commissioned at Tyseley with first production runs of magnets completed

# Tyseley Energy Park Scale-Up











Scaled-up Germany development based on 100% capacity utilisation by end 2025 targeted to produce 100-350 tpa NdFeB with further expansion being evaluated

#### Short-Loop and Long-Loop Recycling HPMS process liberates end-of-life Medium Loop • Primary supply: mixed rare earth carbonate, rare earth oxides magnets in the form of a demagnetised NdFeB powder, Shortest Loop **Recycled supply:** NdFeB alloys & sintered magnets, rare earth which can be fed back into multiple points of the supply chain oxides HyProMag is focused on short-loop Strip Sintered NdFeB recovery solutions from EoL products, reduced CO<sub>2</sub> footprint recycling route. Castina Magnets **RE** Carbonates **RE** Oxides **RE Metals RE Alloy HYPR®MAG** Separation & Mineral Metal **Beneficiations** Purification Decomposition End-of-life Winning Alloying Minina Magnets (Crushina & (Solvent (Roasting/leaching/ (Reduction) Concentrating) extraction) filtration/precipitation) **HYPR**AMAG MKANGO MKANGO MKANGO Melt Bonded Spinning Magnets Long loop NdFeB magnet recycling -Hot Formed chemical process being developed Magnets by Mkango Rare Earths UK Ltd to complement HPMS and short loop processes Short Loop

Longer Loop

MKANGO

Recycle

### Pilot Plant for Long Loop Chemical Process

Recycle



Mkango Rare Earths UK has commissioned a pilot plant for long loop chemical processing of swarf and HPMS powder to produce rare earth carbonate and oxides at Tyseley Energy Park - complementary to the HPMS short loop recycling route being commercialised by HyProMag

# HyProMag USA Rollout

### USA Feasibility Study completed for 1,000tpa NdFeB/magnet production

- State-of-the art rare earth magnet recycling and manufacturing operation with a central Dallas Fort Worth, Texas hub supported by two pre-processing spoke sites in the eastern and western regions of the United States:
  - US\$262m NPV and 23% IRR based on current market prices
  - **US\$503m NPV and 31% IRR based on forecast market Prices**
  - Expansion potential with the inclusion of a third HPMS vessel
- Production of 750tpa of recycled sintered NdFeB magnets and 291tpa of associated NdFeB co-products over a 40 year operating life
- First Revenue targeted in Q1 2027 with a Notice to Proceed expected in mid-2025 following completion of Detailed Engineering Design and Value Engineering phase, which is underway
- Up-front capital cost of US\$125 million with significant opportunities to reduce
- CoTec is responsible for funding the Detailed Engineering Design, Value Engineering and the project development costs



# **Government Support**



Department for International Trade

Recycle

### Minerals Security Partnership (MSP)

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#### 🎲 GOV.UK

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#### Press release

#### UK to host Minerals Security Partnership for first time to boost investment in critical minerals

On Tuesday 10 October, the UK hosted the Principals' meeting of the Minerals Security Partnership for the first time, at the London Metals Exchange.

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	Joint Statement on the Minerals Security Partnership Announce Support for Mining, Processing, and Recycling Projects									2

- HyProMag HPMS technology selected as an MSP project
- MSP (est. 2022) consists of 14 governments, including UK and USA
- MSP aims to ensure adequate supplies of minerals, such as rare earths, to meet net zero carbon goals
- MSP regards resilient supply chains to be critically important for an equitable and sustainable energy transition
- MSP aims to catalyse public and private sector investment in responsible critical mineral supply chains globally

# **Expected Recycling Development Timeline**



Collaboration with Envipro in Japan announced June 2024



Evaluating options for further development of recycling in Canada

To discuss magnet scrap solutions and purchasing, magnet and other product sales please contact magnets@hypromag.com

To discuss collaboration and consultation please contact **technical@hypromag.com** 









### **Rare Earth Mining and Separation Development Projects**



# Songwe Hill Rare Earths Deposit

Mine

### One of very few independent rare earth projects globally with a Definitive Feasibility Study





- Initial Mkango drilling programmes carried out in 2011 and 2012
  - First resource report prepared in compliance with NI 43-101
- Pre-Feasibility Study (PFS) completed in 2015
- 2019 in-fill and step-out drilling programme
  - 60% increase in Measured and Indicated Resources
- Definitive Feasibility Study (DFS) completed in July 2022, with lead engineers SENET (a DRA Global Group Company)
- ESHIA completed and approved by Malawi Government in January 2023 (in compliance with IFC Performance Standards)
- Mining Development Agreement (MDA) signed July 2024
- Granted Strategic Project Status under the CRMA by the European Commission in June 2025

# Malawi - A Favourable Jurisdiction

# Longstanding, supportive relationships with government and local communities

- Premier African rare earths mineral province
- Blantyre, a major commercial centre with rail head and international airport, is located two hours from site by car
- Beneficiation, hydrometallurgical and acid plants to be located in Malawi
- Power co-generated from sulphuric acid plant and supplemented with grid and solar







## Songwe Hill Feasibility Study

### Feasibility Study completed by world leading technical consultants

SENET DRA - Lead engineers for design & management of the feasibility study & front-end engineering design work 

SENET

GEOCONSULT

- ALS Mineral processing Floatation test work and pilot plant program  $\succ$
- ANSTO Hydrometallurgy Test work and pilot plant program  $\geq$
- DIGBY WELLS ENVIRONMENTAL Environmental Social Health Impact assessment (ESHIA)  $\geq$
- KONGIWE ENVIRONMENTAL Environmental Social Health Impact assessment (ESHIA)  $\geq$
- EPOCH Tailings Dam design engineers
- **BARA Mine plan engineers**  $\geq$
- MSA Geological resource & model
- STEINWEG BRIDGE Logistics & transportation studies  $\succ$
- **GEOCONSULT Geotechnical engineers**
- **ZUTARI Geotechnical engineers**  $\geq$
- GENALYSIS Assay test work laboratory  $\geq$
- NAGROM Assay test work laboratory
- SGS Assay test work laboratory



