THE BRITISH MASS SPECTROMETRY COMMUNITY

The 1st MEETING of the SUSTAINABILITY in MS WORKING GROUP UK

MANCHESTER INSTITUTE of BIOTECHNOLOGY
MANCHESTER 09 MAY 2023

In Partnership With...

BMSS · MANCHESTER 1824 · MASS UK · UKRI

MEETING REPORT

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Preface

The future of humanity will pivot on cumulative & concerted actions to reform our collective carbon footprint. The MS community must play its part in that grand project - by implementing achievable actions to enable a managed progression to net zero.

We may start by agreeing metrics of merit to calibrate our progress to a net zero position. This will be a complex journey!

As scientists we can be powerful advocates for change if we are willing to submit to forensic scrutiny of our own endeavours.

The 1st Meeting of the 'Sustainability in MS Working Group' (UK) was convened to explore options for progress. We invite you to review the meeting summary below.

With best wishes on behalf of the organising team.

Perdita Barran & Neil Oldham

MEETING REPORT

Workshop Agenda 09th May 2023

1030: WELCOME; Perdita Barran (MIB) & Neil Oldham (BMSS Chair)
1040: Susan Simon; UKRI
1110: Martin Farley; LEAF
1120: Chris Titman; SHIMADZU
1130: Steve Daly; MSVISION
1140: Richard Stratmann & Adam Hughes; BRUKER
1150: Mahmoud Youssef; EDWARDS
1200: John Chan; WATERS
1210: Darren Willman; THERMO-FISHER
1220: Charlotte Hands; PHARMARON
1230: Alexandra Deschamps-Sonsino; DESIGN COUNCIL UK
1240: LUNCH
1315: FACILITATED BREAK OUT SESSIONS
1445: TEA
1500: SUMMARY PRESENTATIONS FROM BREAKOUT SESSIONS & DISCUSSION
1600: Closing Remark; Perdita Barran and Neil Oldham

MEETING REPORT

Susan Simon

UKRI

UK Research and Innovation

UKRI Environmental Sustainability (ES) Programme Overview

May 2023

INTRODUCTION

MRC Director Capital & Estate

- Buildings
- Physical Security
- Business Continuity
- Health & Safety

MRC Chief ES Officer

- Estates transformation (NetZero)
- Sustainable research operation
- Research in sustainable solutions
- Engagement (internal/external)

Interim Director UKRI Environmental Sustainability Programme

- Research facility transformation (NetZero)
- UK Concordat on sustainable research
- UKRI Policies (travel, procurement, etc.

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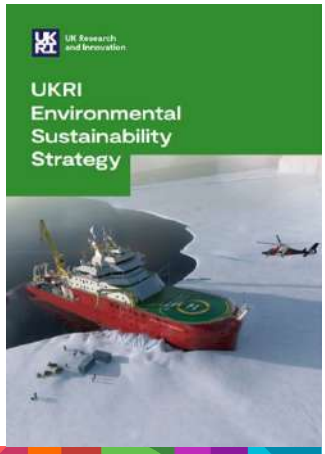
Susan Simon

UKRI

Key Drivers for Environmental Sustainability

- UKRI Research and Innovation outcomes – highlighting the need for proactive change to enhance and protect the environment across a broad range of areas
- Government Net Zero targets
- UKRI Corporate Plan – commitment to delivery of our environment sustainability strategy
- Greening Government Commitments – setting environmental targets and reporting requirements for all government bodies
- Desire to reduce operational costs and carbon emissions alongside innovation in operational delivery
- Opportunity for UKRI to demonstrate leadership for environmental sustainability in the Research and Innovation sector and beyond



Scale of the Challenge (per annum)

141,000 tonnes CO2e

£30M Energy bill

1,493 tonnes of waste

100+ UKRI sites

£500m Procurement spend

~58,000 Individuals and organisations funded

£8.7Bn R&D grant funding

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Susan Simon

UKRI

Carbon control and business cases

Delivering on ES Strategy commitments:

- Net Zero 2040 - Reducing and mitigating all carbon emissions from our owned operations
- To establish carbon emission baselines and reduction targets for directly controlled activity
- To integrate environmental sustainability criteria into all capital & infrastructure investment decisions
- To establish a system for carbon emissions accounting, forecasting, and 'control' to support decision making

Key Objectives:

- Gap analysis and verification of UKRI carbon emissions
- Establish environmental & carbon assessment tools in infrastructure business cases
- Establish UKRI carbon accounting ('control') approach and requirements
- Assurance for UKRI Business Travel policy

Policy change

Delivering on ES Strategy commitments:

- To promote sustainable travel
- To set a position on Carbon offsetting
- To set supplier requirements and provide staff with guidance on sustainable procurement
- To ensure infrastructure decisions are informed – considering the environmental impact of decisions inc to our carbon emissions

Key objectives:

- Update UKRI Business Travel policy
- Set minimum environmental standards for travel contracts
- Agree and publish a position on carbon offsetting
- Implement the UKRI Responsibility Charter
- Enable policy change to ensure ES informed investment decisions

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UKRI

Sector concordat

Delivering on ES Strategy commitments:

- Setting the standard: helping influence positive environmental change
- (Priority 1) Emissions from R&I investments as part of UKRI's scope 3

Key Objectives:

- Lead a sector-wide collaboration to jointly achieve positive environmental change in the UK R&I system.
- To develop a set of principles as part of a new environmental sustainability concordat that all parties can follow and sign up to
- To engage with representatives across the sector (Higher education, independent institutes and funders) to help understand the need for a concordat and gain buy-in

Estates and Infrastructure

Delivering on ES Strategy commitments:

- Work towards NetZero position of UKRI owned operations by 2040
- Drive efficient use of resources and reduce waste
- Protect and enhance health of the living environment
- Protect and enhance quality of the physical environment

Key Objectives:

- Transformation of the UKRI owned estate and research infrastructure to Net Zero position.
- Continuous improvement of our research operations to become environmentally sustainable (reduce use of natural resources and waste).
- Improve biodiversity across our estate

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UKRI Responsible Procurement Charter

Undertaking supplier selection and evaluation so that suppliers who can demonstrate an understanding of; and commitment to reducing their operational and supply chain's environmental footprint are considered. To include but not limited to:

a. Conservation of resources
b. Waste minimization
c. Reduction in greenhouse gasses
d. Pollution to the natural environment
e. Emissions in sourcing and delivery

COLLABORATION – SCIENCE & TECHNOLOGY

IF SCIENTISTS and ENGINEERS cannot solve the problem – then nobody can!

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Susan Simon UKRI

UK Research and Innovation

Thank you

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Martin Farley

LEAF

Sustainable Science

Martin Farley - Sustainable Labs Manager (UCL)

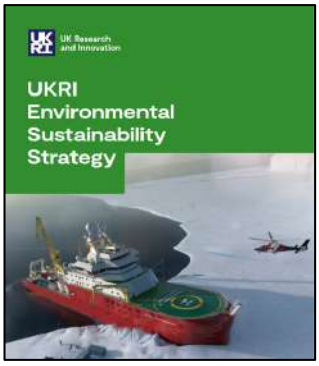
2050 – UK net zero

News story

UK becomes first major economy to pass net zero emissions law

New target will require the UK to bring all greenhouse gas emissions to net zero by 2050.

Published 27 June 2019
From: Department for Business, Energy & Industrial Strategy and The Rt Hon Chris Skidmore MP



Press release

Third of UK's biggest companies commit to net zero

30 of the UK's FTSE100 companies have signed up to the United Nation's Race to Zero campaign.

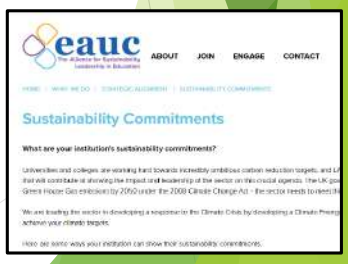
From: Department for Business, Energy & Industrial Strategy and The Rt Hon Kwasi Kwarteng MP
Published 30 March 2021

NERC SCIENCE OF THE ENVIRONMENT

2040 – UKRI net zero

2030 – UCL net zero

EAUC Lists Targets



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Sustainable Labs Today

Sustainable / Green Labs

Green Chemistry

Built Environment
- BREEAM, Passive house labs?
- SKA Labs
- Ventilation Rates
- Net-zero construction

Equipment & Consumables
- Sustainable Tenders
- Manufacturers Impact
- NEED Life-cycle carbon assessments

Lab Operations
- Chemicals, equipment use, etc.
- How staff interact with their facility

THE CAMBRIDGE green CHALLENGE · GREEN LABS ·

The case for sustainable laboratories: first steps at Harvard University

nature

What can you do to make your lab greener?

green lab associates

Green Labs - NL

SELS Sustainable European Laboratories

LEAN LABORATORY EFFICIENCY ACTION NETWORK

The Guardian

Can laboratories curb their addiction to plastic?

Green Your Lab

Network of Sustainable Science and Green Lab Enthusiasts

the caring scientist:

mission sustainable

Environment: Labs should cut plastic waste too

MAX PLANCK SUSTAINABILITY NETWORK

Welcome to the lab of the future

green labs austria

GREEN LIGHT LABORATORIES LIMITED

University of California - multi-institutional sustainable laboratory policy:
www.ucop.edu/sustainability/policy-areas/sustainable-operations/index.html

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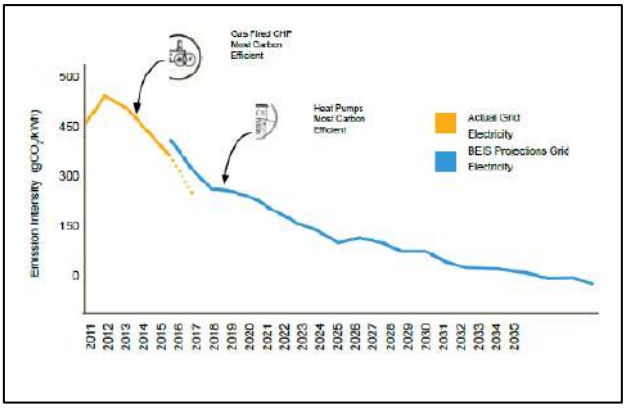
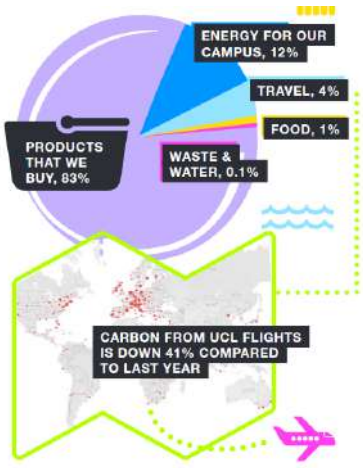
Scopes of Carbon and the future

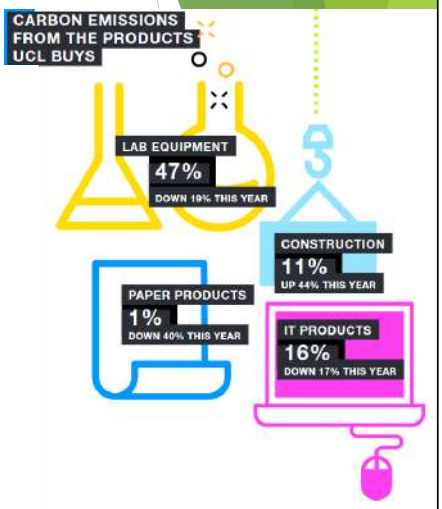


- Carbon emissions associated with each kWh are decreasing, so you need to save more now
- The balance between scopes 1&2 vs 3 are what make knowing what to act so challenging!

