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INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Accelerate-to-Demonstrate (A2D) Facility Annual Event

Plenary Session 1: Opening

Tuesday, May 20th, 9:00 – 10:30am (EAT)

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Agenda

Time	Activity
09:00 – 09:05	Welcome (Mr. Peter Warren, A2D Facility Manager, UNIDO)
09:05 – 09:10	Opening Remarks (Mr. Gerd Müller, Director General, UNIDO)
09:10 – 09:30	Opening Statements: - Mr. Alois Mhlanga, Director, Climate Innovation and Montreal Protocol, UNIDO - Ms. Tally Einav, Head of Office and Representative to Kenya, Comoros, Eritrea, Seychelles and South Sudan, UNIDO - Ms. Lara Hirschhausen, Head of International Climate Finance Innovation Programmes, Department for Energy and Net Zero, UK Government - Dr. Juma Mukhwana, Principal Secretary, State Department for Industrialization, Ministry of Investment Promotion Trade and Industry, Kenya
09:30 – 9:40	Accelerate-to-Demonstrate (A2D) Facility Overview
09:40 – 9:55	Poll on Climate Innovation
09:55 – 10:30	Panel: “How can the implementation of innovative and transformational demonstration projects be accelerated?”

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Announcement

Mr. Gerd Müller,
Director General,
UNIDO

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Opening Statements

Mr. Alois Mhlanga,
Director of Climate Innovation and Montreal Protocol, Technical Cooperation and Sustainable Industrial Development, UNIDO
UNIDO

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Opening Statements

Ms. Tally Einav,
Head of Office and Representative to Kenya,
Comoros, Eritrea, Seychelles and South Sudan
UNIDO

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Opening Statements

Ms. Lara Hirschhausen
Head of International Climate Finance Innovation Programmes, UK Department for Energy and Net Zero

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Opening Statements

Dr. Juma Mukhwana,
Principal Secretary, State Department for Industrialization, Ministry of Investment Promotion Trade and Industry, Kenya

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United Nations Industrial Development Organization (UNIDO)

- UNIDO is the UN Agency for the promotion of inclusive and sustainable industrial development in developing countries.
- UNIDO focuses on three main priorities:

Supporting sustainable supply chains so that developing country producers get a fair deal and scarce resources are preserved.

Limiting climate breakdown by using renewable energy and energy efficiency to reduce industrial greenhouse gas emissions.

Ending hunger by cutting post-harvest losses and developing agribusiness value chains.

UNIDO's expertise:

- Technical assistance and capacity building
- Investment and innovation funding
- Partnerships and collaboration
- Policy dialogues

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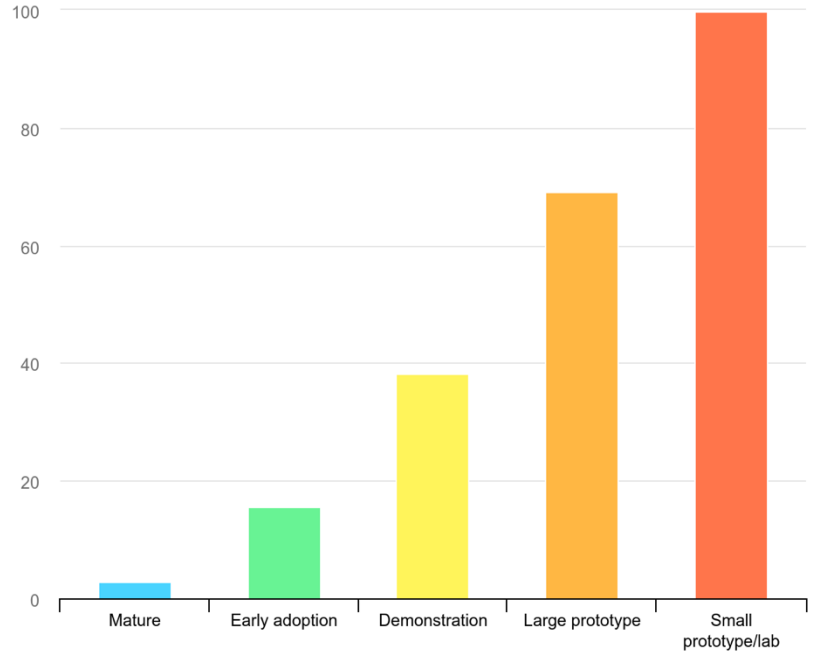
Importance of Demonstration Projects

- Accelerating clean energy innovation is increasingly recognized as vital in global efforts to **combat climate change and to meet the Sustainable Development Goals** (SDGs).
- The International Energy Agency (IEA) highlights that almost 35% of the emissions reductions necessary for achieving a global **net-zero scenario by 2050 will come from technologies that are still in the demonstration** or prototype phase.
- Alongside the **important need for leveraging private sector finance**, at least USD 90 billion in public funding is needed globally by 2026 for clean energy demonstration projects to be commercially ready by 2030.
- The A2D Facility contributes to filling this important gap in support to developing countries by **targeting the demonstration phase of the innovation chain**, bridging earlier-stage and commercial-scale projects.

Relative increase in carbon dioxide emissions savings in 2050 by current technology maturity category:



Energy Technology Perspectives 2020. IEA, 2020.

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Overview of A2D Facility

The Solution

The A2D Facility aims to accelerate the commercialization of innovative climate solutions in developing countries by supporting catalytic and scalable demonstration projects in:

- **Clean hydrogen**
- **Critical minerals**
- **Smart energy**
- **Industrial decarbonization**

Initial Funding and Timescales

- **Initial contribution of ~USD 80 million** from the UK Government
- Initially operates from **April 2023 to March 2029**
- Projects supported through **calls-for-proposals** (first call in July 2024)
- Global (**developing country-focused**) programme
- **Grants of USD 1-5 million** per project.
- Main Sustainable Development Goals (**SDGs**)-of-focus:

Activities bringing **transformational solutions** to the market at scale.

Providing grant support for transformational demonstration projects with strong scalability potential.

Creating and **disseminating knowledge and experiences** to foster collaboration, learning and scalability.

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A2D Facility Year 1 and 2 Key Milestones

COP27 SHARM EL-SHEIKH EGYPT 2022

Initial announcement

7 November 2022

Initial announcement of the new clean energy innovation facility at COP 27.

Official launch

15 May 2023

Official launch of the A2D Facility by UNIDO's DG and UK Ambassador.

Participation in Asia Clean Energy Forum

3 - 6 June 2024

Organization of three events at the Asia Clean Energy Forum.

Call-for-Proposals annuncement event

18 July 2024

Announcement event to launch the first Call-for-Proposals, led by UNIDO Director General Gerd Müller. Launch of the A2D Facility Year 1 Annual Report and A2D Facility website.

Launch of Market Assessments at COP29

14 - 16 November 2024

Launch of 3 market assessments on Critical Minerals, Clean Hydrogen, and Smart Energy & Industrial Decarbonization at COP29.

First demonstration projects begin

January 2025

Selection of the first five supported demonstration projects, with at least one project per thematic area.

Completion of GESI-ESS project

31 March 2025

GESI-ESS Action Plans developed.

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Current A2D Facility-Supported Demonstration Projects

Smart Energy

Smart solar and storage microgrid for industrial-scale deployment at Laxmi Steel factory in Sunwal

Location: ***Nepal***

Peer-to-peer energy-sharing system to convert wasted renewables into community power

Location: ***Nigeria***

Industrial Decarbonization

Biomass gasification plant to power a Kenyan tea factory using local agricultural waste and biomass

Location: ***Kenya***

Clean Hydrogen

Ammonium sulphate fertilizer production facility powered by solar and clean hydrogen

Location: ***Namibia***

Critical Minerals

Local manufacturing of lithium-ion batteries for electric two-/three-wheeler motorcycles, and installation of charging infrastructure in urban and rural areas.

Location: ***Tanzania***

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Video

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Launch of A2D Facility Year 2 Annual Report

Download the annual report on the A2D Facility website

a2dfacility.unido.org

or scan the QR Code

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Mentimeter

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Panel Discussion

How can the implementation of innovative and transformational demonstration projects be accelerated?

Moderator:
Mr. Peter Warren,
A2D Facility Manager,
UNIDO

Ms. Amany Essawi,
International Relations Advisor, Suez Canal Economic Zone, Egypt

Mr. Marcos Leandro Simonetti,
Specialist,
Confederação Nacional da Industria (CNI), Brazil

Ms. Njambi Macharia,
Green Buildings Lead Kenya,
Climate Business Department, IFC

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Further Information

- **A2D Facility Website:** Visit the website here
- **A2D Facility LinkedIn Account:** Follow the LinkedIn page here
- **A2D Facility Mailing List:** Join the mailing list here
- **A2D Facility Year 1 Annual Report:** Access the Annual Report here
- **A2D Facility Market Assessments:** Access the reports here

Second Call-for-Proposals:

- UNIDO - Procurement Portal for detailed information on the second call-for-proposals
- Proposals can be submitted up until 16:00h CET on Monday 7 July 2025
- All enquiries on the call must only be sent to: procurement@unido.org
- Information session Wednesday 21, 14:00 – 15:30 (8th Floor, Room B)

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Accelerate-to-Demonstrate (A2D) Facility Annual Event

Global and Regional Overview of Critical Minerals

Tuesday, May 20th, 11:00 – 12:30pm (EAT)

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Agenda

Time	Activity
11:00 – 11:05	Introduction, Ms. Ghada Ahmed, Project Coordinator – Critical Minerals, UNIDO
11:05 – 11:20	Critical Minerals Market Assessment, Ms. Ghada Ahmed, Project Coordinator – Critical Minerals, A2D Facility, UNIDO
11:20 – 11:35	Global Alliance for Responsible and Green Minerals, Mr. Sascha Raabe, Head of Global Alliance for Responsible and Green Minerals, UNIDO
11:35 – 11:50	Global Mapping of Critical Minerals Value Chain, Ms. Mattie Yeta, Chief Sustainability Officer, CGI
11:50 – 12:05	African Union's Perspective on Critical Minerals in Africa, Mr. John Youhanes Magok Nhial, Mineral Resources Development Expert, African Union Commission
12:05 – 12:30	Q&A

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The Critical Minerals Market Assessment, A2D Facility

Ms. Ghada Ahmed
Project Coordinator, Critical Minerals, A2D Facility, UNIDO

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Critical Minerals Market Assessment: Landscape of Innovators, Technologies, Existing Projects and Financing Mechanisms for Climate Innovation

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Outcomes from the Market Assessments

- The critical minerals market assessments commissioned and completed in 2024 and published at COP29: Critical Minerals, Clean Hydrogen, and Smart Energy and Industrial Decarbonization.

- Focused on the landscape of technologies, stakeholders, innovators, initiatives, existing projects and delivery mechanisms in developing countries.

A2D Facility Market Assessments: Access the reports here

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Landscape of Technologies

Critical Minerals:

- **Midstream:** encompasses the processing and refining of critical minerals into usable forms as well as the recovery of resources from mining by-products such as process tailings, electrorefining sludge, and pyrometallurgical slag.
- **Downstream**: extends beyond the manufacturing, assembly, and distribution of final products, and also covers the recovery, repurposing, and recycling of valuable materials from secondary resources, such as end-of-life manufactured goods.

List of
Critical minerals analysed

- Lithium
- Nickel
- Manganese
- Cobalt
- Graphite
- Rare Earth Elements (REEs)
- Copper
- Platinum Group Metals (PGMs)

The technologies analysed in the assessment can be grouped into five major categories:

Physical-mechanical

- Sorting, flotation, magnetic separation, gravity separation, electrostatic, triboelectric, eddy current separation

Hydrometallurgy

- Leaching: Inorganic acids, organic acids, inorganic bases, oxidising and reducing agents, inorganic compounds, complexing agents, water, microbes
- Leach solution concentration and metal extraction

Pyrometallurgy

- Roasting, calcining, sintering, pelleting and briquetting, smelting, volatilisation (retorting), refining, segregation

Electrometallurgy

- Electrowinning, electrorefining, molten salt electrolysis, electrochemical separations

Bio-based

- Biomining (biometallurgy), bioleaching, biosorption, phytomining.

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Landscape of Innovators

Critical Minerals: A key takeaway from the assessment is that technological innovation in the mid- and downstream segments of the value chain in developing countries relies primarily on technology transfer from developed countries. With that said, homegrown technological innovation in the mid- and downstream segments of the critical minerals sector is slowly emerging in developing countries.

LAC

- Tech for extracting and refining lithium from salar brines and producing battery-grade lithium carbonate (M)
- Tech for extracting and refining lithium from clay deposits and producing battery-grade lithium carbonate (M)
- Tech for producing lithium-ion batteries using lithium carbonate (D)

AFRICA

- Modular tech for recycling lithium-ion batteries using safer chemicals and environmentally sound processes (D)

ASP

- Tech for processing nickel laterites (U/M)
  Tech for producing battery raw materials and battery-grade products (M)
- Tech for producing high-purity silicon ingot for silicon wafers, and solar cells, for solar panel manufacturing (D)
- Tech for recovering energy-critical metals (e.g. nickel hydroxide) from recycled lithium-ion batteries (D)

U = upstream	M = midstream	D = downstream

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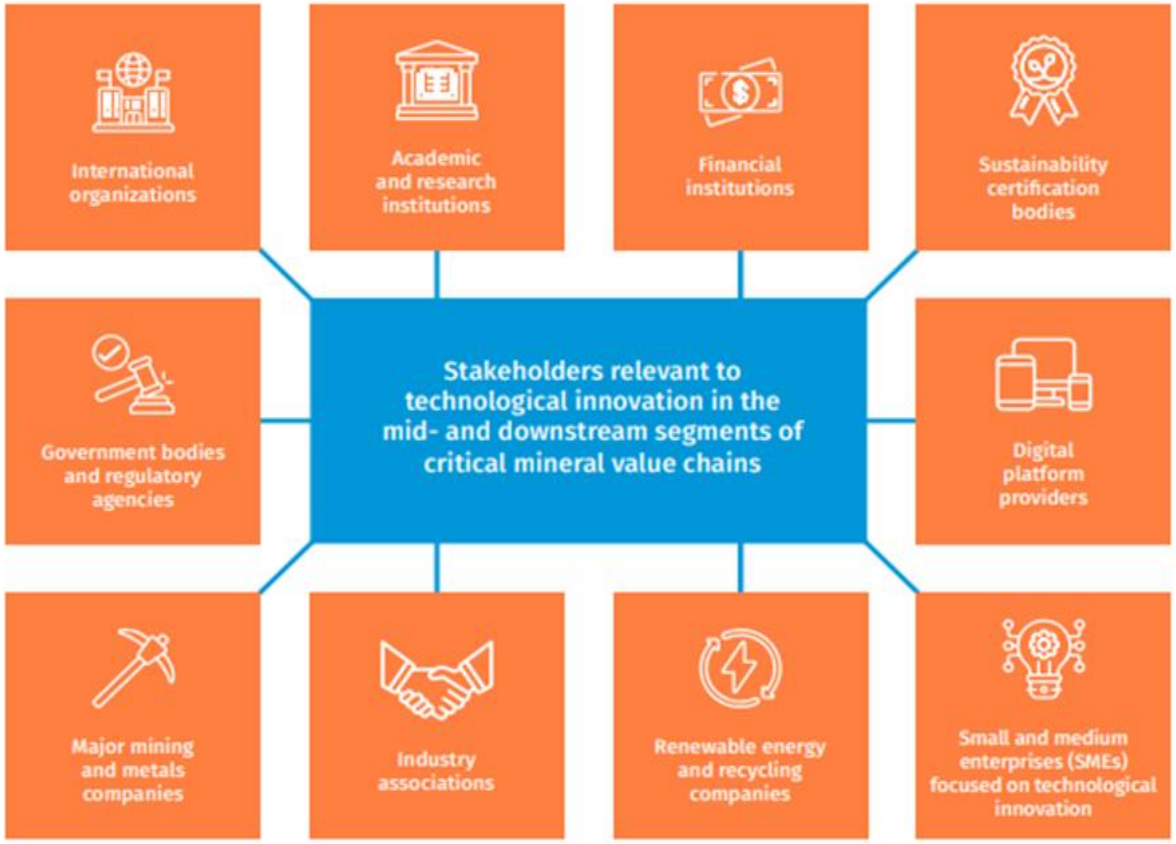
Landscape of Stakeholders

Critical Minerals:



The role of industry associations is a more high-level version of the mining companies that they represent. Organizations such as ICMM (an industry association of mining companies with the objective of improving sustainable development outcomes in the mining and metals industry) influence the direction that sustainable development in mining and mineral value chains may take.

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Landscape of Initiatives

Critical Minerals:

TABLE. Landscape of initiatives (Phase 1)

Initiative	Type	Key technologies involved	Key stakeholders involved	Geographic focus
World Economic Forum's UpLink	Platform for innovators to present their solutions to global challenges	• Waste management systems • Greenhouse gas emission reduction innovations • Resource efficiency technologies	• Startups • Academic institutions • Industry	• Global
Prospect Innovation	Accelerator for technological innovation in the mining sector	• Energy generation and storage • Recycling and recovery • Robotics, mobility, and hardware • Data capture, analytics, and AI • Carbon capture • Synthetic Biology	• Research institutions • Mining companies • Venture capital firms	• Americas • ASP • Europe
Global Battery Alliance (GBA)	Public–private partnership that promotes sustainable battery value chains	• Battery recycling • Tracking methods for batteries in the value chain ("Battery Passport")	• Government • Civil society • Industry	• Africa • Asia • Europe
World Bank Group's Climate Smart Mining (CSM) Initiative	Initiative to provide guidance and technical support on decarbonisation and sustainability in mineral value chains in developing countries	• Critical minerals recycling • Reusing and repurposing EOL materials	• Government • International organizations • Local communities	• Developing countries
Activate.org	Fellowship that supports entrepreneurial scientists and engineers in developing technologies for global challenges	• Broad; supports original ideas of its fellows	• Academia • Government • Corporations • Philanthropic foundations	• United States

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Landscape of Financial Delivery Mechanisms

TABLE. Landscape of financial delivery mechanisms (Phase 1)

Public Sources	Private Sources
• Multilateral Development Banks (MDBs)	• Venture Capital
• Multilateral Climate Finance Funds	• Corporate Venture Capital
• National Development Banks	• Private Equity
• Bilateral Development Agencies	• Accelerators and Incubators
• Government Grants and Subsidies	• Private Banks
• Sovereign Wealth Funds (SWFs)	• Impact Investment Funds

Critical minerals: The preliminary mapping categorized them according to the predominant public or private nature of their funding source, to help guide stakeholders in identifying financing opportunities and gaps and evaluating the potential roles of various financing sources and models in supporting technological innovation.

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Critical Minerals – Regional Landscape

AFRICA

Namibia
South Africa
Zambia

STRENGTHS

- Mineral beneficiation strategies
- Bilateral cooperation with developed countries (e.g. EU-Namibia Strategic Partnership on Raw Materials Value Chains and Renewable Hydrogen [USD 1.1 billion]; South Africa-UK Minerals for Future Clean Energy Technologies Partnership; partnership between Zambia and the Japan Organization for Metals and Energy Security)
- Regional initiatives (e.g. African Green Minerals Strategy and DRC-Zambia Battery Council)
- Industrial development agencies
- Policies advancing SDGs

AREAS FOR IMPROVEMENT

- Circular economy, recycling, and waste management policies
- Power and logistics infrastructure constraints to industrial development
- Government institutional capacity to build up and enforce regulatory frameworks
- Policies advancing SDGs

Reference: UNIDO (2024) Critical Minerals Market Assessment

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Critical Minerals – Regional Landscape

ASP

- Circular economy, recycling, and waste management policies
- Tax incentives for technology development
- Special Economic Zones (SEZs) for industrialisation and downstream activities
- Cooperation with developed countries: Minerals Security Partnership
- National financial mechanisms (e.g. Make in India; Indonesia Battery Corporation; Turkish Growth and Innovation Fund [USD 218 million])
- Policies advancing SDGs

- Regional cooperation and initiatives
- Reliance on imported fossil fuel–based energy
- Policies advancing SDGs

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Critical Minerals – Regional Landscape

LAC

- Financial incentives for companies in mid- and downstream segments (e.g. tax rebates and exemptions)
- State-owned company for lithium value chain
- R&D frameworks and initiatives
- Industry-led initiatives to coordinate stakeholders: Mining Hub
- Multilateral development bank (MDB) support (e.g. International Finance Corporation [IFC] loans and Inter-American Development Bank [IDB] programmes)
- Policies advancing SDGs

- Stringent circular economy policies on critical minerals
- Policies governing mid- and downstream activities are fragmented across different ministries and minerals, lacking cohesive national frameworks
- Regional cooperation and initiatives
- Policies advancing SDGs

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Ten Recommendations to Ramp Up Technological Innovation in the Mid- and Downstream Segments

International support to developing country governments and stakeholders in the innovation ecosystem should be increased, including through technical assistance, capacity building, policy advice, and access to finance.

International and regional organizations and development finance institutions should build on initiatives for the **enabling environment** (e.g. World Bank's RISE Partnership) and **specific innovation projects** (e.g. UNIDO's A2D Facility).

A global multi stakeholder platform should be created to coordinate initiatives, foster collaboration, and share knowledge and data on technological innovation. UNIDO is well-positioned to house such a platform.

UNIDO should lead in ensuring the **continuous gathering, transparency, and analysis of data on innovation**—for example, through rolling surveys and public databases—going beyond the discrete exercise of this assessment.

Developing country policy should provide regulatory guidelines, support domestic collaborations, and offer innovation incentives; **developed country policy** should promote international cooperation, facilitate knowledge transfer, and provide access to finance.

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Ten Recommendations to Ramp Up Technological Innovation in the Mid- and Downstream Segments

Developing countries should prioritise **the development of energy, communications, and logistics infrastructure** to address broader industrial development constraints, in line with the SDGs and national priorities and strategies.

Special programmes should be created to **support small and medium enterprises (SMEs)** involved in technological innovation in developing countries to partner with other stakeholders and access funding opportunities, including UNIDO's A2D Facility.

Policymakers should **incentivise circular policies and practices** through regulations, incentives, and innovation funding; the private sector should **strengthen the business case for circularity** by showcasing cost savings, new revenue streams, and improved resource efficiency.

Industry-led initiatives to coordinate mining value chain stakeholders around common challenges and priorities for innovation—such as Brazil's Mining Hub and other initiatives led by mining associations—should be encouraged.

Besides fostering technological innovation in developing countries, international organizations and governments should put in **place regulatory and financial conditions to facilitate technology transfer** from companies based in developed countries.

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GLOBAL ALLIANCE FOR RESPONSIBLE AND GREEN MINERALS

Partners: UK Government

The Global Alliance for Responsible and Green Minerals at UNIDO

Mr. Sascha Raabe
Head of the Global Alliance for Responsible and Green Minerals at UNIDO

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GLOBAL ALLIANCE
FOR RESPONSIBLE
AND GREEN MINERALS

Global Alliance for Responsible and Green Minerals

A2D Annual Event May 2025

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Background

No Minerals – No Energy Transition

- Demand increase >500% -> Geopolitical tensions
- Mineral supply chains affect human rights, environment, social aspects
- **positive** and **negative!** impacts

Global Alliance

- Launch of the Global Alliance for Responsible and Green Minerals by UNIDO DG Müller, January 2024

UN SG CETM Panel

- Launch of the Panel on Critical Energy Transition Minerals (CETM) by UN SG Guterres, April 2024
- UNIDO member of technical advisory group

Picture source: Sascha Raabe

Picture source: Leon Riedel

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Global Alliance for Responsible and Green Minerals

Objectives

- Providing the participating members with relevant knowledge and capacity for a sustainable minerals' future
- Local processing, higher local added value, more well-paid jobs
- Globally applicable ESG criteria
- Win-win situation for mineral-rich and mineral-demanding countries
- Living wages, safe working conditions
- Protection of local communities and environment
- Higher government revenues for the benefit of the population

IMPACT

- ❑ Just Transition
- ❑ Poverty Reduction
- ❑ Economic Development
- ❑ Security and Peace

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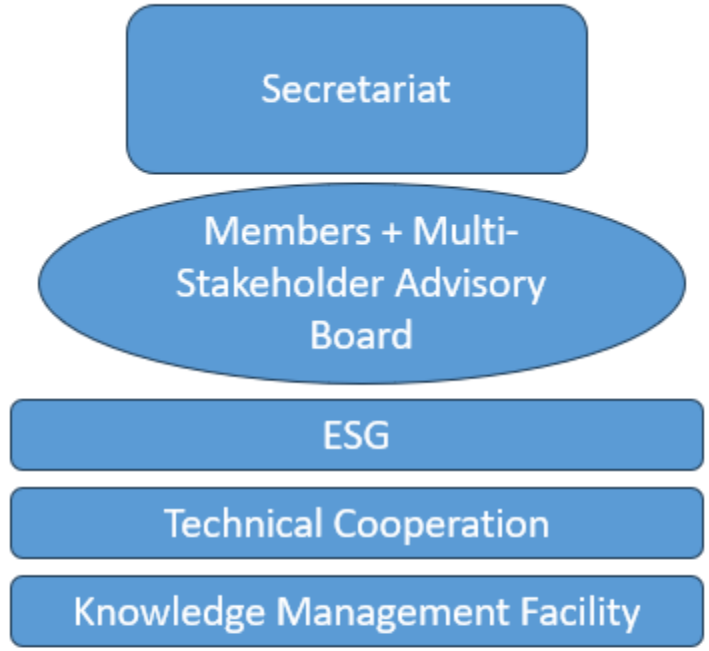
Global Alliance for Responsible and Green Minerals

A Multi-Stakeholder Initiative under UNIDO Leadership

- Governments, private sector, labor unions, NGOs, academia
- Holistic approach: up-, mid-, downstream and recycling
- Policy, capacity building, skills development, knowledge and technology transfer
- Development and implementation of tailored solutions
- Support for the formalization of small-scale mining
- Globally applicable UN ESG criteria as a benchmark for ESG standards



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Strategic Components

- **Collaboration with A2D Facility**
- **Knowledge Management Facility**
  - Repository of tools, guidelines, best practice examples, and expert reports
- **UN Secretary-General's Panel on Critical Energy Transition Minerals**
  - Implementation of the Guiding Principles and Actionable Recommendation in collaboration with other UN entities

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Thank you

Sascha Raabe, Head of the Global Alliance

Picture source: UNIDO

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Global Mapping of the Critical Minerals Value Chain

Ms. Mattie Yeta
Chief Sustainability Officer, CGI

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The African Union's Perspective on Critical Minerals in Africa

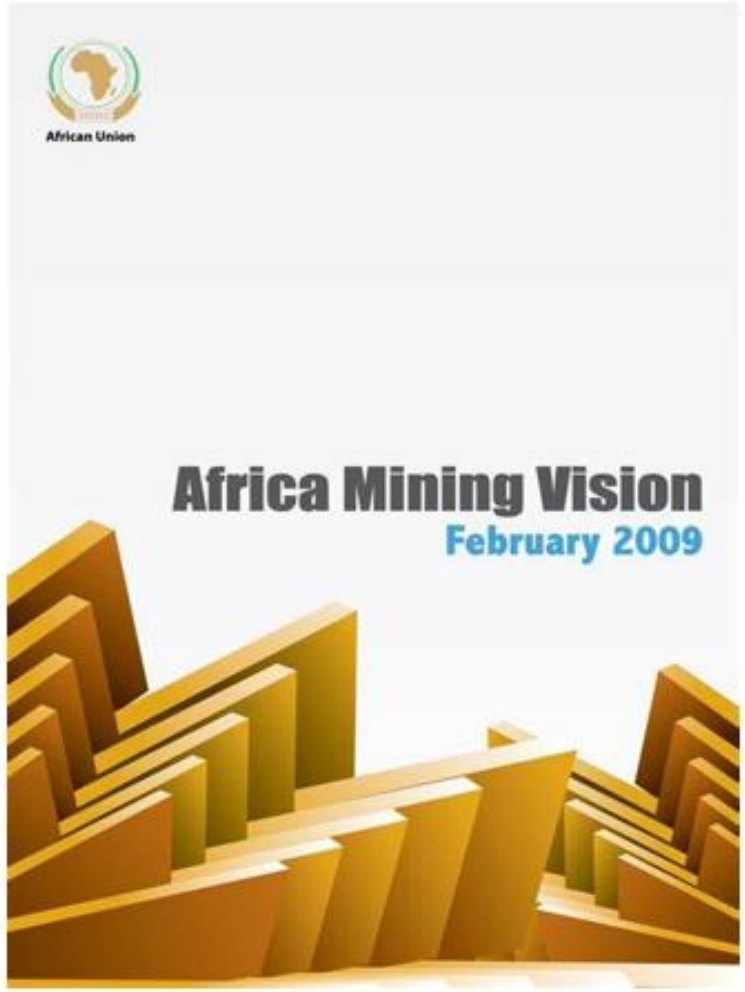
Mr. John Youhanes Magok Nhial
Mineral Resources Development Expert,
Department of Economic Development, Tourism, Trade, and Minerals, African Union Commission

African Union Policies on Mineral Resources Development

Outline

- Africa Mining Vision & Action Plan
- African Union Commodity Strategy & Action Plan
- Africa' Green Minerals Strategy
- African Minerals Development Centre
- Call to Action

Africa Mining Vision & Action Plan



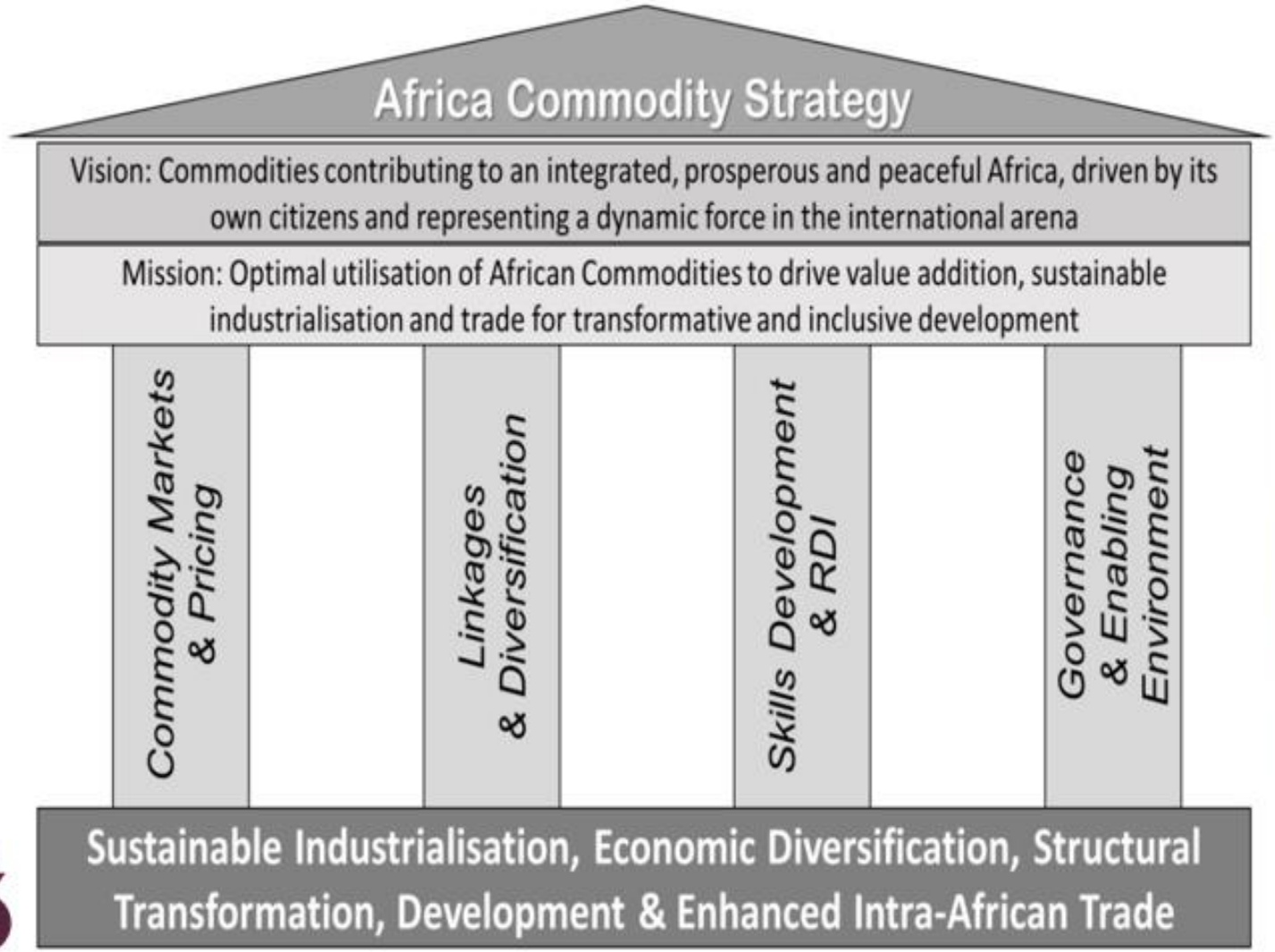
- Adopted in 2009 (AU Assembly)
- **Vision**- : To create a transparent, equitable and optimal exploitation of mineral resources to underpin broad-based sustainable growth & socio-economic development
- Action Plan (2011)

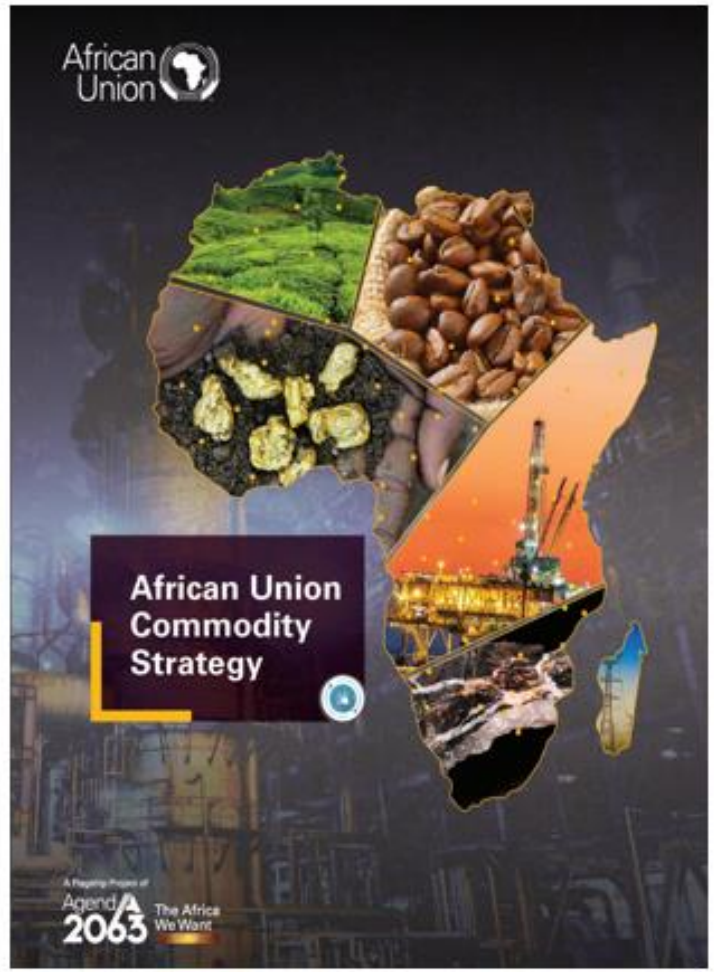
AMV Implementation Instruments

1. AMV Action Plan (2011)
2. Country Mining Vision (CMV) guidebook.
3. AMV-Private Sector Compact (ACMMA, AWIMA etc).
4. The Africa Minerals Governance Framework (AMGF).
5. Geological and Minerals Information System (GMIS).
6. African Mineral and Energy Resources Classification and Management System (AMREC) and the Pan-African Resource Code (PARC)
7. **Africa' Green Minerals Strategy (AGMS): African Union's Mineral Resources Strategy for the Just Transition and Decarbonizing Future.**
8. Regional Mining Vision (i.e. SADC, ECOWAS etc)
9. Draft AU Model Law on Mineral Resources Development (ongoing)
10. AU Artisanal and Small-scale Mining (ongoing)
11. Updating Map presenting Africa's minerals (ongoing)

African Union Commodity Strategy and Action Plan

- At their 24th Ordinary Session in **January 2015**, the Heads of State and Government adopted Agenda 2063 *(Assembly/AU/Dec.565(XXIV)),* which include the Formulation of an African Union Commodity Strategy (AUCS), as a flagship project.
- **From 2017**, the Department of Economic Development, Trade, Tourism, Industry and Minerals (ETTIM) revamped the work to finalize the drafting and formulating the AU Commodity Strategy and its Action Plan.
- *Following further development, the Executive Council formally adopted the African Union Commodity Strategy (AUCS) and its Action Plan in* ***February 2022*** *(EX.CL/Dec.1144(XL)) and approved by the Assembly on the same year.*
- The Strategy addresses challenges identified in the three main commodities sectors (Agriculture, Mining and Energy)





Agend 2063
The Africa we Want

- The first Pillar covers **commodity markets and Pricing** addresses the following strategic issues: financial and capital markets; competitive environment; commodity exchanges and price volatility; and producer power.
- The second Pillar is about **linkages and diversification**, focusing on the management and sustainable use of natural resources; regional value chains development; infrastructure development; and Quality Infrastructure Systems (QIS) development.
- The third Pillar deals with **governance** and the provision of an enabling environment, taking into consideration legal and regulatory policy, as well as human rights issues.
- The fourth Pillar focuses on **skills development and research and development (R&D)** with emphasis on skilled labour; entrepreneurship, technology and innovation.

Africa's Green Minerals Strategy

- The strategy is a **roadmap** for utilizing Africa's mineral wealth for value addition, industrialization, and climate resilience.
- Africa has a significant share of the world's green minerals (***lithium, cobalt, nickel, rare earth elements, and platinum group metals***).
- The strategy aims to **move beyond raw mineral exports** and build integrated value chains for local beneficiation, job creation, and economic diversification.
- The strategy aligns with the Africa Mining Vision (**AMV**) for equitable and sustainable mineral resource management.

Cont.

