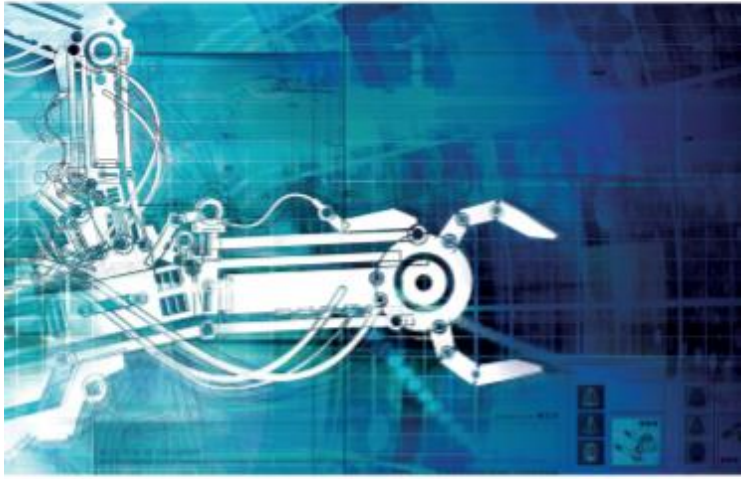
Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

Introduction: Jerome Finlayson, SMAS & Chair of SIR Steering Board

ZERO WASTE SCOTLAND

Scottish Funding Council
Promoting further and higher education

A Manufacturing Future for Scotland



Scottish Funding Council · Innovate UK · Skills Development Scotland · Zero Waste Scotland

SMAS Scottish Manufacturing Advisory Service · HIE · The Scottish Government · Scottish Enterprise