Impacts of Science - Life Cycle Analysis

- Would not promote the replacement of functional models for efficient versions… Why? Because of Embodied Carbon
- Much data on impacts of science skip this crucial aspect
- Lot's 'green' initiatives are unsubstantiated, and driven by marketing





2019-20 UCL Sustainability Report

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With any sustainability scheme you have to ask: Is it better than what we're doing, where's the evidence, and has it really been thought through?

Net Zero Mass Spectrometer enables Scientists to Work Sustainably

07.10.2021 | Editor: Doris Popp

The Thermo Scientific Delta Q Isotope Ratio Mass Spectrometer (IRMS) is a next generation gas IRMS designed to enable detailed analysis with greater precision and accuracy.

The Thermo Scientific Delta Q Isotope Ratio Mass Spectrometer (IRMS).
(Source: Thermo Fisher Scientific)

In addition to its improved specifications, including an upgrade in software to Qtegra ISDS to improve ease-of-use and laboratory productivity, the system's carbon footprint will be neutralized, allowing scientists to carry out their work, while minimizing their environmental impact. The Delta Q IRMS is the first product to be released as part of the IsoFootprint campaign, an initiative to permanently remove CO_2 emissions associated with the manufacture and supply chain of all new inorganic IRMS products. The Inorganic MS (IOMS) team at Thermo Fisher has committed to removing all embodied carbon in its new instrumentation, using technologies, like direct air capture and bio-oil sequestration, that lock away carbon from

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Suppliers & Manufacturers

MIDAS

Your Custom Polyurethane Moulding Supplier

Managing Director – Alan Rance
https://www.midaspattern.co.uk/green-initiative

'Process Carbon Neutral' since July 2020

100%	100%	650	Zero
LED Lighting	Recyclable Packaging	Solar Panels	Landfill

Carbon Neutral Certified and from January 2021, MIDAS to Mitigate ALL Embodied Carbon

New Results — Follow this preprint

Re-use of labware reduces CO_2 equivalent footprint and running costs in laboratories

Martin Farley, Benoit P. Nicolet

doi: https://doi.org/10.1101/2022.01.14.476337

This article is a preprint and has not been certified by peer review [what does this mean?].

Abstract | Full Text | Info/History | Metrics | Preview PDF

ABSTRACT

Laboratory-based research is resource intensive in terms of financial costs and its carbon footprint. Research laboratories require immense amounts of energy to power equipment, as well as large volumes of materials, particularly of single-use item

https://www.biorxiv.org/content/10.1101/2022.01.14.476337v1

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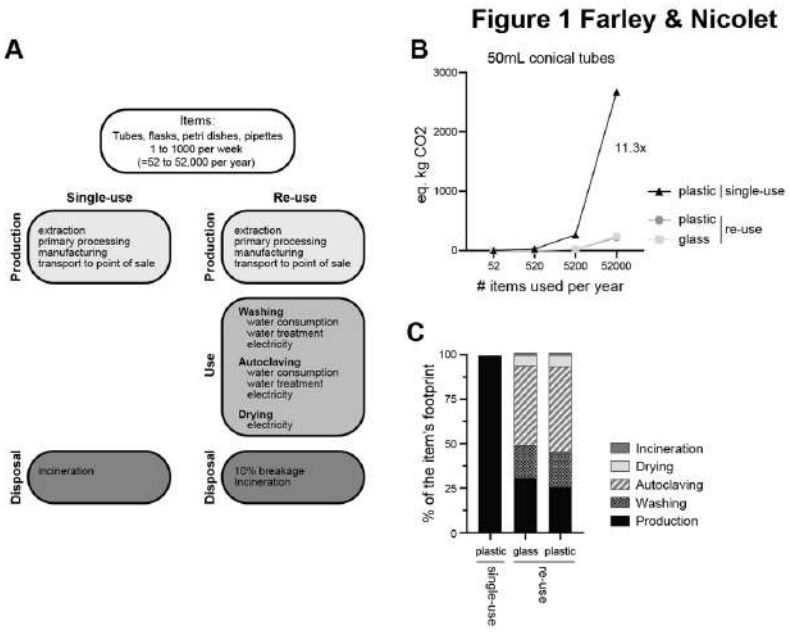

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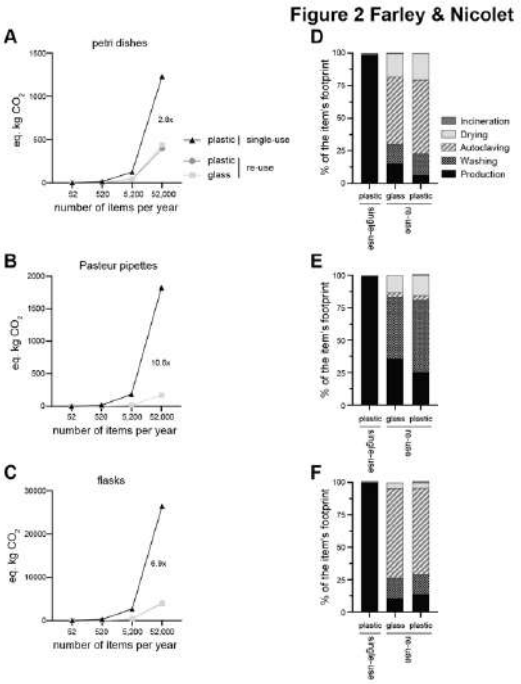

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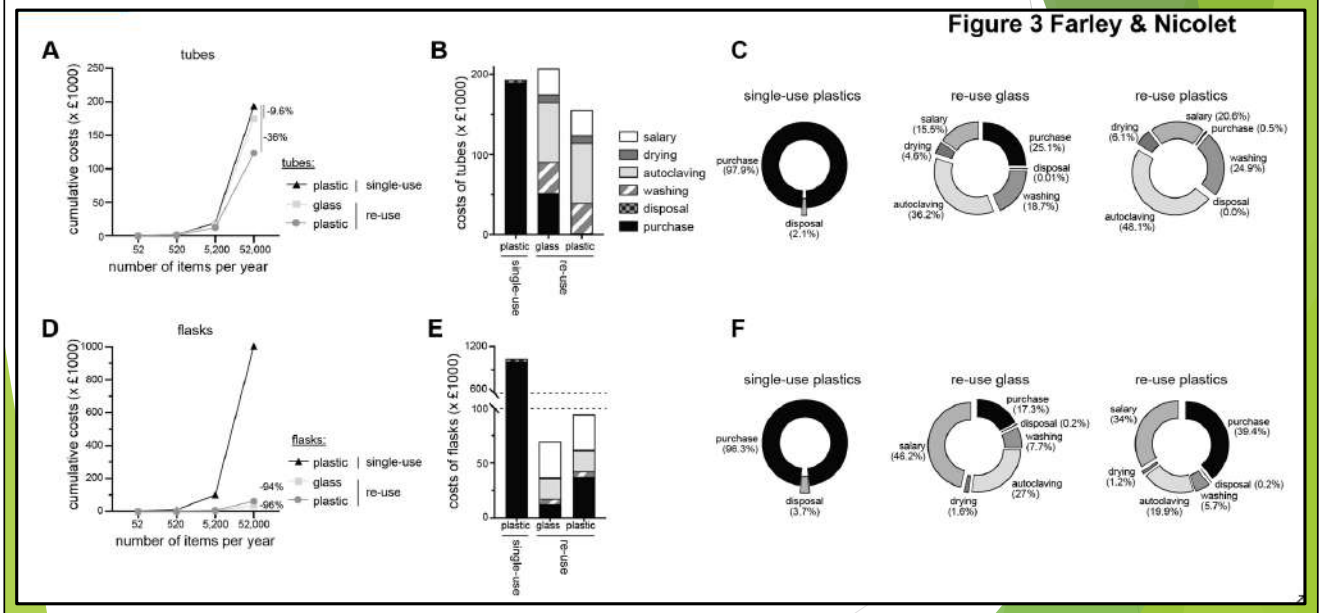

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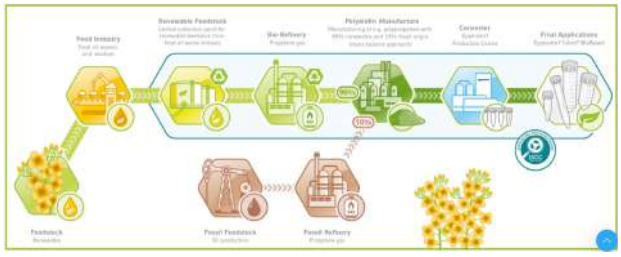
Biobased Tubes



Full length article

Environmental life cycle assessment of polypropylene made from used cooking oil

Christian Moretti, Martin Junginger, Li Shen

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https://doi.org/10.1016/j.resconrec.2020.104750

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"A life cycle analysis compared the conventional way to produce polypropylene made of crude oil and the process with used cooking oil as raw material and showed that the second process has a 62% lower impact on climate change [12]."

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More Research is Needed!