Four Key Pillars

- **Advancing Mineral Development**: Strengthening geological knowledge, exploration, and investment.
- **Developing People & Technological Capabilities**: Building skills, research capacity, and technological expertise.
- **Building Key Value Chains:** Ensuring industrialization through local beneficiation and green technology manufacturing.
- **Mineral Stewardship:** Promoting responsible mining, environmental sustainability, and circular economy principles.

Six Globally Significant Comparative Advantages for Africa

- Substantial endowment of green minerals.
- Huge mining inputs market.
- Immense renewable energy potential.
- Huge unrealized market for electrification.
- Youthful population as a workforce.
- Industrialization potential.

AFRICAN MINERALS DEVELOPMENT CENTER (AMDC)

- **The AMDC** was established by the African Union (AU) in 2016, and it holds the critical mandate of coordinating and overseeing the implementation of the Africa Mining Vision (2009) and its Action Plan (2011). The Center primary purpose is to ensure that the minerals sector contributes to the social and economic transformation, inclusive growth, and sustainable development of African economies, thereby driving the continent's long-term prosperity.

The operational AMDC shall consists of three main organs.

- The **Conference of State Parties** includes Ministers responsible for Mineral Resource Development, the AU Commissioner for Economic Development, Trade, Tourism, Industry and Minerals (ETTIM), the Chairperson of the Advisory Board, and the AMDC Director General. It meets biennially for ordinary sessions and as needed for extraordinary sessions.
- The **Minerals Advisory Board** comprises the AUC Director for Industry, Minerals, Entrepreneurship and Tourism (IMET), members of the Bureau of the AU Specialized Technical Committee on Trade, Tourism, Industry and Minerals (STC-TTIM), Regional Economic Communities (RECs), the AMDC Director General, and a mineral experts selected by the Conference of State Parties.
- **The Secretariat** is led by the AMDC Director General and staffed by AMDC personnel, overseeing day-to-day operations.

Call to Action

- Africa must develop its battery industry, electric vehicle supply chains, and renewable energy infrastructure.
- Collaboration among African governments, the private sector, and civil society is essential.
- Africa can contribute to a sustainable and green future by strategically leveraging its mineral wealth.

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Q & A Session

Further Information

- **A2D Facility Website:** Visit the website here
- **A2D Facility LinkedIn Account:** Follow the LinkedIn page here
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- **A2D Facility Year 1 Annual Report:** Access the Annual Report here
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A2D Accelerate to Demonstrate Facility

Partners: UK Government

Accelerate-to-Demonstrate (A2D) Facility Annual Event

Challenges in Technological Innovation in Critical Minerals and Success Stories

Tuesday, May 20th, 4:00pm – 5:30pm (EAT)

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Agenda

Time	Activity
16:00 – 16:05	Introduction, Ms. Ghada Ahmed, Project Coordinator – Critical Minerals, UNIDO
16:05 – 16:20	Electric Charging Batteries in Transportation Sector in Tanzania, Ms. Noela Roberta Kabelinde and Mr. James Emanuel Batamuzi, Oasis Group
16:20 – 16:35	Scaling EV Battery Recycling Technologies, Mr. Paul Cornick, ReLiB Project, University of Birmingham
16:35 – 16:50	Scaling Circular Electronic Waste and Battery Solutions in Latin America: Lessons from the Field, Mr. Francisco Pereira, Project Director, Fortech Circular, Costa Rica
16:50 – 17:05	Lithium-Ion Battery Recycling in South Africa, Ms. Lesego Bianca Siwela, Lead Project Engineer, Cwenga Lib
17:05 – 17:30	Q&A

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A2D Accelerate to Demonstrate Facility

Partners: UK Government

Accelerating the Implementation of Clean, Affordable and User-Friendly Smart Energy Solutions

Ms. Noela Roberta Kabelinde
Mr. James Emanuel Batamuzi
Oasis Group Tanzania

PRESENTATION

OASIS

Payless Energy Limited

United Nations Industrial Development Organization (UNIDO)

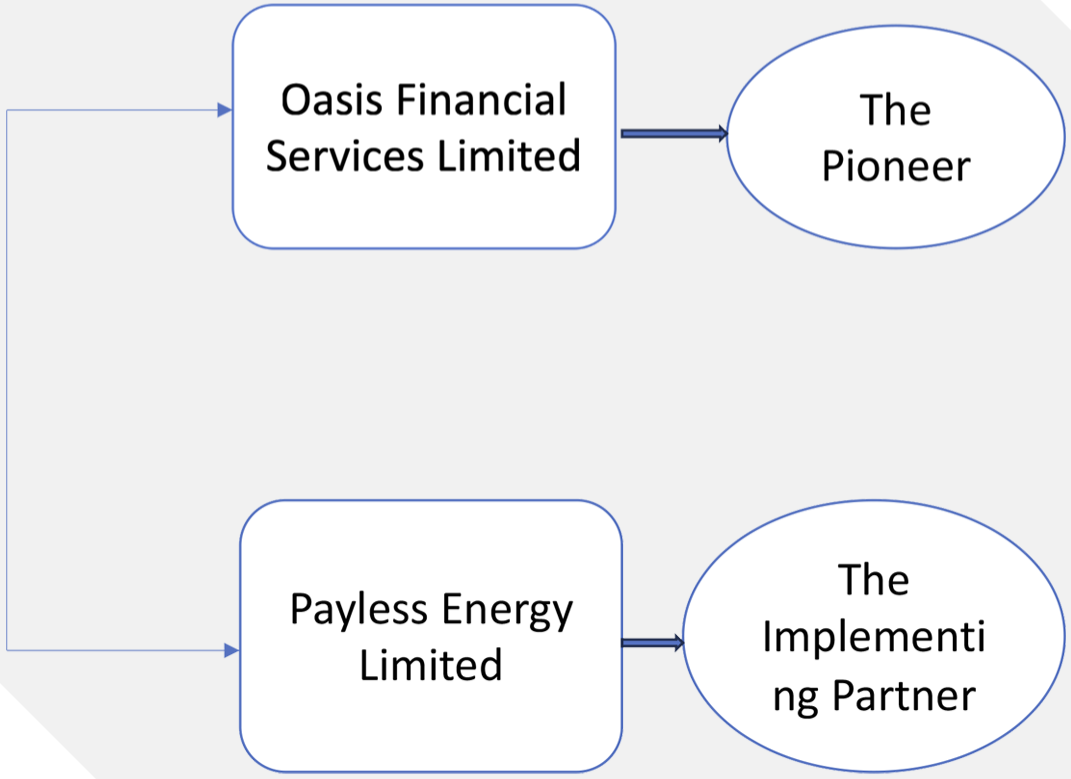
Accelerate-to-Demonstrate (A2D) Facility

Accelerating the Implementation of Clean, Affordable & User-friendly Smart Energy Solutions Using Electric Charging Batteries in Transportation Sector

The project is centered at manufacturing and assembly of electric two and three-wheel motorcycles.

The Project involves localization of:

1.Lithium Batteries Assembly
2.Chassis Production
3.Establishment of Charging Infrastructure Network



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A2D Accelerate to Demonstrate Facility

Phase I

- Commissioning the factory to kick start production
- Importation of CKD units to introduce and enhance brand visibility
- Establishment of battery charging and swapping infrastructure in Dar es Salaam and Unguja, Zanzibar

Phase II

- Expansion of the factory and scaling up production
- Establishment of nationwide battery charging and swapping infrastructure network (Starting with major urban centers)
- Establishment of a robust R&D Unit

OASIS

OUR PREPAREDNESS

- The initial funding of USD 2,780,000 from the internal sources has been invested in
  - Land acquisition and factory construction;
  - Procurement of key machinery;
  - Raw materials;
  - Inventory (e-bikes and e-scooters);
  - Supporting technologies.
- We have secured a grant under A2D program to accelerate the project implementation
- Procurement of CKDs (e bikes) is completed and the shipment is enroute to Dar es Salaam
- Factory commissioning has commenced, with the completion expected in August 2025.
- We have engaged BDO East Africa (under UKAID funded Manufacturing Africa program) to conduct tailor made Market Analysis to inform the production scale up.
- The company owns a 122,500 sqm fenced plot for the factory expansion (production scale up).

LITHIUM ION CELLS GRADING MACHINERY

Operating Factory : Our factory is located at Ununio, Bahari Beach, under Plot No. 7, Block B , Kunduchi, Dar es Salaam, Tanzania (Area – 6,006 Sqm).

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UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Mapinga, Bagamoyo – Plot 561 – 741 (122,500 square metres)

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OUR LITHIUM-ION CELLS SORTING MACHINERY

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Chassis Bending Machinery

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Chassis Bending Machinery

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Inventory – OASIS, Voltix Model

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400 Completely Knocked Down (CKD) vehicles

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PROJECT OVERALL IMPACT

- Youth and Women Empowerment
  - Direct and Indirect employment
  - Employability and entrepreneurship skills development
- Contribution to operational efficiency in business and service delivery
- Contribution to Government Revenue
  - Taxes and levies
- Reduction of Carbon foot prints

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ALIGNMENT WITH NATIONAL AND GLOBAL INITIATIVES

- National Development Vision
  - National Strategy for Growth and Poverty Reduction
  - Development Plans (FYDP I, II, and III)
- Sustainable Development Goals
  - SDG 1 (No Poverty)
  - SDG 5 (Gender Equality)
  - SDG 7 (Affordable and Clean Energy)
  - SDG 8 (Decent Work and Economic Growth)
  - SDG 9 (Industry, Innovation and Infrastructure)
  - SDG 11 (Sustainable Cities and Communities)
  - SDG 13 (Climate Action)

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THANK YOU

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Payless Energy Limited

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A2D Accelerate to Demonstrate Facility

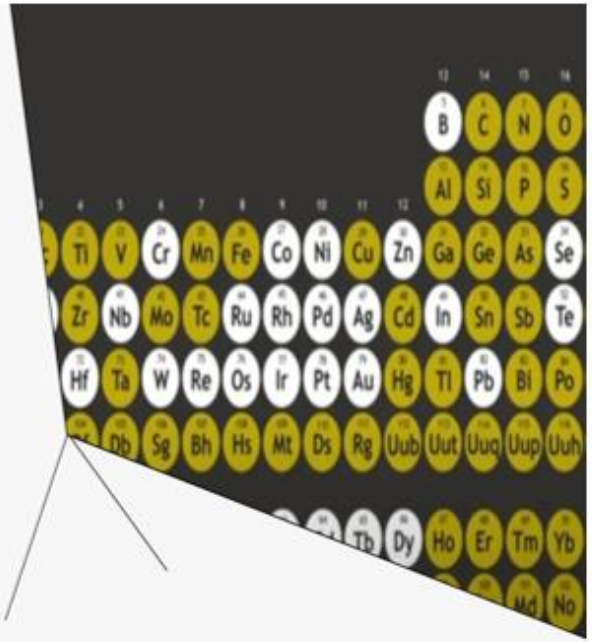
Partners: UK Government

Scaling EV Battery Recycling Technologies

Mr. Paul Cornick
Lead of Operational and Commercialisation Activity of ReLiB Project, University of Birmingham, UK

UNIVERSITY OF BIRMINGHAM

Birmingham Centre for Strategic Elements and Critical Materials



Strategic elements and critical materials are essential to modern society. They are present in many different energy efficient technologies. Our expertise in science, economics and law allows us to answer the challenges that are created by the need for strategic elements and critical materials.

- The University of Birmingham is a large, research intensive and global 100 university turning over £1bn with 8500 staff and 35,000 students.

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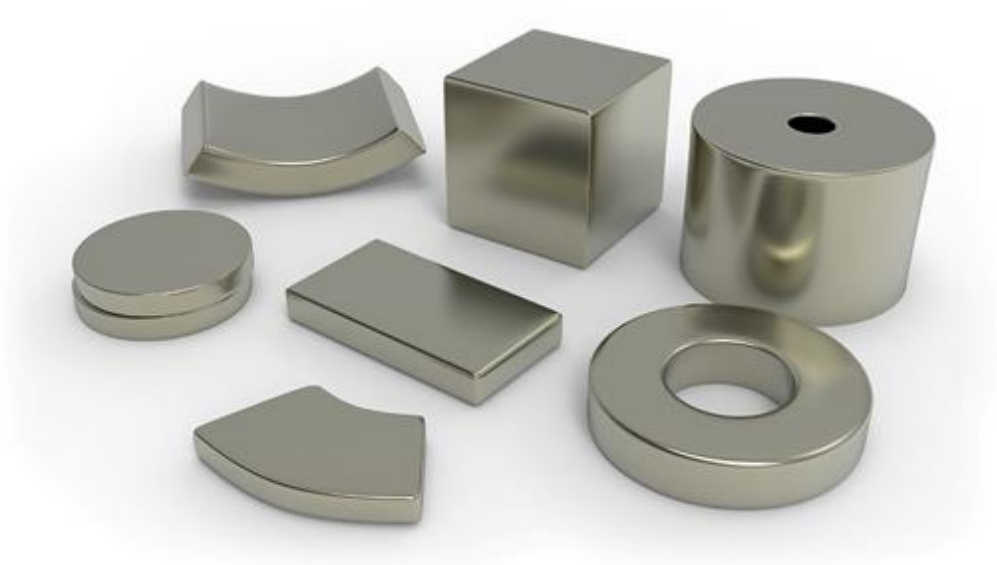
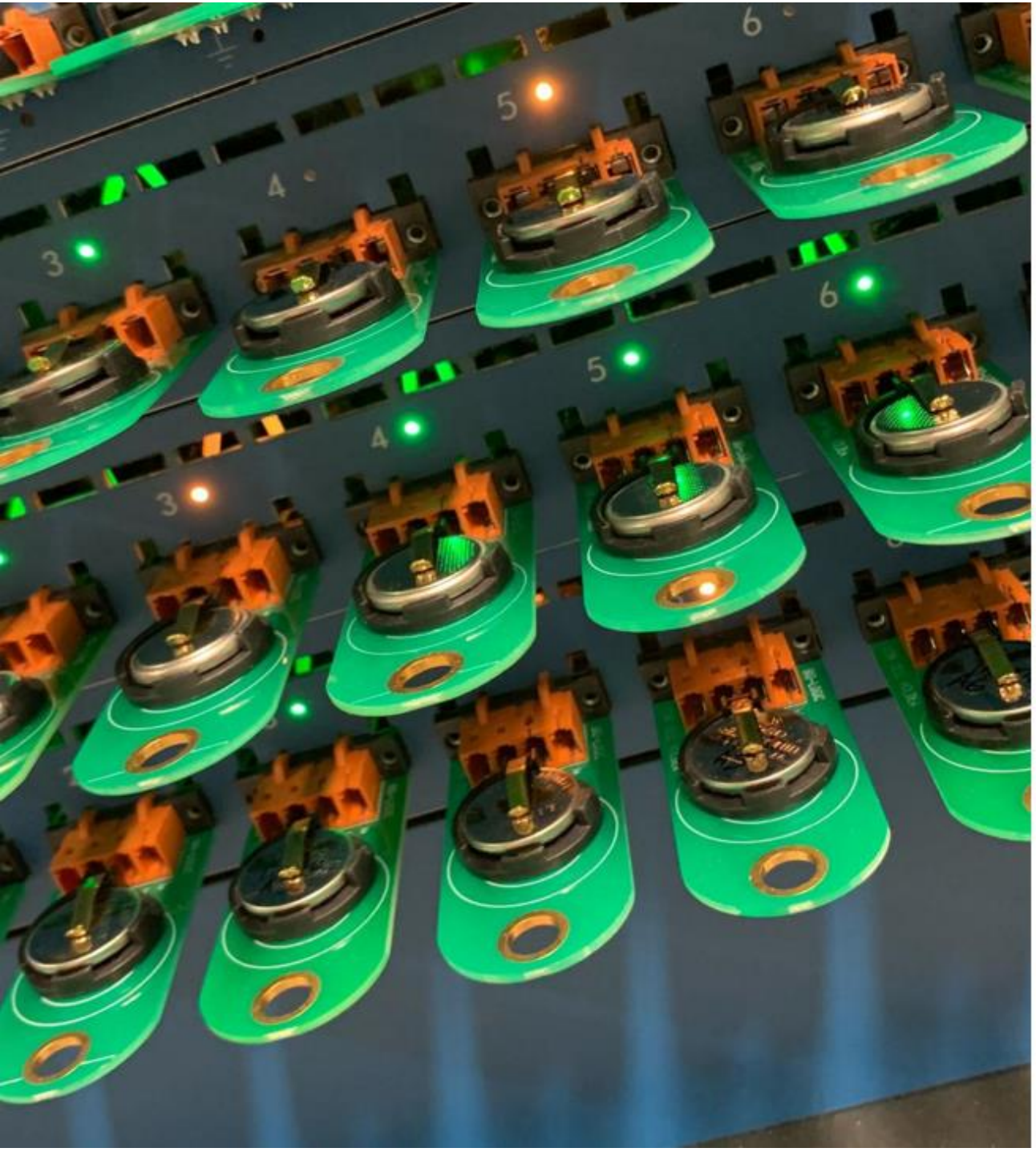


Recycling Rare Earth Magnets

Rare earth magnets are a critical component of modern energy technologies. We are developing the science that will allow us to recycle scrap magnetic material into brand new magnets.
Rare earth magnets find many applications in modern energy technologies. They are at the heart of many offshore wind turbine generator designs and are key to some types of electric vehicle motor and other high efficiency motors, such as in pumps and drives. A clean economy will be dependent on the availability of rare earths.



THE FARADAY INSTITUTION ReLiB

REUSE & RECYCLING OF LITHIUM ION BATTERIES

Lithium Ion

ReLiB

Recycling and Reuse of EV Lithium-ion Batteries

The transition to electric vehicles (EVs) brings challenges and opportunities associated with the need to manage volumes of a projected 28,000 tonnes of EV lithium-ion batteries needing recycling by 2030. To cope effectively with these volumes, vast improvements in the speed, environmental footprint and the economics of recycling processes will be required, not least as the security of supply of critical materials is becoming an ever-increasing priority for Government. To this end ReLiB is developing recycling technologies that will put the UK at the cutting edge of research and development whilst also building the industrial capacity to underpin the transition to EVs.

ReLiB's vision is to provide a UK EV battery recycling industry with a pipeline of scalable technologies that are responsive to regulatory drivers, new battery designs and chemistries, and the opportunities afforded by Industry 4.0.

The project aims to develop - and scale - the following technologies:

- cathode leaching to industrial level.
- upcycled electrode materials used in new cells.
- binder recovery (where there is an economic or regulatory rationale to do so).
- biorecovery of materials, e.g., metals from plastic EV battery waste, from secondary waste solutions - "zero waste" concept.
- data informed recycling routes based on digital diagnostic tools that can interface seamlessly with battery data passports to assess the batteries key recycling indicators.
- high power anode recovery and reuse.
- graphite recovery and reuse.
- identification of new research topics that fit with changing battery design and chemistry systems and regulatory drivers.

Timeline with milestone/deliverables (to March 2025)

- Demonstration of effective leaching from end-of-life EV batteries.
- Investigation of a cell-dismantling route for recovery of materials from end-of-life battery cells as an alternative to shred and sort.
- Routes for short loop direct recycling and upcycling of common cathode materials.
- Evaluation of optimum methodology for recovery and reconditioning of current and future anode materials.
- Scale up of selective metal bioleaching processes using natural and bioengineered bacterial strains.
- Production of remanufactured cells from recycled materials for long-term cycling and investigation of causes of failure.

Project innovations

Unlocking safe, cheap and environmentally benign routes for the separation, recovery, remanufacture and recycling of materials contained within EV batteries is critical to the success of the EV revolution and the sustainability of manufacturing supply chains. The project will achieve this through direct targeting of fast, efficient dismantling processes to boost productivity and safety within the waste and recycling sector. This will provide high-purity and high-value recovered material streams, maximising the environmental gains of the transition to EVs.

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Duration
1 March 2018 - 31 March 2025

Funding
£18.5 million

Principal Investigator
Professor Paul Anderson
University of Birmingham

Project Leader
Dr Daniel Reed
University of Birmingham

Project Manager
Paul Cornick
University of Birmingham

University Partners
University of Birmingham (Lead)
University of Edinburgh
University of Leicester
University of Oxford
Newcastle University
Imperial College London

+ 20 Industrial Partners

ReLiB.org.uk
@ReLiBProject
www.linkedin.com/showcase/ReLiB-project

The Faraday Institution

The UK's flagship programme for electrochemical energy storage

- research
- skills development
- market analysis
- early-stage commercialisation

Bringing together research scientists a industry partners on projects with commercial potential that will:

- reduce battery cost, weight, and volume
- improve performance and reliabilit
- develop whole-life strategies inclu recycling and reuse

27+

Academic partners

85+

Industry partners

500+

Researchers from many disciplines

Web: www.faraday.ac.uk

Twitter: @FaradayInst

LinkedIn: TheFaradayInstitution

The ReLiB Academic Superpowers

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UCL

THE UNIVERSITY of EDINBURGH

Newcastle University

UNIVERSITY OF OXFORD

UNIVERSITY OF LEICESTER

Imperial College London

Key Messages

1. **Recycling of Lithium-ion Batteries is complicated; very complicated & needed!**
    - Recycling means many different things to many different people
    - There are many, many steps in the recycling processes covering upfront triage to re-manufacturing of electrodes
    - Recycling EV batteries is a national security matter – both from an energy and economic (SUPPLY) point of view
    - Recycling EV batteries could reduce new mining by up to 40% (IEA 2024)

2. **The scale and pace of transition to zero emission vehicles is breathtaking**
    - Global car fleet is circa 1.7 bn units
    - 7 years ago fewer than half a million fully EVs were built per annum globally; today this is more like 17 million
    - EV batteries are heavy things – typically 500 kgs + (containing significant vol. of CRMs)
    - ZEVTC's Roadmap sums up the scale well: https://zevtc.org/global-roadmap/

3. ReLib is a basic research grant (TRL 1- 4) working on *practical* technical solutions to recover *valuable* and *non-valuable* materials that may be *'critical'* or may not be *critical*

4. The current state of play in the UK for EV recycling is pretty much the production of low grade black mass that is off-shored typically to the East – but this is changing and is changing fast!

Recycling of Critical Minerals

Strategies to scale up recycling and urban mining

A World Energy Outlook Special Report

International Energy Agency

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Recycling reduces the need for new mines, enhancing security and sustainability

A successful scale-up of recycling can lower the need for new mining activity by 25-40% by 2050 in a scenario that meets national climate pledges. While accelerated clean energy deployment calls for a substantial expansion of new mines and refineries to meet material demand, it also creates an opportunity for secondary supply to play an increasingly valuable role. In the Announced Pledges Scenario (APS), which reflects national climate pledges, recycling reduces new mine development needs by 40% for copper and cobalt, and close to 25% for lithium and nickel by 2050. The market value of recycled energy transition minerals grows fivefold, reaching USD 200 billion by 2050. As a result, requirements for primary materials start to decline around mid-century. Nonetheless, investments in new mines remain essential as supply levels required by mid-century are still higher than today's production and existing mines face natural declines in output.

ReLiB Tech Transfer Use Case – Hinckley Recycling Nigeria

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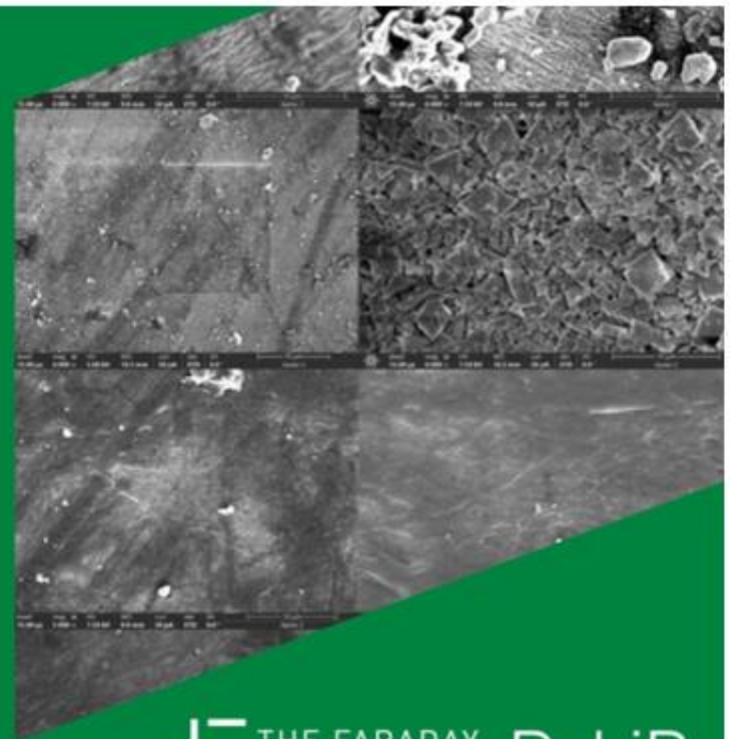
Research paper

Pretreatment and Valorization of Critical Materials from Lithium-Ion Batteries Using Electrostatic and Magnetic Separation



THE FARADAY INSTITUTION ReLiB

REUSE & RECYCLING OF LITHIUM-ION BATTERIES

ReLiB Tech Spin Out Use Case – Newcastle University

UNIVERSITY OF BIRMINGHAM

Newcastle University engineer wins prestigious Enterprise Fellowship

Published on: 24 January 2025

Dr Mahfuz Kamal has been awarded an Enterprise Fellowship by the Royal Academy of Engineering to support him as CEO of University spin-out company RecoVolt.

RecoVolt is a Newcastle University spin-out company commercialising an innovative battery discharge system. The system is used with lithium-ion batteries at their end-of-life to ready them for battery recycling.

Dr Mahfuz Kamal

Advanced power electronics and intelligent algorithms are used to discharge multiple batteries simultaneously, addressing a productivity area that the recycling industry has identified as needing urgent attention.

Dr Kamal explained: "For batteries to be recycled safely, any charge still held in the battery needs to be fully discharged.

"By removing any remaining charge, the risk of fire during the recycling process is reduced. Any remaining charge in the batteries can also be used to power the recycling process, offsetting operational costs."

The innovation also has potential use by scrap yards and insurance companies by ensuring safe storage, faster transport and value generation from assessing written-off vehicle batteries for reuse.

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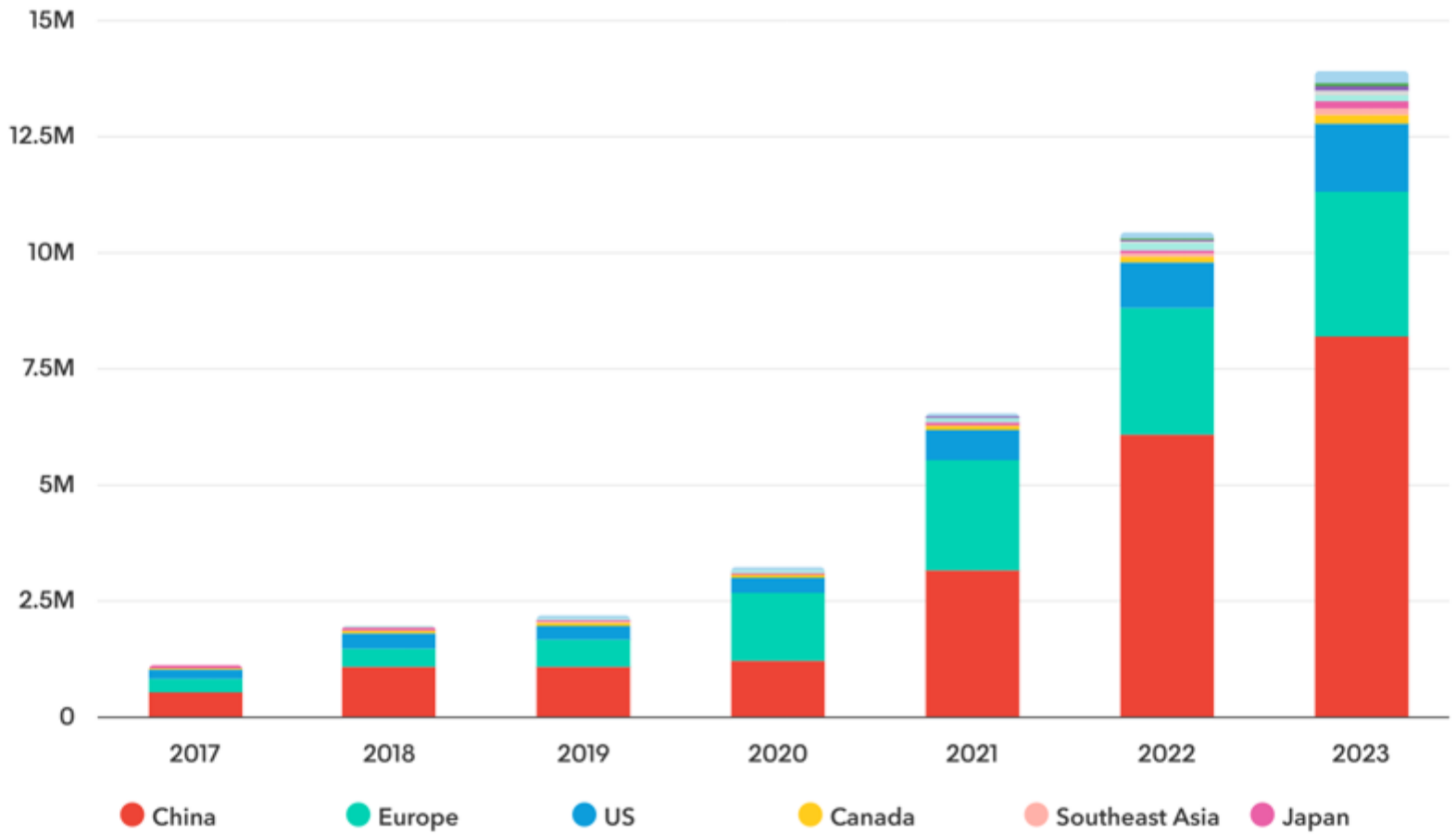
Global passenger EV sales by market (Scale & Pace) – IEA 2024



Global 2030 Projection - IEA 2024

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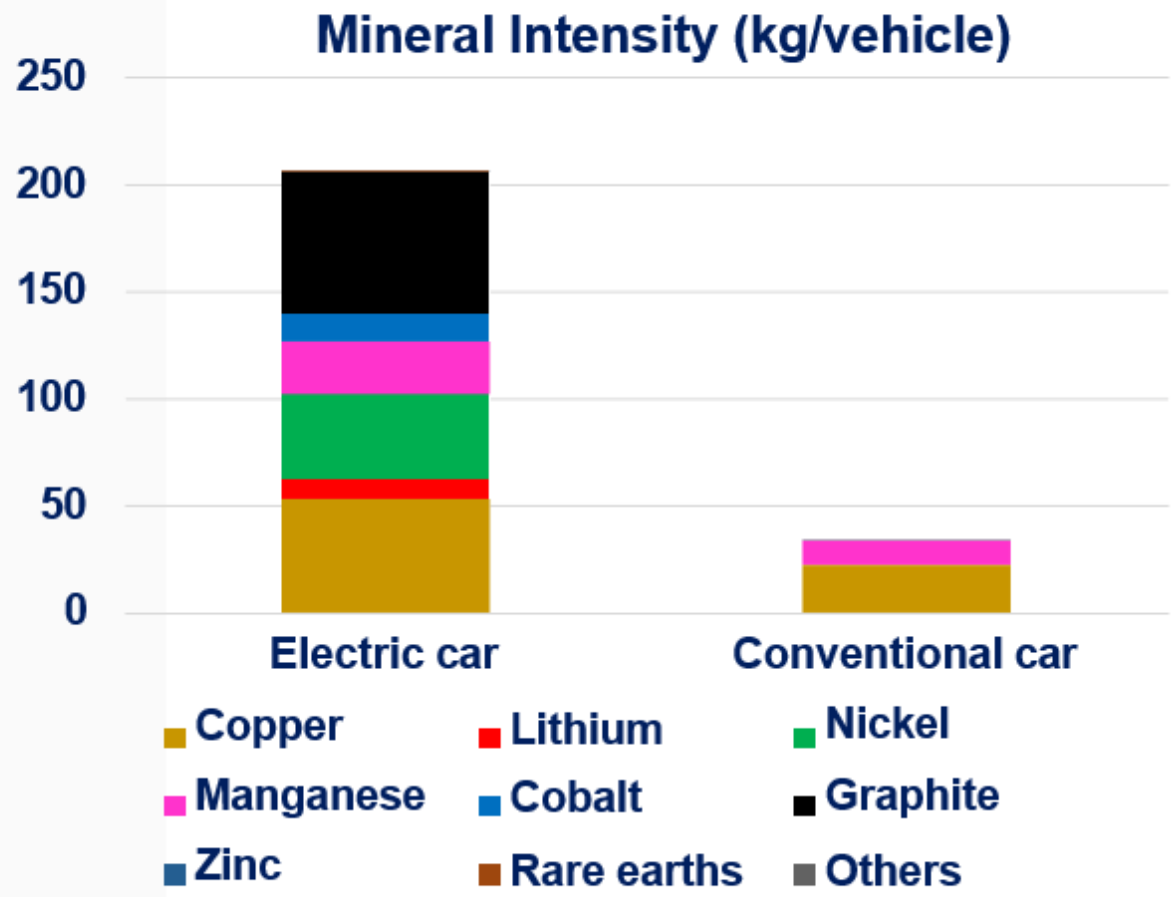
The industry outlook

The ten largest carmakers are set to sell over 20 million electric cars in 2030, exceeding current policy targets

As of 2023, the ten largest global automakers all have established clear electrification targets. Together, these automakers sold over 40 million cars in 2023, representing about 55% of global sales. Although some manufacturers have missed or postponed near-term targets – often pointing to underwhelming consumer demand – they have not scaled back their longer-term ambitions. If each company in the top ten meets their target, over 20 million new electric cars could be sold in 2030. Notable examples include BMW's target of 50% of deliveries in 2030 to be BEVs; Toyota's 3.5 million BEV sales target in 2030; Stellantis's 5 million BEV sales target in 2030; and GM's target of a global EV manufacturing capacity of 2 million per year by 2025. In addition, Tesla is targeting production of 20 million electric cars in 2030, which – combined with the targets of the top ten – would be roughly equivalent to the projected sales in the STEPS in that year.

The mineral intensity of EVs (IEA 2024)

- EVs are *very* mineral-intensive.



https://www.iea.org/data-and-statistics/charts/minerals-used-in-electric-cars-compared-to-conventional-cars

LIB Chemistries affect which Minerals are Demanded

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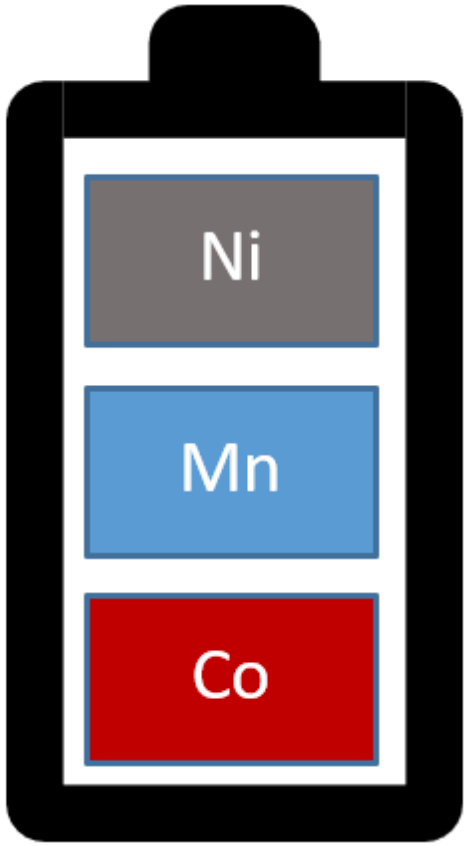
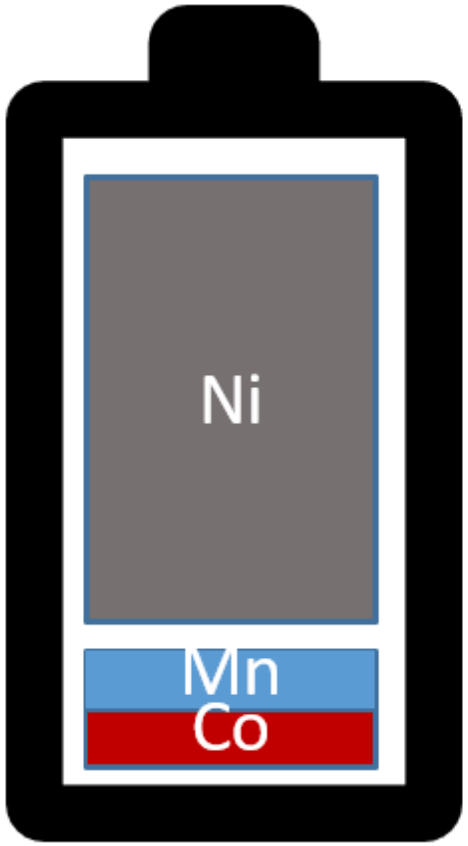


NMC 111



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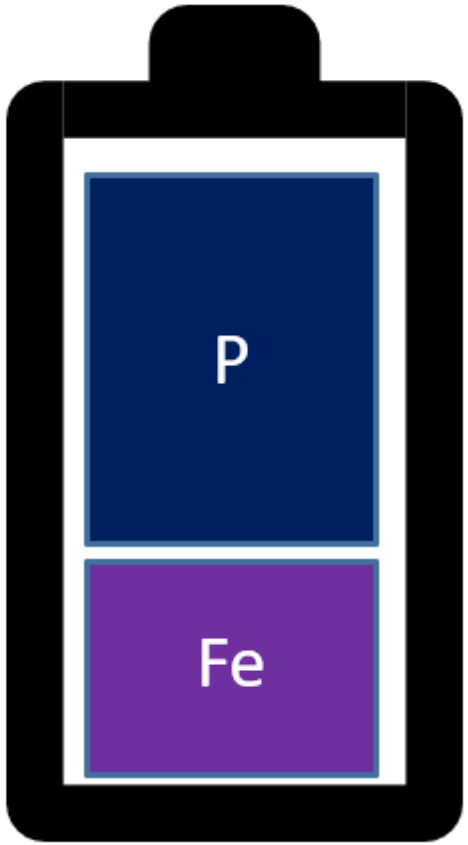


LFP

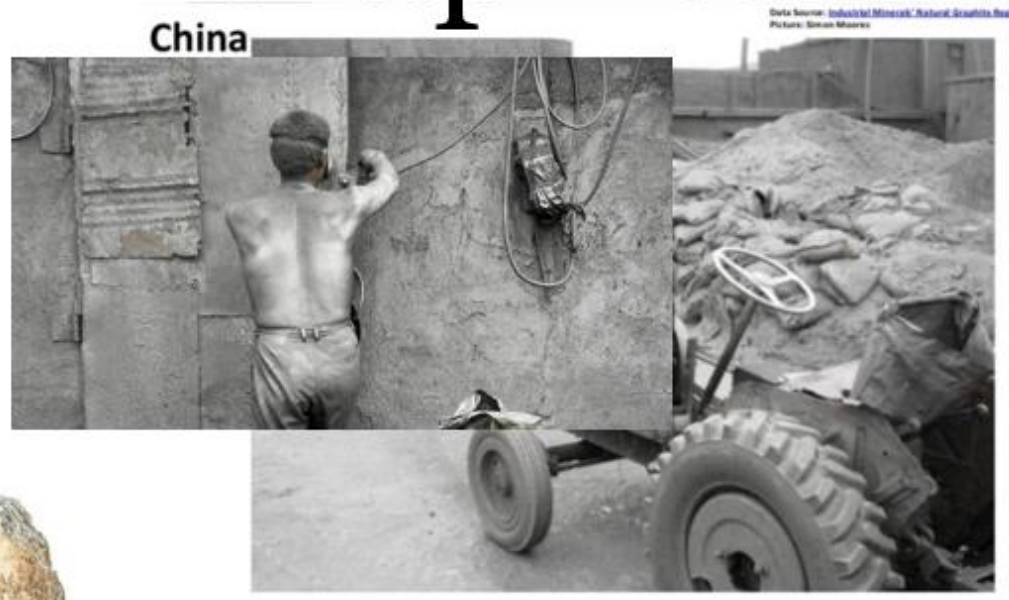
Cobalt

Country	Production (MT)	Reserves (MT)
DR Congo	120 000	3,500,000
Russia	7,600	250,000
Australia	5,000	1,200,000

Lithium

Country	Production (MT)	Reserves (MT)
Australia	55 000	5,700,000
Chile	26 000	9,200,000
China	14 000	1,500,000
Argentina	6 200	2,200,000

Graphite



Country	Production (MT)	Reserves (MT)
China	820 000	73,000,000
Brazil	68 000	70,000,000
Mozambique	30 000	25,000,000
Russia	27 000	?