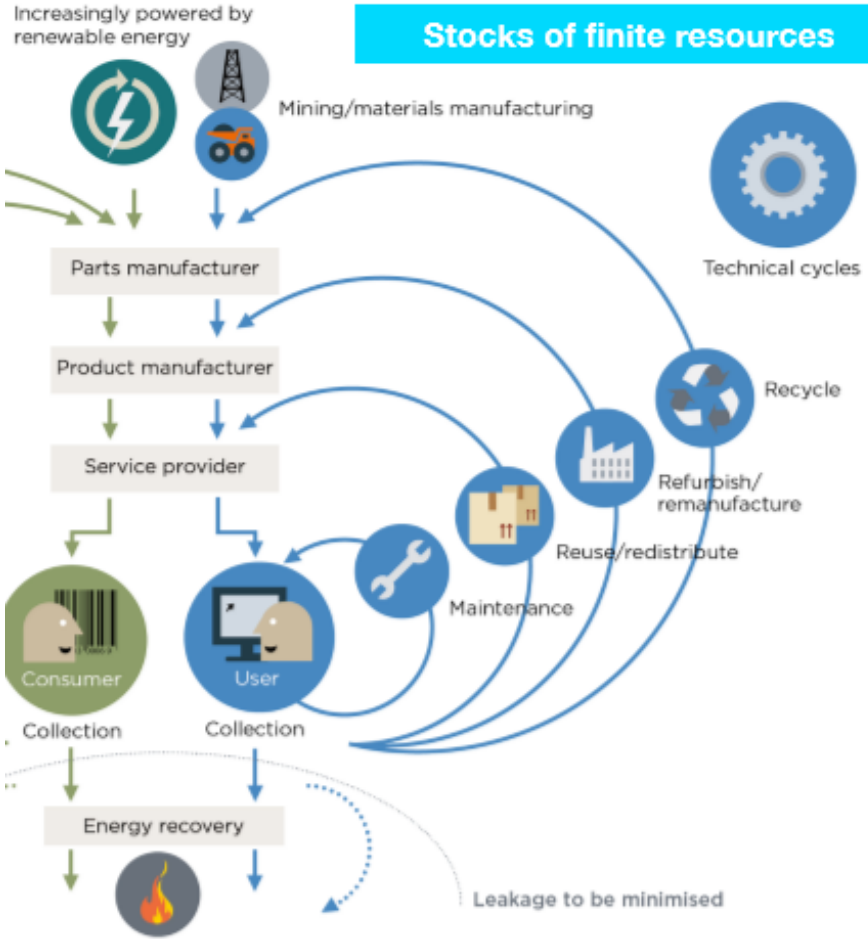
Shaping the Manufacturing Action Plan

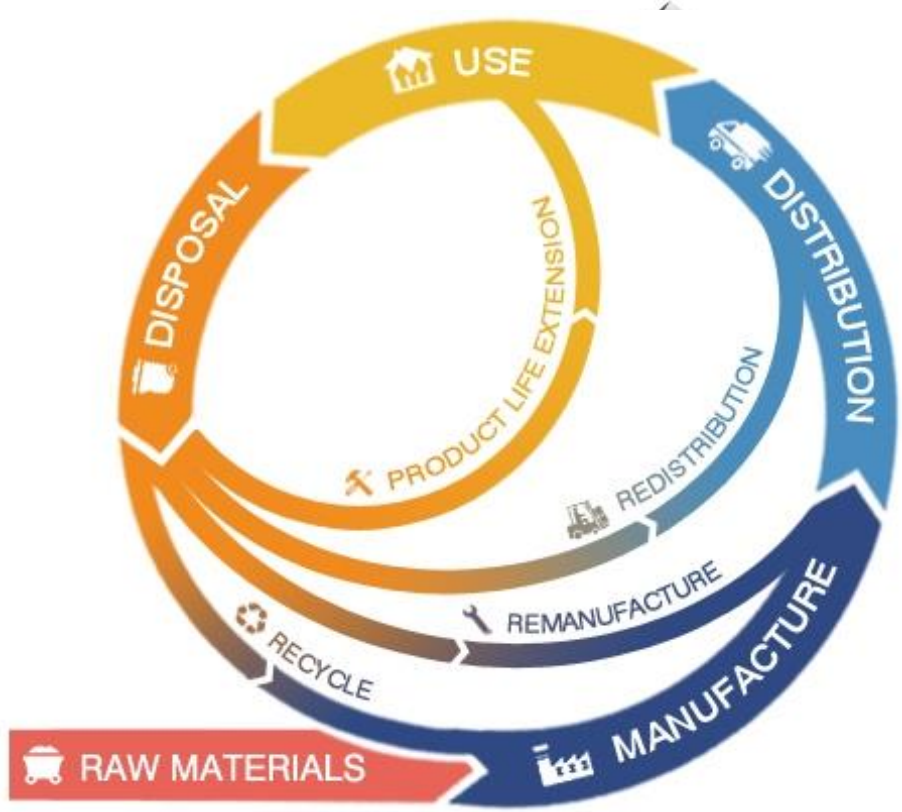
Action themes:

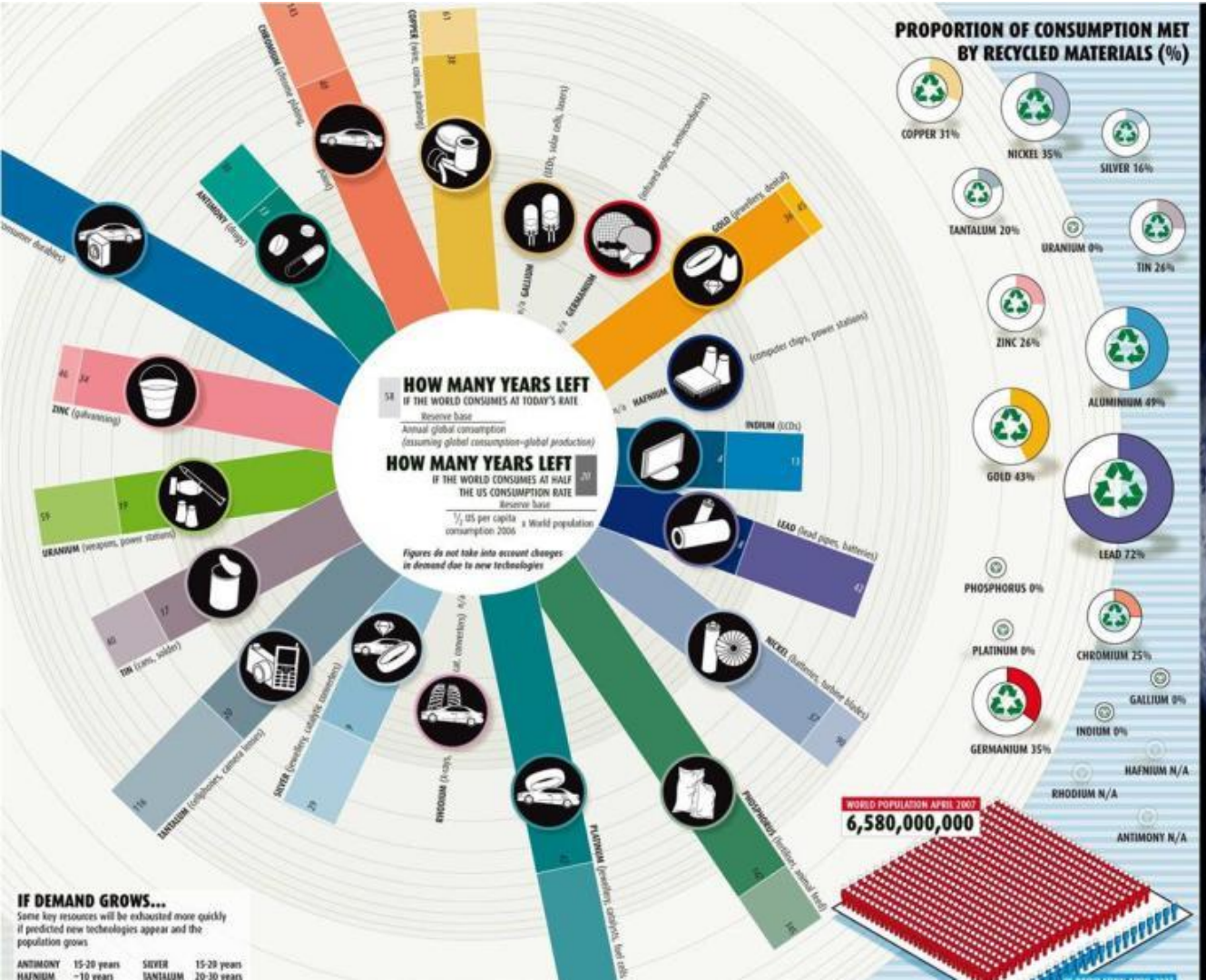
- Leadership
- Skills and Jobs
- Circular Economy
- Energy Efficiency & Decarbonisation
- Competitive Infrastructure
- Investment in SMART Manufacturing
- Supply Chain Capability
- Technology & Innovation