- What are the CO2 emissions of scientific pathways?
- Where are the real balance points between sterile and reusable? Contaminated and not?
- Storage temperatures
- LCAs of so many products and processes still unknown

Funding Environments

Funding opportunity

Environmental sustainability in life sciences and medical practice

Opportunity status:	Open
Funders:	Medical Research Council (MRC)
Funding type:	Grant
Total fund:	£1,000,000
Maximum award:	£100,000
Publication date:	15 December 2021
Opening date:	3 January 2022
Closing date:	1 March 2022 16:00 UK time

Last updated: 13 January 2022

Timeline

- **3 January 2022 00:00**
  Opening date for outline applications
- **End of January (to be confirmed)**
  Webinar about the call
- **1 March 2022 16:00**
  Closing date for outline applications
- **13 May 2022 (to be confirmed)**

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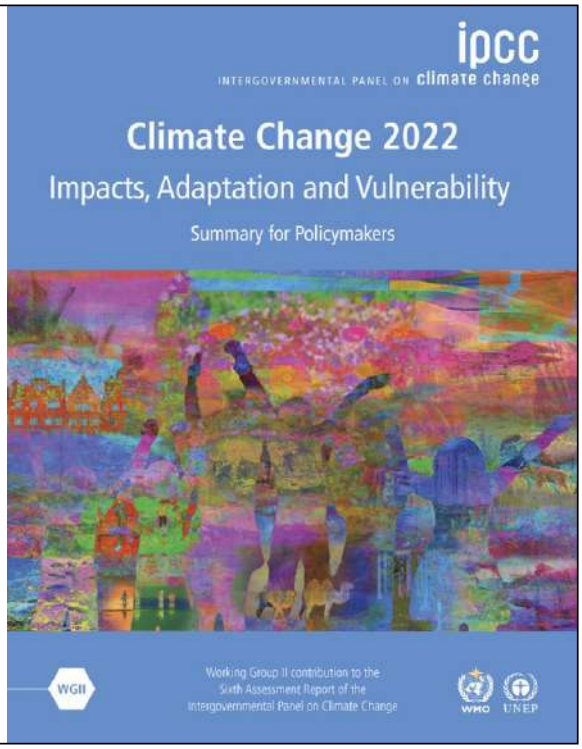
BUT

- We need action now…..
- We know reuse is better typically, and reduction is obviously better



There's a reason we all follow H&S, but don't all implement sustainable practices…

Athena SWAN GENDER CHARTER

If there was a standard, what might it look like?
How do we know if a lab is "green"?

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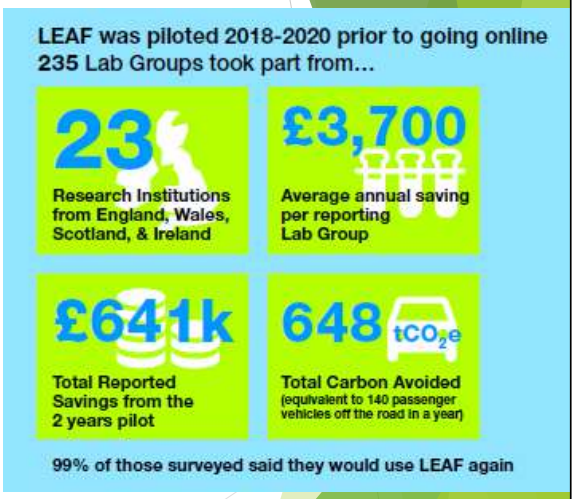
LEAF: Laboratory Efficiency Assessment Framework

- Standard in Sustainable Laboratory Operations
- Criteria in areas like ventilation, equipment, people, facilities/space, procurement & waste, samples & chemicals, and research quality
- Bronze, Silver, Gold categories of criteria
- User-led initiative
- Crucially allows you to estimate impact in CO2 and money saved, with inbuilt calculators

LEAF 2018-2020 Pilot Results

- 225+ submissions from 23 Institutions (England, Scotland, Ireland, Wales)
- £3,700 – Average saving per lab / annum
- 2.9 tCO2e – Average CO2 reduction per lab / annum
- Equivalent of 132 cars taken off the road (620 tonnes of CO2 equivalent)
- 52% had used a system before, though 74% said it was driving new good practice and not a validation of the existing
- 99% said they would participate again



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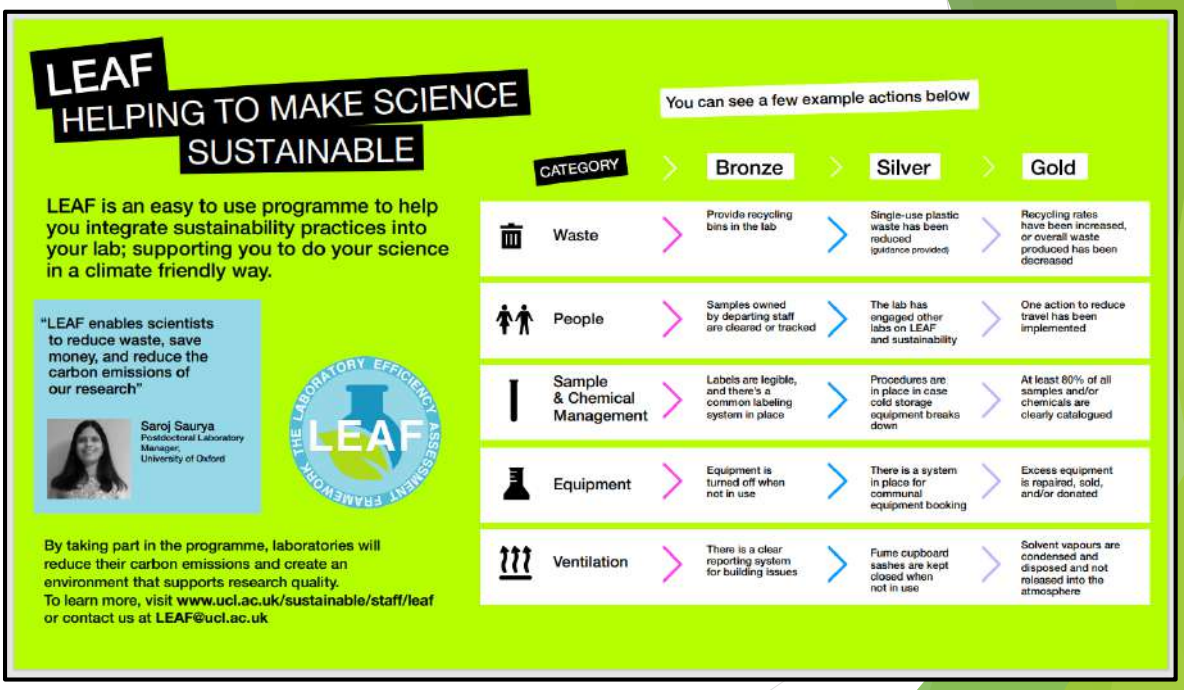

LEAF Update

- Been online for 2 years
- 105 Institutions signed up since going live in Feb 2021 from 16 countries. 3,700 users from 2,700 labs
- Stated target for MRC facilities to achieve Gold by 2025
- World's largest Green Lab Programme
- Both Exeter and Bristol have reached 100% uptake in their labs, the only institutions in the world to accomplish this

National Technician Development Centre for Higher Education

UK Research and Innovation

MRC Medical Research Council

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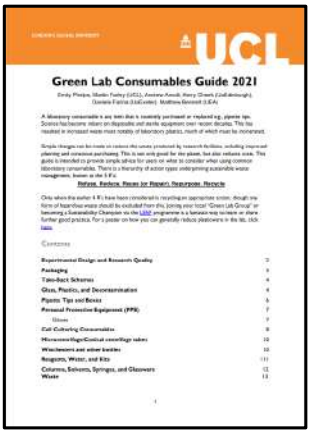
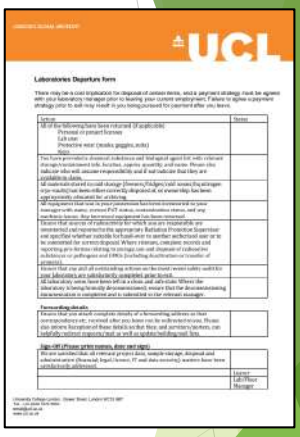
Resources





- https://www.ucl.ac.uk/sustainable/staff/labs/resources-and-materials

Grassroots goes pretty far!

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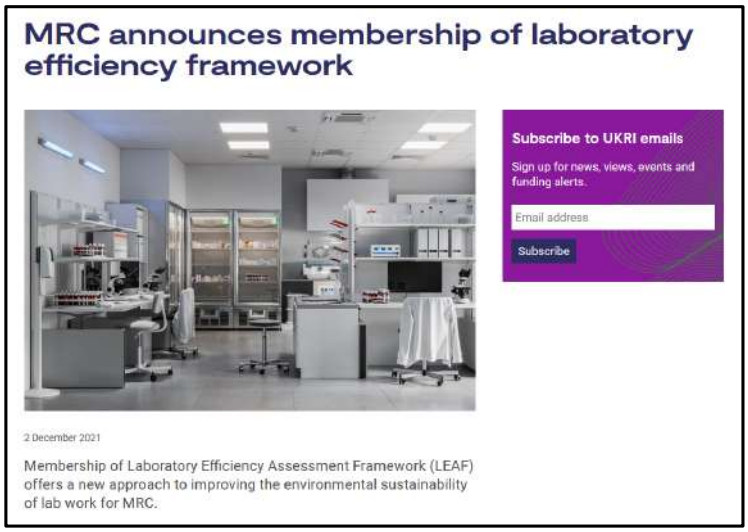

Ideal Targets for Faculties

- 1. 100% uptake of LEAF in labs, and Green Impact in offices
- 2. No - Fly Zone: No flights for Eurostar destinations, and within England?
  - Remote speaking rules also
- 3. Vegetarian catering
- 4. Out-of-hours agreed with E&F to shut down building, reduce ventilation
  - Switch-off
  - Include Animal Facilities
- 5. Consumable & Waste Review
- 6. Require teaching to integrate sustainability
  - Students are taught impact of practices, and practical teaching reviews consumables

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Martin Farley

LEAF

Thank you!

@GreenLabGuy
@LEAFinLabs

m.farley@ucl.ac.uk

THANK YOU
-Sustainable UCL
-UoExeter Technical Services
-Matthew Bennett, UCL
-UCL ISD, Aaron Kashab, Vindya Dassanayake
-Joanna Marshall-Cook, UCL
-UoBristol Sustainability
-UK Reproducibility Network
-NTDC
-UKRI, MRC, NERC
-Everyone using LEAF!

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Chris Titman

SHIMADZU

SHIMADZU
Excellence in Science

Sustainability in MS Workshop

Shimadzu Corporation

Tuesday 9th May 2023

Chris Titman
Shimadzu UK Limited

Shimadzu Corporation

Corporate Philosophy

Contributing to Society through Science and Technology

Management Principle

Realizing Our Wishes for the Well-being of Mankind and the Earth.

Create a Bright Future

Engage in activities as a responsible member of society

while working towards harmony between the earth, society, and people.

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Chris Titman SHIMADZU

Well-being of Mankind and the Earth

- Development of science and technology
- Contribution to human health
- Realization of a society with healthy longevity

- **Commitment to Carbon Neutrality**
- **Creation of Circular Economy**
- **Contribution to the conservation of biodiversity**

Sustainability Charter

In 2021 created the Shimadzu Group Sustainability Charter committed to addressing three themes:

Contributing to the "Well-being of Mankind and the Earth,"

Contributing to industry and society

Corporate governance throughout

Taking on the Challenge of Achieving Sustainability

As a member of society, we endorse the Global Compact proposed by the UN

We will continue solving issues associated with sustainability *e.g.*, achieving SDGs.