Critical Materials Implications

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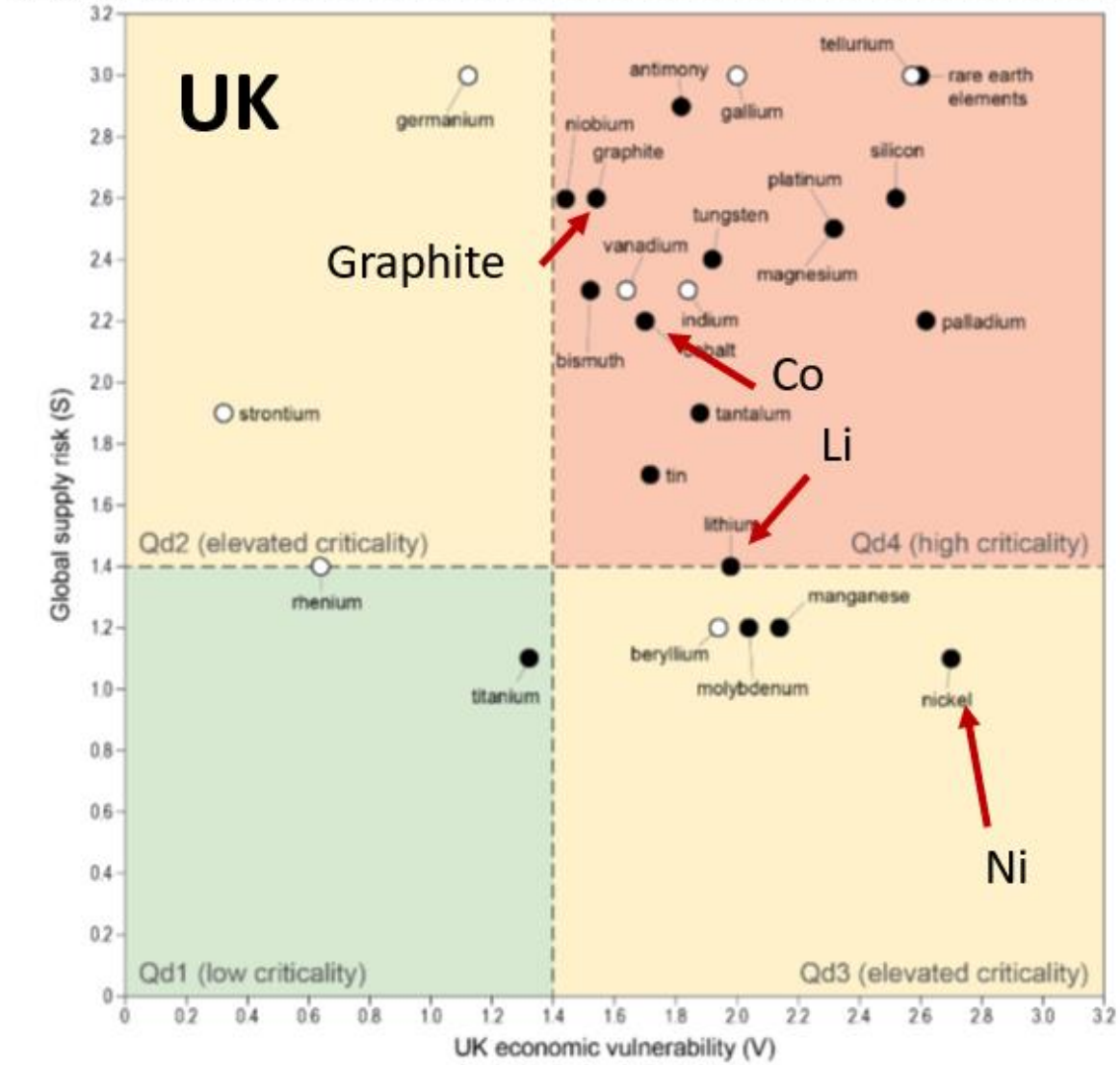
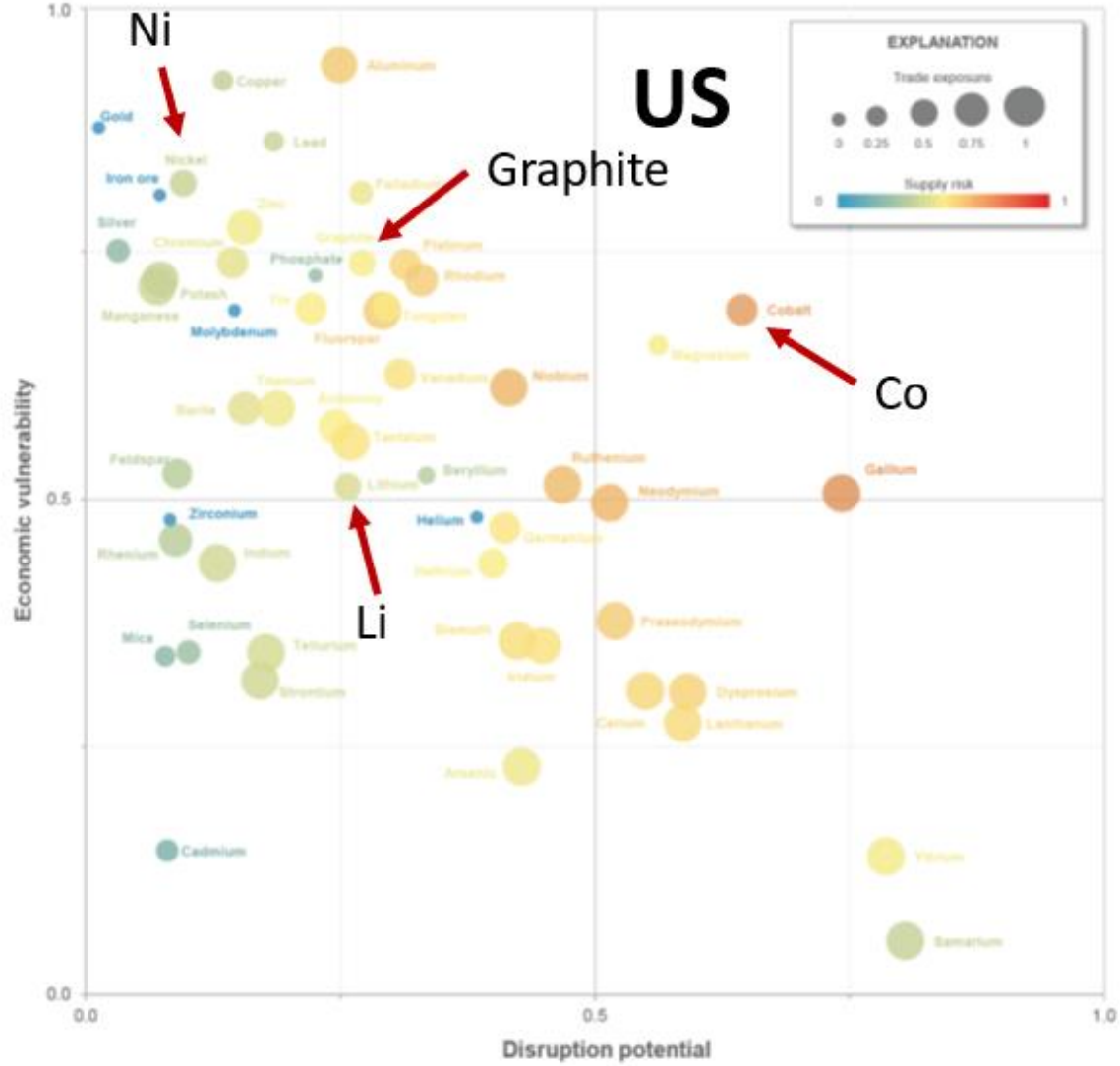
US - The Energy Act of 2020 defines a " critical material " as:

- Any non-fuel mineral, element, substance, or material that the Secretary of Energy determines:
- (i) has a high risk of supply chain disruption; and
- (ii) serves an essential function in one or more energy technologies, including technologies that produce, transmit, store, and conserve energy

Thought: Are critical minerals/materials 'critical' without a qualifying political, social, economic & technological context? And do minerals become critical only when they are serving another political or economic agenda?



https://www.bgs.ac.uk/download/uk-criticality-assessment-of-technology-critical-minerals-and-metals/



https://pubs.usgs.gov/of/2021/1045/ofr20211045.pdf
https://www.federalregister.gov/documents/2022/02/24/2022-04027/2022-final-list-of-critical-minerals

Criticality Assessment – EU 2023

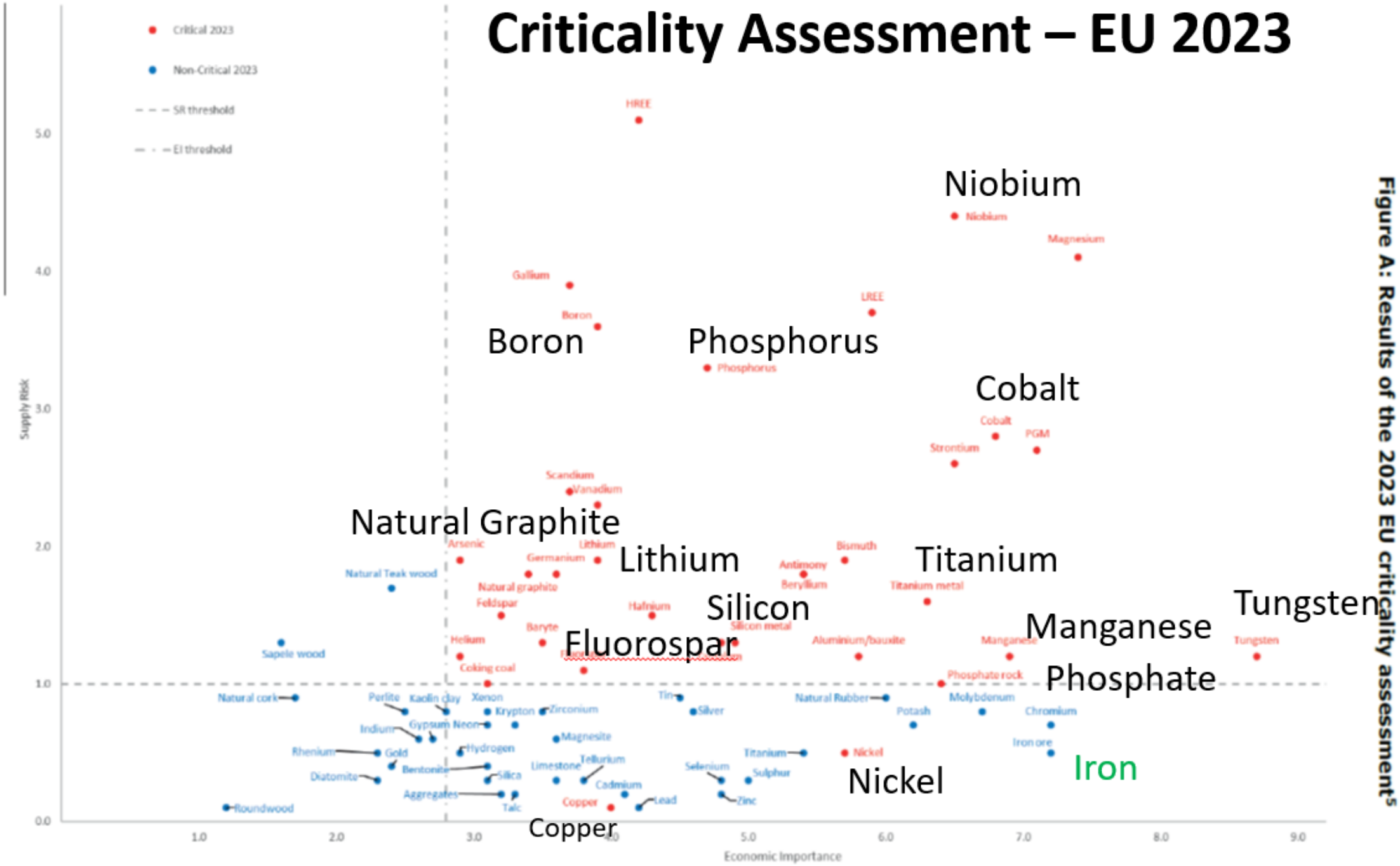


Figure A: Results of the 2023 EU criticality assessment[5]

[5] Copper and nickel do not meet the CRM thresholds, but are on the CRM list as Strategic Raw Materials.

What is Sustainability?

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'avoidance of the depletion of natural resources in order to maintain an ecological balance.'
Oxford English Dictionary

4 R's of Sustainability

Reduce, Re-use, Recycle and Recover

Over materials life-cycle

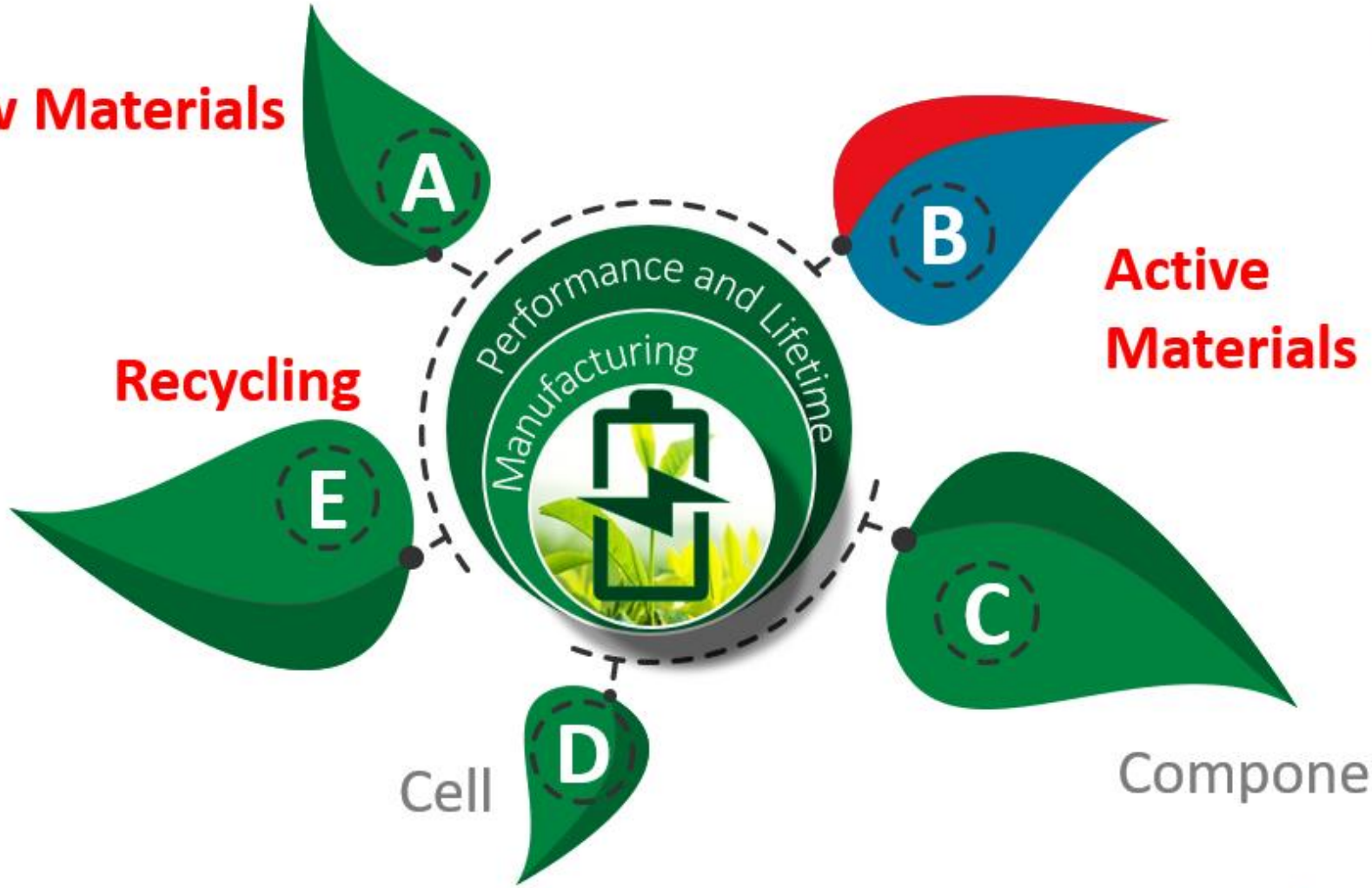
- Critical Materials
- Energy Use
- Environmental Impact

Sustainability in Battery Materials?

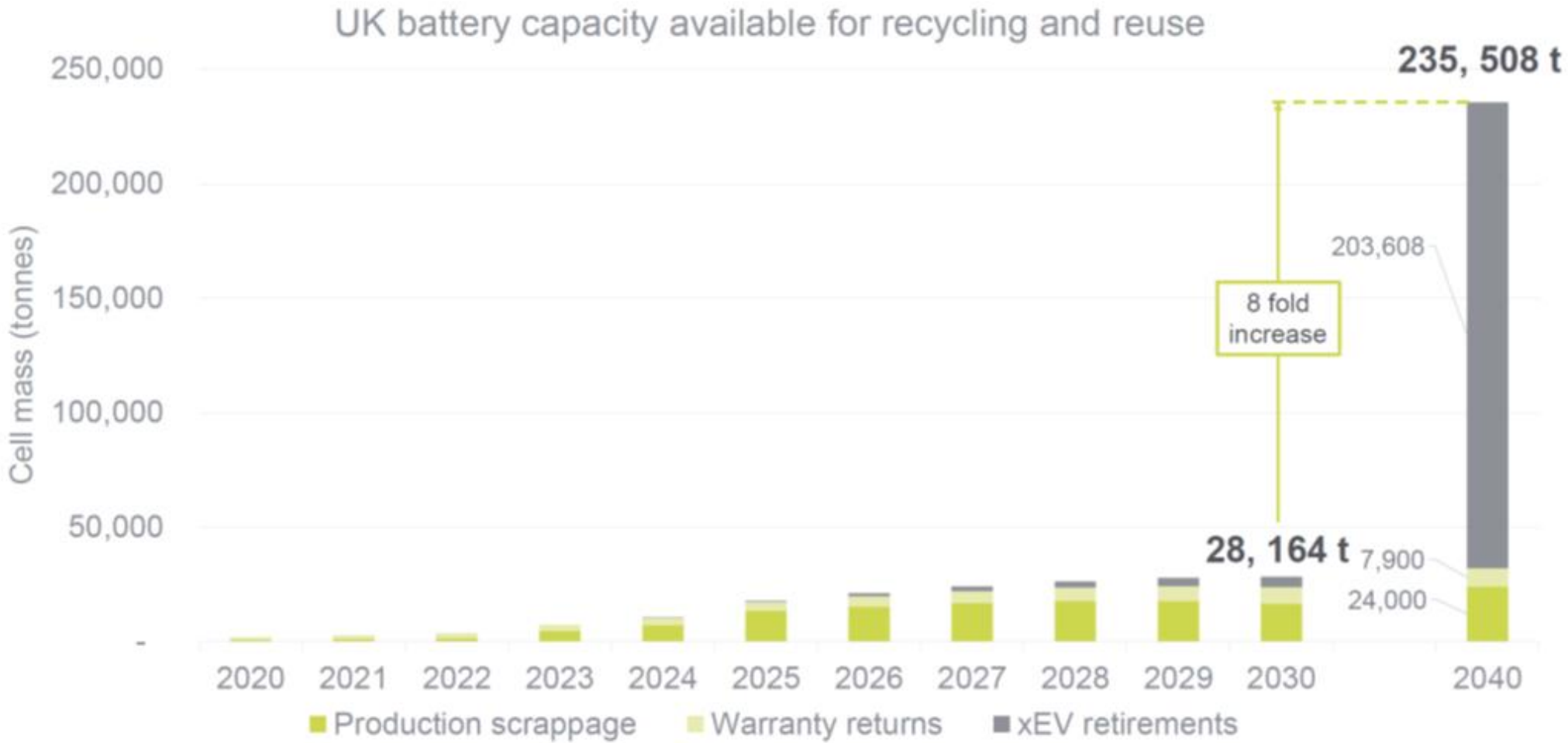
Energy

Waste

Resources



By 2040, the dominant feedstock for battery materials will be from EoL vehicle retirements. A total of 235,000 tonnes will be available for recycling and reuse by 2040, almost 8 times that in 2030.



Notes: Analysis based on BEV and PHEV sales in the UK from 2012, warranty recalls based on 2020 BNEF data and cell production forecasts published by the APC

Problem summary

UNIVERSITY OF BIRMINGHAM

The EV battery recycling problem:

Too big, too complex, too expensive.

And market failure is preventing industry from tackling the problem on their own.

Key Messages

UNIVERSITY OF BIRMINGHAM

1. **Recycling of Lithium-ion Batteries is complicated; very complicated**
   - Recycling means many different things to many different people
   - There are many, many steps in the recycling processes covering upfront triage to re-manufacturing of electrodes
   - Recycling EV batteries is a national security matter – both from an energy and economic (SUPPLY) point of view
   - Recycling EV batteries could reduce new mining by up to 40% (IEA 2024)

2. **The scale and pace of transition to zero emission vehicles is breathtaking**
   - Global car fleet is circa 1.7 bn units
   - 7 years ago fewer than half a million fully EVs were built per annum globally; today this is more like 17 million
   - EV batteries are heavy things – typically 500 kgs + (containing significant vol. of CRMs)
   - ZEVTC's Roadmap sums up the scale well: https://zevtc.org/global-roadmap/

3. **ReLib is a basic research grant (TRL 1- 4) working on *practical* technical solutions to recover *valuable* and *non-valuable* materials that may be *'critical'* or may not be *critical***

4. **The current state of play in the UK for EV recycling is pretty much the production of low grade black mass that is off-shored typically to the East – but this is changing and is changing fast!**

ReLiB Vision & 5 Year View

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Vision

Vision

The goal of ReLiB is to provide a UK EV battery recycling industry with a 'pipeline' of scalable technologies that are responsive to regulatory drivers, new battery designs and chemistries, and the opportunities afforded by Industry 4.0

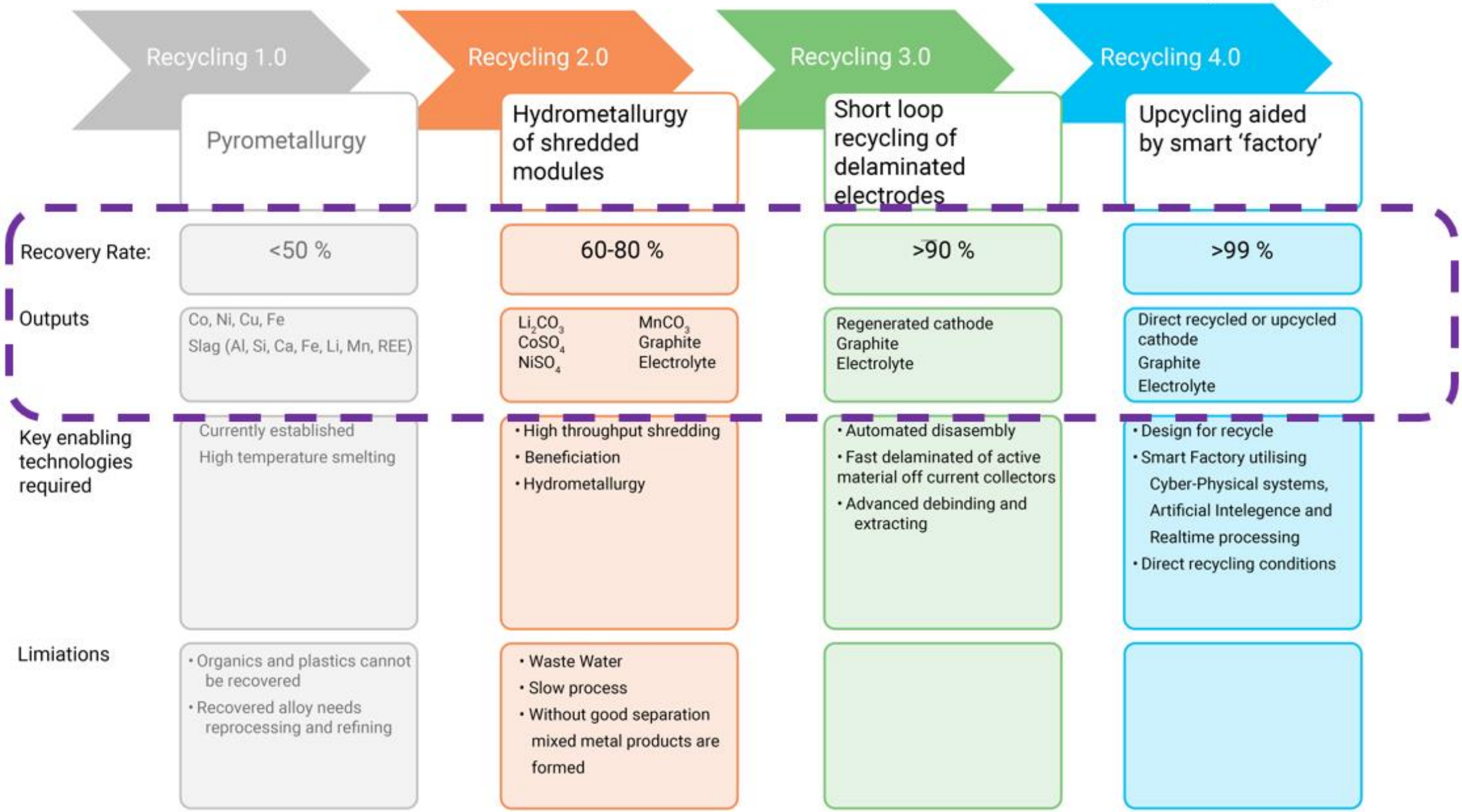
5 Year View

In five years we aim to see the following technologies developed—***and scaled***:

1. cathode leaching work to industrial level
2. upcycled electrode materials used in new cells
3. binder recovery (where there is an economic or regulatory rationale to do so)
4. biorecovery of materials *e.g.* metals from plastic EV battery waste, from secondary waste solutions—'zero waste' concept—(where there is an economic or regulatory rationale to do so)
5. smart disassembly, separation and regeneration technologies *e.g.* direct recycling to protect the material crystal structure and embedded value of electrode material for reuse
6. digital diagnostic tools that can interface seamlessly with battery data passports to assess the state of health of batteries and inform recycling routes
7. identification of new research topics that fit with changing battery design & chemistry systems and regulatory drivers.

ReLiB Technology Pipeline

Increase recovery rate
Output higher value products



Impact of moving to BATTERY RECYCLING 3.0

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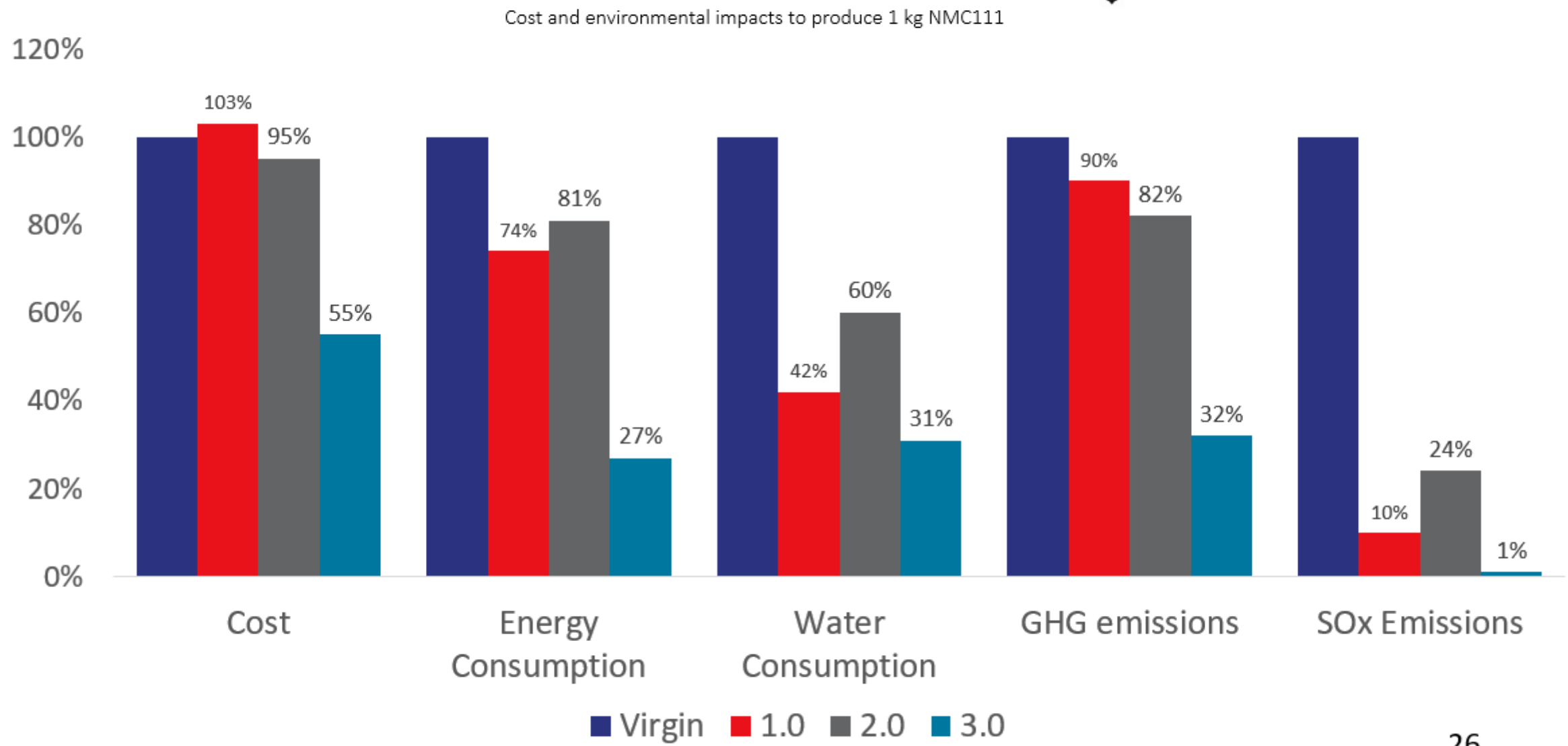

L. Gaines et. Al. Recycling 2021, 6, 31. https://doi.org/10.3390/recycling6020031

Technology Pipeline: ReLiB Know-How

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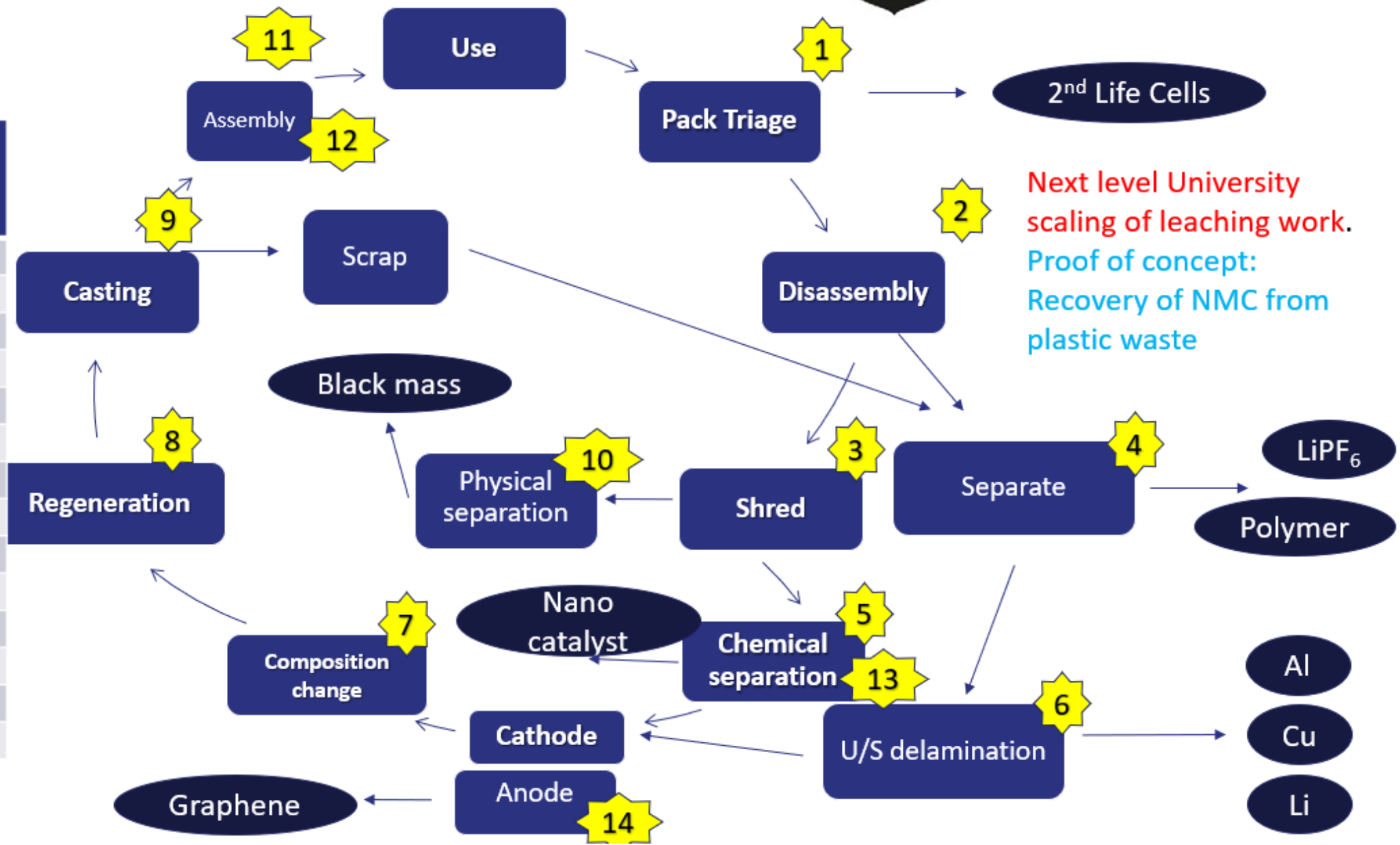

ReLiB Know-how

1. Fast assessment protocol
2. Robotic manipulation
3. Safety protocols
4. Opening protocols
5. Organic acid lixiviants
6. U/S delamination
7. DES/organic acids
8. Regeneration protocols
9. Novel binders
10. Separation protocols
11. Novel adhesives
12. Novel pack designs
13. Nano-catalyst production
14. Graphene generation

Map of ReLiB technology

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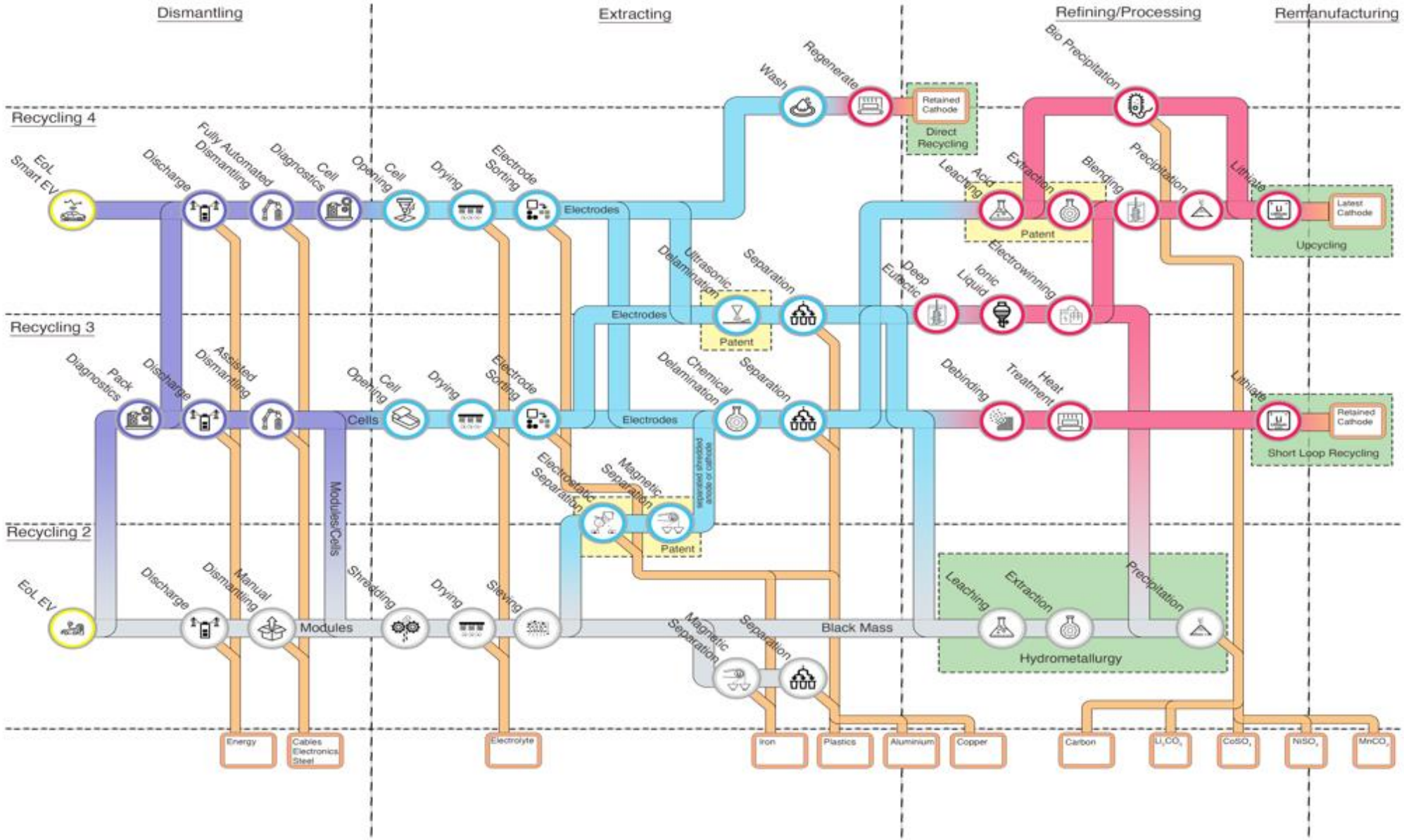

RELIB IP (1)

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Electrode Separation by Sonication (University of Leicesster) (WO 2021/152302 filed 27/1/2021)

- capable of handling high throughputs required for volumes expected by the end of the decade without extensive solvent use or liquid waste production
- sufficiently mild to enable recovery of active materials with minimum degradation thus facilitating 'direct' recycling (by far the most favourable route economically and environmentally and the only viable route for low value active materials such as LFP)

Purifying and Separating Black Mass (University of Leicester)

- patent pending technology allows lithium-ion battery black mass, a low-value mixture of anode and cathode and other materials, to be purified directly within minutes of operation at room temperature.