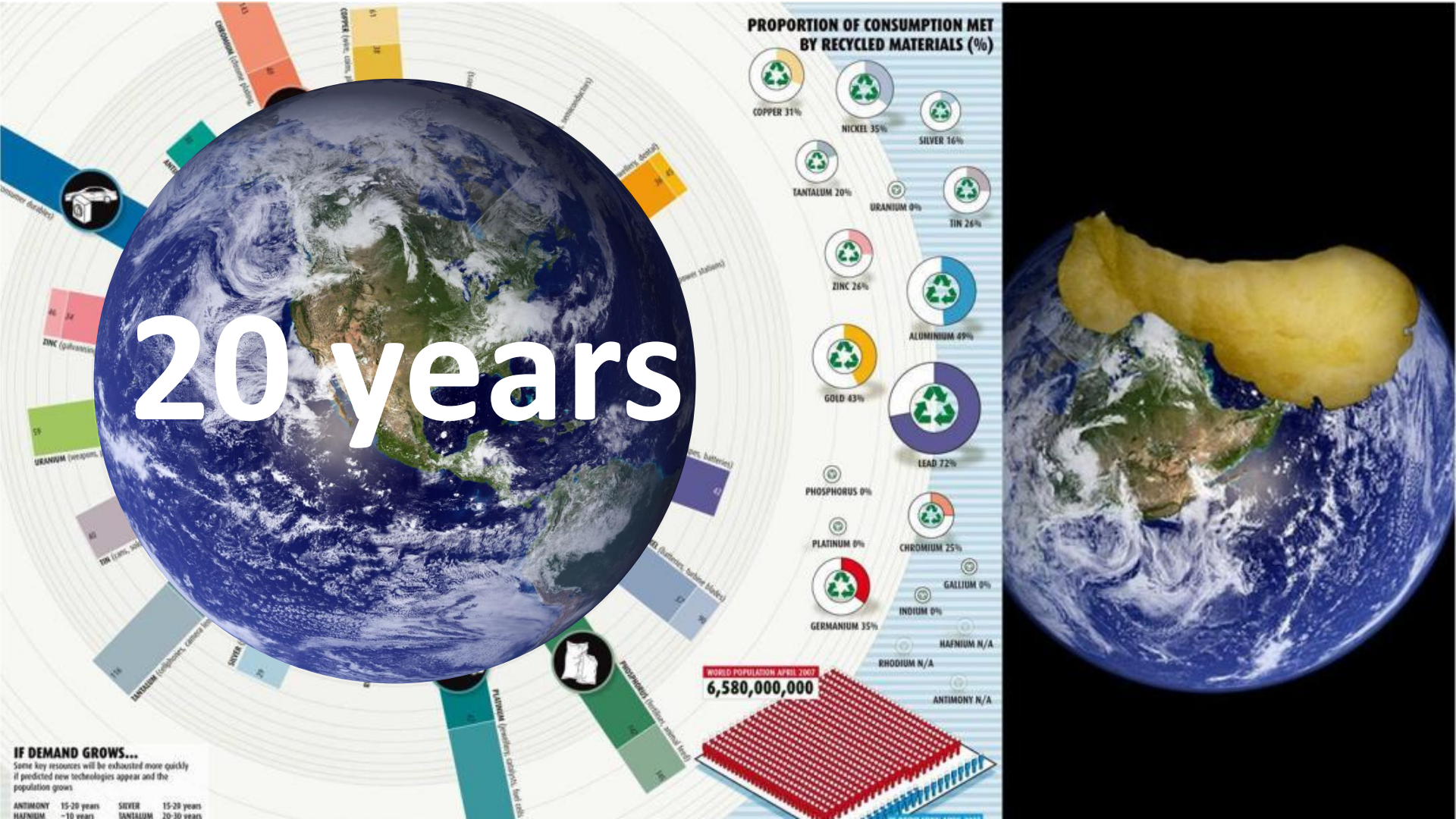
Measuring Progress

tute for
ACTURE
Reconditioning


Increasingly powered by renewable energy
Stocks of finite resources
Mining/materials manufacturing
Technical cycles
Parts manufacturer
Product manufacturer
Service provider
Recycle
Refurbish/ remanufacture
Reuse/redistribute
Maintenance
Consumer
User
Collection
Collection
Energy recovery
Leakage to be minimised


USE
DISTRIBUTION
DISPOSAL
PRODUCT LIFE EXTENSION
REDISTRIBUTION
REMANUFACTURE
RECYCLE
RAW MATERIALS
MANUFACTURE


HOW MANY YEARS LEFT
IF THE WORLD CONSUMES AT TODAY'S RATE
Reserve base
Annual global consumption
(assuming global consumption=global production)
HOW MANY YEARS LEFT
IF THE WORLD CONSUMES AT HALF THE US CONSUMPTION RATE
Reserve base
½ US per capita consumption 2006 x World population
Figures do not take into account chnges in demand due to new technologies
IF DEMAND GROWS...
Some key resources will be exhausted more quickly if predicted new technologies appear and the population grows
ANTIMONY 15-20 years
HAFNIUM ~10 years
SILVER 15-20 years
TANTALUM 20-30 years
ZINC (galvanising)
URANIUM (weapons, power stations)
TIN (cans, solder)
TANTALUM (capacitors, chinese lanterns)
SILVER (jewellery, catalytic converters)
RHODIUM (catalytic converters)
PLATINUM (jewellery, catalysts, fuel cells)
PHOSPHORUS (fertilizers, animal feed)
NICKEL (batteries, turbine blades)
LEAD (lead pipes, batteries)
INDIUM (LCDs)
HAFNIUM (computer chips, power stations)
GOLD (jewellery, dentist)
GERMANIUM (infrared optics, semiconductors)
GALLIUM (LEDs, solar cells, lasers)
COPPER (wire, coins, plumbing)
CHROMIUM (chrome plating)
Alloys
ANTIMONY (alloys)
(consumer durables)
PROPORTION OF CONSUMPTION MET BY RECYCLED MATERIALS (%)
COPPER 31%
NICKEL 35%
SILVER 16%
TANTALUM 20%
URANIUM 0%
TIN 26%
ZINC 26%
ALUMINIUM 49%
GOLD 43%
LEAD 72%
PHOSPHORUS 0%
PLATINUM 0%
CHROMIUM 25%
GALLIUM 0%
GERMANIUM 35%
INDIUM 0%
HAFNIUM N/A
RHODIUM N/A
ANTIMONY N/A
WORLD POPULATION APRIL 2007
6,580,000,000