What does this look like:

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Shimadzu Forest

Shimadzu Forest retains the AAA Rating (Japan Habitat Evaluation & Certification)

A Chestnut Tiger Butterfly Drinking Nectar from a Fujibakama Flower

https://www.shimadzu.com/environment/initiative/004.html

Enabling everyone, Europe

https://www.shimadzu.eu/beemore

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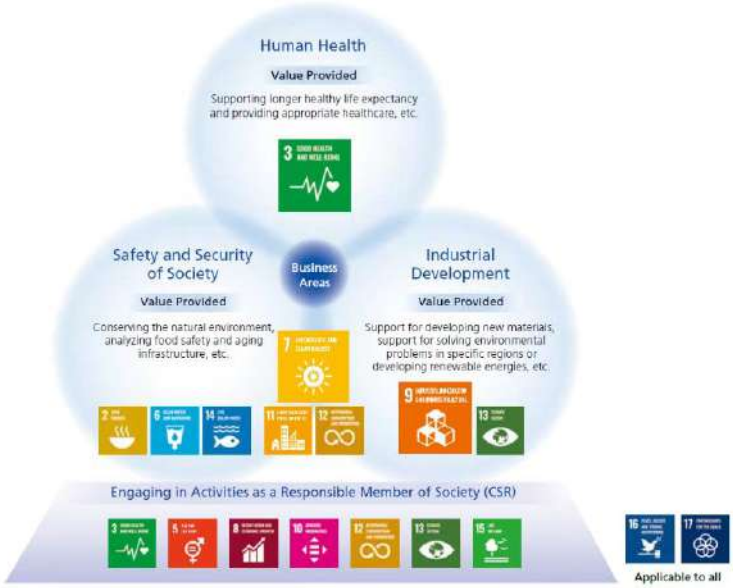
Sustainability Activities

https://www.shimadzu.com/sustainability/index.html

United Nations – Sustainable Development Goals

https://www.un.org/sustainabledevelopment/

How Company Activities Relate to SDGs



Shimadzu Group's Five Initiatives for Environmental Management

1. Responding to Climate Change
2. Initiatives to Create a Circular Society
3. Development and Provision of Environmentally Friendly Products and Services
4. Initiatives to Conserve Biodiversity
5. Proactive Environmental Protection Activities of Each Employee

https://www.shimadzu.com/sustainability/approach/environmental/management.html

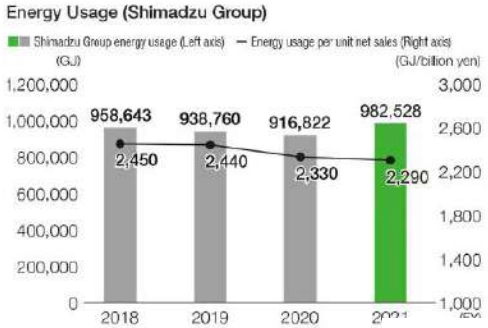
What does this look like:

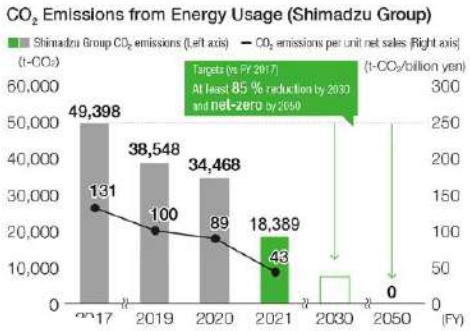
Chris Titman

SHIMADZU

Energy Usage & CO2 Emissions

RE100, a global environmental initiative, Shimadzu Group pledge to use 100 % renewable energy in its business activities by 2050, 85% by 2030





TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

RE100 CLIMATE GROUP | CDP

Energy Usage & CO2 Emissions

RE100, a global environmental initiative, Shimadzu Group pledge to use 100 % renewable energy in its business activities by 2050, 85% by 2030

Energy Usage (Shimadzu Group)

Shimadzu Manufacturing Asia Sdn. Bhd. (Malaysia)

CO2 Emissions from Energy Usage (Shimadzu Group)

Shimane Shimazu Co., Ltd.

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

RE100 CLIMATE GROUP | CDP

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Eco-Products Plus

	Criterion
1	At least 25 % lower energy consumption
2	At least 25 % smaller size (in terms of weight, volume, or footprint)
3	At least 25 % less use of consumables such as gases and solvents
4	At least 25 % reduction in CO_2 emissions*1 based on life cycle assessment due to longer life
5	At least 25 % reduction in noise level*2
6	At least 25 % improvement in energy density*3

Shimadzu offers "Eco-Products Plus" products, which are products that are certified to achieve outstanding environmental performance.

LCMS-2050 High-Performance Liquid Chromatograph Mass Spectrometer

DSF-60C30 Super-Heated Dewaxing Furnace

Trinias Angiography System

An example - LCMS-2050

Decrease in size
260 x 650 x 280 (W x D x H)

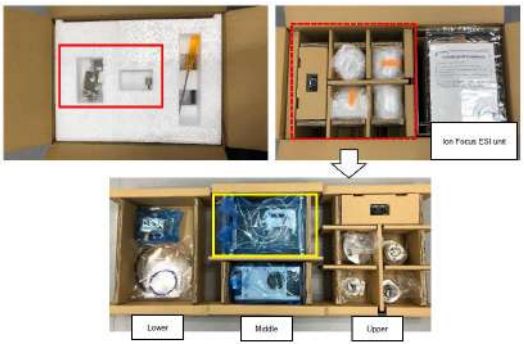
Decrease in Weight
34 kg

Decrease in Power usage
Down to 43%

Eco Mode Power saving

What else to consider

- Lifecycle, options for a circular economy (options for older instruments)
- Maintain support for older instruments (minimum within software)
- Application Considerations i.e. solvent consumption, consumable consumption
- Ensure in-field upgrade are available and practical *i.e.,* LCMS instrument



What we want to get from today

This overview by no means is a a fixed plan
In the spirit of Kaizen we continually evolve this to become better

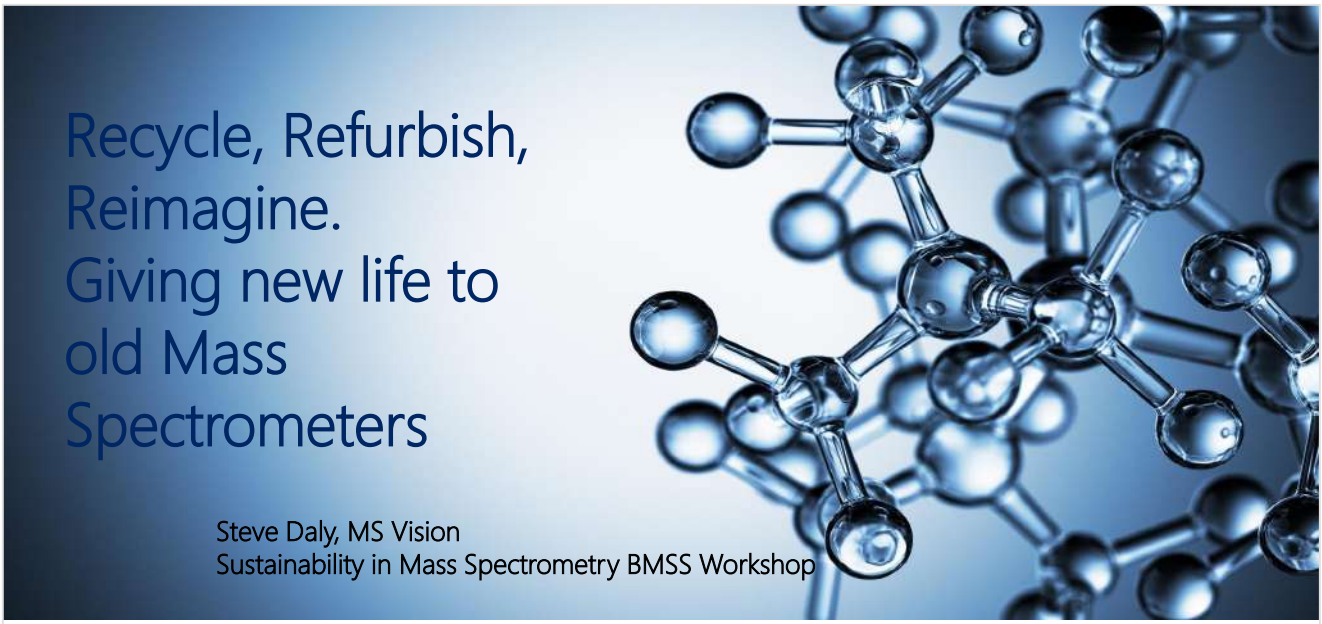
As such we have a diverse group of people from Shimadzu here today
Engineers, R&D, Applications, Customer Support, Sales

Being part of today will hopefully allow us to do things better:
- Understand Expectations
- Direct Corporate Feedback
- Directing Change

We care and come to this with an open mind to improvement

Steve Daly

MSVISION



MSVision
Dedicated to Mass Spectrometry

What happens to a mass spectrometer when it dies?

Sometimes, you want to get rid of your mass spectrometer

- Budget for a newer model.

- No longer working =(.

- Too expensive to keep running.

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MEETING REPORT

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There is life after death!

Do not just leave your old MS rotting away in a forgotten corner of your lab! There are other ways!

- Refurbish and resale – you may not have a use, but we can find someone who does.

- Spare parts – your mass spectrometer can be an organ donor to keep others alive.

- Upcycling. Turning your trash into treasure!

3

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Refurbishment, Resale and support

10-20 donor instruments per year (including LC)

50% refurbished and resold

50% stripped for parts

4

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MEETING REPORT

Refurbishment and resale example.

- Waters ZQ single quad.
- Donated by a school in the Netherlands.
- Refurbished and tested at MS Vision.
- Sold to a University in Belgium.

Support – Examples in Manchester.

We support several instruments in Manchester:

Q-Tof1 (MoQTof), serial number UB054, 25 years old
Q-Tof2 (J2), serial number UC294, 23 years old

And we modified one instrument for high mass:

Q-Tof Ultima Global, serial number GAA081, 21 years old but now sadly switched off

General "out of vendor" support. We have ~50 instruments (around half on contracts) that are out of vendor support.

The oldest is a Quattro II, serial number 6416E which is 26 years old.