Battery Direct Recycling (University of Birmingham) (PCT/GB2021/052701 filed 20/10/2021)

- for efficient separation and recovery of oxides from blended oxide cathodes
- also potential for mixed oxide waste streams, e.g. from consumer batteries

Battery Recycling (University of Birmingham) (application 2108590.7 filed 16/6/2021)

- physical and magnetic separation processes for beneficiation of recovered 'black mass'
- application with battery recycling company EverResource
- technology being developed with EverResource through Innovate UK SMART project

RELIB IP (2)

UNIVERSITY OF BIRMINGHAM

Rapid Discharge of EV Batteries (Newcastle University)

- Capable of handling high throughputs required for volumes expected by the end of the decade (EoL)
- This technology regulates the power flow into and out of batteries on a cell or module basis, allowing batteries to be grouped to contribute to a specific load regardless of their SOC, SOH, or voltage profile. This ensures that the battery states are equalised in one cycle, resulting in a balanced discharge. University Spin Out Dec 23

Upcycling/Recycling Graphite to Next Generation Graphite – SiOx Anodes (University of Birmingham)

- IP Summary:

The use of colloidal silica solutions during the initial delamination process, which have successfully delivered such a composite, demonstrating the concept of upcycling graphite to next generation graphite – SiOx Andoes.

Binder Recovery (University of Birmingham)

- UoB Academics considering the merit of IP around binder recovery as the method developed looks promising in terms of potential to scale

Bio Recovery of Nano Particles (University of Edinburgh)

- Selective Mn bio-precipitation by shewanella oneidensis leading to an improved process for the bio-precipitation of Mn from acidic leachate obtained from spent LIBs.

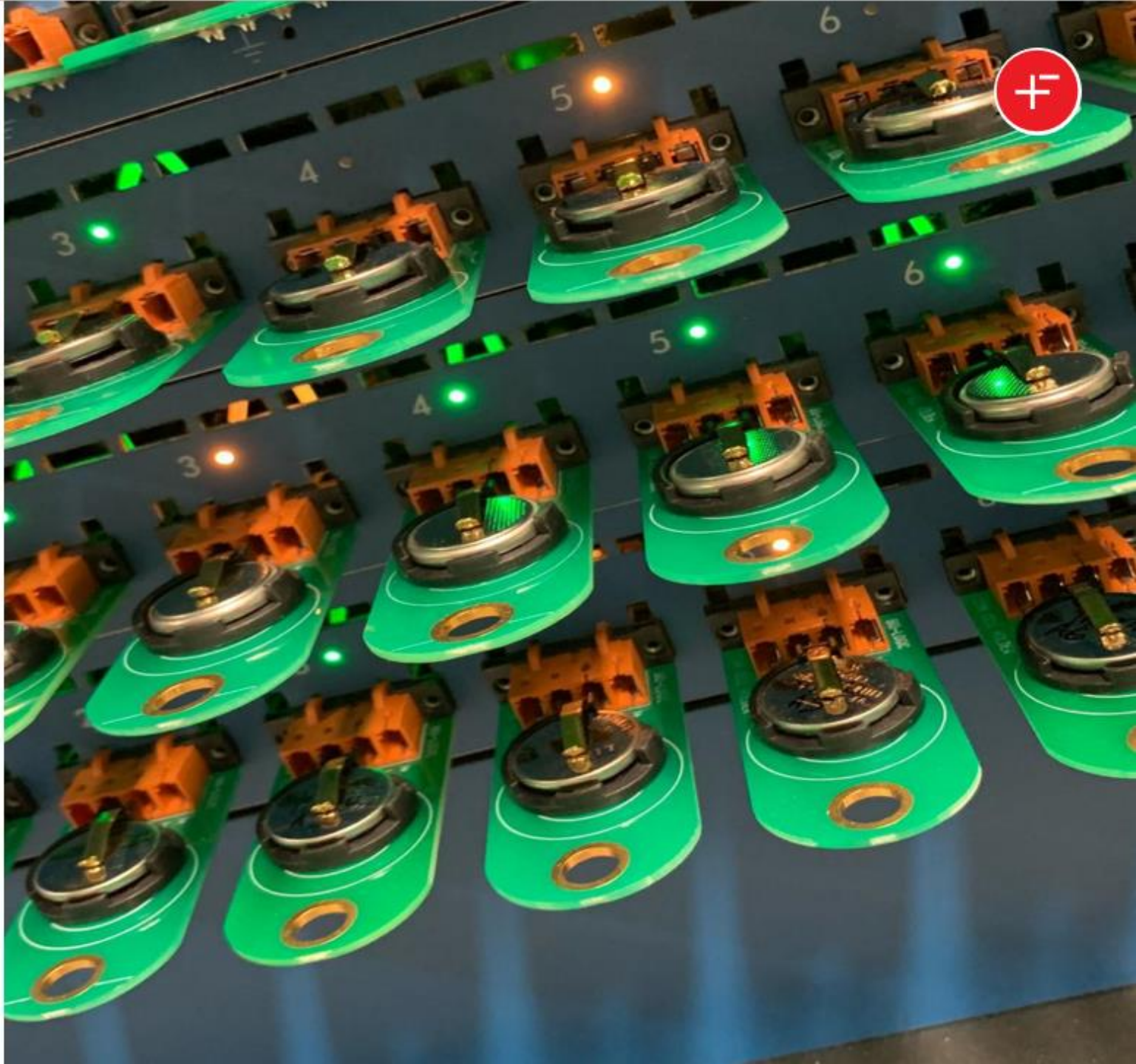
Research Highlights

ReLiB is developing a suite of process technologies that it continues to refine towards its vision of providing a UK EV battery recycling industry with a pipeline of scalable technologies.

Case study:

Recovery and regeneration of cathode materials

Scientists in the ReLiB project, led by the University of Birmingham, have patented a selective leaching technology to recycle, upcycle and regenerate cathode materials. This allows the manganese-rich materials to be separated from the other valuable battery components. These materials can be regenerated or can be upcycled for use in next generation cathode materials. By combining this technology with a direct recycling approach, the remaining high value Ni- and Co-rich materials can also be recovered and regenerated, thus enhancing the UK's capability in battery recycling.



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Research Highlights

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Case study:

LOW VALUE MATERIAL RECOVERY: PVDF BINDER RECOVERY

In lithium-ion (Li-ion) batteries, the electrode materials are adhered on the surface of the current collectors by binder materials. The most popular binder is polyvinylidene difluoride (PVDF) due to its chemical and electrochemical stability. Binder recovery facilitates subsequent critical recovery of electrode materials and crucially reduces environmental pollution caused by thermal treatment.

This novel development enables the green solvent to dissolve PVDF in a narrow temperature window. Our selected solvent enables a smart down-stream separation of the PVDF which also enables the solvent to be recycled and reused. The PVDF is recovered by evaporation of the solvent at the end of the operation. Black mass can be delaminated from current collectors for further treatment after the binder has been removed.

Research Highlights

ReLiB is developing a suite of process technologies that it continues to refine towards its vision of providing a UK EV battery recycling industry with a pipeline of scalable technologies.

Case study:

Patented ultrasonic delamination technique to return high purity materials to new battery manufacture

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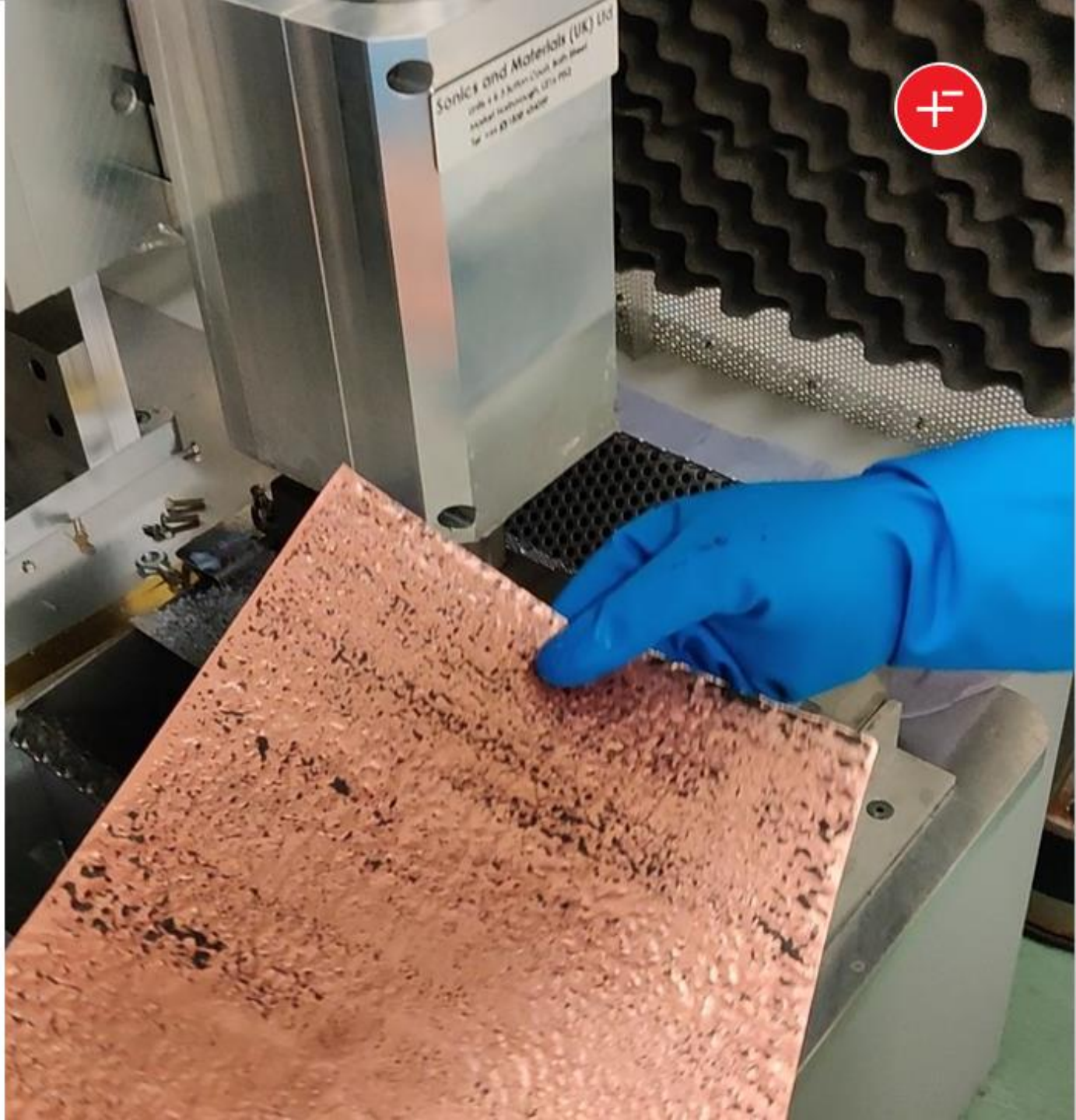
A new method, which uses ultrasonic waves to separate out valuable electrode material from the current collectors, is 100 times quicker and greener relative to current separation methods. Materials recovered using the technique have higher purity, and therefore higher value, than those recovered in conventional recycling approaches and are potentially easier to use in new electrode manufacture. The technique is being developed further as part of REBLEND - a Faraday Battery Challenge collaborative R&D project.



ReLiB Policy & International Engagement

Department for Energy Security & Net Zero

Department for Science, Innovation & Technology

WEST MIDLANDS COMBINED AUTHORITY

Foreign, Commonwealth & Development Office

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

IIT BOMBAY

U.S. DEPARTMENT OF ENERGY

ZEV TRANSITION COUNCIL

HOUSE OF LORDS

Agency for Science, Technology and Research
SINGAPORE

Birmingham City Council

Department for International Trade

THE FARADAY INSTITUTION

ReLiB Industrial Engagement

UNIVERSITY OF BIRMINGHAM

Recycle.

Working to develop, improve and scale recycling technologies and transition them to industry by improving current industry practices to beyond 90% efficiency.

UNIVERSITY OF LEICESTER · THE UNIVERSITY of EDINBURGH · Newcastle University · UCL · UNIVERSITY OF OXFORD · Imperial College London · UNIVERSITY OF BIRMINGHAM

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Scaling Circular Electronic Waste and Battery Solutions in Latin America: Lessons from the Field

Mr. Francisco Pereira,
Project Director, Fortech Circular Costa Rica

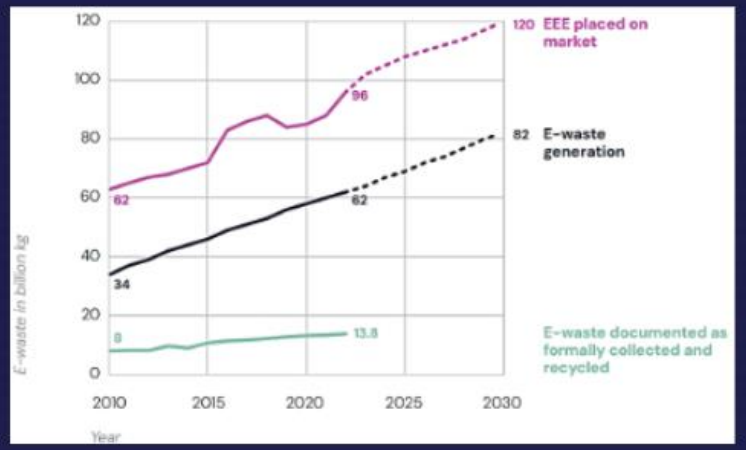
FORTECH
Circular

Towards a Circular Economy For Li-ion Batteries in LATAM

Francisco Pereira – Project Director

e-Waste generated has doubled in 12 years

(Regionally & Globally)



Growth in generated e-waste is outpacing growth in formal collection & recycling

Driven by technological progress, increased consumption, limited repair options, short lifecycles and inadequate management infrastructure.

Recycling rate is 12% for the continent, 3% for Latinamerica

(13 LATAM countries studied)

Secondary raw material generation from e-waste:
Current: $28 billion
Potential: $91 billion

Most losses occur due to incineration, landfilling or substandard treatment. (informal sector "cherry picking")

It contains both hazardous & valuable materials

In 2019, e-Waste from LATAM had:

- 7 t of gold
- 0.31 t of rare earth metals
- 591 kt iron
- 54 kt copper
- 91 kt aluminium

Managing e-waste can represent an economic opportunity

But also contained at least:

- 2.2 t of mercury
- 0.6 t cadmium
- 4.4 kt lead
- 4 kt brominated flame retardants
- 5.6 Mt of Greenhouse Gases-equivalents (due to refrigerants)

These are poorly managed within the region, generating various risks to the stability of a healthy environment.

FORTECH'S CRITICAL METAL EXTRACTION PROCESSES

1. COLLECTION & REVERSE LOGISTICS

- Retailers (EPR)
- Municipal Collection
- Fortech B2B Pick-up Services

2. RECEPTION & DISSASSEMBLY

CLASSIFICATION

MANUAL DISSASSEMBLY

3. EXTRACTION TECHNOLOGIES

COMPONENTS

MACHINERY

4. MATERIAL RECOVERY & QUALITY ASSURANCE

RAW MATERIALS

PURITY ANALYSIS

5. REFINERY & REUSE

- Refineries
- Foundries
- Manufacturers

13 CLIMATE ACTION

SIMEC® by FORTECH

PROPIETARY EXTRACTION TECHNOLOGY FOR LI-ION BATTERIES

- 6 years R&D, regional pioneers
- Modular & Scalable
- Recovery of all battery materials (>98% rate)
- By extracting metals from 1,000 tons of batteries using Fortech's process instead of mining:

💧 We save over **1.5 million cubic meters of water** — the equivalent of **625 Olympic swimming pools** or the **annual water use of more than 14,000 families.**

🌍 We avoid **5000 metric tons of CO_2 emissions** — the same as taking **over 1,000 combustion engine cars off the road for a year**, or planting **over 220,000 trees.**

17 PARTNERSHIPS FOR THE GOALS

KEY AREAS OF COLLABORATION

No single stakeholder can build a circular economy alone.
Public, private, and academic sectors must work together to ensure safety, transparency, and sustainability.

¿WHAT?	¿WHY?	¿HOW?	
Devolution & Reverse Logistics	Give consumers a clear & easy way to return unused or damaged products	Linking collection centers with Recyclers	Creation of devolution and reverse logistics programs
Awareness Campaigns	Promote the importance of recycling & where to dispose e-waste	Marketing of key messages	Website with initiatives & Map of collection points
Academy-Industry Link	Creation of capabilities & green job opportunities	Link academy with industry needs	Develop academic programs
Circular Economy Solutions	Reduced mining, resource exploitation & waste generation	Safe & eco-friendly extraction processes	Financing mechanisms for SME to acquire technologies
Traceability & Statistics	Understand current efforts & establish realistic objectives	Development of cloud-based data software	Measuring & Evaluation of KPIs
Legal Framework	Promote & Incentivize Circular Economy	Collection & recycling goals for products put in the market (EPR)	Incentives for those who comply with goals

FORTECH

Public private partnership

"Enabling a circular solution for Lithium-ion batteries in Mexico"

1. Implementation of international best practices in sustainable battery treatment and recycling

2. Establishment of a reverse logistics value chain

3. Applied second-life research for electric vehicle batteries

4. Regulatory framework and institutional alignment

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Funding programme

Partners in Transformation
develoPPP

Implementado por

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

En cooperación con

FORTECH Circular

ENABLING THE LOOP FOR LATIN AMERICA

New Green Job Opportunities:

- EV Maintenance/Repair Technicians
- E-Waste & Battery Collectors
- E-Waste & Battery Disassembling Technicians
- Combustion to Electric Vehicle Conversion Technicians
- Battery 2nd Life Product remanufacturing Technicians
- Recycling line operators
- Material Analysis & Certification Chemists
- R+D Innovation Chemists & Engineers
- International Logistics Experts

8 DECENT WORK AND ECONOMIC GROWTH

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

FORTECH

Contact

CEO

Guillermo Pereira – gpereira@fortech.cr

Project Director

Francisco Pereira – fpereira@fortech.cr

More Information

GIZ Project

About Fortech

ISO 9001 2015 – Quality (QMS)

ISO 14001 2015 – Environmental Management

ISO 17025 2017 – Lab Accreditation

ISO 45001 2018 – Health & Safety

www.fortech.cr
www.fortechcircular.com

Headquarters
Parque Industrial Zeta,
Building # 29 Cartago - Costa Rica

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Sustainable Technology Solution for Lithium-Ion Battery Recycling in South Africa

Ms. Lesego Bianca Siwela,
Lead Project Engineer, Cwenga Lib

Battery Recycling

Cobalt

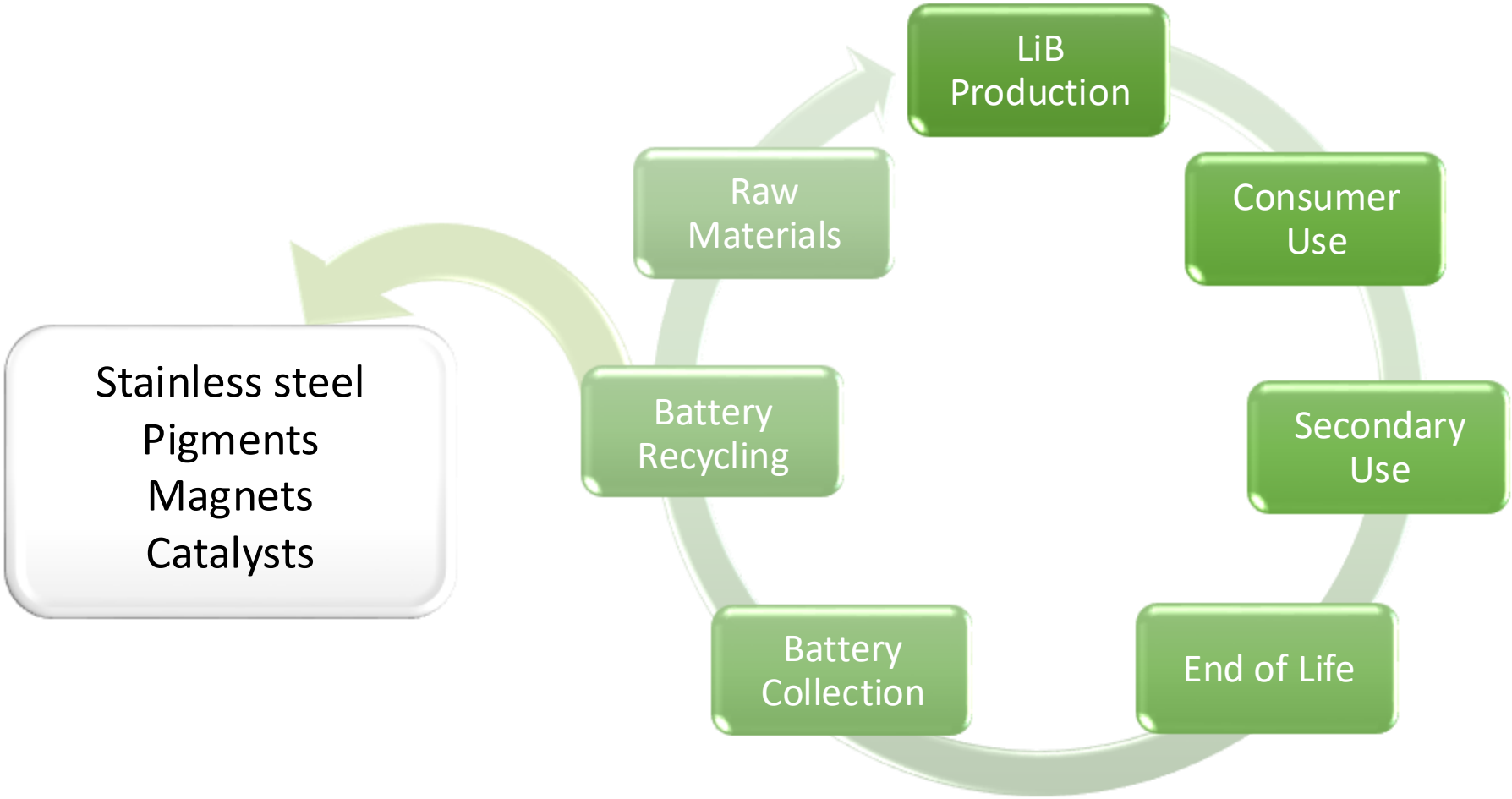
Nickel

Manganese

Lithium

Cwenga Lib
BATTERY RECYCLING

Circular Economy



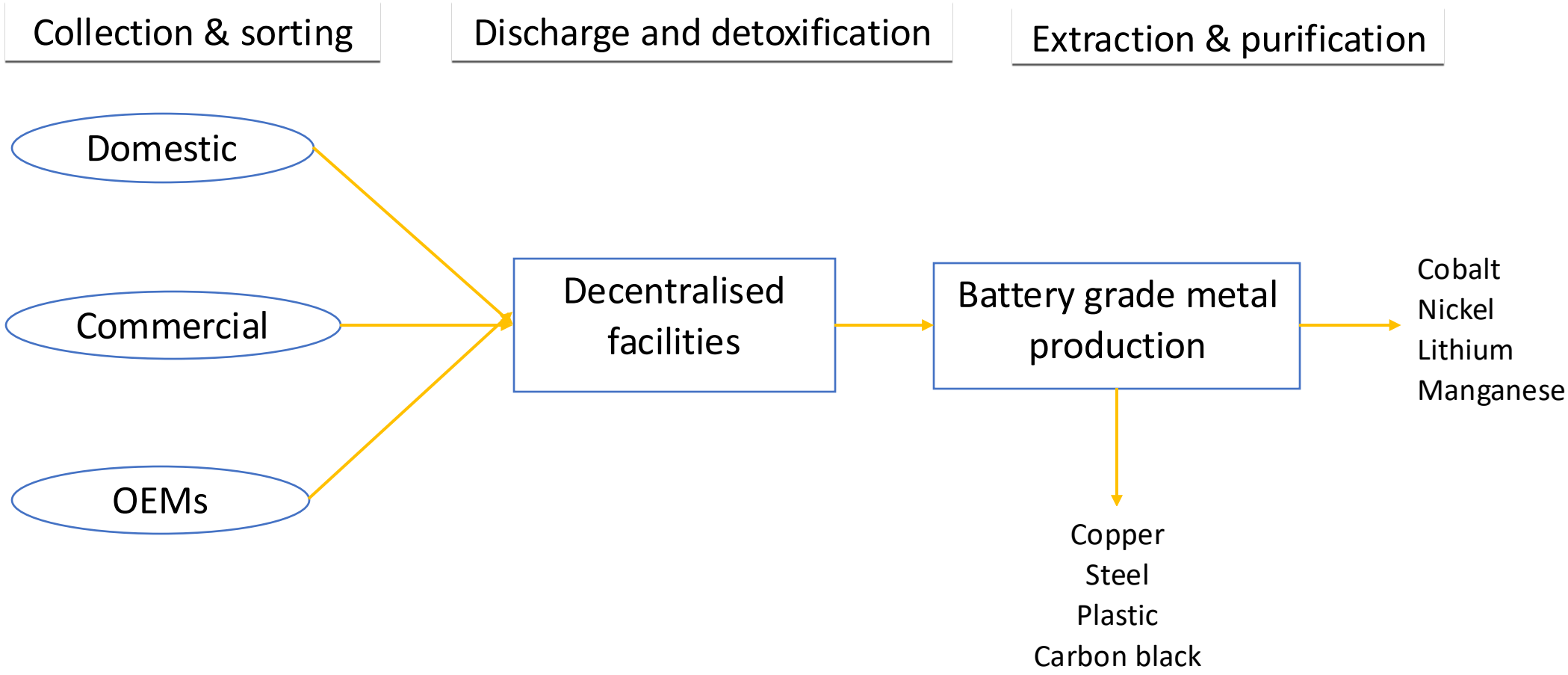
Cwenga Lib
BATTERY RECYCLING

Sustainable

- The components of the cathode are separated
- Cobalt can be converted into a pigment used in pottery, helping local industry
- The reagents used are recycled

Cwenga Lib
BATTERY RECYCLING

Modular Model



Cwenga Lib
BATTERY RECYCLING

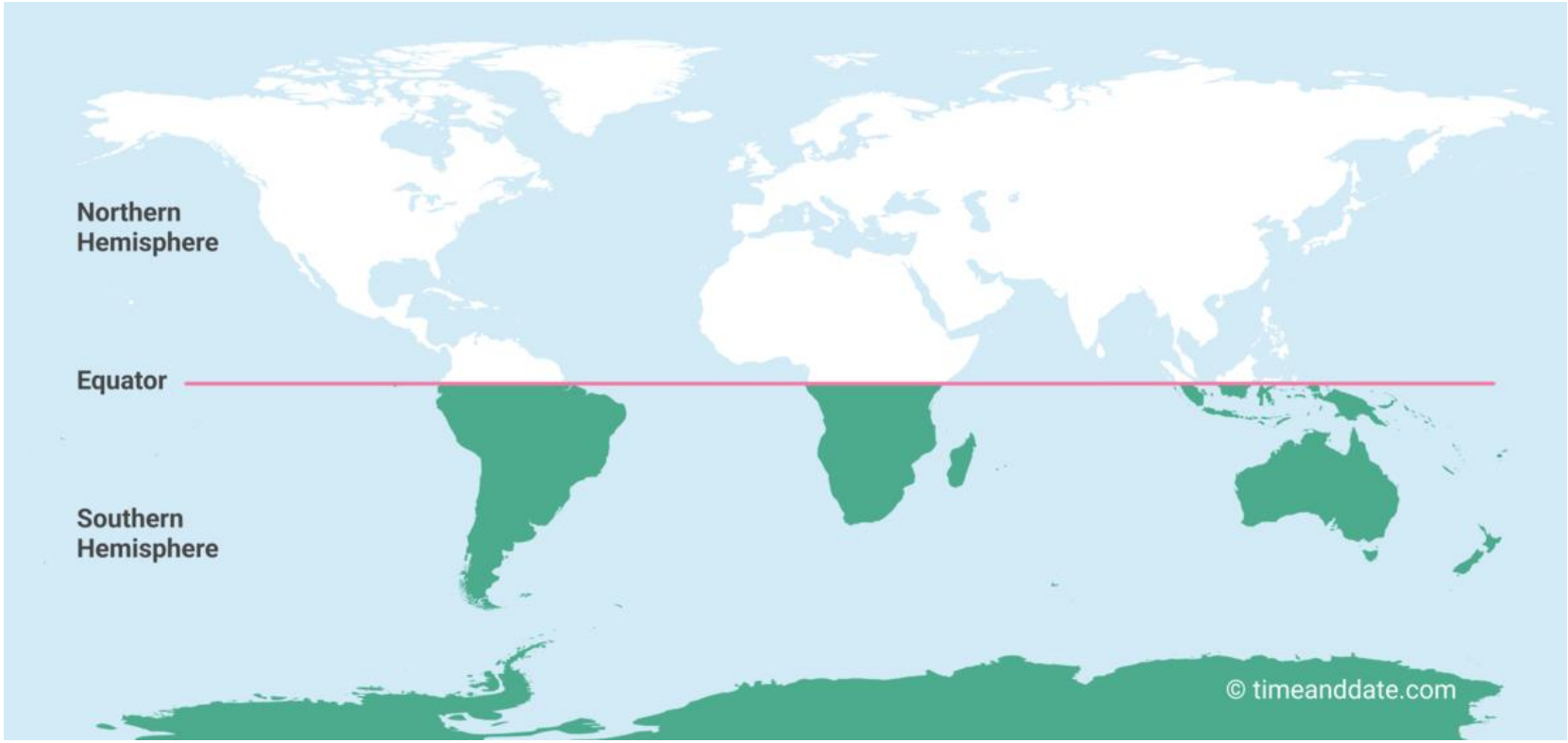
Zero liquid effluent discharge

- Food grade chemical only are used
- Operates at ambient temperatures – low hazard
- Products from the plant are solids and can be sold

Cwenga Lib
BATTERY RECYCLING

Global

- The required reagents are easily available from multiple sources



Cwenga Lib
BATTERY RECYCLING

Small Scale

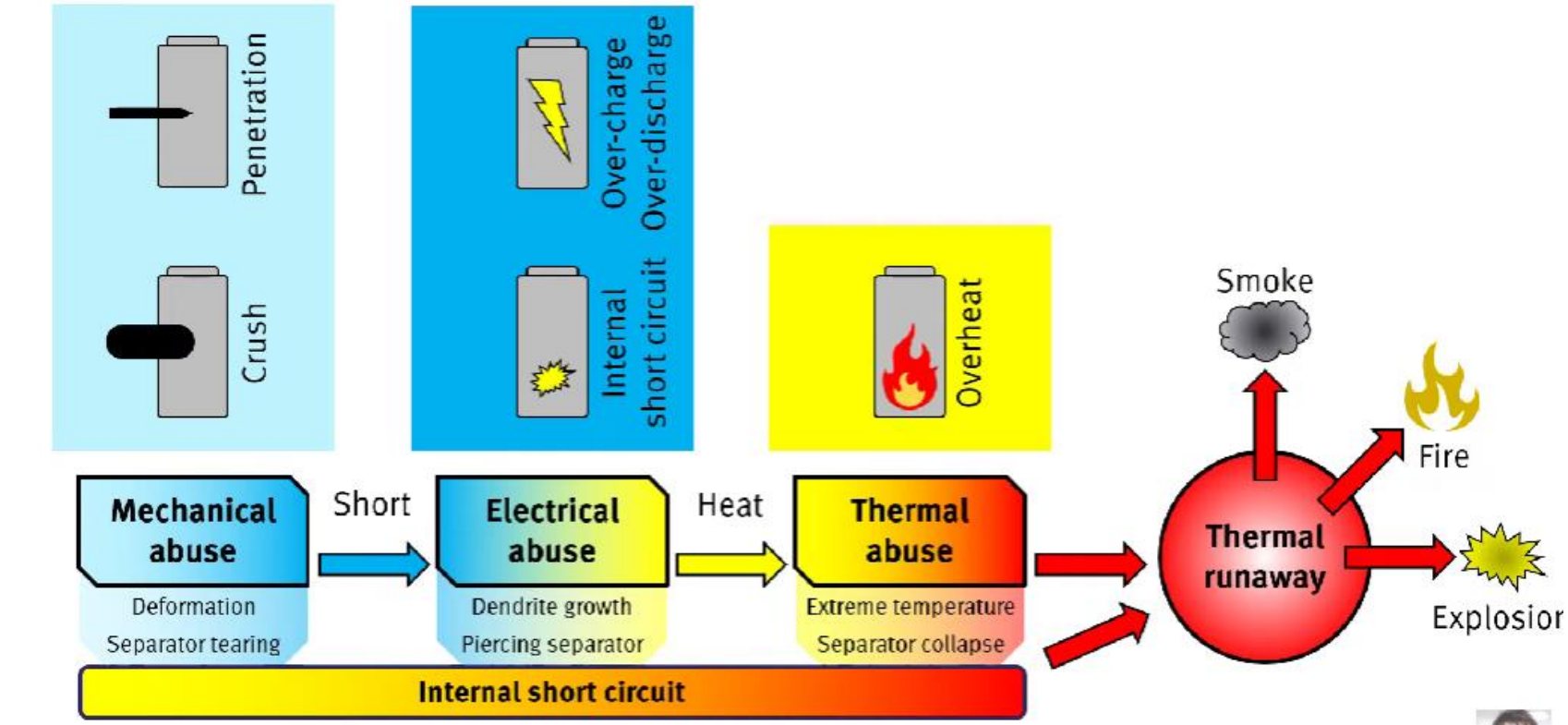
- Containerised plants
- Plants can be placed in various areas
  - Reducing the need for transport and storage
- The cost of setting up recycling plants is low