20 years
PROPORTION OF CONSUMPTION MET BY RECYCLED MATERIALS (%)
COPPER 31%
NICKEL 35%
SILVER 16%
TANTALUM 20%
URANIUM 0%
TIN 26%
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SILVER 15-20 years
TANTALUM 20-30 years

Example SIR projects

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

Scottish Institute for Remanufacture

Project Update

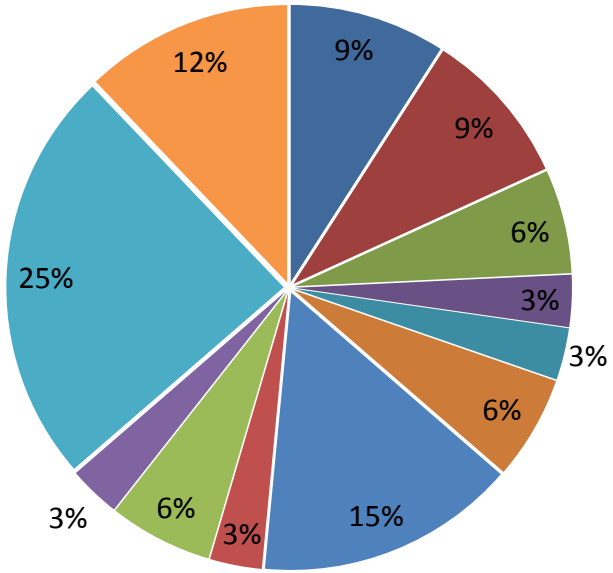
ZERO WASTE SCOTLAND

Scottish Funding Council
Promoting further and higher education

Projects by Research Area

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

Projects by research area
Total 33



- Material Assessment
- Prediction of Life

Non Destructive Inspection– 18%

- Cleaning
- Additive Manufacturing

Material Restoration – 9%

- Testing

Verification – 3%

- Process Improvements
- New Reman Product
- Tools

Process & Tools – 24%

- Reverse Logistics
- Business Tools
- Business Model

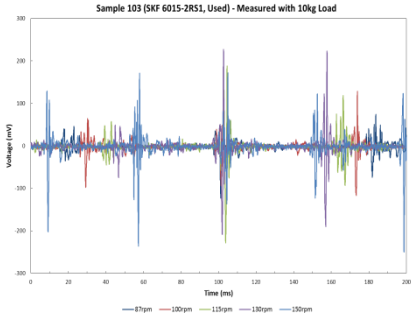
Business Model & Business Tools – 34%

- Design

Design – 12%

Cummins – University of Strathclyde
Ball Bearing Reuse

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning



Scope

- Predict the remaining life of sealed roller bearings: investigate if it is possible to determine the levels of wear on used roller bearing

Results

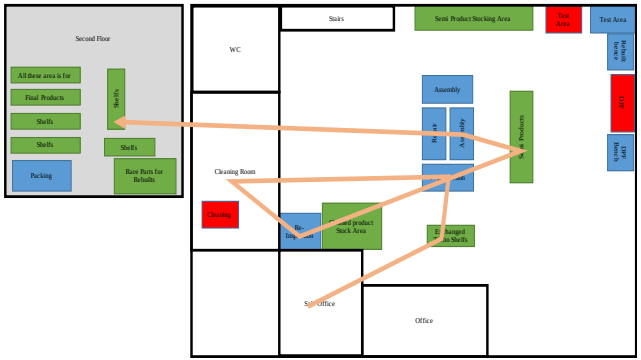
- Clear difference between new and used bearings, used bearings gave different acoustic emissions.
- Next Step: What do the different acoustic emissions mean and what would pass / fail criteria look like.