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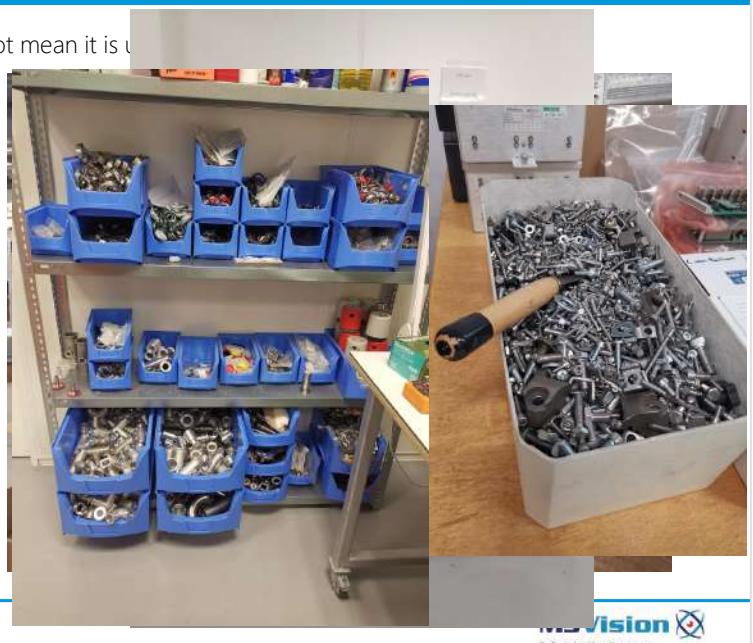
Spares – rescuing working parts from broken instruments.

Just because an instrument no longer works, does not mean it is u
Many parts can be recovered and recycled.

- Roughing and turbomolecular pumps
- PCBs, power supplies and other electronics
- Sources
- Ion optics
- EPCs and EPC components.
- Vacuum fittings/gauges and screws.



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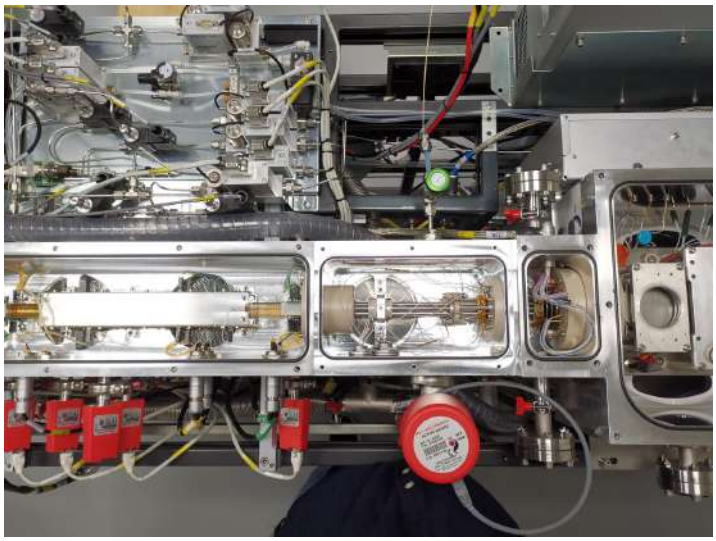
Upcycle – who says you cannot teach old dogs new tricks?

Take an old instrument … and make it do things it never could before.

- Photosynapt. Modified a Synapt G2 to perform mass and mobility selection ion spectroscopy measurements with IR and UV.



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MEETING REPORT

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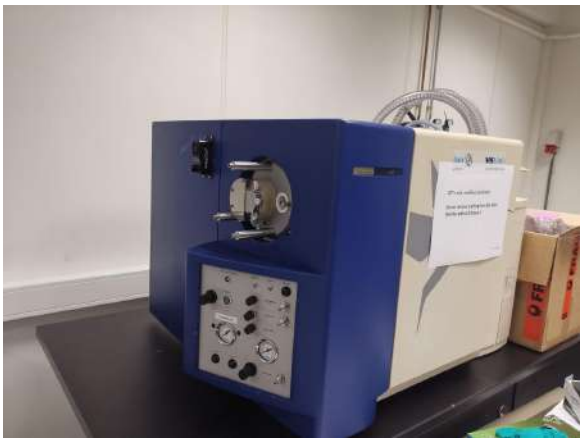
Upcycle – who says you cannot teach old dogs new tricks?

Take an old instrument … and make it do things it never could before.

- Photosynapt. Modified a Synapt G2 to perform mass and mobility selection ion spectroscopy measurements with IR and UV.

- Himass LCT Premier
  - Modified for high mass applications
  - (2 high mass LCTS going out to new owners this year. And we are collecting another this month we may well modify should any of you like one too …)



Giving a 20 year old instrument a place in a world of MRTs and orbitraps.

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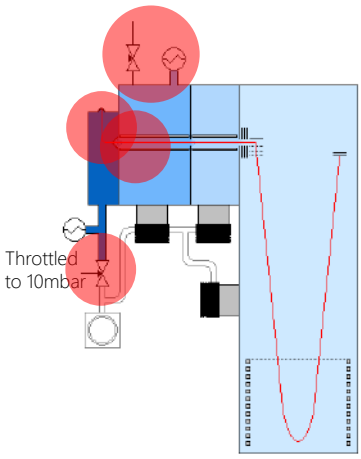
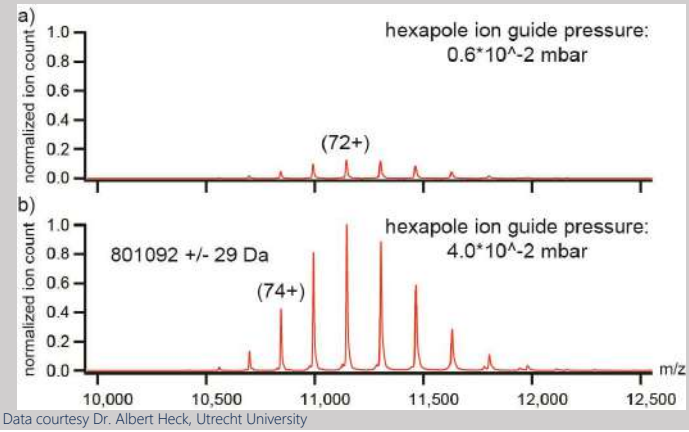
High Mass LCT Premier.



Throttle valve in the source vacuum line
Pressure sleeve around the ion guide
Gas inlet in the ion guide housing
Increased voltage range on sample- and extraction cones



Data courtesy Dr. Albert Heck, Utrecht University

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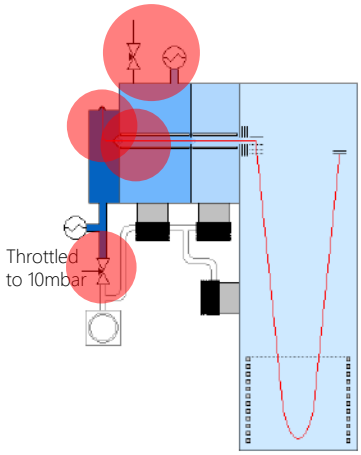
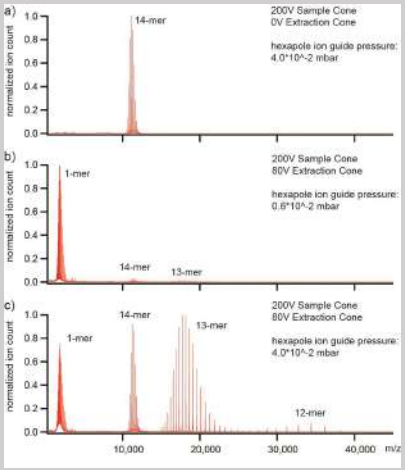
MEETING REPORT

High Mass LCT Premier.





High ion guide pressure, **low** activation

> Good transmission for high m/z

Low ion guide pressure, **high** activation

> Good dissociation but we loose high m/z ions

High pressure, **high** activation

> Need high pressure for high m/z transmission, high voltage for dissociation

Data courtesy Dr. Albert Heck, Utrecht University

MSVision Dedicated to Mass Spectrometry

Conclusions

The end of your use of a mass spectrometer is not the end of the life of the mass spectrometer!

Recycle for part.
Refurbish for other uses
Reimagine for new applications.