Cwenga Lib
BATTERY RECYCLING

Battery Collection and Storage

Cwenga Lib
BATTERY RECYCLING

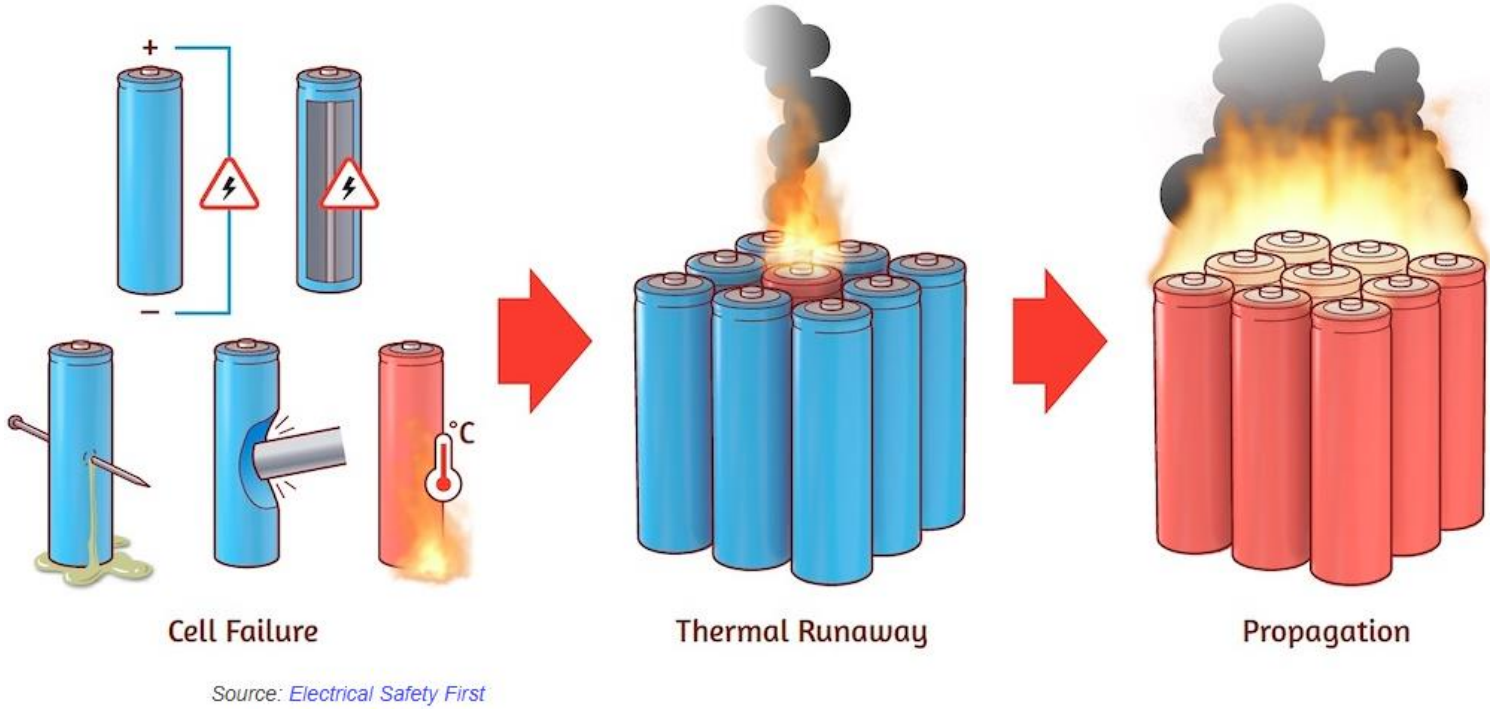
Risk of improperly stored batteries



Cwenga Lib
BATTERY RECYCLING

Hazards

- Batteries might not be fully discharged at collection
  - Can result in short circuit which can increase battery temperature and lead to fire
- Physical damage:
  - Puncturing, dropping and crushing
- External heat sources
- Chain reaction can occur



Source: Electrical Safety First

Cwenga Lib
BATTERY RECYCLING

Hazards

- Electrolyte: lithium hexafluorophosphate electrolyte
- May leak, resulting in production of hydrofluoric acid

- Reaction of LiPF6 with water:

$$LiPF_6 + H_2O \rightarrow 2HF + LiF + POF_3$$

- Reaction of HF with CaCl2:

$$2HF + CaCl_2 \rightarrow CaF_2 + 2HCl$$

Cwenga Lib
BATTERY RECYCLING

Safe

- Chemicals used are ‘food grade’,
  - so essentially non-hazardous.
- Toxic components of the batteries are converted to inert and valuable components
- Fire hazards are controlled by discharge in a heat-sink solution

Cwenga Lib
BATTERY RECYCLING

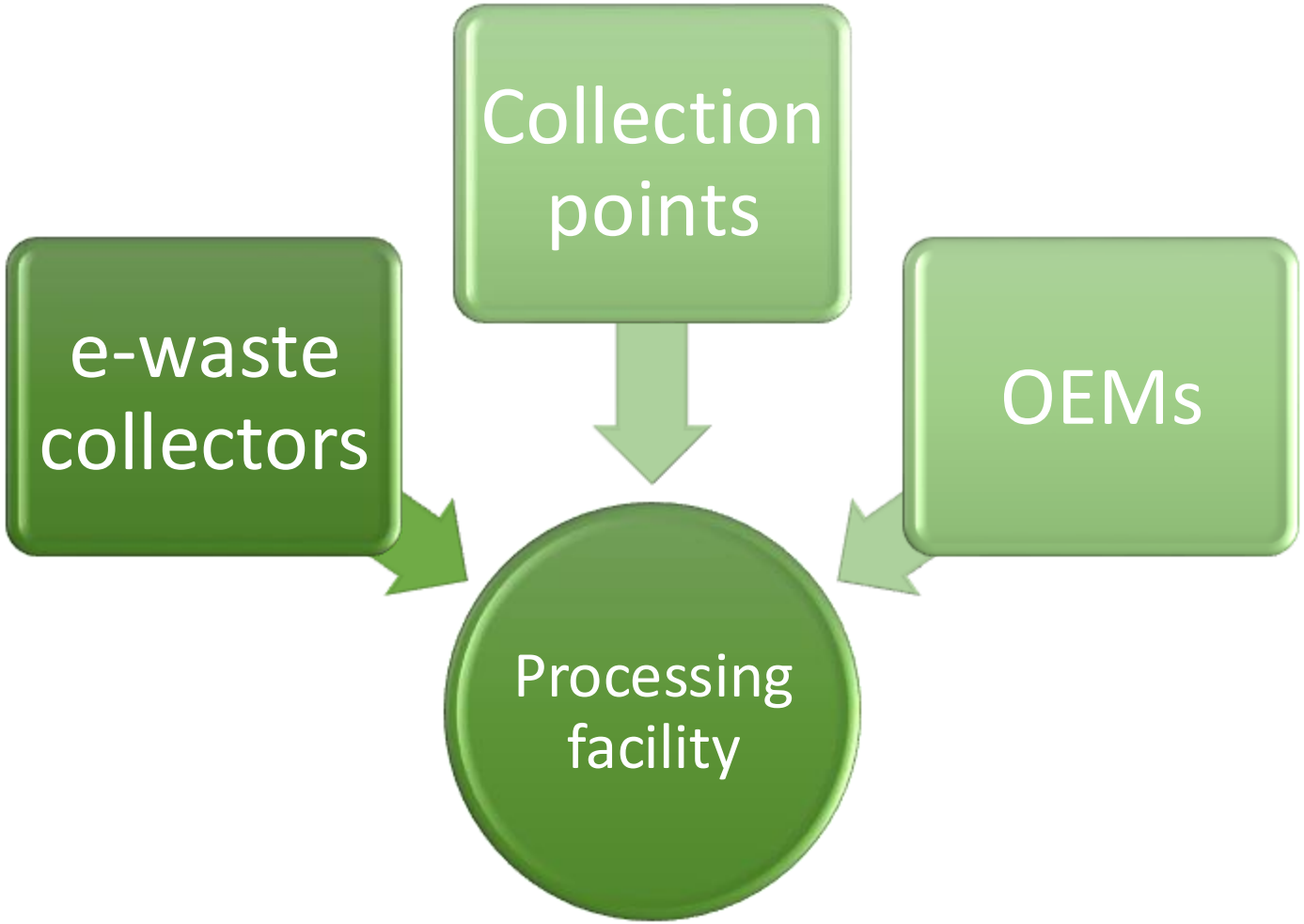
Collection

Many batteries are being stored in households, and some in landfills present a possible fire and toxicity hazard

Collection agents and OEMs can collect and deliver the used batteries to a Storage Facility

Cwenga Lib
BATTERY RECYCLING

Central processing facilities



Cwenga Lib
BATTERY RECYCLING

Storage

- Clearly labelled storage bins
- Storage solution to discharge the batteries slowly, to detoxify the electrolyte, and provide a heat sink
- Bins are half full, transported to Cwenga Lib's facility
- Partnerships with producers (Motor vehicles, cell phones, storage batteries) and e-waste collectors to treat their spent batteries

Cwenga Lib
BATTERY RECYCLING

Training

Collection agents to be trained in identifying different types

- Lithium-Ion Batteries
- Nickel Metal Hydride
- Nickel Cadmium Batteries
- Alkaline (non-rechargeable)

Safe storage and transport to recycling facility

Hazards of not properly storing the batteries

Cwenga Lib
BATTERY RECYCLING

Ongoing developments

- Plant commissioned and operating in Gauteng
  - Capacity of 500 kg/day
- Expansion
  - Placement of other modular plants at collection hubs and end users

Cwenga Lib
BATTERY RECYCLING

The Future

- Expand to serve regionally
  - Setting up recycling plants in other neighbouring countries
  - Expanding the sizing of the plant to meet the collection rate
- Continual storage protocol implementation

Cwenga Lib
BATTERY RECYCLING

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www.batteryrecycling.co.za

Follow our page for more updates

Cwenga Lib
BATTERY RECYCLING

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INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Q & A Session

Further Information

- **A2D Facility Website:** Visit the website here
- **A2D Facility LinkedIn Account:** Follow the LinkedIn page here
- **A2D Facility Mailing List:** Join the mailing list here
- **A2D Facility Year 1 Annual Report:** Access the Annual Report here
- **A2D Facility Market Assessments:** Access the reports here

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INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Accelerate-to-Demonstrate (A2D) Facility Annual Event

Thematic Session 1.1 - Smart Energy in Action: Demonstrating Pilot Innovations and Pathways to Scale

Tuesday, May 20th, 11:00pm – 12:30pm (EAT)

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Agenda

Introduction by Moderator

- Ms. Yi Zhang, Project Coordinator – Smart Energy and Industrial Decarbonization, A2D Facility, UNIDO

Keynote Speaker

- Mr. Will Farmer, Economic Advisor, Department for Energy Security and Net Zero, UK Government

A2D Facility Smart Energy Market Assessment Presentation

- Ms. Yi Zhang, Project Coordinator – Smart Energy and Industrial Decarbonization, A2D Facility, UNIDO

A2D Facility Smart Energy Demonstration Projects Presentations

Grid Resilience through Intelligent Photovoltaic and Storage in Nepal

- Mr. James Hancock, Head of Innovation and Business Development, Swanbarton Limited
- Ms. Moon Pradhan, Communications Specialist, Practical Action Nepal

Smart Grid Scale-Up in Nigeria (Ubuntu Energy)

- Mr. Nwangele Chukwuemeka Godwin, Director, Greenage Technologies

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INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Agenda

Innovate UK Smart Energy Portfolio

- Ms. Clara King, Innovation Lead, Innovate UK

CGI Smart Energy Solutions

- Ms. Mattie Yeta, Chief Sustainability Officer UK and Australia, CGI

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INDUSTRIAL DEVELOPMENT ORGANIZATION

A2D Accelerate to Demonstrate Facility

Partners: UK Government

Thematic Area: Smart Energy

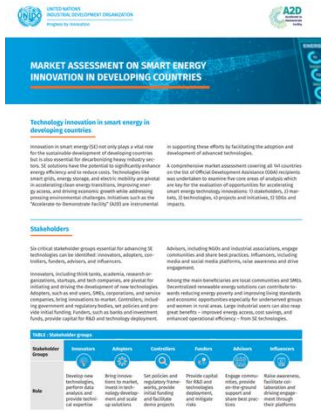
➢ **Challenge:**

- Industries in developing countries, such as manufacturing, power, transport and buildings in developing countries face inefficiencies in energy use and emissions.

➢ **Solution (A2D Facility's focus):**

- Smart energy technologies, including machine learning, blockchain and Artificial Intelligence (AI), can help to optimize and digitalize energy management across sectors, such as transport, industry, power and buildings.

Market Assessment on Accelerating Innovation in Smart Energy



Programme, Projects and Initiatives:

- A2D Facility
- Global Alliance on AI for Industry and Manufacturing
- UNIDO 4IR Strategic Framework to accelerate the attainment of inclusive and sustainable industrial development by 2030

UNIDO's expertise in Smart Energy

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A2D Accelerate to Demonstrate Facility

Partners: UK Government

Keynote Speaker

Mr. Will Farmer, Economic Advisor, Department for Energy Security and Net Zero, UK Government

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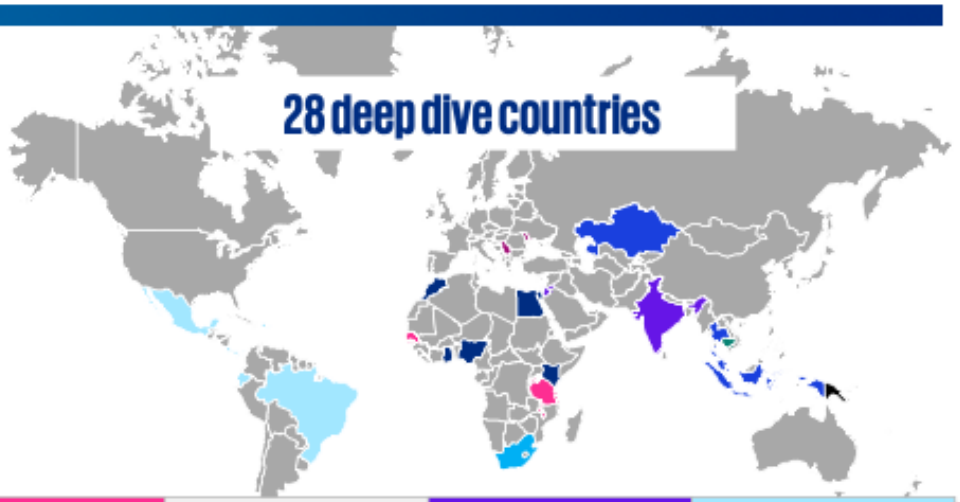
A2D Accelerate to Demonstrate Facility

Partners: UK Government

A2D Facility: Market Assessment on Smart Energy and Industrial Decarbonization



While the assessments provide a global view covering all 141 ODA recipient countries, a representative set of countries has been selected for deep dive analysis. These deep dives look at these countries as suitable environments for advancing and leveraging innovative technology solutions in smart energy and industrial decarbonization, they also provide an overview of existing and planned relevant projects. The selection of deep dive countries involved a nuanced approach based on performance in relevant indicators (including exclusion criteria) as well as regional, sub-regional and income-level representation.

Africa LDC	Africa LMIC	Asia LDC	Asia LMIC	Asia UMIC	Europe UMIC	Americas UMIC	Oceania LMIC
1. Malawi	6. Kenya	13. Cambodia	14. India	16. Kazakhstan	20. Moldova	22. Domin. Republic	28. Papua New Guinea
2. Rwanda	7. Egypt		15. Jordan	17. Indonesia	21. Serbia	23. Costa Rica	
3. Tanzania	8. Morocco			18. Malaysia		24. Mexico	
4. Senegal	9. Ghana			19. Thailand		25. Panama	
5. The Gambia	10. Nigeria					26. Brazil	
	11. Mauritius					27. Ecuador	
	12. South Africa						

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Partners: UK Government

Landscape of stakeholders:

The importance of each stakeholder group varies along the technology innovation development process. This is reflected by the degree of the stakeholder involvement across different TRL stages. Moreover, each stakeholder group is constituted of different sub-groups whose importance differs.

Stakeholder Groups (exemplary representatives)	Innovators	Adopters	Controllers	Funders	Advisors	Influencers
	▪ Think tanks ▪ Academia ▪ Research organizations ▪ Startups ▪ Tech companies ▪ Corporate R&D ▪ Manufact. associations	▪ End users ▪ SME users ▪ Large Users ▪ Service companies ▪ Product manufacturers and retailers ▪ Private sector	▪ Government bodies ▪ Regulatory bodies ▪ Certification bodies ▪ Utilities ▪ Network operators ▪ Local authorities	▪ Banks ▪ Donors ▪ Financial Bodies ▪ Private finance ▪ Investment funds	▪ NGO's ▪ Energy associations and organizations ▪ Industrial associations ▪ Consultants	▪ Media ▪ Social media influencers ▪ Associations ▪ Ministers
Role	Develop new technologies, perform data analysis and provide technical expertise	Bring innovations to market, invest in technology development and scale up solutions	Set policies and regulatory frameworks, provide initial funding and facilitate demo projects	Provide capital for R&D and technologies deployment, and mitigate risks	Engage communities, provide on-the-ground support and share best practices	Raise awareness, facilitate collaboration and driving engagement through their platforms

Level of Involvement for each TRL Group — Low / Limited / High

At **TRL 3-4, innovators and advisors** are highly engaged in developing and refining the technology, while **funders** provide the required initial financial support (the majority of the interviewed experts stated that tech companies and corporate R&D play a pivotal role, and still 30% state that that start-ups are critical stakeholders at this stage).

As the technology progresses to **TRL 5-6, adopters and controllers** become more involved, with increased funding and advisory support (based on 80% of the interviewees). By **TRL 7**, all stakeholders, including adopters and influencers, are significantly engaged, adopters integrate the technology into operations, controllers ensure compliance, and **funders provide substantial investments for large-scale demonstrations** (30% of interviewees emphasized the importance of developing banks and bilateral donors' funding).

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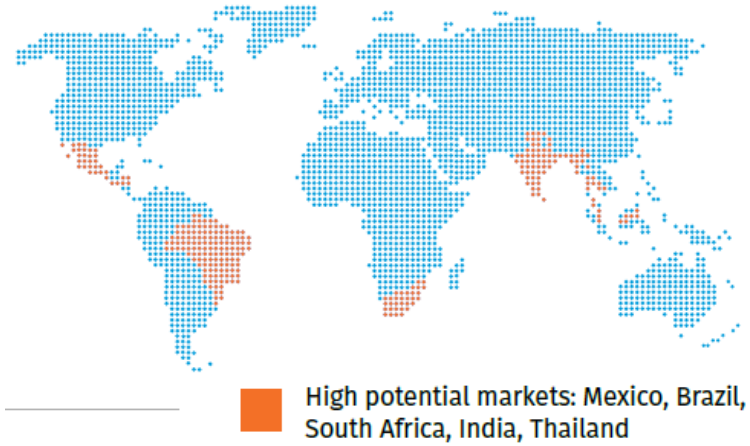
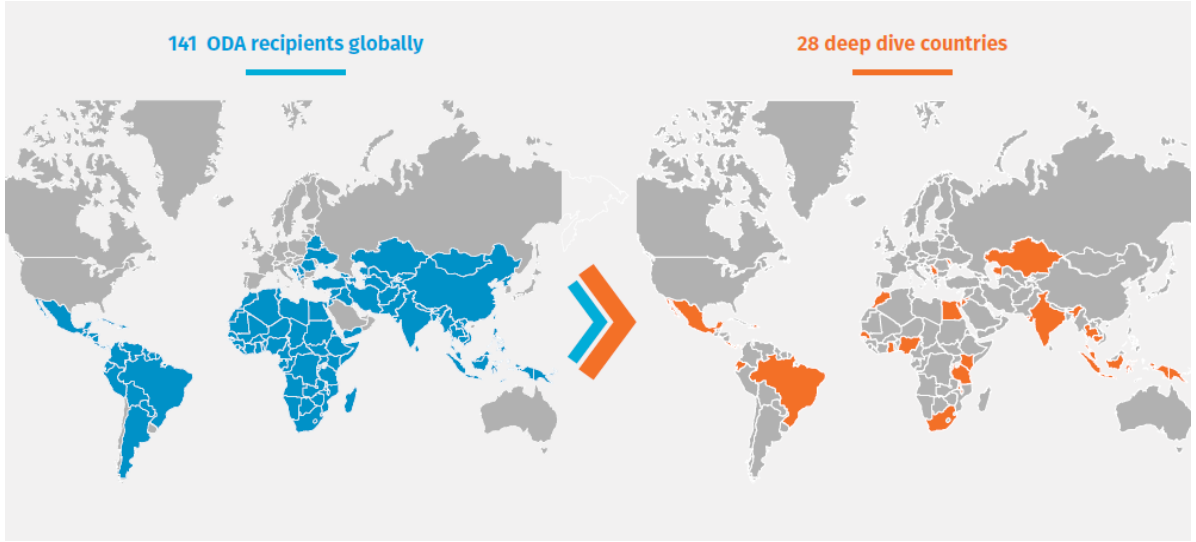
Landscape of innovators:

Smart Energy and Industrial Decarbonization:
High-potential markets include India, Brazil, Thailand, South Africa, and Mexico, as they provide strong enabling environments and policy frameworks which advance the continued reduction in the costs of renewable energy technologies, making them more accessible.



Source: UNIDO A2D Facility Market assessment on smart energy and industrial decarbonization innovation in developing countries, November 2024



Source: UNIDO A2D Facility Market assessment on smart energy and industrial decarbonization innovation in developing countries, November 2024

Adoption of innovative technologies in both smart energy and industrial decarbonization fall into four main categories:
1) political and legal,
2) economic,
3) technological and environmental,
and 4) social.

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Summary of key findings – smart energy

Across developing countries, a **wealth of national regulations and policies on sustainability, energy, and climate plans can be found, especially in Africa and Asia**. The **forerunners in Africa include Nigeria, Egypt, and Ghana**, while **India and Thailand are among the leaders in Asia**. These **policies do not necessarily strictly address *technology innovation* in smart energy**, yet they cover relevant **issues related to smart energy** including the development and **promotion of smart grids, advanced metering infrastructure (AMI), energy storage solutions, renewable energy integration, electric vehicle (EV) infrastructure, and demand response systems**.

Key issues related to technology innovation in smart energy covered by policies and regulatory frameworks across developing countries

Least-developed countries (LDCs):

- Technologies such as **mini and micro hydro systems, solar photovoltaics**, and **smart metering** are recognized as enhancing energy access and efficiency.
- Policies promote **feed-in tariffs** and **energy management systems (EMS)** and support relevant **research and public education initiatives**, with the aim of **diversifying energy supply**, improving efficiency, and **promoting sustainable development**.

Lower middle-income countries (LMIC):

- Policies address the integration of **renewable energy sources and smart grids**, by using **innovative energy storage solutions** to create resilient energy systems.
- Moreover, there a focus on implementing **advanced metering infrastructure (AMI)**, developing **electric vehicle** charging infrastructure, and **promoting energy efficiency** through **EMS**.

Upper middle-income countries (UMIC):

- A focus lies on **modernizing energy systems** through **smart grids, EMS, large-scale integration of renewables, AI for grid optimization, advanced energy storage systems, AMI, and demand-side management** with the goal of enhancing efficiency, reliability, and sustainability.
- Consumer engagement is also treated as an important element of a comprehensive approach that is driven by global and national sustainability goals.

Most common topics identified globally

Renewable energy integration:
- Focus on **solar, wind and hydro energy**; development of **solar photovoltaic systems and wind turbines**.

Energy efficiency and energy management systems (EMS):
- Promote **energy-efficient devices and technologies**

Smart grids and advanced metering infrastructure (AMI):
- Implement smart grids and advanced metering for **better efficiency and real-time data**.

Energy storage solutions:
- Highlight the role of **lithium-ion batteries and pumped hydro storage, for grid stability**.

Policy and regulatory support:
- Enforce **laws and incentives like tax exemptions**

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Landscape of technologies and initiatives:

The numbers on the map are representative of initiatives (excluding projects and multi-country initiatives) across the 28 deep-dive countries. The numbers for regional groupings include multi-country initiatives as well. The results are based on secondary research using multiple sources including multilateral agency websites, policy databases and general desktop research. This overview is not exhaustive and may not accurately reflect the distribution across regions.

Examples for regional initiatives

Africa

1. Smart energy solutions for Africa: Ghana, Kenya, Malawi, Morocco, Nigeria, Rwanda, South Africa, Tanzania
2. Project development program: Kenya, Nigeria, Ghana, Rwanda
3. Energizing Development: Kenya, Malawi, Rwanda, Senegal, Tanzania

Americas

RELAC Initiative (Renewables in Latin America and Caribbean): Dominican Republic, Ecuador, Costa Rica, Panama

Global

The Cement Breakthrough, launched at COP28, is co-led by Canada and UAE and endorsed by the global cement and concrete association, will benefit developing countries through knowledge and technology sharing for low-carbon cement production

Examples for national initiatives

Americas

SE	ID
Smart grids	Sustainable fuels
Energy storage systems	Circular economy
Integrating renewable energy (RE) sources	

14

Africa and Europe

SE	ID
Smart grids	Sustainable fuels
Energy storage systems	Circular economy
Energy efficiency	Energy efficiency

34

Asia and Oceania

SE	ID
Smart grids	CCUS
Big data	Circular economy
Energy storage systems	Sustainable fuels
Energy efficiency	Energy efficiency

27

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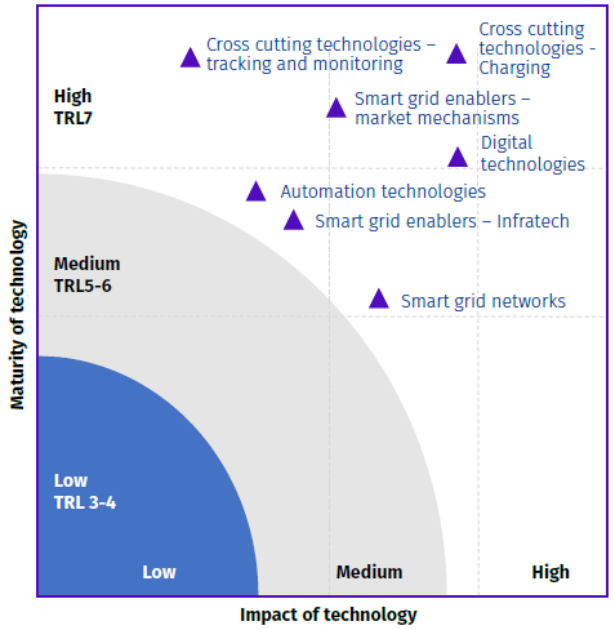
Landscape of technologies and initiatives:

Smart Energy: Approximately 50 relevant smart energy technologies within the Technology Readiness Level (TRL) range 3 to 7 were identified and assessed. Most of these technologies are currently in the post-conception phase, with nearly 50% at the prototype or pilot testing stages.



Source: UNIDO A2D Facility Market assessment on smart energy and industrial decarbonization innovation in developing countries, November 2024

- **Smart Energy and Industrial Decarbonization:** National Initiatives in Americas: 13 identified with RELAC being the most prominent one "REnovables in Latin America and the Caribbean (RELAC)." In Africa and Europe: 32, such as “African Circular Economy Alliance (ACEA)". Asia and Oceania: 27 initiatives identified, such as “Asia-Pacific Economic Cooperation (APEC) Smart Grid Initiative"

- **Smart Energy:** Smart grids Sustainable fuels Energy storage systems Circular economy Integrating renewable energy (RE) sources, Energy efficiency, Big Data

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A2D Facility Smart Energy Demonstration Project

Grid Resilience through Intelligent Photovoltaic and Storage Phase 2 (GRIPS 2) in Nepal

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A2D
Accelerate to Demonstrate Facility

Partners: UK Government

James Hancock, Head of Innovation and Business Development, Swanbarton Limited

Moon Pradhan, Communications Specialist, Practical Action Nepal

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A2D Facility Smart Energy Demonstration Project

Smart Grid Scale-Up in Nigeria (Ubuntu Energy)

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Partners: UK Government

Chukwuemeka Godwin Nwangele,

Director, Greenage Technologies

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Innovate UK
Smart Energy Portfolio

Clara King, Innovation Lead, Innovate UK

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CGI
Smart Energy Solutions

Mattie Yeta, Chief Sustainability Officer UK and Australia, CGI

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Further Information

- **A2D Facility Website:** Visit the website here
- **A2D Facility LinkedIn Account:** Follow the LinkedIn page here
- **A2D Facility Mailing List:** Join the mailing list here
- **A2D Facility Year 1 Annual Report:** Access the Annual Report here
- **A2D Facility Market Assessments:** Access the reports here

Grid Resilience through Intelligent Photovoltaic and Storage Phase 2 (GRIPS 2)

Climate Change is affecting Nepal, the heart of Himalayas

4th
most vulnerable to
Climate Change

11th
most prone to
Earthquakes

30th
most susceptible
Flood Risk

Nepal is exposed to and defenseless against the above risks

This makes access to electricity unreliable....

99.8%
Electricity Depends On Hydro

3-5 hr
Power Cut In A Day For Industries

$3.7B
Worth Fuel Imports

- There is a **discrepancy** between energy supply and demand
- **Overdependence** on hydro affects quality and reliability of energy
- **Climate change** puts energy security at risk

Over $250M lost

every year in diesel expenses

This directly hurts the key businesses and the economy

PV in Nepal

- Solar Deployment on the rise
- Gham Power owns and operates > 10 MW solar across 25 industries
- Significant Impact:
  - Reduced Fossil Fuel Imports
  - Financial Savings

- Minimal GESI considerations
- Minimal Environmental considerations
- No circularity plans

Why Smart Grids Are Needed

PV alone cannot solve our problem. It cannot:

Displace diesel completely

Provide immediate response during outage

Solve power quality related issues

Swanbarton Microgrid Management System (MMS)

Making **Sustainable** Power **Affordable** and **Resilient**

- Power available for critical systems when it is needed
- Energy infrastructure on the site works together
- Cost of power is minimised
- Assets do not become “white elephants”

How do we do this?

Load & generation forecasting

To understand what is going on

Intelligent load shedding

To remove unnecessary loads from the system

Dynamic battery floor technology

To maximise battery use while ensuring a power reserve

Project Background (GRIPS)

Successfully demonstrated a smart microgrid for generator displacement

Prototype system bringing MMS from TRL5-7

- 100 kW / 200 kWh BESS
- 50 kWp PV
- Residential apartment in Kathmandu, Nepal

Funded by
ENERGY CATALYST

Supported by
Innovate UK
Foreign, Commonwealth & Development Office

Project Overview (GRIPS 2)

Demonstration of industrial scale smart grid technology for generator displacement

Industrial scale-up of GRIPS

- 2 MW / 4 MWh BESS
- 1 MWp PV
- Laxmi Steel Factory, Sunwal, Nepal

Beneficiary

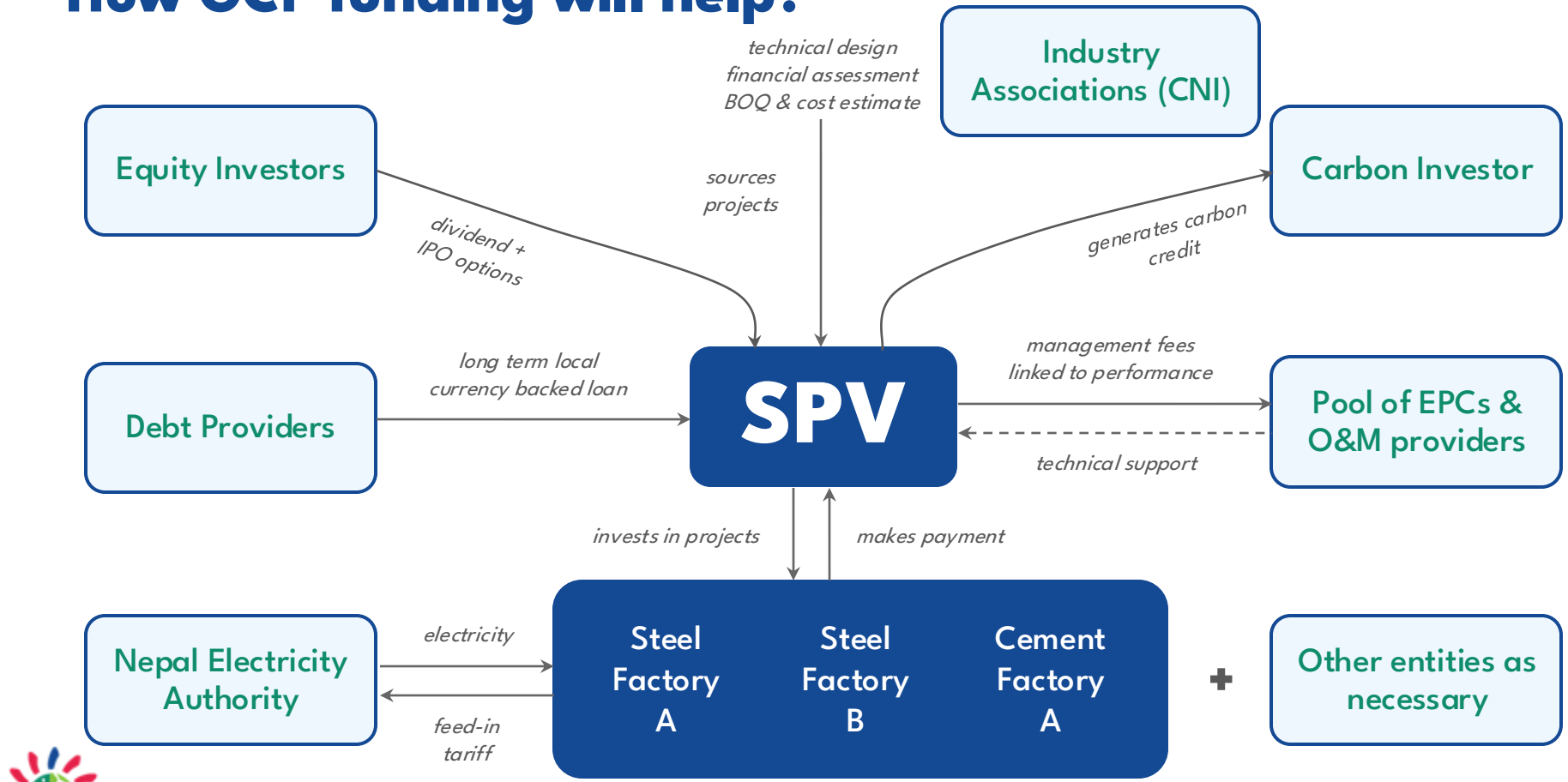
Steel Industry: Laxmi Steels

1,000 kl
Diesel Displaced

2,800
Tonnes
Carbon Curbed

$1.3 million
Financial Savings

How GCF funding will help?



ESS/GESI

Work with the private sector to develop and implement:

- **GESI action plan**
- **ESS action plan**

Steering committees:

- Diverse stakeholder group:
  - Local government, diverse industry partners, NGOs, etc.
- Highlight benefits of change
- Deliver transformational change

Project Overview (GRIPS 2)

01 Demonstrating industrial generator displacement

02 Reduce industrial emissions

03 Broad adoption of smart grid technology in the industrial sector

04 GESI & ESS inclusive business models

05 Adoption beyond Nepal, targeting South and Southeast Asia

GRIPS
Grid Resilience through Intelligent Photovoltaic Storage

Any Questions?

Here's to contributing to the bright future of Nepal with reliable electricity!