Benefits

- Material cost savings of £40,000 for this particular application but much larger opportunities exist company wide.
- Access to expertise which does not exist within Diesel Recon – Ultrasonic Acoustic Emission

The Turbo Guy– Heriot Watt University
Increasing productivity & competitiveness through practical workplace solutions

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning



Scope

- Calculate more accurate production costs given the variability in quality of returned turbos and work required to bring them to as new standard

Results

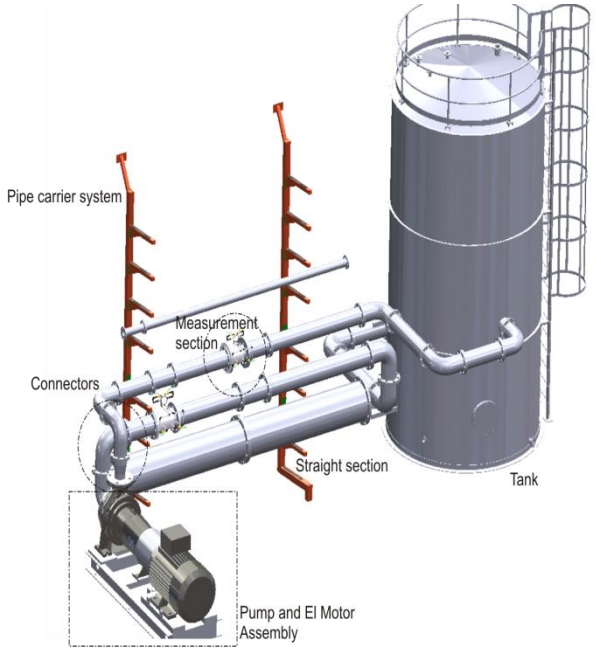
- Database created and new methodology implemented
- Accurate production costs per turbo calculated
- Production flow redesigned and individual workspaces reorganised

Benefits

- Increased productivity by 20%
- 15% reduction in costs
- Resulted in more accurate job quotations
- Increased reuse of parts opposed to purchasing replacements

Weir Group– University of Strathclyde Test Rig

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning



Scope

- Investigate feasibility of a reconfigurable test rig design that supports the testing of a wide a range of pumps with interchangeable components.
- Define optimum component sizes to allow best coverage of an range of pressures and flows.

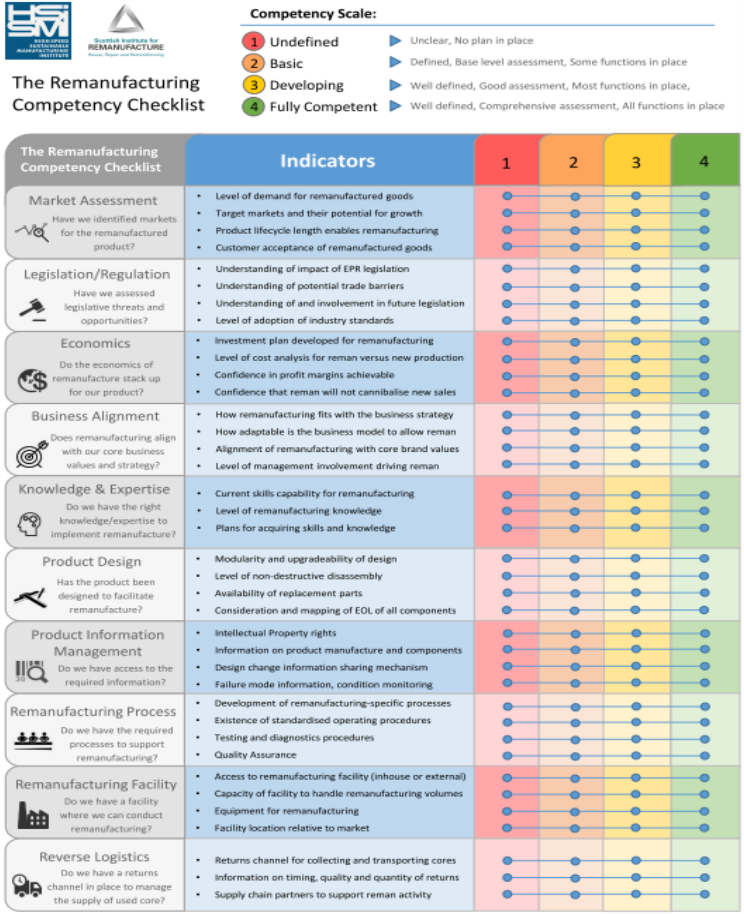
Results

- Outline design proposed that can be assembled from mostly standard components
- Custom components required for the flange reducer and the measurement section.
- Details 3D CAD visualisation created to allow cost estimation