MSVision Dedicated to Mass Spectrometry

MEETING REPORT

Steve Daly

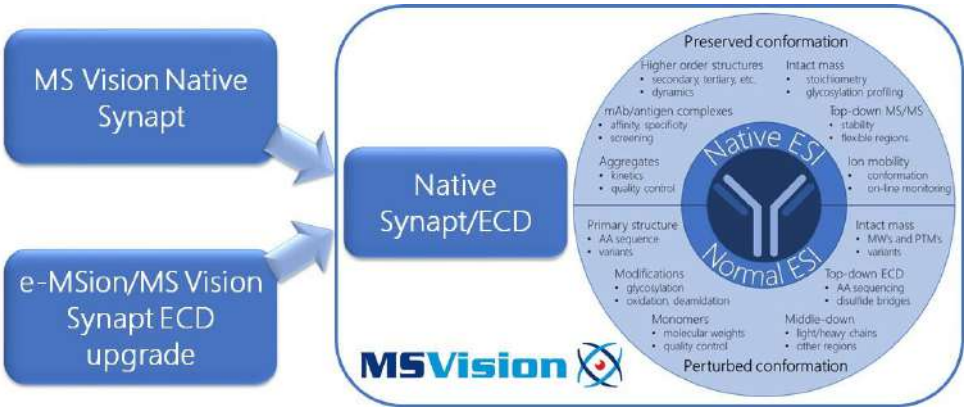
MSVISION

Thank you for your consideration

On behalf of MS Vision

Steven Daly

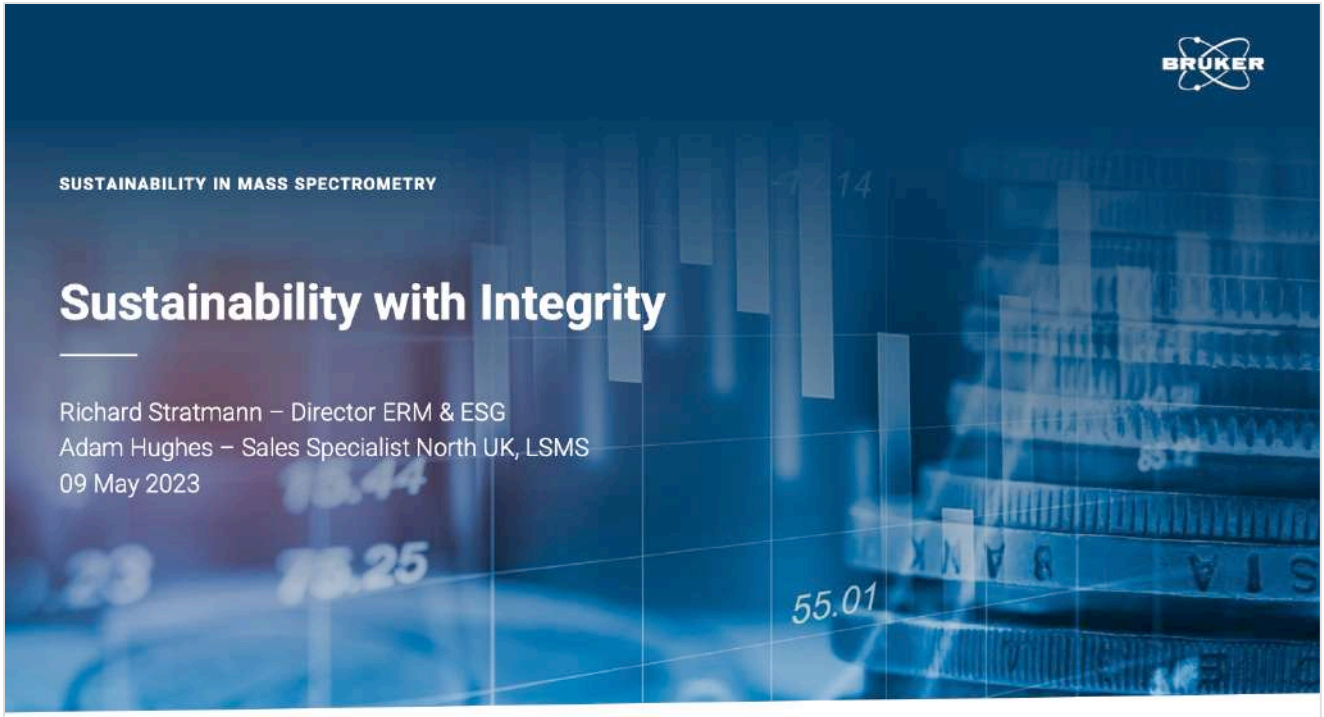
& Lisa McGowan - lm@msvision.com



MSVision
Dedicated to Mass Spectrometry

MEETING REPORT

R. Stratmann & A. Hughes BRUKER



SUSTAINABILITY WITH INTEGRITY

BRUKER

Introduction

Richard Stratmann
Director ERM & ESG Bruker CALID

- Dutch
- >15 years experience in Finance and ESG
- Worked in the Netherlands, Italy, UK, Malaysia and Singapore in Financial audit, automotive, FMCG (coffee)
- Developing and executing ESG strategy

Adam Hughes
Sales Specialist North UK, Life Science Mass Spec

- UK (Manchester)
- >15 years com. experience in Chromatography / Mass Spec
- Master in Chemistry, University of Sheffield (2006)
- MBA, The Open University (2022)
- Proteomics, imaging, chromatography, business dev.

MEETING REPORT

R. Stratmann & A. Hughes BRUKER

SUSTAINABILITY WITH INTEGRITY

Market Leader in High-Performance Scientific Instruments

+8 500
Employees

+100
offices worldwide

1 200
Employees dedicated to R&D

+4 000
Patents pending or granted

SUSTAINABILITY WITH INTEGRITY

Premier Provider of High-Performance Scientific Instruments, and Life Science Research & Diagnostic Solutions

Differentiated. Innovative. Entrepreneurial.

Since 1960 track record of technological pioneering

Culture of disciplined entrepreneurialism

Extensive collaborations with renowned science labs

Deep chemistry, biology & physics applications expertise


Prof. Günther Laukien


Bruker Physik AG's first operational facility, Karlsruhe


1962: NMR laboratory with KIS1


1980: MM1, the first mobile detection system


D8 ADVANCE, X-ray powder diffraction instrument launched in 1997

MEETING REPORT

R. Stratmann & A. Hughes BRUKER

SUSTAINABILITY WITH INTEGRITY

Our ESG fundamentals

Environment
Reduce the environmental impact

Innovation
Enable advancements in human health and the health of the broader ecosystem

People
Enable a cooperative, diverse, inclusive and people-oriented culture

- Bruker Corporations ESG report to be published mid June
- Many examples of how our instruments positively contributed to society
- Strategy of 'what matters most'

SUSTAINABILITY WITH INTEGRITY

Some examples of how we put ESG to life

- Environmental and Energy management systems
- Solar panels
- Energy reduction on heating and lighting
- Electrial vehicle company car policy
- Transition to sourcing green energy
- Bike stimulus plan
- Charging stations in our facilities

- Social fund raising initiatives (Sozial AG)
- Take free day off for social volunteering
- Gender neutral job postings
- Free of charge COVID—19 tests & vaccinations
- Production safety and health protocols
- Blood donations

- Code of Conduct
- Anti-bribery and corruption policy
- Supplier code of conduct
- Internal audit function
- Quality management system
- Whistleblower scheme
- Trainings offered
- Focus on business with Integrity

MEETING REPORT

SUSTAINABILITY WITH INTEGRITY

Environmental impact? Bruker 4D-Proteomics™ *Ecosystem*

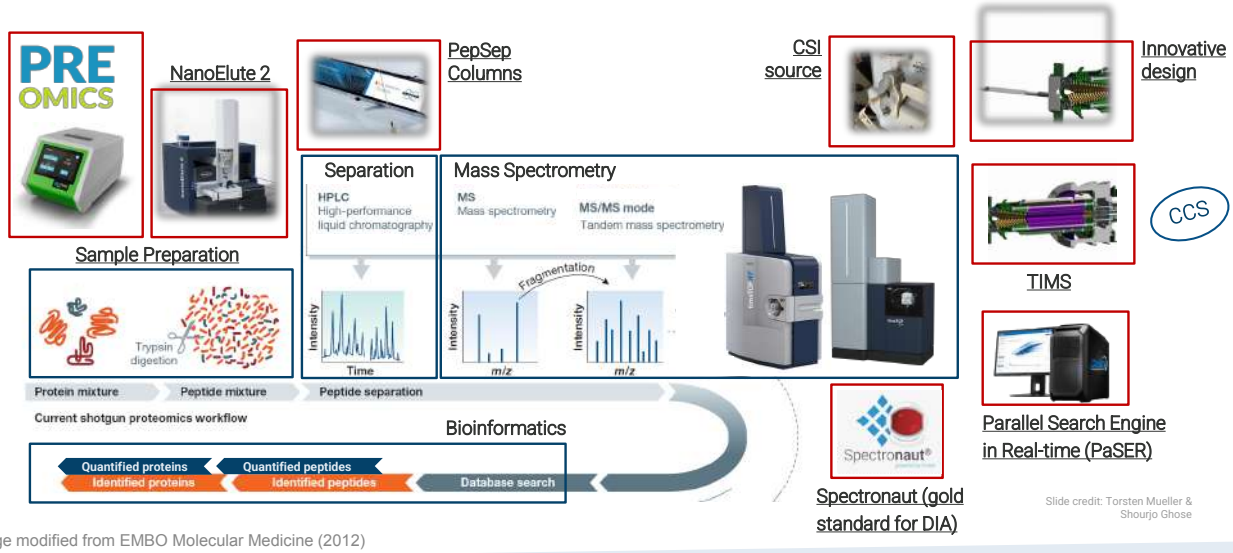


Image modified from EMBO Molecular Medicine (2012)

SUSTAINABILITY WITH INTEGRITY

New production facility in Bremen

- Planned by Fraunhofer Institute for Production and Automation (IPA)
- Optimized for efficient, high throughput MS production
- Sustainable building according to LEED Standard
- Regenerative heat recovery – use of waste heat from production
- Photovoltaic & electric mobility and bicycle support

R. Stratmann & A. Hughes BRUKER

SUSTAINABILITY WITH INTEGRITY

High Throughput label free MS and speedy PASEF

Speedy-PASEF: Analytical flow rate chromatography and trapped ion mobility for deep high-throughput proteomics

Lukasz Szyrwiel[1], Christoph Gille[1], Michael Mülleder[2], Vadim Demichev[3,4]* and Markus Ralser[1,3,4]*

[1]Department of Biochemistry, Charité – Universitätsmedizin Berlin, Berlin, Germany.
[2]Core Facility High-Throughput Mass Spectrometry, Charité – Universitätsmedizin Berlin, Berlin, Germany
[3]The Wellcome Centre for Human Genetics, Nuffield Department of Medicine, University of Oxford, UK
[4]Max Planck Institute for Molecular Genetics, Berlin, Germany

*Email: vadim.demichev@charite.de and markus.ralser@charite.de

Abstract

Increased throughput in proteomic experiments can improve accessibility of proteomic platforms, reduce costs and facilitate new approaches in systems biology and biomedical research. Here we propose Speedy-PASEF, a combination of analytical flow rate chromatography with ion mobility separation of peptide ions, data-independent acquisition and data analysis with the DIA-NN software suite, for conducting [illegible] high-quality proteomic experiments that require only moderate sample amounts. For instance, using a 500-µl/min flow rate and a 3-minute chromatographic gradient, Speedy-PASEF quantified 5,211 proteins from 2 µg of a mammalian cell-line standard at high quantitative accuracy and precision. We further used Speedy-PASEF to analyze blood plasma samples from a cohort of COVID-19 inpatients, using a 3-minute chromatographic gradient and alternating column regeneration on a dual pump system, for processing 398 samples per day. Speedy-PASEF delivered a comprehensive view of the COVID-19 plasma proteome, allowing classification of the patients according to disease severity and revealing plasma biomarker candidates. Speedy-PASEF thus facilitates acquisition of high-quality proteomes in large numbers.

timsTOF HT

Enhancing High Throughput, 4D proteomics

timsTOF flex MALDI 2

Maximized contextual information

SUSTAINABILITY WITH INTEGRITY

- Global need to move towards renewable energy (Wind, Solar, Nuclear fusion…)
- Bruker President and CEO has invested in fusion energy and is the Executive Chairman of Gauss Fusion GmbH https://www.gauss-fusion.com/

The future…

"Our mission is to lead the commercialization of magnetic confinement fusion power plants and related technologies"

MEETING REPORT

SUSTAINABILITY WITH INTEGRITY

Any questions…

https://www.bruker.com/en/about/csr/our-sustainable-business-practices-corporate-social-responsibility.html

Mahmoud Youssef

EDWARDS

CONTENTS

EDWARDS

MEETING REPORT

Mahmoud Youssef EDWARDS

Part of Atlas Copco - Committed to Sustainable Productivity

Edwards joined the Atlas Copco Group in January 2014

Swedish based group with 150 years of engineering and innovation

Leading provider of Industrial productivity solutions to a wide range of sectors

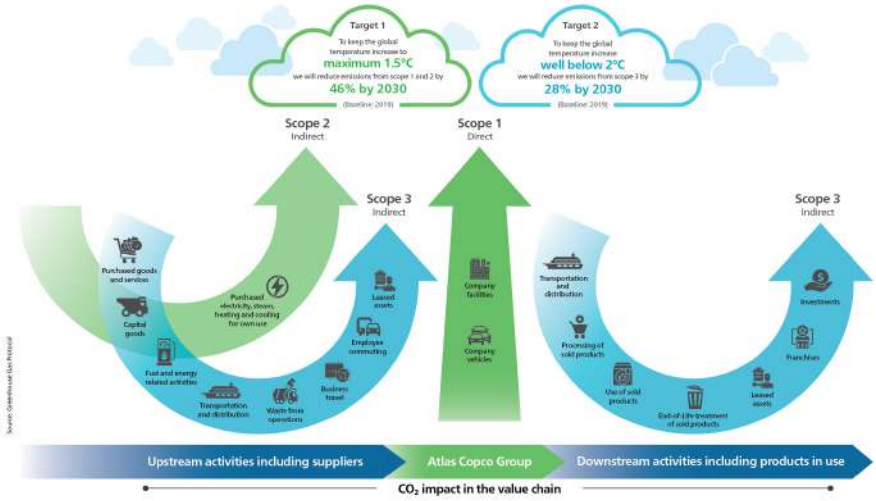
Global scale and footprint

- Manufacturing in more than 20 countries
- Customers in over 180 countries
- 44,000+ employees

The Atlas Copco Group has set two science-based targets that we commit to achieve by 2030, with 2019 as the base year.