Pilot Demonstration Project under UNIDO's Accelerate-to-Demonstrate (A2D) Facility

Smart Energy

Ubuntu Energy

GREENAGE TECHNOLOGIES

UNIDO

Stakeholder map

Team

Project lead
Greenage Technologies

GIS data and analytics
Nithio

Solution user
PEIWA/Government

Energy developer
Eauxwell

Government
IUK/REA/Enugu State

Data/Analytics
Oxford University/
SolarGIS

Africa’s Energy Paradox

Solar power is wasted while
600 million Africans
lack electricity access in a
deplorable grid setup

GW

Of underutilized solar power

$B

Spent on diesel annually

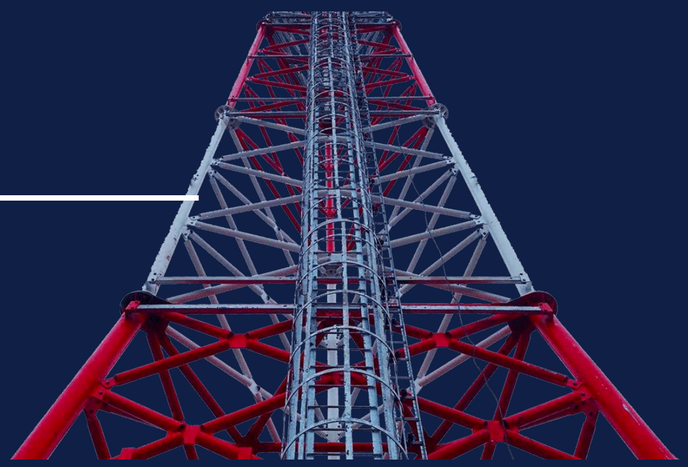
$MTCO_2$

In avoidable annual emissions

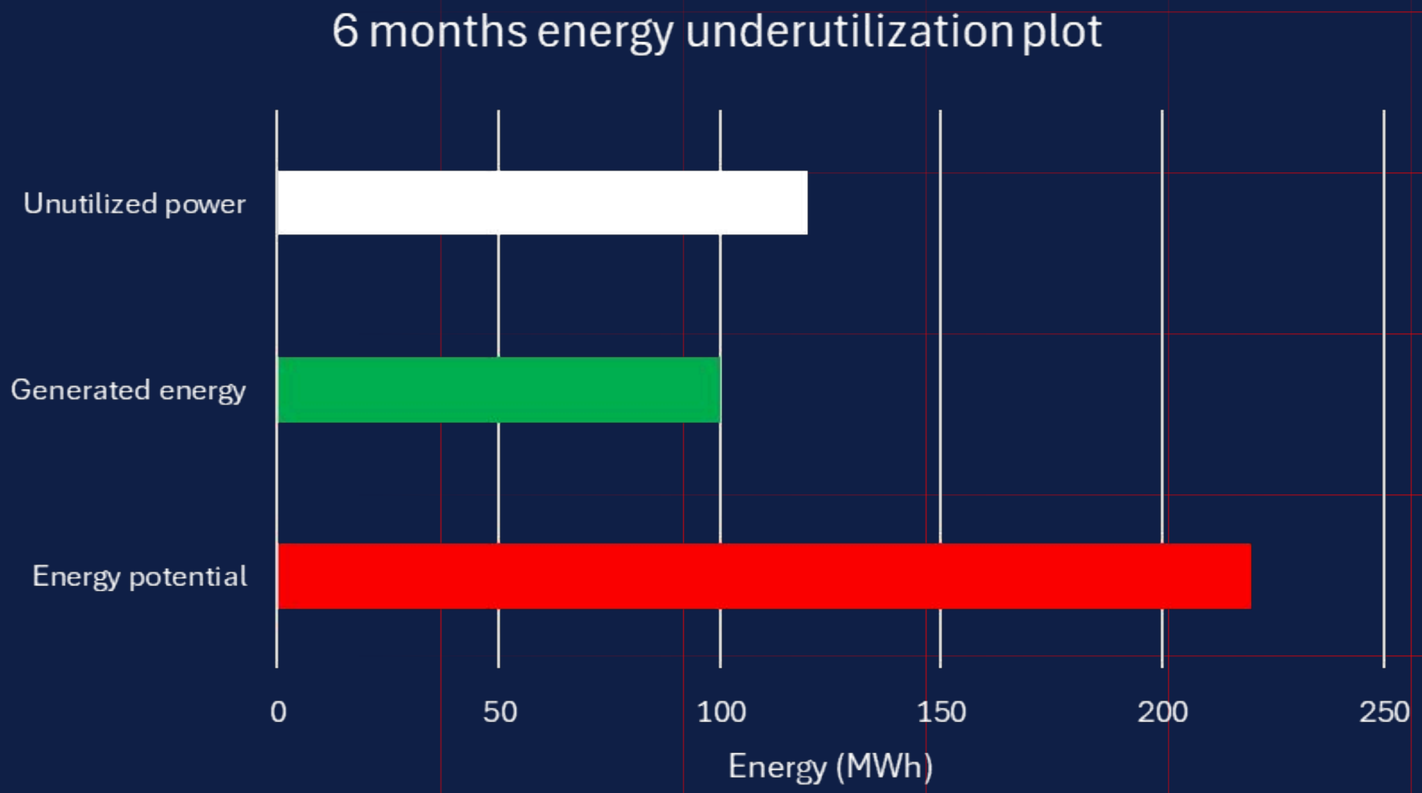
- There is no grid for power flow
- No existing trading framework and software
- Lack of automation for distribution of power

Africa’s Energy Paradox

University faculty
140 kWp solar PV system



Nearby telecommunication tower
< 5 kW power consumption



GWh

Of underutilized solar power

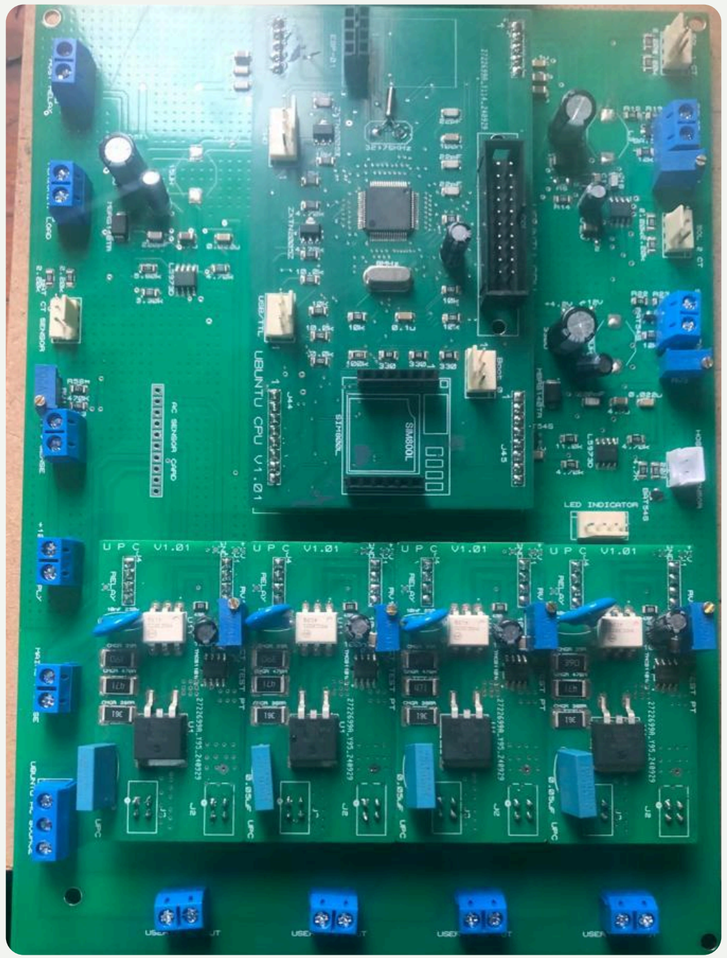
$B

Spent on diesel annually

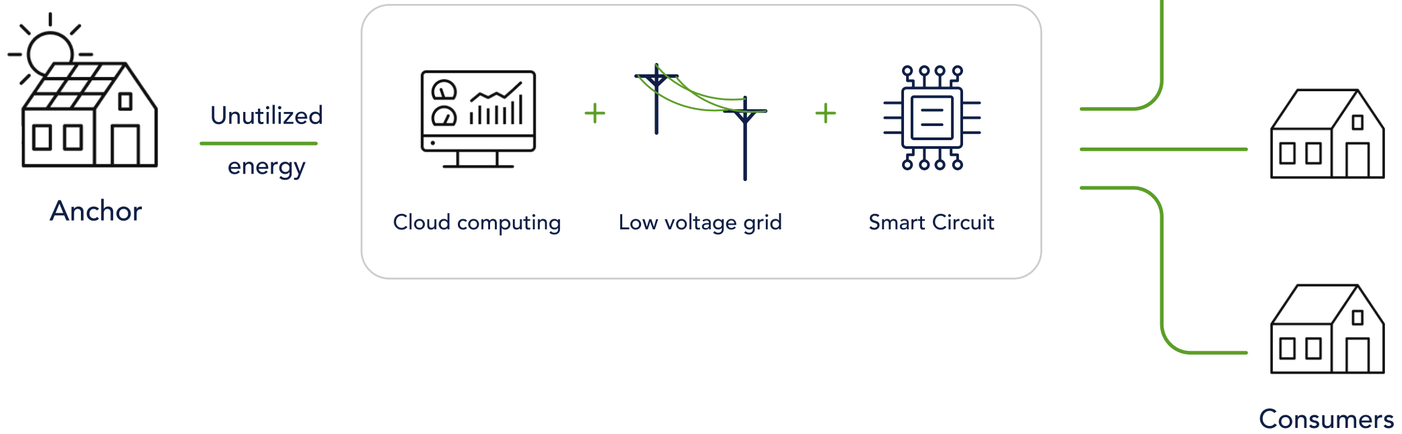
Downtime of telecommunication towers

Solution

Automated power distribution/sharing with P2P trading



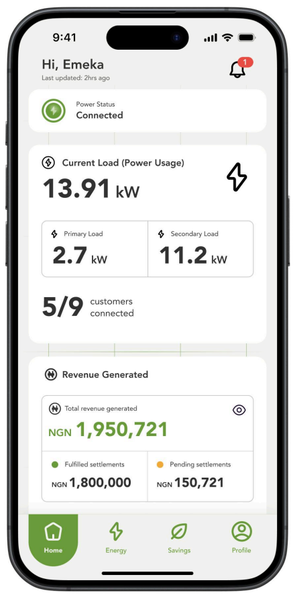
Semi-conductor smart circuit



- Novel patent on power distribution technology
- Identifies excess capacity and consumer demand
- Redistributes excess energy from one anchor site to 5-20 community consumers
- Enables energy trading software for easy access and cost savings
- ML and optimization/DSR

Solution Optimize energy use data, equipment usage, energy use time, socio-economic data, solar equipment data

Anchor
Mobile App

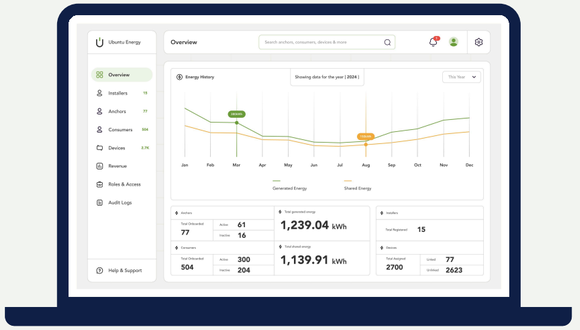


Sells energy and earns revenue

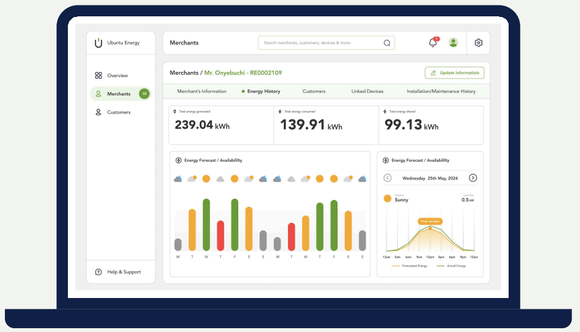
Consumer
Mobile App

Buys clean energy cheaper than diesel

UE
Web App



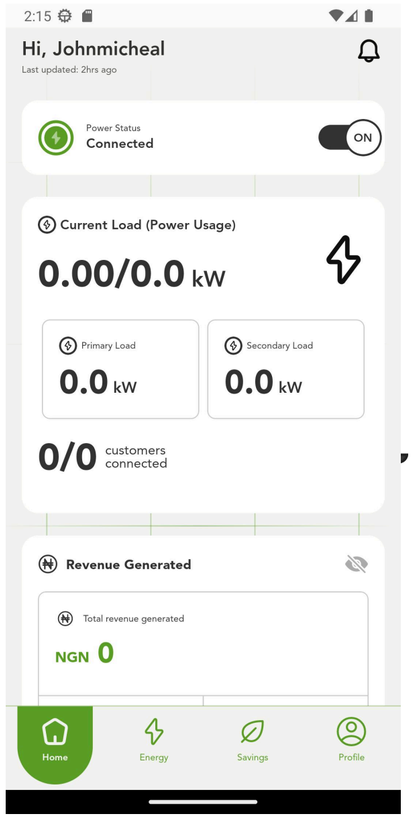
Installer
Web App

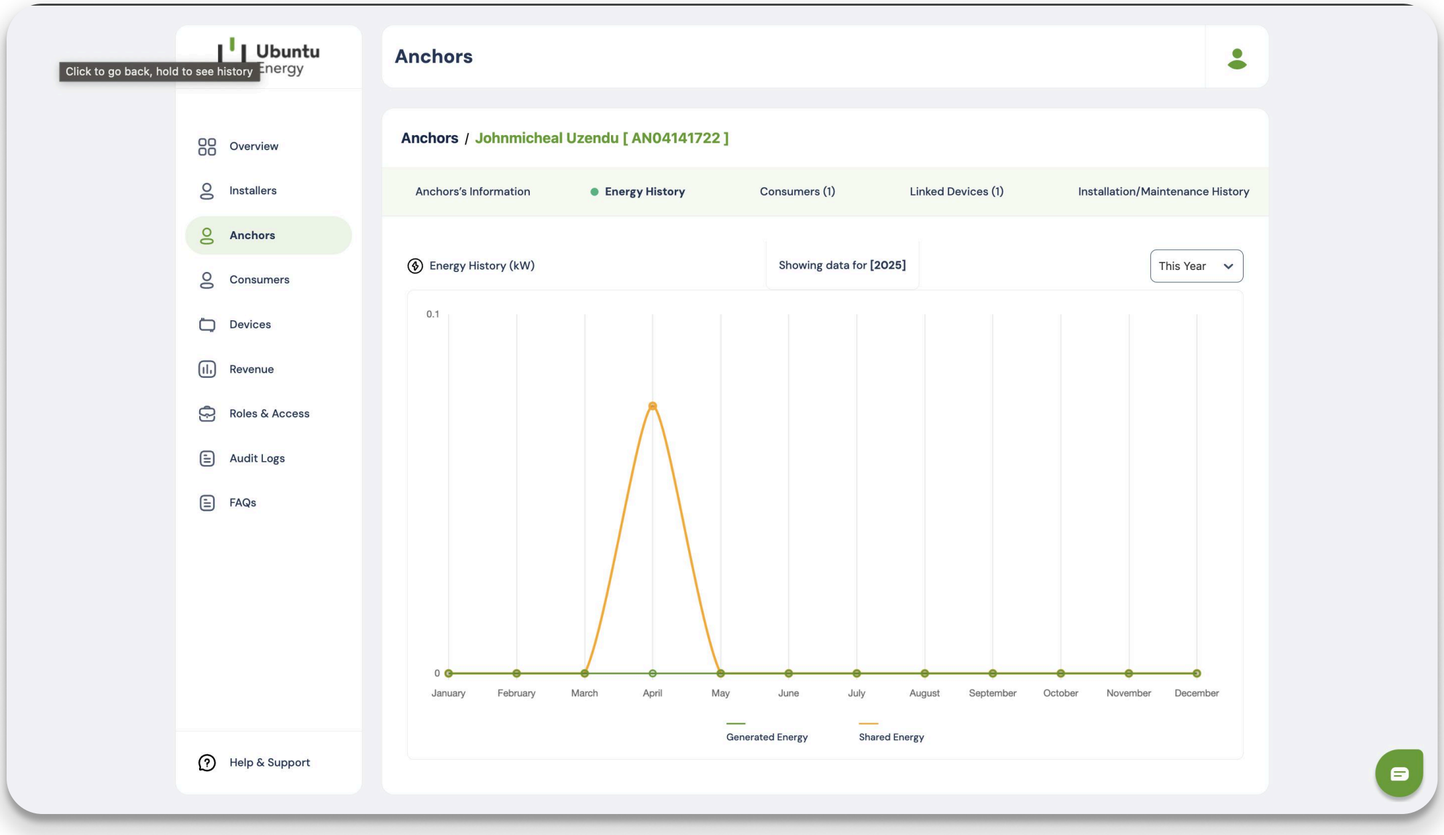


Remotely monitor and predict energy usage

Integration

System integration

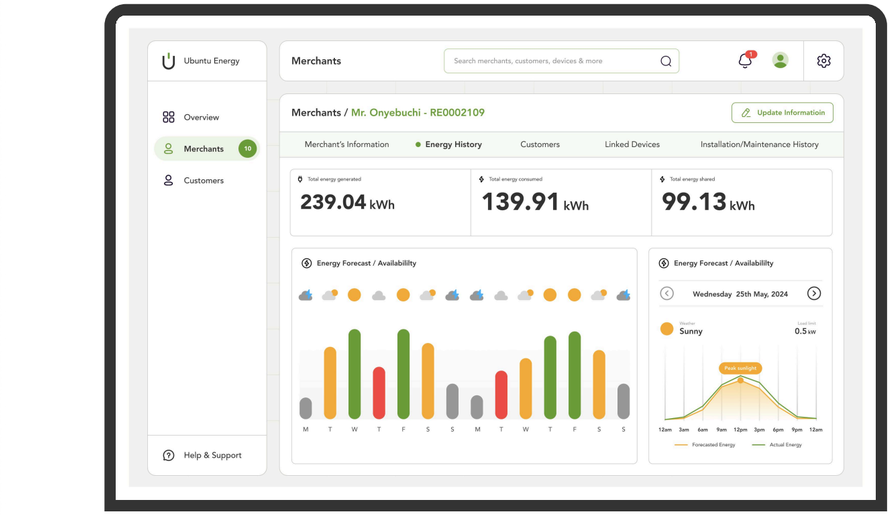




- Real time tracking of energy data from hardware
- Readability of information between hardware and software
- Remote control of hardware from software

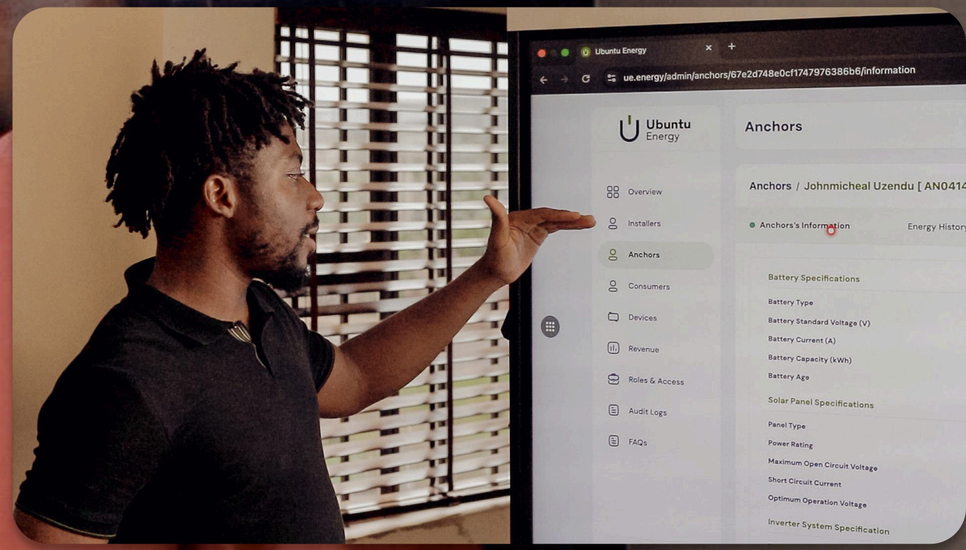
Rollout

UE
Site deployment



- Started rolling out to sites
- First system successfully installed
- System to be commissioned soon
- Further sites to follow

System integration photos



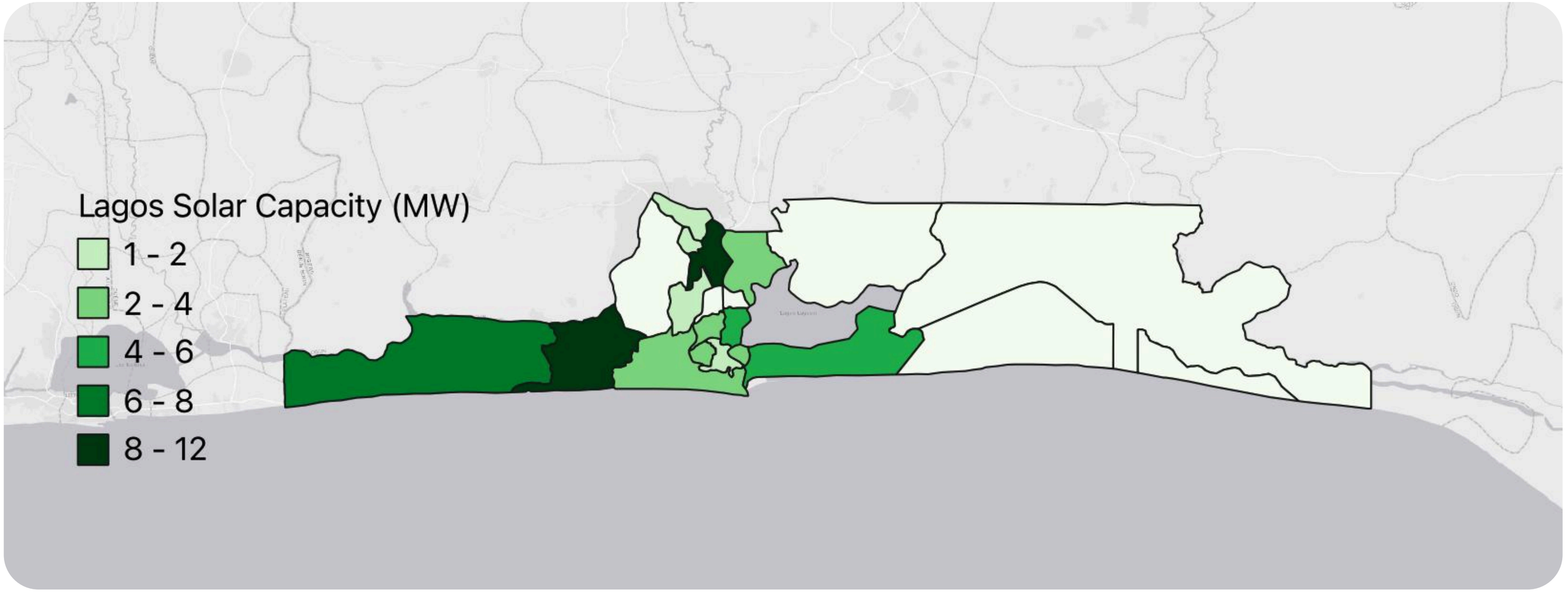
Grid planning

Distribution of solar panels

Over 200,000 PV panels installed

Grid planning

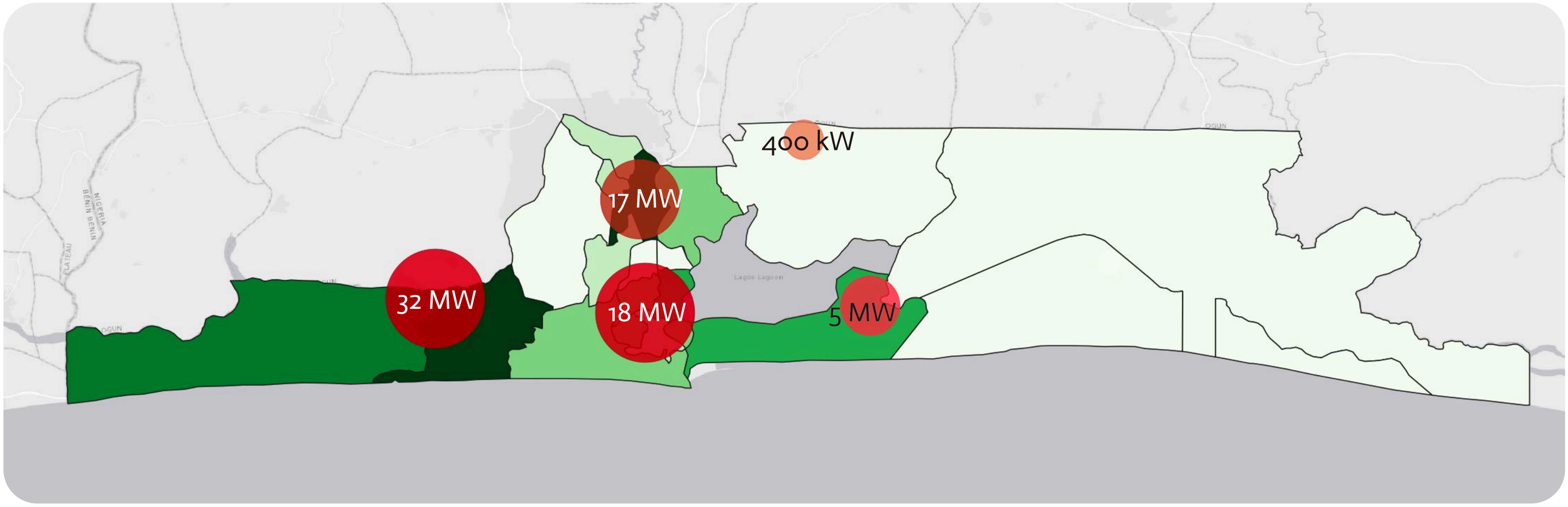
Current solar installation capacity



Estimated 71 MW of solar potential currently in Lagos

Grid planning

Hotspots of PV potential



Community Engagement and Scaling Plan

Training

Train energy developers on new technologies and its benefits.

Conferences

Organize conferences with national and international participants to share insights

Workshops

Organize workshops in communities teaching new energy technologies

Inclusion

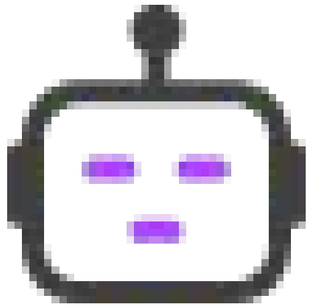
Target unserved and under-served areas including women and small businesses

Opportunities/Next steps to curb inefficiency

- Scale to 2000 site
- Scale adoption
- Commercialize

- Use GIS to identify all sites
- Target solution
- Develop national framework

- Predict solar generation



- Predict energy demand
- Match supply and demand
- Demand side response
- Energy analytics
- Advanced metering
- Infrastructure planning

Ubuntu Energy

Thank You!

GREENAGE TECHNOLOGIES

UNIDO

Welcome to Innovate UK

The UK’s innovation agency

Clara King – Innovation Lead

UKRI Innovate UK

Innovate UK is the UK's innovation agency

As part of UK Research and Innovation (UKRI), **Innovate UK** is publicly funded to drive innovation and productivity across the UK.

It works to create a better future by inspiring, involving and investing in businesses that are developing life-changing innovations.

UKRI Innovate UK

Our domains

Three pivotal domains to support innovation across critical sectors

Innovate UK

We support businesses at all stages

From spin-outs and start-ups to growth and scale

Spin-Out

Support to **commercialise innovations**, patents or technologies being developed and to leverage intellectual property. **Making connections** with research expertise to bring **groundbreaking innovations** to market.

Start-Up

Support to mitigate risk, **validate business models**, secure **initial funding** and gain early customer traction. **Encouraging innovation** and iteration to help startups achieve **product-market fit**.

Growth

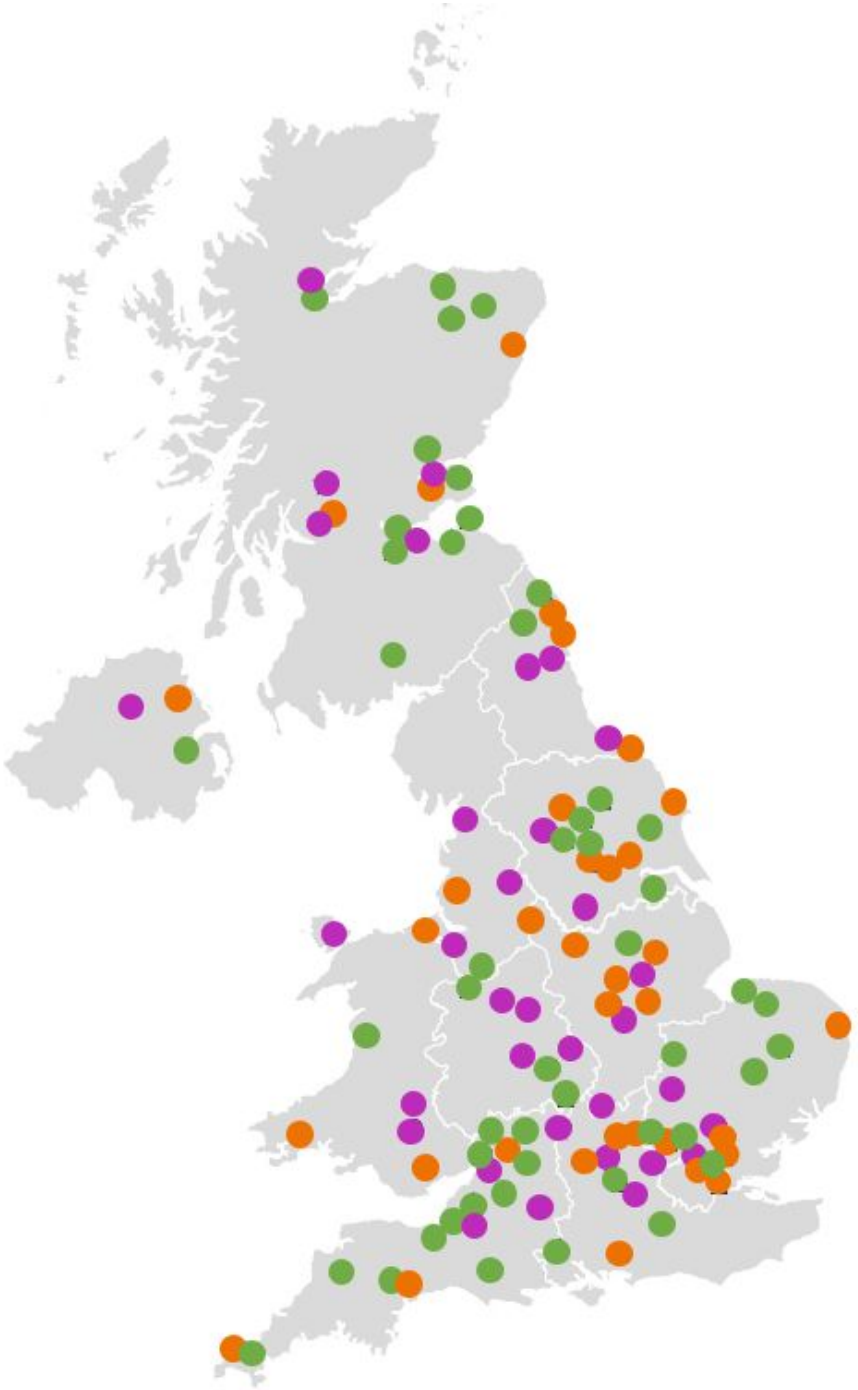
Expert advice to **improve market presence**, innovate product offerings, enter new markets and **enhance competitive positioning**. Support with innovative and **sustainable expansion**, productivity and customer satisfaction.

Scale

Advice to **increase productivity** and expand customer base by connecting to **sector expertise** and proven business models. Support for innovators on funding, **enhancing infrastructure** and **optimising processes** for growth.

UKRI Innovate UK

Innovate UK footprint



From funding and advisory services to facility and technology access, Innovate UK and our partners offer innovation support to businesses everywhere in the UK.

The geographical distribution of our staff and facilities ensures we engage place-based stakeholders and meet the needs of the regions and nations of the UK.

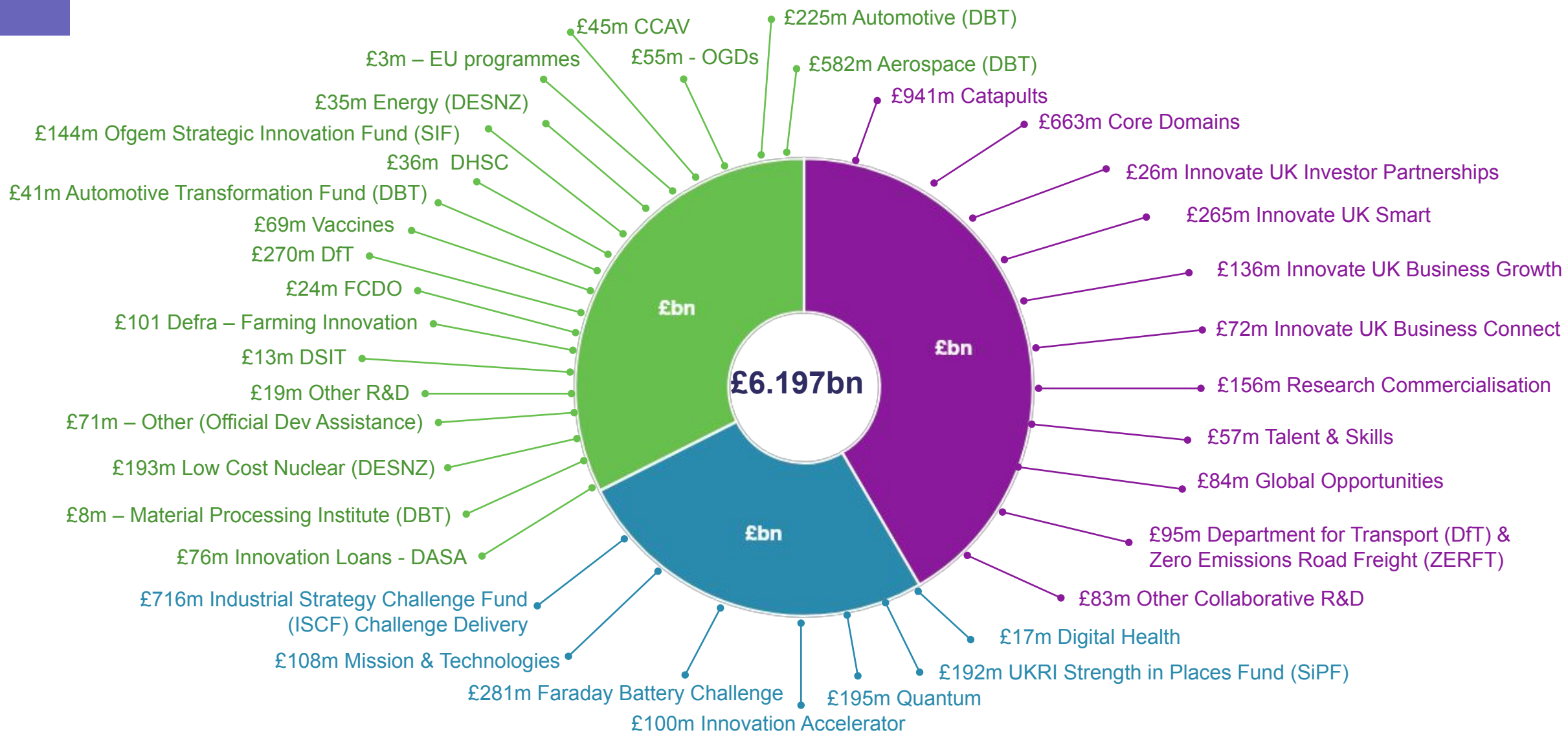
- *Regional Managers, Partners, Offices and KTAs*
- *Innovate UK Catapult Network*
- *UK Agri-Tech Centre*

UKRI Innovate UK

Spending profile

*All figures are are indicative and maybe subject to change.

Total expenditure in financial year 2024/25*



ENERGY
ACCESS TEAM

Energy Access Programmes

Innovate UK

UKaid from the British people | AYRTON FUND

UKaid from the British people | AYRTON FUND

Our mission is to **accelerate the innovation needed to reach sustainable development goal 7**. By providing financial and advisory support to innovators we help create strategic partnerships, uncover insights and develop business models to improve lives in Africa and Asia.

International Clean Energy Funds

UKaid | AYRTON FUND

Department for Energy Security & Net Zero | Foreign, Commonwealth & Development Office | Department for Science, Innovation & Technology

£1 billion over **5 years (2021-2026)** to support clean energy research, development and demonstration in developing countries.

UKaid Transforming Energy Access

Foreign, Commonwealth & Development Office

£225m research and innovation platform **2016 - 2027**
Supporting early-stage testing and scale up of innovative technologies and business models that accelerate an inclusive clean energy transition in developing countries.