Benefits

- It is estimated that expanding the current testing capability could increase orders for pump overhaul and testing by 70%.
- Increasing the utilisation and capability of the test rig would create or safeguard 3 to 4 Technical jobs.

Remanufacturing Competency Checklist



The Remanufacturing Competency Checklist

Competency Scale:

1. Undefined — Unclear, No plan in place
2. Basic — Defined, Base level assessment, Some functions in place
3. Developing — Well defined, Good assessment, Most functions in place,
4. Fully Competent — Well defined, Comprehensive assessment, All functions in place

The Remanufacturing Competency Checklist	Indicators	1	2	3	4
Market Assessment — Have we identified markets for the remanufactured product?	• Level of demand for remanufactured goods • Target markets and their potential for growth • Product lifecycle length enables remanufacturing • Customer acceptance of remanufactured goods				
Legislation/Regulation — Have we assessed legislative threats and opportunities?	• Understanding of impact of EPR legislation • Understanding of potential trade barriers • Understanding of and involvement in future legislation • Level of adoption of industry standards				
Economics — Do the economics of remanufacture stack up for our product?	• Investment plan developed for remanufacturing • Level of cost analysis for reman versus new production • Confidence in profit margins achievable • Confidence that reman will not cannibalise new sales				
Business Alignment — Does remanufacturing align with our core business values and strategy?	• How remanufacturing fits with the business strategy • How adaptable is the business model to allow reman • Alignment of remanufacturing with core brand values • Level of management involvement driving reman				
Knowledge & Expertise — Do we have the right knowledge/expertise to implement remanufacture?	• Current skills capability for remanufacturing • Level of remanufacturing knowledge • Plans for acquiring skills and knowledge				
Product Design — Has the product been designed to facilitate remanufacture?	• Modularity and upgradeability of design • Level of non-destructive disassembly • Availability of replacement parts • Consideration and mapping of EOL of all components				
Product Information Management — Do we have access to the required information?	• Intellectual Property rights • Information on product manufacture and components • Design change information sharing mechanism • Failure mode information, condition monitoring				
Remanufacturing Process — Do we have the required processes to support remanufacturing?	• Development of remanufacturing-specific processes • Existence of standardised operating procedures • Testing and diagnostics procedures • Quality Assurance				
Remanufacturing Facility — Do we have a facility where we can conduct remanufacturing?	• Access to remanufacturing facility (inhouse or external) • Capacity of facility to handle remanufacturing volumes • Equipment for remanufacturing • Facility location relative to market				
Reverse Logistics — Do we have a returns channel in place to manage the supply of used core?	• Returns channel for collecting and transporting cores • Information on timing, quality and quantity of returns • Supply chain partners to support reman activity				

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

- Developed by the High Speed Sustainable Manufacturing Institute
- Assesses all areas of a business
- Also available as a workshop

Scottish Institute for
REMANUFACTURE
Reuse, Repair and Reconditioning

A Few Announcements

NEW SEPA GUIDANCE ON REUSE

Do you reuse products?

If ‘yes’

You need to read this document to find out whether waste regulation applies to you, and how to comply

SEPA Guidance

Reuse Activities and Waste Regulation

Who is this guidance for?

This guidance is intended for:

- anyone who undertakes activities which involves the reuse of products – for instance local authorities, charity shops, community reuse organisations, remanufacturing companies, repair shops / services, logistics companies that transport used goods, retailers that take back used goods, online reuse organisations, auction houses, pawnbroker etc.
- SEPA staff who advise and regulate such reuse activities

What is the aim of the guidance?

The guidance aims to provide clarity on when waste legislation applies to reuse activities and what you have to do to comply.