Mine

# Songwe Hill Feasibility Study

### A new sustainable source of rare earth production

Songwe Hill mixed rare earth carbonate split by value

- One of the few rare earths projects globally to have reached Feasibility Study stage
  - Life of Mine: 18 years producing mixed rare earth carbonate (MREC) grading 55% total rare earth oxides (TREO)
  - Averaging 5,954 tpa TREO in MREC
    - o 1,953 tpa NdPr, and 56 tpa of Dy & Tb oxide





# Songwe Hill Rare Earths Deposit

Mine

### 18,000 meters drilled in 129 boreholes across three exploration phases



Southward view of Songwe Hill terrain model draped with geological map showing all drilling to date

Project History

- First phase of 12 boreholes in 2011
- Second phase of 25 boreholes in 2011-2012
- Third phase of 92 boreholes in 2018

#### **Exploration Upside**

- Early deep exploratory holes (maximum 360m) end in carbonatite – deposit open at depth
- Later boreholes average 120m depth for resource definition

### Songwe Hill Rare Earths Deposit

Mine

### 18 Year Mine Life – Open Cast Mining – Further Exploration Potential (



# Songwe Hill Processing

Mine

### **Extensive Processing Flow Sheet Development and Piloting**



# Mkango in the Community

Mine

### Strong Track Record in Corporate Social Responsibility

#### **boNGO Worldwide Partnership**

- Happy Classroom Project
- Enhancing 3 local primary schools
- 18 classrooms painted with school syllabus

#### **Scholarships**

 Secondary education fees paid for the top 12 students from 3 local primary schools – 58 students to date

#### Local community infrastructure projects

- 8 water boreholes & pumps installed. 14 maintained quarterly in the local area
- Bridge construction & extensive road refurbishment









.Before – an unhappy classroom

- 2.After a Happy Classroom after renovation
- 3.Water Pump in Mphembezu
- 4.New Bridge Constructed

### Pulawy – A New European Rare Earths Hub

- Major opportunity to develop a new rare earths hub in Poland underpinned by sustainably sourced and traceable mixed rare earth carbonate from Malawi and other sources
- Scoping and prefeasibility studies for Pulawy to date indicate low operating costs and modest capex due to location and technology
- An integrated in-house source of mixed rare earth carbonate and group capability for rare earth magnet manufacturing and recycling differentiates the project from all other rare earth projects in Europe
- The Songwe Hill Rare Earths Project will supply Pulawy Songwe is one of the very few advanced stage rare earth projects globally with DFS and ESHIA complete, and Mine Development Agreement signed
- Technical partner, Carester, is the leading expert in rare earth separation outside China the conventional nitric separation technology being used is a low-cost ex China technology which has been operated in Europe for many years – circular process with no liquid waste streams
- Future growth opportunities being evaluated include rare earth metal, alloy and magnet manufacturing, leveraging off expertise within HyProMag, which is developing magnet manufacturing in Germany, UK and USA
- Scope of Definitive Feasibility Study includes potential integration of other sources of rare earth carbonate and expansion options

# **Pulawy Rare Earth Separation Project**

1503

Warsaw

110km)

Gdansk

(450km)

201

### Pulawy Separation Project, Poland – Awarded EC Strategic Project Status

 European rare earths hub underpinned by sustainably sourced, mixed rare earth carbonate from Mkango's project in Malawi

 Site adjacent to a largescale fertiliser and chemicals plant owned by Grupa Azoty Pulawy, the EU's second largest manufacturer of nitrogen fertilisers



## **Proposed Site for Separation Plant**

Refine

- 8-hectare site located next to Pulawy Fertiliser and Chemicals Plant with access to road, rail, reagents, by-product customer and utilities
- Opportunity to explore expansion opportunities in the upcoming DFS.

### Access to infrastructure

- High, medium and low voltage power network, natural gas and process steam network
- Water supply system, sewerage and wastewater treatment plants
- Internal railway of 60km enables fast transportation of raw materials and products
- Electronic weighbridge for trucks and trains
- Easy connections with the national road network, \$12
   Expressway



S12 Expressway

### **THANK YOU**

William Dawes, Chief Executive Officer – will@mkango.ca Alexander Lemon, President – alex@mkango.ca Robert Sewell, Chief Financial Officer – rob@mkango.ca



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Scientific and technical information contained in this Presentation including sampling, analytical, and test data underlying the information has been approved and verified by Dr. Scott Swinden PGeo of Swinden Geoscience Consultants Ltd who is a "Qualified Person" in accordance with National Instrument 43-101- Standards of Disclosure for Mineral Projects ("NI 43-101"). Scientific and technical information contained in this presentation relating to the mineral resource estimate has been approved and verified by Jeremy Witley Pr. Sci Nat of The MSA Group Pty Ltd, who is a "Qualified Person" in accordance with NI 43-101. The Qualified Persons refer red to above are independent of the Company. An NI 43-101 Technical Report supporting the results of the definitive feasibility study for the Songwe Hill Rare Earths Project ("Songwe" or the "Project") in Malawi has been prepared by SENET, a DRA global company, under the guidance of Mr. Nick Dempers, who is a "Qualified Person" in accordance with NI 43-101, and was filed on the Company's profile on SEDAR+ on August 19, 2022.

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