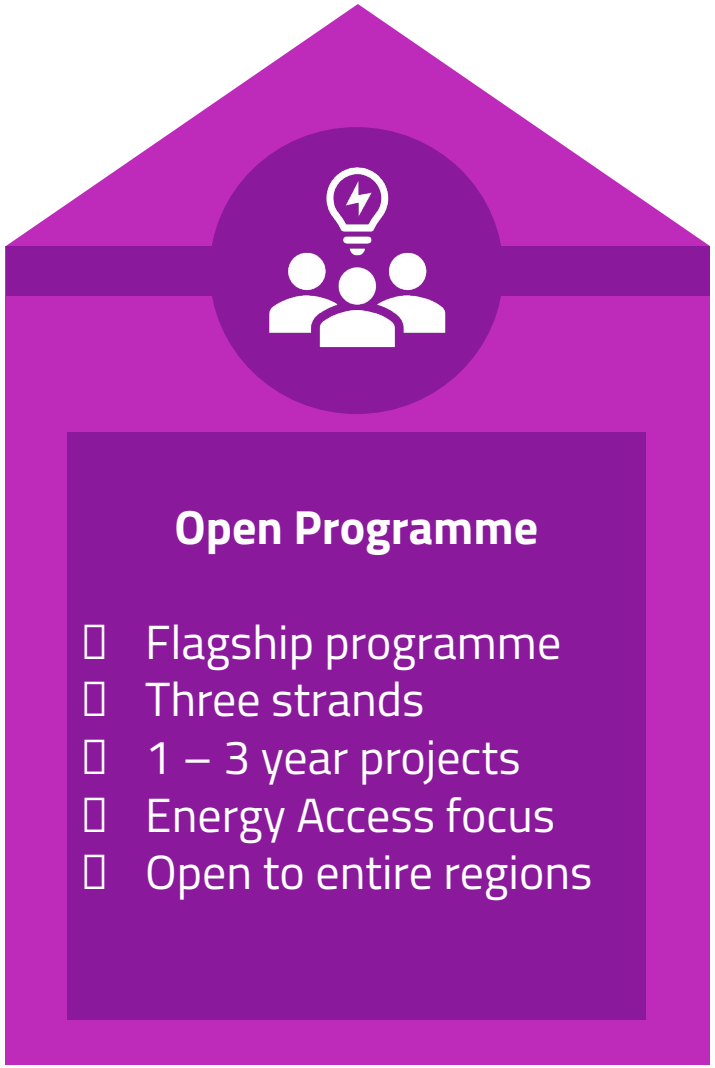
THEMES	Low Carbon Supplies	Super-Efficient Demand	Smart Delivery
THEMATIC CHALLENGES*	**Next Generation Solar** (FCDO) **Zero Emissions Generators** (FCDO)	**Sustainable Cooling** (DESNZ & FCDO) **Modern Cooking** (FCDO) **Energy Efficiency** (FCDO) **Industrial Decarbonisation** (DESNZ) **Clean Transport** (DESNZ & FCDO)	**Smart Energy** (DESNZ & FCDO) **Energy Storage** (FCDO & DESNZ) **Clean Hydrogen** (DESNZ & FCDO) **Critical Minerals** (DESNZ) **Leave No-One Behind** (FCDO)

* DSIT funds activities across all of the thematic challenges

https://www.gov.uk/guidance/ayrton-fund https://tea.carbontrust.com/

Innovate UK Energy Access Team: Overview

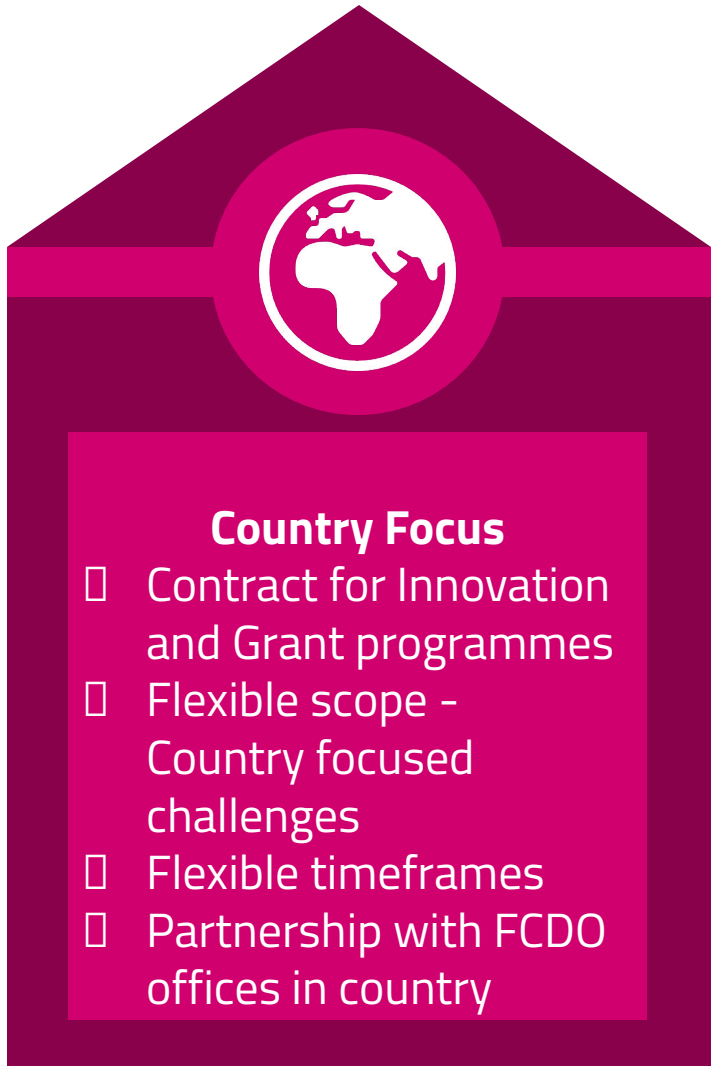
- > £300m budget
- >£200m ODA
- >550 projects
- > 1500 participants
- > 48 countries



Open Programme

- Flagship programme
- Three strands
- 1 – 3 year projects
- Energy Access focus
- Open to entire regions

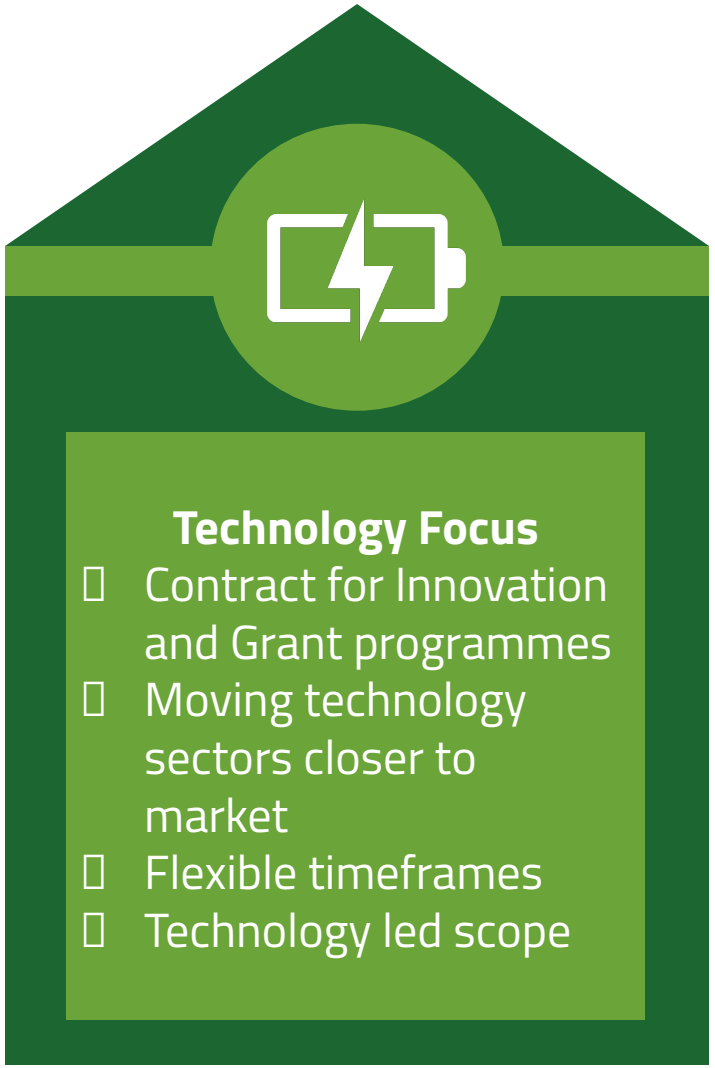
ENERGY CATALYST



Country Focus

- Contract for Innovation and Grant programmes
- Flexible scope - Country focused challenges
- Flexible timeframes
- Partnership with FCDO offices in country

British High Commission Dar es Salaam

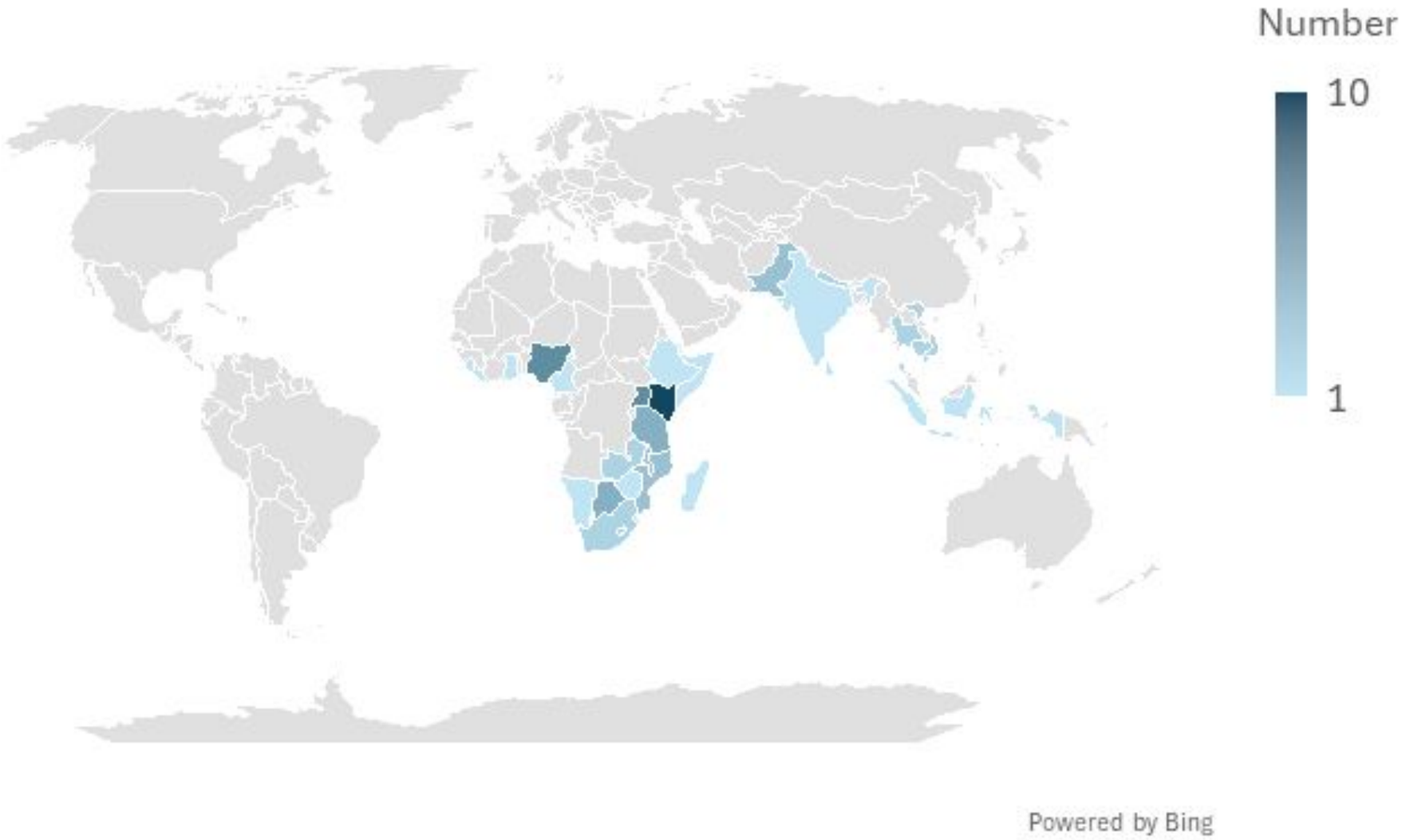


Technology Focus

- Contract for Innovation and Grant programmes
- Moving technology sectors closer to market
- Flexible timeframes
- Technology led scope

ZE-Gen.

Energy Access Project Locations

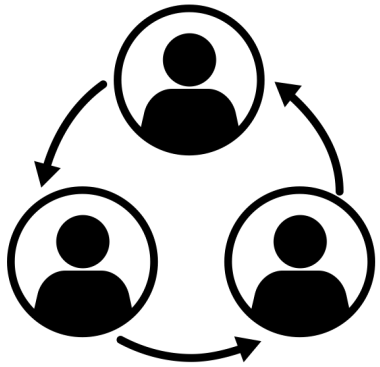


Energy Catalyst accelerates innovation that enables affordable, reliable, sustainable and modern energy for all.

To improve lives in Africa, Asia and the Indo Pacific we...

- Provide financial and advisory support to innovators from around the world.
- Create strategic partnerships with local businesses and communities.
- Uncover insights on how to unlock the best outcomes in the countries we work with.
- Develop business models that share value and create local benefits.

Energy Catalyst combines three key activities to deliver this vision

Collaboration	Competition	Acceleration
		
Collaboration building to help innovators find project partners	Open grant calls to develop and demonstrate innovative tech and business models	Business advice, learning from overseas, showcasing and dissemination

Smart Energy Systems Portfolio

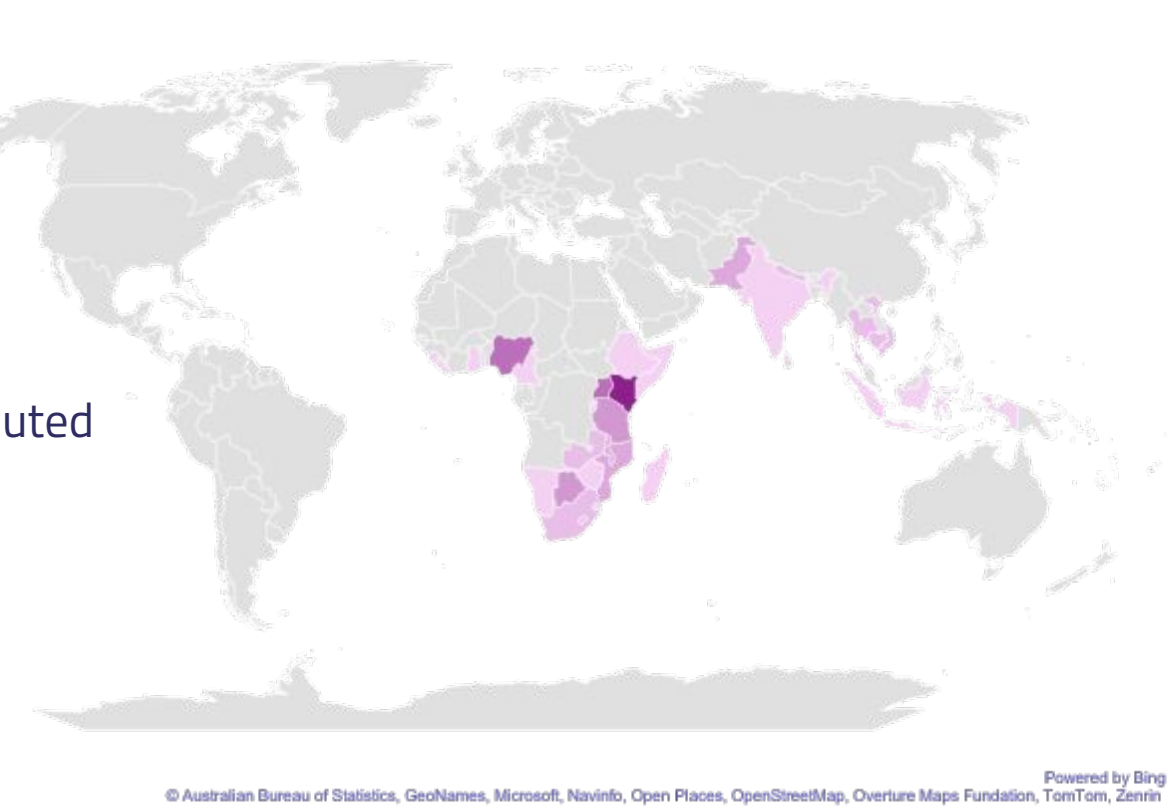
Ayrton Fund definition: Systems which accelerate a series of related technologies which enable more efficient and effective network delivery of energy.

Projects: 58 projects
Live: 24
Total ODA funded projects: 374

Total project costs: £43,890,273

Total IUK contribution: £29,190,584 of £180,000,000 contributed by Innovate UK through ODA energy access projects

Although direct funding may seem minimal, many organisations are targeting smart energy systems through a range of sectors and challenges.



Inclusive Energy

SCALING UP

Inclusive Energy: Case Study

- A real-time **monitoring system** for **biogas digesters** using intelligent sensing and communications.
- Smart Biogas is designed to monitor a large number of biogas systems over a wide geographical area.
- Their meters collect data on the operation and functionality of biogas plants and provide automated fault alerts and performance insights.
- This technology enables smart power, with pay per use options and the convenience of billing homes and users individually to ensure efficiencies on both ends.
- The system allows easy monitoring of digesters to indicate faults or repair needs.

Smart Biogas products were developed through 3 Innovate UK grants:

1. Energy Catalyst Round 4: Initial product development

2. Energy Catalyst Round 6: Mid Stage: Further market research, user testing an feedback incorporation

3. Energy Catalyst Round 9: Late Stage: product development with hardware and software enhancements to allow commercialisation

Inclusive Energy: Impact

8,826
MWh of clean energy monitored

14,187
tCO2 emission reductions enabled

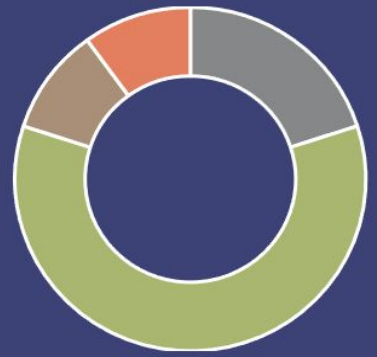
26,208
Number of people reached (assuming 4x per household)

120
Household annual USD savings* (biogas versus LPG)

What the biogas we monitor is used for

- Clean cooking / households
- Electricity generation
- Heating and lighting

What the solar we monitor is used for



- Households and streetlights
- Refrigeration
- Agri-machinery
- Micro-businesses

Inclusive Energy: Post-project impacts

CEO of Inclusive Energy, Vijay Bhopal, with Co-founders of Sistema.bio, Camilo Pagés (Left) and Alex Eaton (Centre).

- As of November 2024, Inclusive Energy (funding recipient for SmartBiogas in Rounds 6, 7, and 9) is now part of Sistema.bio (Round 6), a global leader in biogas technology.
- Sistema.bio will incorporate Inclusive Energy's technology to put in place the first digitally-verified biogas carbon credits.
- Sistema.bio is a social enterprise platform dedicated to empowering family farmers by providing access to innovative biodigester technology, training, and financing.
- Sistema.bio is now the first global biogas platform capable of delivering carbon and methane emissions reduction projects at scale with real-time high-quality digital Measurement, Reporting and Verification (dMRV), enabling the delivery of carbon emission reduction projects at scale with high-quality digital monitoring.

Thank you

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A2D Accelerate to Demonstrate Facility

Partners: UK Government

Accelerate-to-Demonstrate (A2D) Facility Annual Event

Thematic Session 1.2 - Smart Energy Synergies:
A World Café of Collective Insight and Regional Innovation

Tuesday, May 20th, 2:00pm – 3:30pm (EAT)

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Partners: UK Government

Introduction

Moderator

- Ms. Yi Zhang, Project Coordinator – Smart Energy and Industrial Decarbonization Project Coordinator, Accelerate-to-Demonstrate (A2D) Facility, UNIDO

Co-Moderator

- Ms. Ghada Ahmed, Critical Minerals Project Coordinator, Accelerate-to-Demonstrate (A2D) Facility, UNIDO

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Agenda

Time	Session Segment	Activity Description
Before 14:00	Session Preparation: Choose Your First Virtual Café	• Participants entering the room will have the opportunity to choose a café for the session • VIP café will be identified
14:00 – 14:15	Welcome and Introduction	• Moderator provides an overview of the session • Participants introduce themselves
14:15 – 14:30	First Round Café	• Moderator presents the first Café task, followed by a 15-minute group discussion • Participants discuss the question at their tables
14:30 – 14:40	Harvesting Insights & Choose your second virtual café	• Capture ideas and insights from the first Café • Participants select their second café preference • New VIP café will be identified
14:40 – 14:55	Second Round Café	• Moderator presents the second Café task, followed by a 15-minute group discussion • Participants discuss the question at their tables
14:55 – 15:05	Harvesting Insights & Choose your third virtual café	• Capture ideas and insights from the second Café • Participants select their third café preference • New VIP café will be identified
15:05 – 15:20	Third round Café	• Moderator presents the third Café task, followed by a 15-minute group discussion • Participants discuss the question at their tables
15:20 – 15:30	Harvesting Insights & Café Closure	• Capture ideas and insights from the third Café • Session wrap-up

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First Round Café (15 minutes)

What are the most pressing energy challenges in developing countries, and how can smart energy solutions address them?

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Second Round Café (15 minutes)

How can smart energy solutions be adapted to local contexts in developing countries to ensure sustainability and community engagement?

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Third Round Café (15 minutes)

How can private finance be unlocked to accelerate smart energy demonstration projects in developing countries?

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Did you like the Café?

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Further Information

- **A2D Facility Website:** Visit the website here
- **A2D Facility LinkedIn Account:** Follow the LinkedIn page here
- **A2D Facility Mailing List:** Join the mailing list here
- **A2D Facility Year 1 Annual Report:** Access the Annual Report here
- **A2D Facility Market Assessments:** Access the reports here

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Accelerate-to-Demonstrate (A2D) Facility Annual Event

Accelerating Progress towards SDG 9 on 'Industry, Infrastructure and Innovation' through Hydrogen Innovation

Tuesday, May 20th, 11:00pm – 12:30pm (EAT)

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Agenda

Introduction by moderator
•Pankhuri Poddar, Project Coordinator – Clean Hydrogen, Accelerate-to-Demonstrate (A2D) Facility, UNIDO

Keynote speaker
•Ms Lara Hischhausen, UK Department of Energy Security and Net Zero

Panel Discussion

•Ayodeji Stephens, Africa Energy Lead, High Level Climate Champions

•Joyce Kabui, Climate Envoy, Office of President of Kenya

•Jerome Namaseb, CEO Daures Green Hydrogen Village

•Sandra Banda, Technical Advisor GIZ Kenya

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Welcoming remarks

Pankhuri Poddar, Project Coordinator – Clean Hydrogen, Accelerate-to-Demonstrate (A2D), UNIDO

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Keynote Speaker

Ms. Lara Hischhausen,
UK Department of Energy, Security and Net Zero

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Panel Discussion

Moderator:
Pankhuri Poddar,
Clean Hydrogen Lead, A2D Facility
UNIDO

Ayodeji Stephens
Africa Energy Lead,
High Level Climate Champion

Sandra Banda
Technical Advisor,
GIZ Kenya

Jerome Namaseb
Chief Executive Officer
Daures Green Hydrogen Village

Joyce Kabui
Climate Envoy,
Executive Office of President of Kenya

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Accelerate-to-Demonstrate (A2D) Facility Annual Event

Commercializing Clean Hydrogen through Innovative Business Models

Tuesday, May 20th, 2:00pm – 3:30pm (EAT)

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Agenda

Presentation of Clean Hydrogen Market Assessment

- Pankhuri Poddar, Project Coordinator – Clean Hydrogen Lead, Accelerate-to-Demonstrate (A2D) Facility, UNIDO

H2 Global Presentation

- Hanna Graul, Research Associate, H2Global Foundation
- Leah Mpinga, Research Associate, H2Global Foundation

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Market Assessment Presentation

Pankhuri Poddar, Project Coordinator – Clean Hydrogen, Accelerate-to-Demonstrate (A2D), UNIDO

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Market assessment on accelerating innovation in clean hydrogen

What: the large-scale, new market assessment presents new evidence and analysis covering the landscape of critical minerals innovations, stakeholders, barriers, initiatives, Sustainable Development Goal (SDG) impacts, financial delivery mechanisms and existing projects.

Purpose: it fills an important gap in the data, evidence and analysis on clean hydrogen in developing country contexts.

Access the report at
https://a2dfacility.unido.org/
or scanning the QR code.

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CLEAN HYDROGEN MARKET ASSESSMENT IN DEVELOPING COUNTRIES

- Selection Criteria
- Key findings
  - Landscape of Technologies
  - Landscape of Innovators
  - Landscape of Stakeholders
  - Landscape of Initiatives
  - SDG Assessment
- Regional analysis

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Selection criteria

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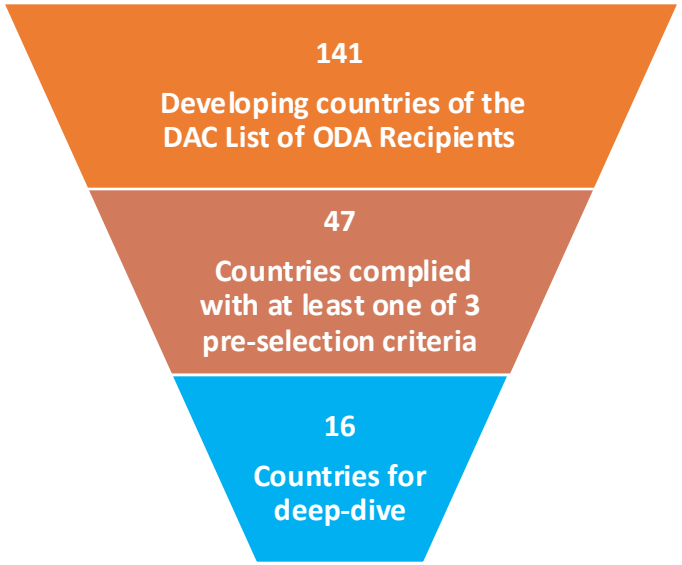
Key elements of a successful hydrogen development ecosystem

How were the pioneer countries identified?

DESCRIPTION OF THE FUNNEL



Asia	America	Africa	Europe
India	Argentina	Egypt	Türkiye
Indonesia	Brazil	Kenya	Ukraine
Malaysia	Colombia	Morocco	
Vietnam	Costa Rica	Namibia	
	Mexico	South Africa	

Which criteria were analysed and why?

International partnerships	Resources, capabilities, assistance, and collaboration platforms
Financing mechanisms	Overcoming financial barriers securing off-take, pilot projects and new solutions
Projects and innovation	Capabilities and interest on building a clean hydrogen economy
Hydrogen roadmaps	Specific targets and goals to build a robust clean hydrogen ecosystem
Hydrogen associations	Private sector involvement and securing stakeholders across the value chain

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CLEAN HYDROGEN LANDSCAPES

- **Landscape of Technologies**

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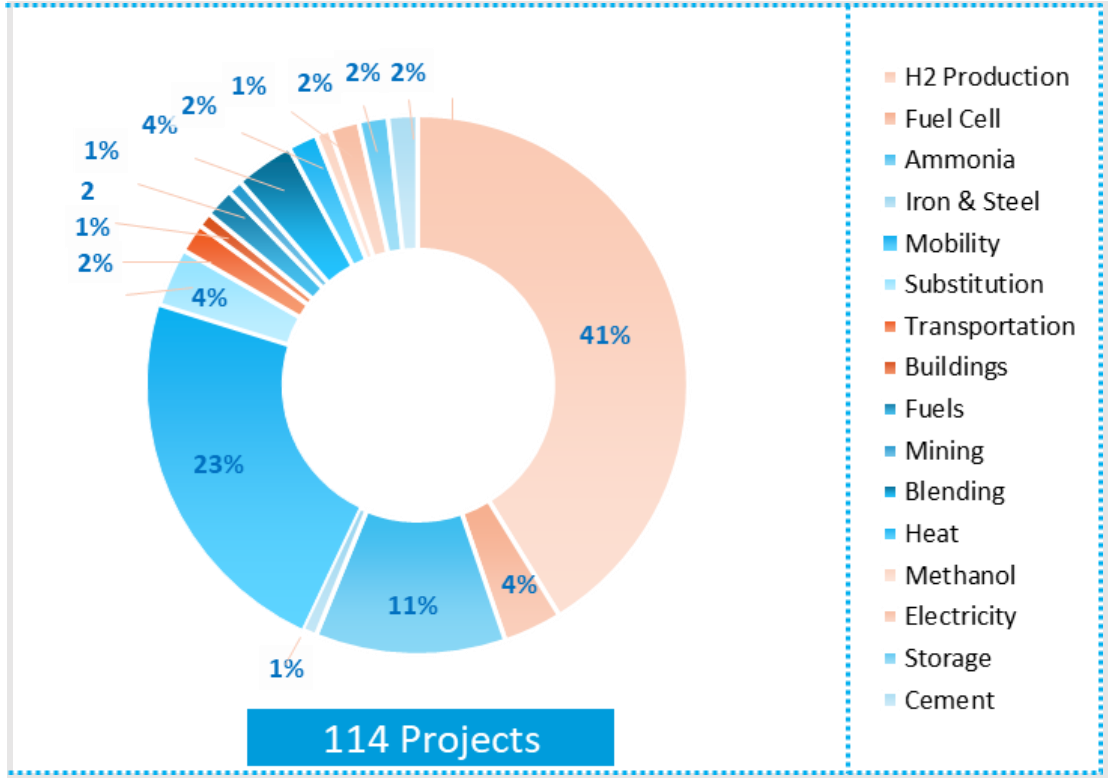
Clean hydrogen technologies are being developed across 35 developing countries, with a particular focus on clean hydrogen production.



- Over 110 hydrogen projects with technologies in TRLs 6 to 9 in late-stage planning in 35 developing countries.
- **41% of the projects focus on hydrogen production,** followed by 23% on mobility, while less than 5% correspond to technologies for hydrogen use in the cement, iron, and steel industry.
- **LAC hosts 36% projects, Asia 29%, and Africa 25%.** The three regions are focusing mostly on clean hydrogen production technologies.

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CLEAN HYDROGEN LANDSCAPES

- **Landscape of Innovators**

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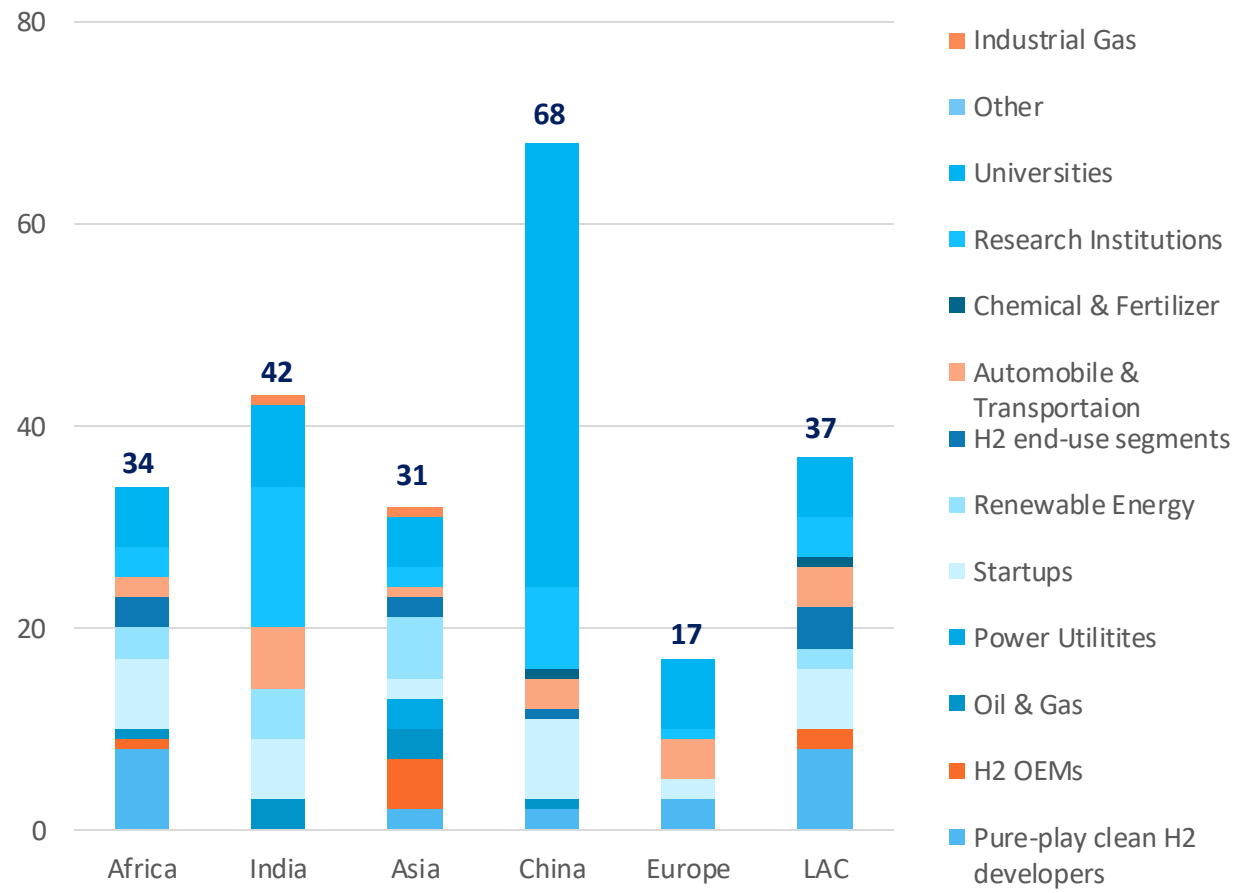
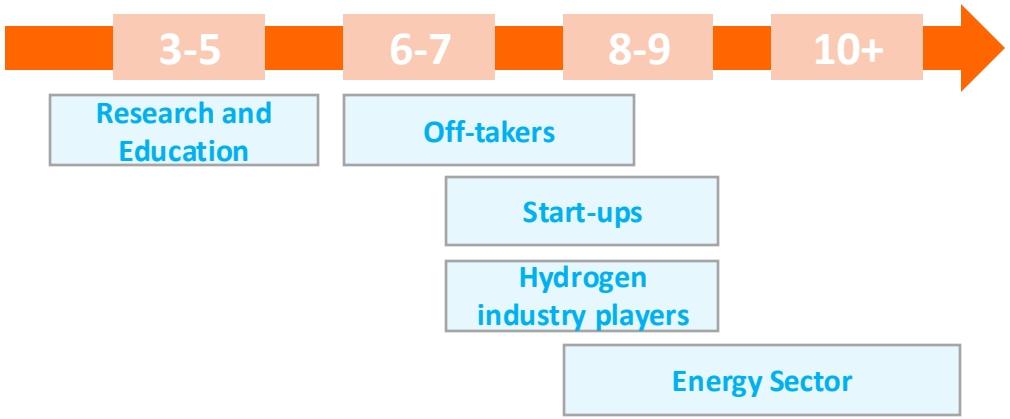
More than 200 innovators were identified in developing countries, most of them from universities and research institutes in Asia

Innovators grouped by category and Region



- **Most innovators belong to universities** (33.9%) and to **research institutes** (13.4%).
- Strong **leadership from China and India,** followed by LAC.
- Despite several projects led by educational centres, **the industry sector is achieving higher TRLs, testing and adopting technologies in TRLs 6-9.**

How are innovators advancing innovation to further stages?



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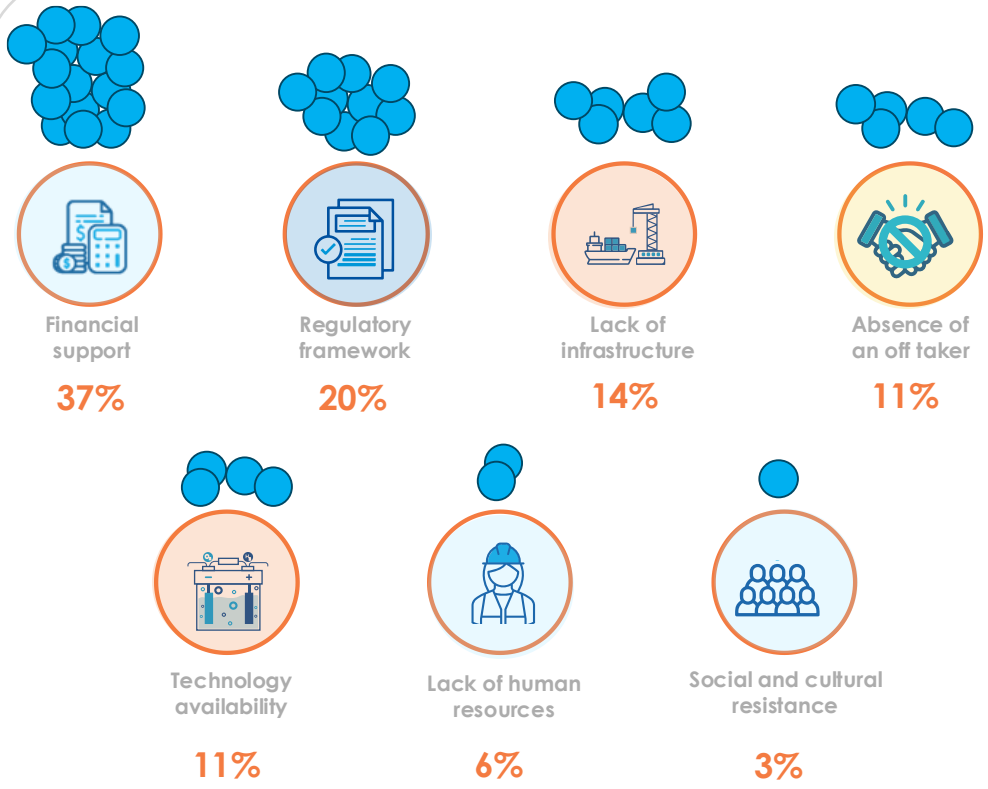
Most of the barriers faced by innovators rely on financial limitations, no binding regulations, and lack of infrastructure



Result from interviews and surveys carried out with more than 70 projects developers from developing countries working on clean hydrogen projects

Macroeconomic Challenges

- Lack delivery mechanisms.
- Required financing to take projects to further stages.

Regulatory barriers

- No binding regulation.
- Roadmaps to translate into policies and laws.

Infrastructure & Technological Barriers

- Necessary laboratory equipment.
- Lack of infrastructure.

Off-Take and Market Risks

- Off-take agreements needed to secure funding.
- Market uncertainty.

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Clean Hydrogen Landscapes

- **Landscape of Stakeholders**

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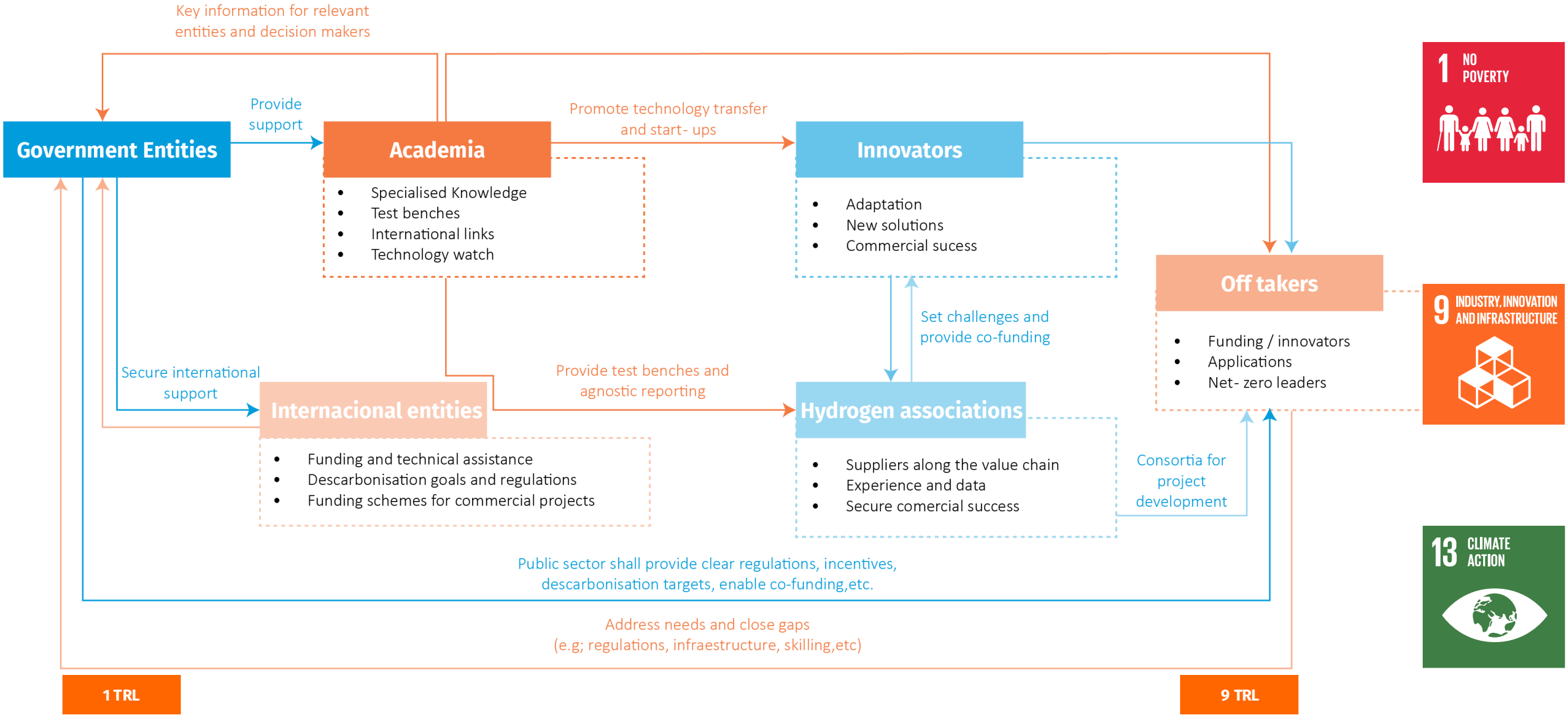
SUSTAINABLE DEVELOPMENT GOALS

A strong ecosystem can secure successful clean hydrogen projects



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Clean Hydrogen Landscapes

- **Landscape of Initiatives**

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National initiatives: how countries are advancing at a national level towards clean hydrogen

- There is **limited binding regulation** for clean hydrogen use nor for hydrogen-based R&D.
- Introduction of **regulatory sandboxes** allow technologies to be tested in controlled experimental environments, and help governments understand the necessary regulatory requirements.
- There are **few certification schemes** for clean hydrogen in developing countries: China; Brazil's; and 12 LAC countries implementing CertHiLAC.
- **National hydrogen hubs** are being planned in more than 15 developing countries, though China is the only country with a fully operational hub

Developing countries which have mostly introduced policy initiatives and regulatory frameworks to advance on clean hydrogen


Brazil

Egypt


India


Morocco

How are these countries advancing?