EDWARDS

Atlas Copco science-based targets



MEETING REPORT

Mahmoud Youssef EDWARDS

Our locations

EDWARDS

Product Company - Lutin

Example activities include:

- use of renewable electricity
- improvements in lighting – LED installation
- HVAC synchronisation and central control implementation
- heat recovery from air compressors
- heat recovery from chiller

CO_2 reduction at this facility focusses on a reduction in gas use, reducing reliance on this energy source and supporting business resilience

EDWARDS

MEETING REPORT

Mahmoud Youssef EDWARDS

Vacuum for mass spectrometry

		 Wet pump	 Dry pump 
	**Noise**	Louder pumps – many users buy additional noise enclosures	Lower noise level – no additional noise enclosure required **Saving: >£800**
	**Electrical power**	High power consumption, 700W - >1000W	Lower power: nXRi: 450W, nXLi: 700W **Saving: up to £3,000 p.a.**
	**Heat**	High heat emission – users need to upgrade their air condition	Lower heat emission. Potentially no AC upgrade required. **Saving: >£900 p.a. on electricity**
	**Service**	Regular oil change – risk of contamination and needing proper planning	5 years interval. No resource for planning annual oil changes. **Higher cost, but less frequently.**
	**Size**	Heavy and large with higher capacity	Highest pumping density. One nXRi can replace two wet pumps. **Saving: Valuable space**

EDWARDS

Our solution – Dry pumps from Edwards

Edwards nXRi

Very compact and small
High performance
Energy-efficient
Wide range (30-120 m³/h)

Edwards nXLi

Covering higher performance (110/200 m³/h)

Produced in Lutin

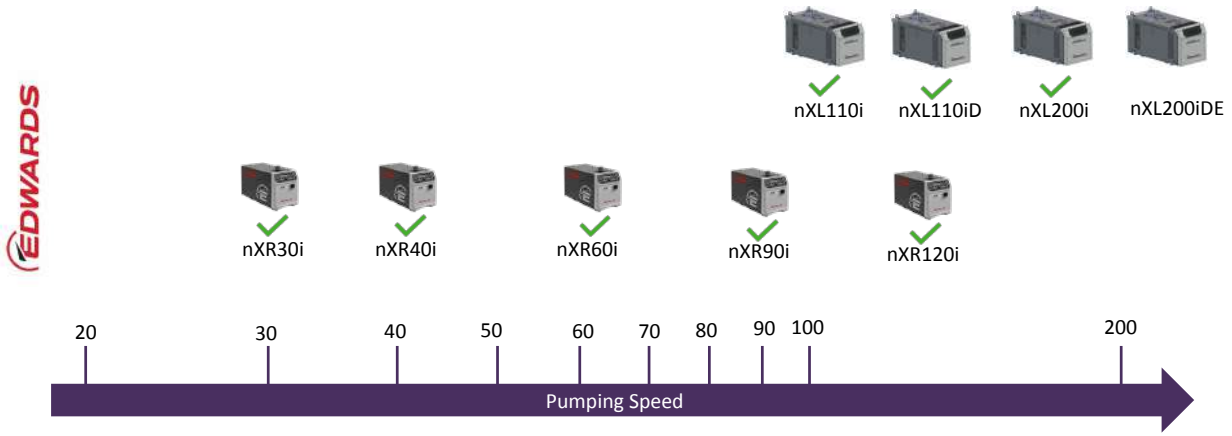
Common advantages:

- Five years no service
- Wide range of pumping performance
- Low noise and vibration
- Plug'n'play pump with air-cooled and single-phase motors

EDWARDS

MEETING REPORT

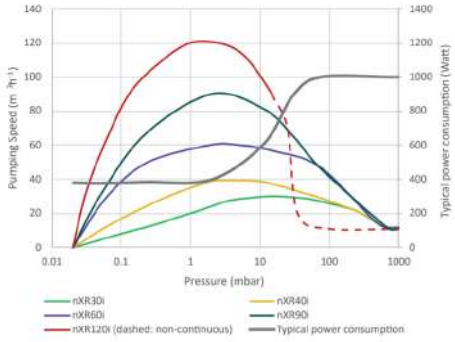
nXRi and nXLi product range



nXRi – Dry Multi-Stage Roots

Available in 30, 40, 60, 90 and 120 m^3/h sizes
Extremely compact multistage roots pumps
Less than 30kg weight
Fully oil and particulate free
Wide voltage range and easy to control
5-year service life

PUMPING PERFORMANCE



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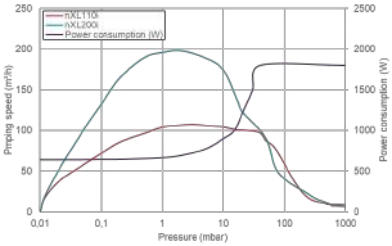
nXLi - Dry Multi-Stage Roots

Available in 110, 200 single inlet and 110 m^3/h dual inlet

Enhanced versions currently under development

- Electronics upgrade to update pump controller
- The Enhanced platform will also include 200 m^3/h dual inlet version
- Planned launch: Q4 2023



Weight 75-81 kg

200-240 volts +/-10% range

5-year service life

A dual inlet pump can replace two pumps on different duties

nXLi

nXLi Enhanced

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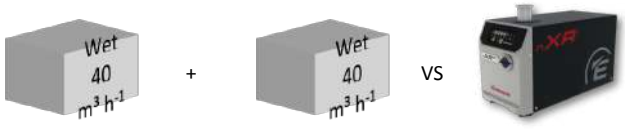
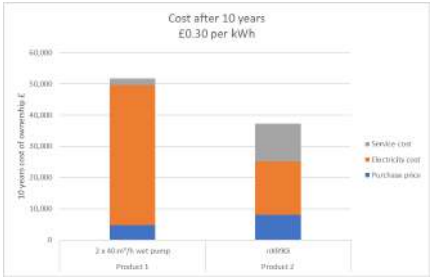
Example: nXR90i replacing two Typical rotary vane pumps



Power	650 W	650 W	500 W
Service interval	1 year	1 year	5 years



Saving of £27k over 10 years

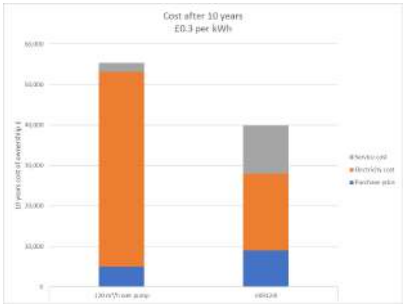
Reduction of 25 tonnes of CO2 over 10 years

nXRi costs includes second service after 10 years running ie giving another 5 years of life

Assuming energy cost of £0.30 / kWh. Includes air conditioning energy savings

Example: nXR120i replacing one typical rotary vane pump

Power	1400 W	550 W
Service interval	1 year	5 years



Saving of £29k over 10 years

Reduction of 26 tonnes of CO2 over 10 years

nXRi costs includes second service after 10 years running ie giving another 5 years of life

Assuming energy cost of £0.30 / kWh. Includes air conditioning energy savings

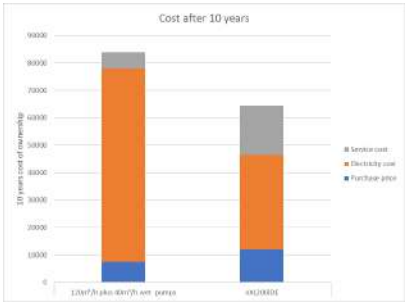
Example: nXL200iDE replacing Two typical rotary vane pumps

+

VS

Will become available with Enhanced platform

Power	1400 W	650 W	1000 W
Service interval	1 year	1 year	5 years



Saving of £36k over 10 years

Reduction of 32 tonnes of CO2 over 10 years

nXLi costs includes second service after 10 years running ie giving another 5 years of life

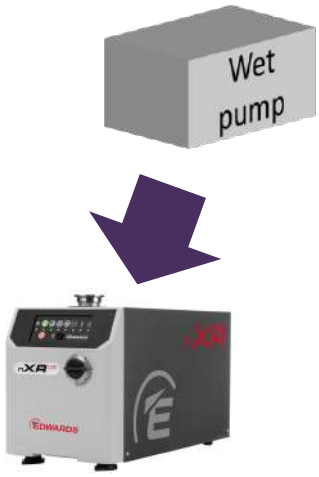
Assuming energy cost of £0.30 / kWh. Includes air conditioning energy savings

Summary

- Replace your existing rotary vane pump with a new dry pump
- Save up to 70% power and heat – and benefit from lower noise
- Contact us for a trial opportunity

- **Benefits:**

Clean | Energy efficient | Low heat | Low noise | Compact | Long service



EDWARDS

John Chan

WATERS

Waters™

Sustainability in Waters

John Chan, Vernon Mutwale
Waters Corporation

Waters Environmental, Social & Governance Strategy

Waters™

ESG Strategy

Our guiding principle is to leave the world better than we found it. Our ESG strategy is grounded in this principle, which informs everything from how we think about our energy use or packaging materials to how we support and develop our employees and give back to our local and global community.