When activities do fall within the scope of waste legislation, SEPA will act to protect the environment, maintain a level playing field and prevent illegal exports to developing countries. However, SEPA wants to make compliance as straightforward as possible, because we recognise the benefits of reuse to the environment, the economy and society in general.

We also want to ensure that SEPA staff are able to provide clear and consistent advice on which activities fall within the scope of waste legislation, and what the implications of this are.

What is the scope of the guidance?

This guidance applies to the reuse of **products or components of products**. It does not apply to **materials** for recycling, for example recovered paper, scrap metal, glass cullet, soil, rubble etc.

Only products and components of products which are being **reused for their original purpose** can be considered to be 'reused' or 'prepared for reuse'[1]. If the items are being used for a different purpose then this is 'recycling', and not within the scope of this guidance document. The Waste Framework Directive definitions of these terms are provided at the end of the guidance note.

SEPA reserves the right to depart from this guidance and to take appropriate action to avoid harm to human health or pollution of the environment.

What do we mean by 'reuse'?

Reuse means 'any operation by which products or components **that are not waste** are used again for the same purpose for which they were conceived' (Waste Framework Directive 2008)

If products become waste, then they must be prepared for reuse – 'checking, cleaning or repairing recovery operations by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing'. Preparation for reuse is a waste management activity and waste controls apply[2].

This document gives guidance on whether a product that is destined for reuse is a waste or a non-waste. Annex 1 provides full legal definitions and Annex 2 provides a flowchart to guide the decision.

[1] This is a requirement of the Waste Framework Directive, in order to protect the environment from risks which may occur as a result of using a product for a purpose it wasn't designed for. 'Upcycling' and 'repurposing' activities can usually be carried out under an exemption from Waste Management Licensing.

[2] Just because an activity involves checking cleaning or repairing does not mean that the item is waste.

SEPA
Scottish Environment Protection Agency

Speak to Lorna Walker on the SEPA stand today

Pick up a copy of the guidance

or find it at:

www.sepa.org.uk/regulations/waste/guidance

Strathclyde University

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

- Remanufacturing Research Group are looking for some feedback on 3 different definitional tools.

PhD Research: Building a Scottish Remanufacturing Network

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

Exercise 1: Assessing the role of SIR in the Scottish Remanufacturing Network

Aim of exercise:

- Inform SIR as to their current strengths and gaps in service provision to the network
- To highlight and future services that you think SIR should offer

Exercise 2: Mapping the Scottish Remanufacturing Network

Aim of exercise:

- Develop detailed network map of Scottish Remanufacturing network
- Provide detailed overview to companies and universities as to the nature of the network in Scotland and their role within the network
- Provide data and analysis with which to inform policy and legislation aimed and boosting remanufacturing in Scotland

Jack Barrie
PhD Circular Economy
Schmidt-MacArthur Fellow

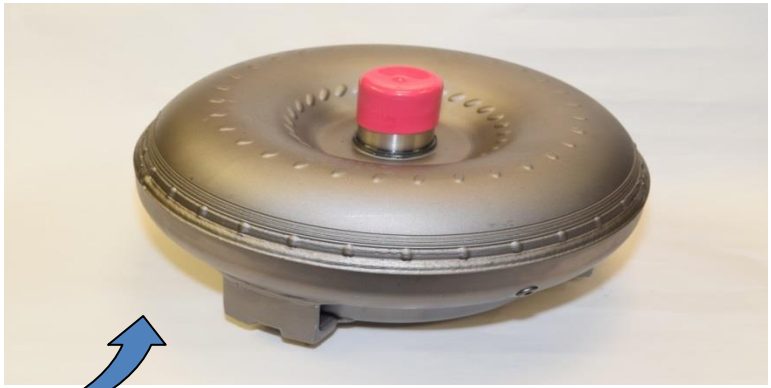
ELLEN MACARTHUR FOUNDATION
Rethink the future

University of Strathclyde

Scottish Institute for REMANUFACTURE
Reuse, Repair and Reconditioning

THANK YOU

www.scot-reman.ac.uk @SIRemanufacture



BEFORE

AFTER

ZERO WASTE SCOTLAND

Scottish Funding Council
Promoting further and higher education