- Certification Schemes
- Tax credits
- Budget allocation
- VAT exemptions
- Laws for clean hydrogen use
- Cash incentives

Regional and international initiatives are key for knowledge sharing and facilitating shared transport, storage, and technology infrastructure

Regional clean hydrogen initiatives

International cooperation and partnerships are crucial for developing countries to build a clean hydrogen market and foster innovation, where resources and capabilities for scaling-up are needed. These initiatives can serve as platforms for cooperation across different regions.

- Regional initiatives serve as platforms for sharing technical expertise and best practices, promoting knowledge exchange and capacity building.
- They enhance regional potential by reducing costs through shared investment and infrastructure.
- Nevertheless, there are not many regional initiatives in place as of today.

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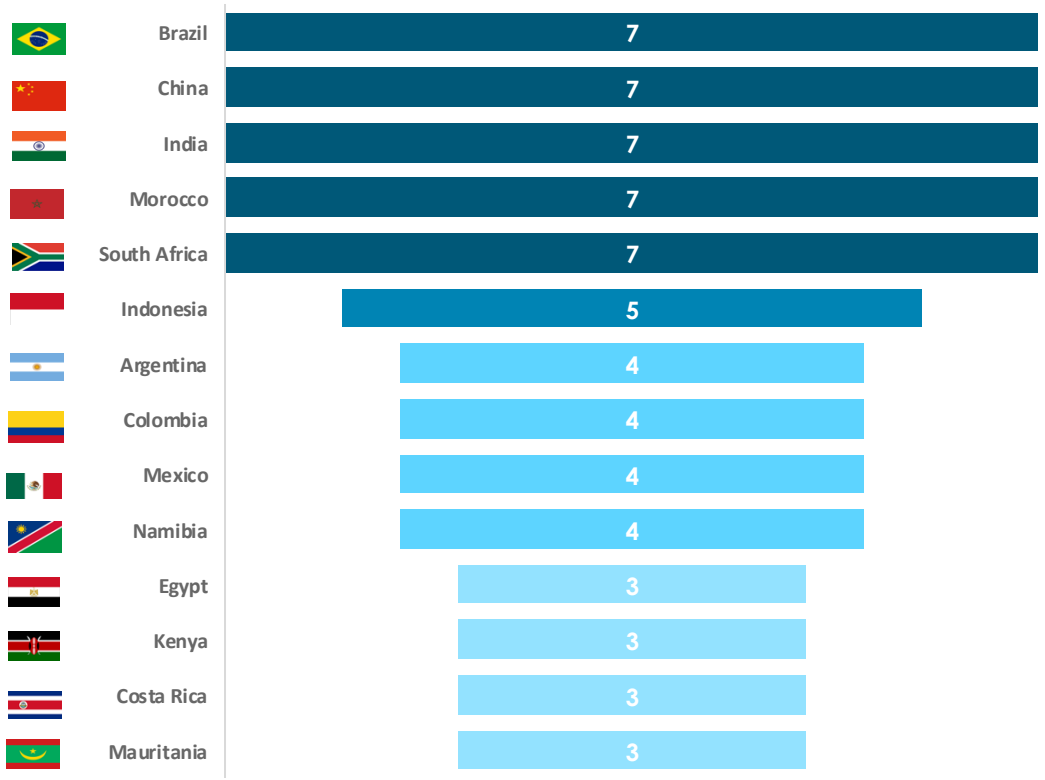
The identified gaps extend beyond specific issues and include the limited number of countries receiving support

Whom are they providing support?



How are they providing support?

International initiatives are concentrated on…

- Supporting Prefeasibility studies
- Development of regulatory frameworks
- Technical and financial assistance
- Global standards not focused on developing countries.

But there are topics that are still unattended….

- Lack of laboratories and materials, capacity and knowledge Hydrogen security protocols
- Infrastructure required for exporting
- Unattended segments of the clean hydrogen value chain as transport and storage
- Coordination between the countries and cross-country technological exchange
- Promotion of dialogue in the Global South to share regional perspectives

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SUSTAINABLE DEVELOPMENT GOALS

Delivery Mechanisms

Delivery Mechanisms

RECOMMENDED FINANCIAL INSTRUMENTS TO DE-RISK INVESTMENTS

1	Supply Risks	Long term cost-efficient purchase agreements for renewable electricity with technical clauses for price volatility; infrastructure funds and public-private partnerships for renewable energy projects
2	Market/Off-Take Risks	Tax benefits, subsidies, quotas and blending mandates to boost local demand. Long-term purchase agreements, contracts for difference, along with guarantees by export credit agency and partial-risk/credit guarantees by DFIs and MDBs are recommended.
3	Infrastructure Barriers	Development finance from multilateral banks and DFIs to catalyze the construction of key infrastructure units, higher involvement of the government through public-private partnerships and the development of special economic zones and industrial clusters, such as hydrogen hubs
4	Macroeconomic Risks	Foreign exchange swaps, interest rate hedging, and derivatives, along with contracts for fixed-rate loans are encouraged.
5	Technological Risks	Define selection criteria to prioritize projects led by credible primary technology developers. Performance, product, and availability guarantees can be considered, though the high cost of coverage can be a deterrent

Collaboration between government, key stakeholders & financial institutions is essential to boost investors' confidence

In Namibia, the Government and Hyphen Hydrogen Energy engaged in extensive dialogues to create a 40-year concession agreement. Additionally, the government of Namibia secured an option for a 24% equity stake in the project through SDG One Fund, demonstrating its commitment and further de-risking investments.

In Latin America, DFIs and MDBs are actively working with governments to provide technical assistance in designing hydrogen roadmaps.

In India, the government is offering subsidies to encourage domestic manufacturing of electrolysers and green hydrogen. It has also allocated budgetary support for pilot projects and research initiatives to support this infant industry and attract private players.

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SDGs Assessment

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Clean hydrogen has the potential to contribute mainly to SDGs 1, 9 and 13

Direct Linkages

Soft Linkages

How are the countries progressing towards SDGs?

- Stimulating infrastructure development
- Fostering research and innovation
- Creating jobs
- Supporting decarbonisation of hard-to-abate sectors

- As the technology matures, drives socio-economic transformation
- Enhancing quality of life
- Contributing to the Net-Zero ambitions

Public and private sectors need to collaborate to address social and environmental risks of large-scale hydrogen projects

Job displacement in traditional sectors

Potential conflicts over water resources

- **Forced resettlement of indigenous communities**
- **Potential land conflicts**

Environmental Risks

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Partners: UK Government

SUSTAINABLE DEVELOPMENT GOALS

Regional analysis

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Latin America and the Caribbean

The region can leverage its electricity matrix, with already more than 60% renewables, to produce clean hydrogen

Hydrogen Opportunities

- Electricity matrix comprising over 60% renewables, focusing on clean hydrogen applications for sustainable mobility and existing industries
- Local clean ammonia production to reduce dependence of importing fertilisers.
- hydrogen-based mobility to reduce pollution in large urban areas with dense populations and inefficient public transport.
- Exportation of hydrogen and ammonia is currently the top interest for project developers.

Financing Mechanisms

- Financing mechanisms from multilateral banks are being implemented in the LAC region for clean hydrogen, by providing both financial support and technical assistance, supported by institutions as:
  - Inter-American Development Bank
  - World Bank
  - European Union

Barriers

- Lack of regulatory frameworks.
- Lack of technical expertise.
- Limitations in enabling infrastructure for hydrogen or derivatives.
- Potential resistance with local communities.

Initiatives

- The LAC Clean Hydrogen Action (LCHA) includes six members, five of which are developing countries, excluding Chile.
- H2LAC is a regional platform supported by international organisations to promote green hydrogen development in 16 Latin American and Caribbean countries.
- CertHiLAC is a regional certification scheme by the IDB aimed at boosting competitiveness and integration in Latin America's hydrogen sector, with 12 countries signing a Joint Declaration for its implementation in 2023.

Potential Regional Hubs

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Asia

Asian target markets and domestic industrial demand will ensure the off-take of premium products, de-risking a critical aspect for advancing projects.

Hydrogen Opportunities

- Significant industry for clean hydrogen applications.
- Energy storage, clean hydrogen production, and mobility projects are found in all stages of development.
- Clean hydrogen production projects are currently in the late-stage planning phase.
- Proximity to potential off-takers as Japan, South Korea, and Singapore.

Barriers

- Regulatory diversity and varying levels of infrastructure development.
- Regional differences regarding access to technology and foreign or internal financial support.
- High dependence on fossil fuels.

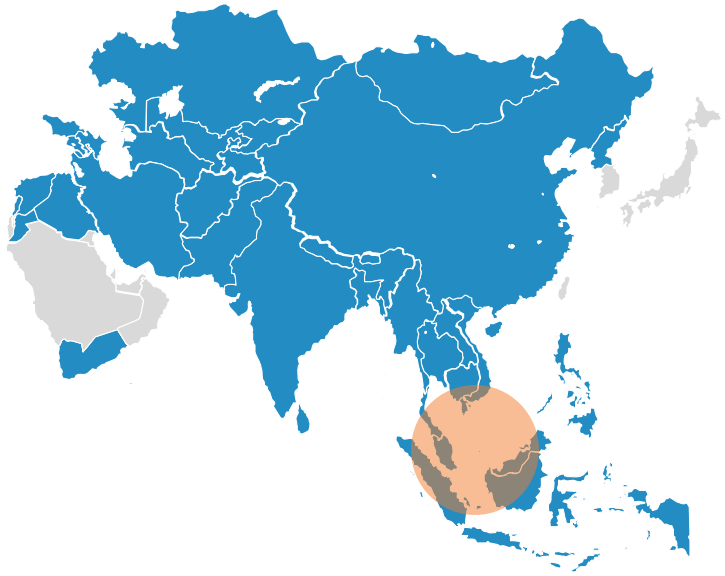
Financing Mechanisms

- In Asia, clean hydrogen projects are being funded mostly through Government allocations and investments by state-owned enterprises. There is a growing interest from the private sector given its proximity to Japan, South Korea, and Singapore. Institutions that have an active presence in the region are:
  - Asian Development Bank
  - World Bank

Initiatives

- Investment in R&D and incentives for hydrogen production (mainly in China and India).
- The Asia-Pacific Green Hydrogen Alliance (APAC) aims to accelerate green hydrogen development in the region, with Indonesia being the only developing country among its five members, alongside Australia, Japan, Singapore, and South Korea.

Potential Regional Hubs



- Southeast Asian countries as Indonesia, Viet Nam and Malaysia. Singapore can be part of this hub to act as off taker and export point of developing countries hydrogen-based solutions.

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Africa

Project developers in Africa are primarily concentrated in the southern and northern regions of the continent, where they have received significant support from European stakeholders looking to harness the region's vast renewable energy potential.

Hydrogen Opportunities

- Clean hydrogen projects are primarily focused on clean hydrogen production and hydrogen for mobility applications.
- There are also clean hydrogen projects for ammonia production, synthetic fuels, and applications in the iron and steel industries, though these are currently less prevalent.
- Hydrogen-based microgrids as a solution for clean electricity to rural areas and isolated communities.

Barriers

- Several countries are not even industrialised or less than 25% of the population has energy access, resulting in a limited number of innovators.
- Energy access is limited in Africa, even in countries with significant potential for hydrogen production.
- High dependence on fossil fuels.
- Limited access to advanced technology and financial resources.
- Deficits in infrastructure for hydrogen or derivatives exportation and logistical challenges.
- Political and economic instability.

Financing Mechanisms

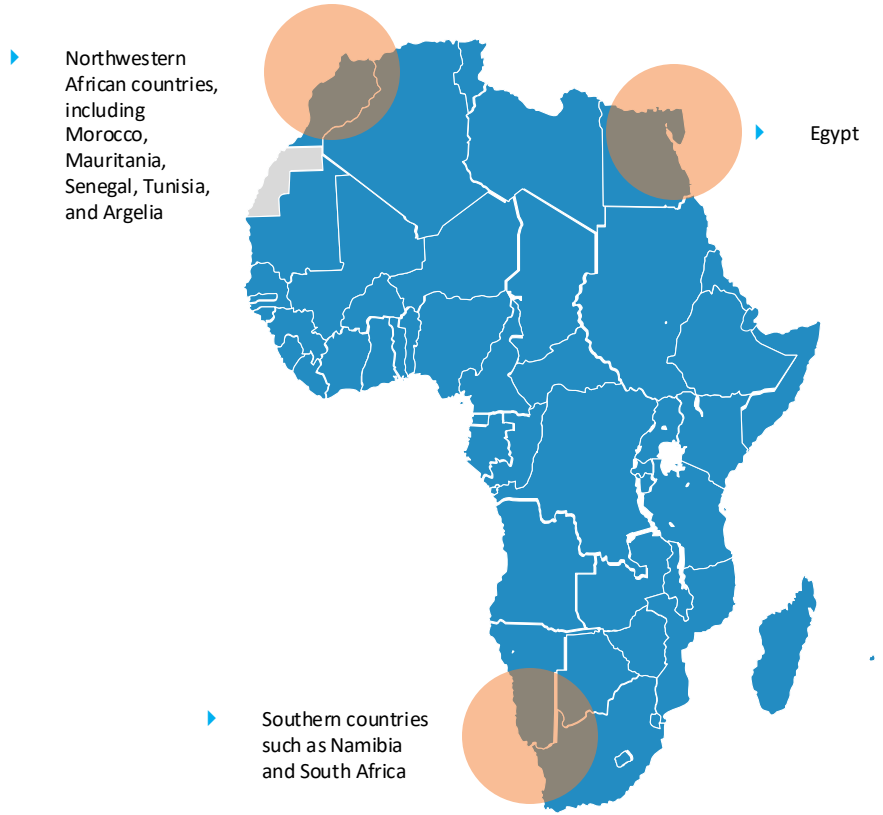
Grants and debt are pivotal financial instruments in Africa to secure funding for clean hydrogen projects. Financing institutions are playing an increasingly active role in supporting clean hydrogen projects across Africa by providing grants and loans, such as:

- European Union
- Government of Germany
- Development finance institutions as KfW

Initiatives

- The Africa Green Hydrogen Alliance (AGHA), launched in 2021, includes seven developing countries and emerging markets.
- The African Hydrogen Partnership (AHP) is a non-profit trade association focused on developing green and natural hydrogen resources, with over thirty members from various African countries.

Potential Regional Hubs



1. MENA countries as Morocco and Egypt are considered within this regional analysis.

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Key takeaways

- Private sector involvement is key
- Public and private sector need to collaborate more
- Fostering a healthy innovation ecosystem is crucial
- Adaptation and research are necessary
- Most projects concentrate on hydrogen production and end-use applications.
- Other value chain segments, such as hydrogen storage, transport, and alternative carriers, have made limited progress in developing countries.
- We need to strengthen regional cooperation
- Still many challenges and barriers need to be address

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H2 Global Presentation

Hanna Graul
Research Associate, H2Global Foundation

Leah Mpinga
Research Associate, H2Global Foundation

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Still Missing H2Global Slides

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Accelerate-to-Demonstrate (A2D) Facility Annual Event

Innovative Financing Mechanisms for Demonstration Projects Session

Tuesday, May 20th, 4:00pm – 5:30pm (EAT)

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Agenda

Introduction
- Mr. Peter Warren, Accelerate-to-Demonstrate (A2D) Facility Manager, UNIDO

Opening Presentation
- Mr. Karim ould Chih, Division Chief, Innovative Finance and International Financial Institutions, UNIDO

Panel Discussion
- Ms. Jenny Hasselsten, Senior Energy Specialist, World Bank
- Ms. Cathy Chen, Associate Director, KPMG, UK
- Mr. Mahandra Rooplall, Industry Development Planner, Industrial Development Corporation, South Africa
- Mr. Karim ould Chih, Division Chief, Innovative Finance and International Financial Institutions, UNIDO

Fishbowl Activity
- Audience Participation

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TRANSFORMATION PATHWAYS FUND PROGRAMME

Driving sustainable industrial transformation in global value chains

A2D Facility Annual Event, 20th May 2025, Nairobi/Kenya

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Industry is a key driver of climate change and value chain emissions

GHG EMISSIONS

One third of global direct CO_2 emissions from industry

NATURAL CAPITAL DEPLETION

Food, energy, and textile value chains drive >70% of man-made pressure on biodiversity

WATER SCARCITY

Industry including agri-food systems account for almost 90% of global freshwater withdrawals

FOOD INSECURITY

Over 250m people suffer from acute food insecurity in the Global South

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SUSTAINABLE DEVELOPMENT GOALS

THE CHALLENGE – lack of climate finance to modernize industry

Industry is a key driver of climate change

- **VALUE CHAIN EMISSIONS:** Nearly 80% of products' GHG emissions lie within their upstream & downstream value chain.
- **VULNERABILITY TO CLIMATE CHANGE:** Strong need for climate-resilient practices, infrastructure and technologies across key industrial sectors.
- **HIGH MITIGATION POTENTIAL:** Industry has significant GHG emissions and saving potential given limited technology adoption in EMDEs.
- Exports into the EU to be exposed to the European Union's Supply Chain Directive and in future the Carbon Border Adjustment Mechanism (CBAM)

Industrial climate finance is severely lacking

- **GLOBAL SOUTH's CRUCIAL ROLE:** Emerging markets and developing economies account for over half of global manufactured value added and 2/3 of manufactured goods consumption
- **INVESTMENT BARRIERS:** Companies including SMEs in the EMDEs face barriers like lack of long-term financing, low market awareness, and limited familiarity with environmental technologies
- **SEVERE UNDERFUNDING**: Industry receive less than 1% of global climate finance, needing to grow to over 10% by 2030 to meet annual mitigation finance.
- **PRIVATE FINANCE GAP:** Private funding is scarce in low and middle-income countries accounting for only a third of climate finance

Strong need to modernize and green industries + **Higher level of industrial climate finance required**

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THE SOLUTION – Transformation Pathways Fund Programme

A catalytic partnership set-up to address the financial and knowledge and capacity barriers

UNIDO

- **Deep technical expertise** on industrial development and sustainable supply chains
- **Global reach and network** through its international presence and established partnerships with governments, industry associations, companies and financial intermediaries
- Engagement in **key transformation and decarbonization initiatives**: e.g., Partnership for Net Zero Industry, Global Matchmaking Platform, Clean Energy Ministerial Industrial Deep Decarbonization Initiative
- **Key flagship projects**: Global Eco-Industrial Parks Programme, Industrial Energy Efficiency Accelerator, SWITCH to circular economy value chains, Private Financing Advisory Network
- Numerous **technical assistance** programmes that support the implementation of TPI

Finance in Motion

- **Leading impact asset manager** with strong track record across multiple asset classes, geographies and impact themes
- **4bn EUR across 9 funds** currently managed and advised
- **15 years of experience** in origination and generation of new impact assets through an extensive local network of 15 regional offices
- **Operational excellence:**
  - Experienced investment management team paired with strong topical and asset-class specific expertise
  - Efficient investment operations
- **Deep technical expertise** in decarbonization of industry, buildings and transport, agriculture, and land use change

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SUSTAINABLE DEVELOPMENT GOALS

TRANSFORMATION PATHWAYS FUND PROGRAMME

Bridging the climate financing gap in industry with innovative climate finance along global value chains

MISSION

I. Mobilize private capital for industry in UNIDO Member States

II. Decarbonize and future-proof industry, aligning with national priorities

III. Create jobs in industrial sectors (incl. a gender-responsive strategy)

TARGETS

i. Deliver up to **3 bn USD of investments**

ii. Reduce GHG emissions by **64 Mtons of CO2eq**

iii. Support at least **450,000 jobs**

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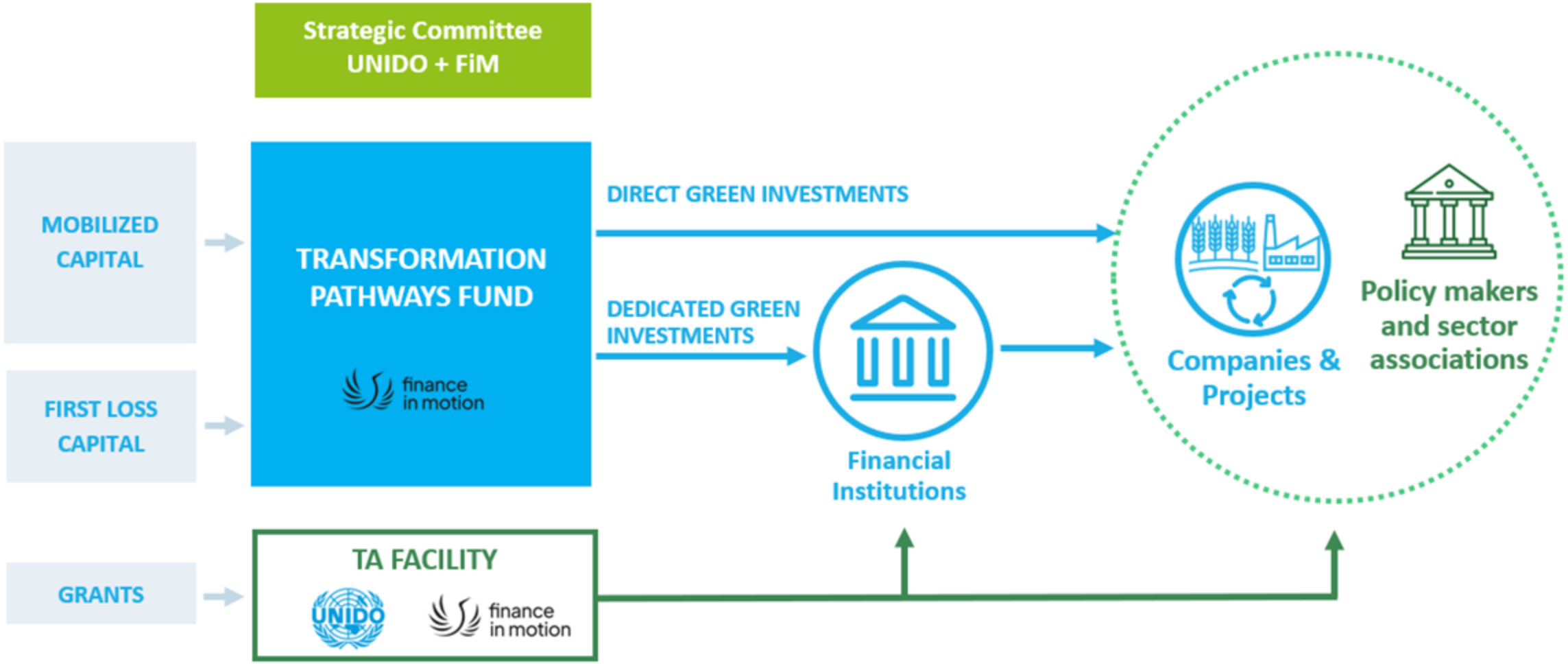
GOVERNANCE – clear roles and responsibilities



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ALIGNMENT – initiative fully aligned with UNIDO priorities

TPF seeks to support the decarbonization of EMDEs industries in global value chains

- Renewables for industry
- Efficiency and Circularity measures
- Electrification and sustainable fuels
- Climate smart inputs

Clean energy and climate action

Renewable and clean energy
Energy efficiency
Industrial decarbonization
Green hydrogen
Nature-based solutions

Ending hunger

Sustainable agribusiness
Food safety and quality
Agro-technology and innovation
Infrastructure development
Local value addition

Sustainable supply chains

Local value addition
Sustainability standards and trade
Circular economy
Youth, women, SMEs
Sustainable investment

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ILLUSTRATIVE EXAMPLES

INVESTEE	Financial institution	Manufacturing company
INSTRUMENT	600k USD intermediated loan	2 m USD corporate loan
SECTOR OF END BORROWER	Food processing (dairy)	Textile
FINANCED ACTIVITIES	• 500 kW roof-top solar PV to supply facility with renewable energy • Replace outdated equipment with energy-efficient alternatives, including refrigeration units, pumps, and motors	• Upgrading machinery: energy-efficient weaving and dyeing machinery to enhance production capacity • 1 MW roof-top solar PV to supply renewable energy for operations
KEY OUTCOMES	• 800 MWh of electricity generated • 700 tCO2 annual emission savings • 20% reduction in energy consumption	• 1,120 tCO2 annual emission savings • 30% higher production capacity • 20% energy cost savings • Enhanced energy security
TECHNICAL COOPERATION	• ESMS development for financial institution • Impact assessment support • Sector-level workshop for food processers to enhance efficiency in production	• Impact assessment support • Staff trainings on new systems • Gender-focused capacity building • Feasibility study on use of alternative fuels and renewable energy

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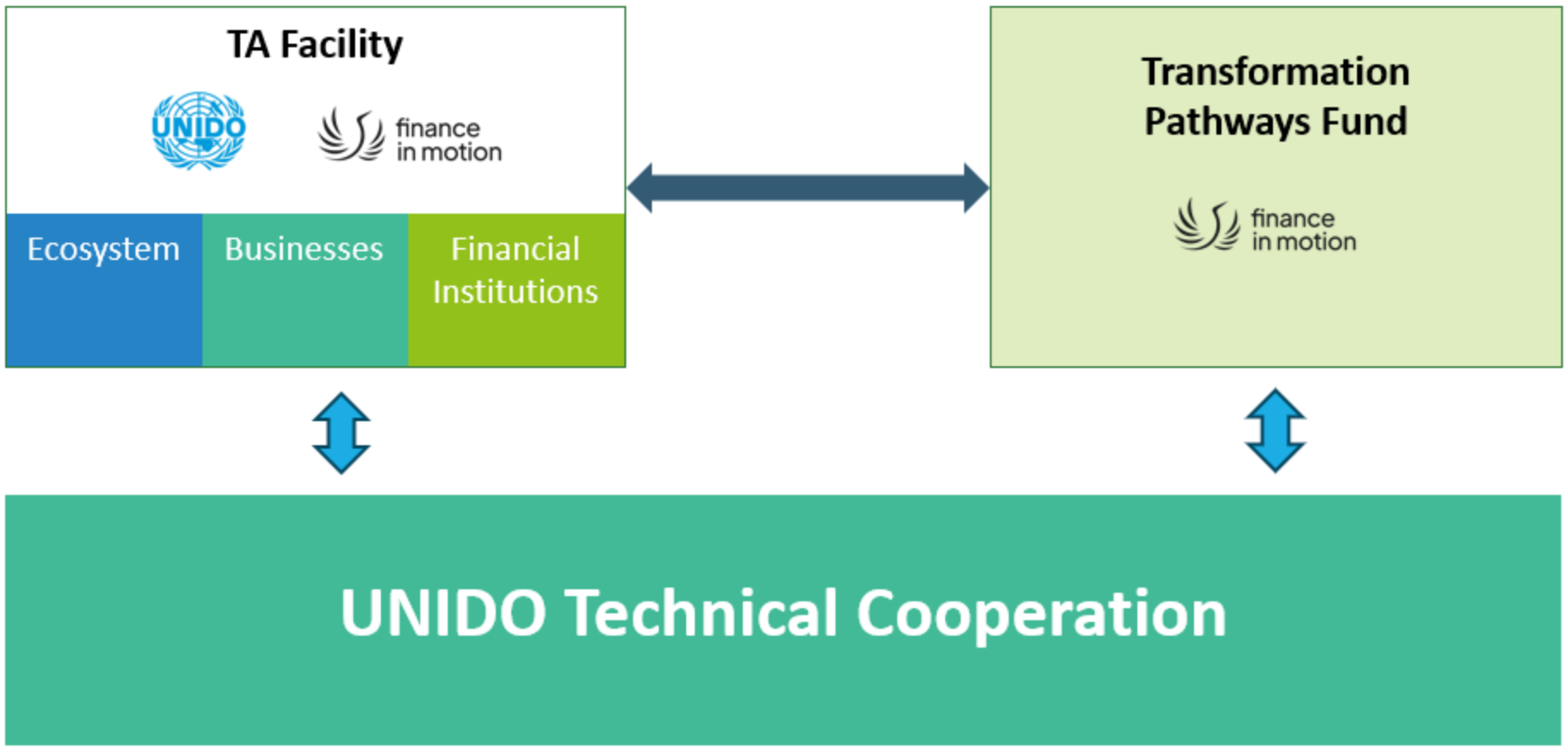
UNIDO TC AS FOUNDATION – initiative leverages on existing expertise

Creating synergies and complementarities



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SUSTAINABLE DEVELOPMENT GOALS

THANK YOU

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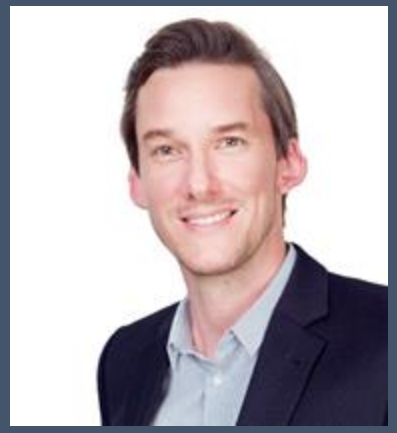

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Fishbowl – Audience Interventions

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Accelerate-to-Demonstrate (A2D) Facility Annual Event

Measuring Innovation and Transformational Change in Climate Action

Tuesday, May 20th, 2:00pm – 3:30pm (EAT)

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Agenda

Introduction

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Opening Presentation

- Ms. Federica Baldo, Team Assistant, Accelerate-to-Demonstrate (A2D) Facility, UNIDO

Panel Discussion

- Mr. Will Farmer, Economic Advisor, Department for Energy Security and Net Zero, UK Government
- Ms. Thu Tran Minh, Senior Energy Advisor, Netherlands Development Organisation SNV
- Ms. Njambi Macharia, Green Buildings Country Lead – Kenya, International Finance Corporation (IFC)
- Mr. James Coombs Obrien, Innovation Lead, Innovate UK

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A2D Facility: Supporting Catalytic Projects to Transform Sectors

- **“Lighthouse” demonstration projects** in critical minerals, clean hydrogen, industrial decarbonization and smart energy.
- **Impacts on SDGs** 13 (climate action), 1 (no poverty) and 9 (industry, innovation and infrastructure) in supportive enabling environments that foster scalability.
- Projects at the demonstration phase and at the **implementation and operation stages of project development** (earlier-stage pilot-testing or planning-related activities are out-of-scope).
- Strong focus on **sharing lessons-learned, dissemination and monitoring** (supported projects facilitating training and capacity building, regular high-quality monitoring and reporting, risk management, hosting study tours, and presenting in international events and workshops, alongside the construction and equipment implementation activities).

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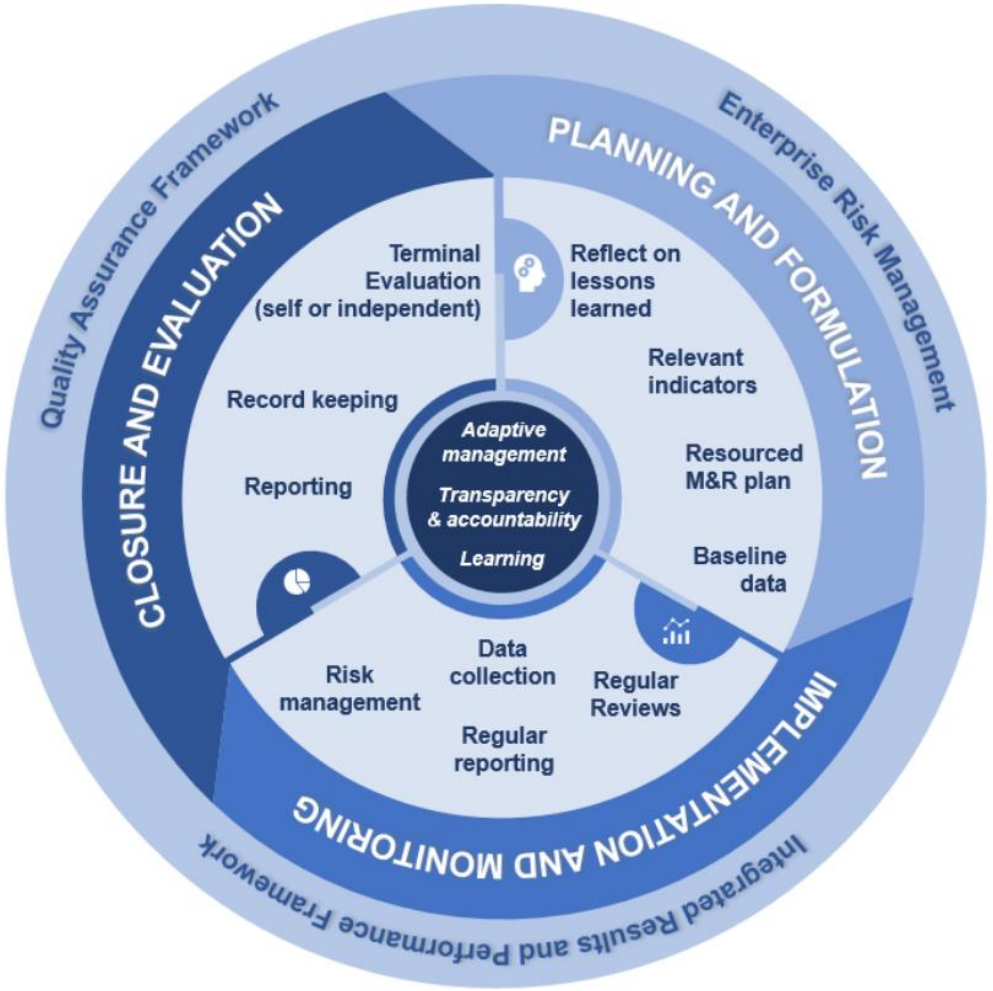
A2D Facility: Monitoring and Reporting

The transformational impact (*KPI-15*) indicator tracks early signs of transformation in projects, or the extent to which key activities either are being, or have a good likelihood of being, transformational.

- Continuous examination of progress achieved during the implementation of a project to track compliance with the plan and to take necessary decisions to improve performance.
- UNIDO monitors all projects through a Logical Framework ("Logframe").
- Project performance and payments linked to meeting agreed milestones, deliverables and results.



Reference: UNIDO (2021) "UNIDO Monitoring and Reporting Policy" (document DGB/2021/14)

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A2D Facility: Logframe

IMPACT	OUTCOMES	OUTPUTS
Shaping a **sustainable shift in local markets** by enabling clean energy technology solutions that are ready for wider uptake, catalysing increased climate ambition and transformational change	Innovative clean energy technology **solutions are ready for wider uptake**, while creating confidence in wider stakeholders and market players to adopt, replicate and scale clean technology solutions.	Innovative clean energy **technology solutions show signs of progression** towards real world application.
	Demonstration **projects successfully demonstrate the benefits and feasibility of alternative clean energy technology** solutions, generating high quality learning and creating a 'lighthouse' effect.	**Increased knowledge** of, and demand for, innovative clean energy technologies.
	Enhanced knowledge, understanding, data and networks.	**Enhanced capacity, capability, resources and infrastructure** that enable clean energy innovation for sustainable long-term development.

A2D Facility: Logframe

IMPACT indicators	OUTCOMES indicators	OUTPUTS indicators
• Estimated greenhouse gas emissions reduced or avoided.	• Domestic and/or international attention. • Solutions increased in maturity and operational capability. • Public and private finance leveraged.	• Barriers addressed in the adoption of innovative technology solutions. • Relationships formed to accelerate market readiness of innovative clean technologies. • Knowledge sharing and dissemination activities. • Capacity building activities. • Contribution to SDGs achievement. • Demonstration project meets the criteria in the OECD DAC Gender marker.

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A2D Facility: Gender Equality and Social Inclusion Monitoring and Reporting

All supported projects report against a gender output indicator focused on compliance with OECD-DAC gender equality policy marker score 1 throughout the project cycle.

Code	Value	Explanation	Minimum Criteria (should be met in full)
2A	Significant expected contribution to gender equality	Gender issues are not the main objective of the project or programme but are significantly reflected and integrated (mainstreamed) in all relevant dimensions: results, activities, M&E framework.	There is at least one explicit gender equality related output backed by at least one gender-specific indicator. A gender analysis of the project has been conducted and the findings inform project design. Data and indicators are disaggregated by gender, where applicable. The M&E component of the project is designed to report on the expected gender equality results. The logframe/results framework measures progress towards the project's gender-related output(s) through gender-specific indicators to track outcomes/impact.
3.3	A2D Project Monitoring Tool: Output Indicator 3.3	Demonstration project meets the criteria in the OECD DAC Gender Marker	A positive impact on advancing gender equality and/or the empowerment of women and girls, reducing gender discrimination or inequalities, or meeting gender-specific needs (OECD marker 1)

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A2D Facility: Environmental and Social Safeguards Monitoring and Reporting

All supported projects report against an ESS output indicator in the project's Logframe, which complies with UNIDO'S Environmental and Social Safeguards (ESS) Policies and Procedures throughout the project cycle.

Code	Value	Explanation	Minimum Criteria (should be met in full)
3.4	A2D Project Monitoring Tool: Output Indicator 3.4	Demonstration project aligns with UNIDO's ESSPP and its Operational Safeguards (9) meeting as well criteria outline in GEF-GCF ESS Indicators	A positive impact on environmental sustainability and social inclusion, including the protection of biodiversity, sustainable land and water management, climate change mitigation and pollution reduction: **Programmatic OS** OS 1: Environmental and Social Assessment OS2: Protection of Natural Habitats OS3: Involuntary Resettlement OS4: Indigenous People OS5: Pest Management 0S6: Physical Cultural Resources OS7: Safety of Dams **Framework Operational Safeguards** OS8: Information Disclosure OS9: Accountability and Grievance Systems The project ensures equitable benefits, particularly for marginalized groups such as women and indigenous peoples and local communities (ILPs), and adheres to the criteria outlined in both UNIDO's Operational Safeguards in addition to GCF and GEF's Environmental and Social Indicators (particularly on social inclusion 68th GEF Council Meeting)

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