We aim to fulfill these promises through our three Environmental, Social and Governance pillars:

Environmental	Social	Governance
Reduce our most significant environmental impacts • Reduce GHG emissions by 35% by 2025 from a 2016 baseline • Reduce waste to landfill by 50% by 2025 from 2019 baseline; zero waste to landfill by 2030 • Decrease water use intensity by 2025 from 2019 baseline	Become more representative of the society we live in • Increase % of women in leadership (YOY) • Increase % of Black and Latinx employees (YOY) • Increase number of students exposed to, and Waters volunteers engaged in, STEM education in the community (YOY)	Enhance long-term stakeholder value with good governance and effective oversight • Active Board oversight of enterprise risk management • Deliver robust ethics and compliance program • Provide disclosures in accordance with GRI and SASB

Our Progress

15%	58%	95%	21%	40%
Decrease in Scope 1+2 greenhouse gas emissions from 2016-2021	Electricity sourced from renewables in the form of Renewable Energy Credits and on-site solar panels	Waste from our largest manufacturing sites diverted from landfill to recycling or waste to energy	Decrease in water use intensity from 2020-21	Electric or Hybrid-Electric vehicles in our EMEA region

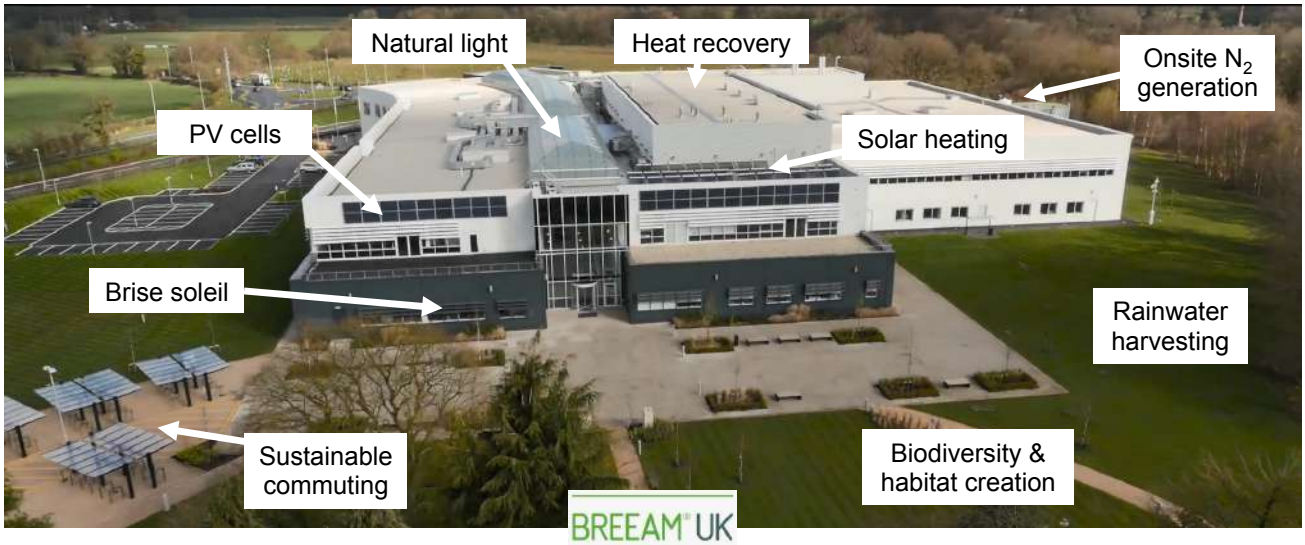
MEETING REPORT

John Chan

WATERS

Waters MS HQ, Wilmslow

Waters™



Environmental impact of LC-MS/MS instruments

Waters™

Life cycle assessment studies have found that the major impact of our products occurs in the use phase therefore initial focus was to look for opportunities to reduce impact there.

Power Consumption
Vacuum pumps, heating of the ion source, capillary voltage & electronics

Gas Consumption
Nitrogen for desolvation in electro-spray & collision cell gas

Waste heat
impacting air conditioning, generated by instrument & backing pumps

Solvent
Lower flow rates with UPLC in contrast to HPLC → less solvent consumption

Method run time
Shorter methods with UPLC → less solvent per sample & higher throughput

Power Consumption
Pump motor, Peltier elements, column heaters, ventilation

MEETING REPORT

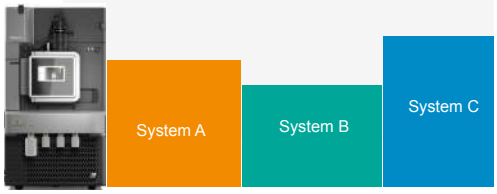
Waters delivers a more sustainable and economic solution

Meeting operating costs and sustainability goals

- Xevo TQ Absolute is designed for significantly reduced Environmental impact and running costs
  - ~50% less electricity consumption, with no compromise on sensitivity
  - ~50% less gas consumption
  - Reduced air conditioning demand with significantly lower Btu/hr
  - Photomultiplier detector that maintains performance and lasts the lifetime of the instrument

	Waters Xevo TQ Absolute	System A*
Relative Bench Width	100%	184%
Power consumption	1460W	3077W
Air conditioning Demand (Heat displacement)	4,980 Btu/h	10,500 Btu/h
Nitrogen/zero air consumption	23 L/min	52 L/min
Audible noise	59.2 dB	68 dB

- Xevo TQ Absolute is the Smallest high-end Tandem Mass Spectrometer on market (45% the size of System A)
  - Less materials used in manufacture
  - Requires less resource to package and transport
  - Allows lab space to be used more efficiently



* Based on publicly available information

Sustainability through product life-cycle

- Adopting a lifecycle thinking approach to product designs
  - Sustainability is embedded in our product development process.
  - We have a dedicated LCM team developing multi-use platforms and modules (e.g. with new generation semiconductors)
  - Working with suppliers for vacuum systems and PSUs to reduce power consumption
  - Increased usage of recycled and recyclable materials in product packaging
  - End of life instrument and component support for customers
- Our products comply with applicable regulations on product use & safety, material composition, and hazardous substance restrictions
  - Eco-design directive
  - WEEE Directive
  - RoHS Directive
  - REACH Directive
  - PFAS regulations
- Environmental accreditations
  - ISO 14001 accreditation for our manufacturing sites

Working with our Customers for a Sustainable Future

Waters™

- Better understanding of your needs
  - What are your organisation's sustainability goals?
  - How do you define objectives & metrics, so we can support measurement of progress
  - Sustainability requirements are a key part of our design thinking
  - "WE ARE LISTENING and we're here to learn!"
    - Audience of engineers and scientists in Wilmslow listening!

MSCI ESG RATINGS AAA
CCC B BB BBB A AA AAA

TOP 100 BARRON'S Most Sustainable Companies 2022

https://www.waters.com/webassets/other/Waters-2022-Environmental-Social-and-Governance-Report.pdf

Questions?

Waters™

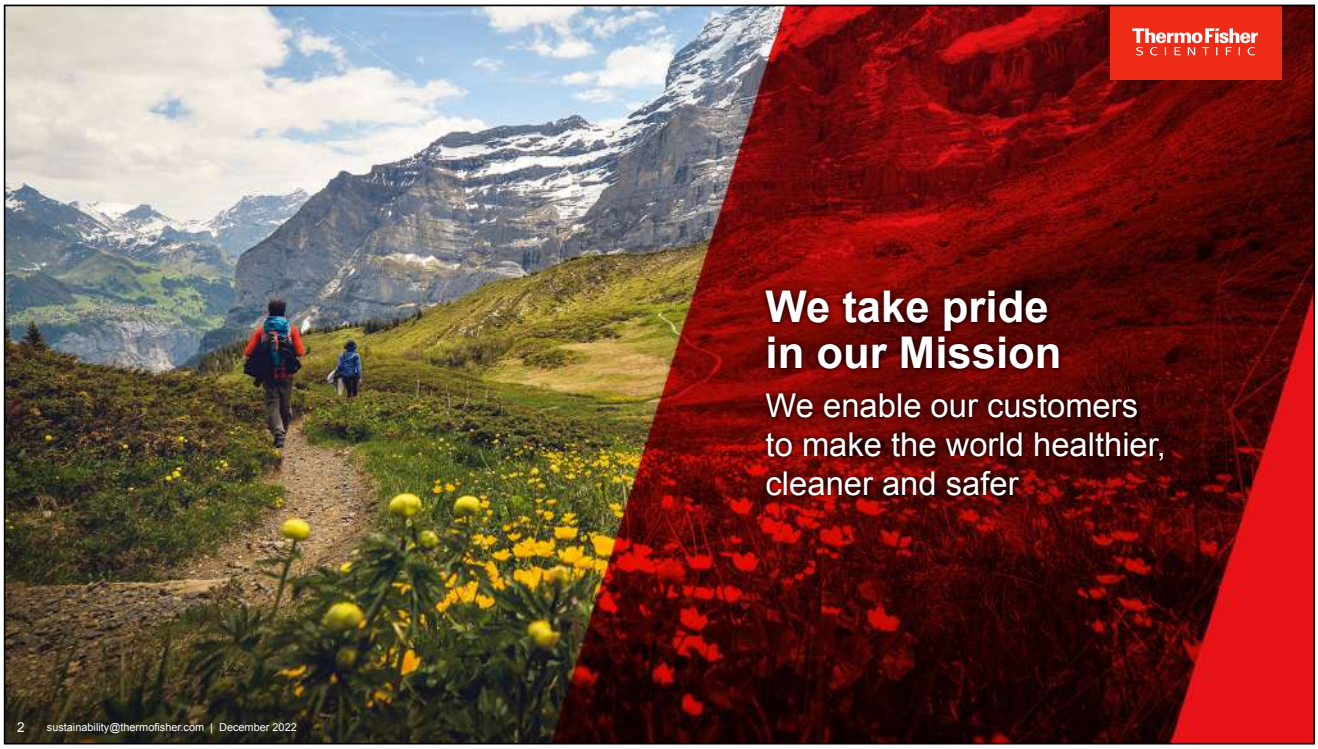
Darren Willman THERMO-FISHER

ThermoFisher SCIENTIFIC

Thermo Fisher Scientific Sustainability Update

Darren Willman
Senior Sustainability Program Leader - Analytical Instruments
9th May 2023

The world leader in serving science



MEETING REPORT

Environmental Sustainability at Thermo Fisher

Environmental sustainability is an integral component of our approach to Corporate Social Responsibility and supports Thermo Fisher in enabling customers to make the world healthier, cleaner and safer.

Our environmental sustainability includes three primary focus areas:

Climate

We are committed to reaching net-zero emissions by 2050 in alignment with the Science Based Targets initiative and the Paris Agreement.

Product Design

By incorporating sustainability principles into our products, we help customers advance sustainability.

Nature

We are advancing science-based approaches to water, water quality and waste.

To learn more, visit thermofisher.com/csr

Our Path to Net Zero: Targets

Our climate strategy includes greenhouse gas (GHG) emissions reduction targets that align with the Paris Agreement, the 1.5°C pathway and the Science Based Targets initiative's Net-Zero Standard.

SCOPE 1&2

50%

We raised our 2030 reduction target to 50% from 30%.*

SCOPE 3

90%

Engaging 90% of suppliers (by spend) to set science-based targets by 2027.

NET ZERO

SCOPE 1, 2 and 3 EMISSIONS BY 2050

***New target is 50.4%. Both targets from a 2018 baseline.**.

Darren Willman THERMO-FISHER

Our Path to Net Zero: Approach

Thermo Fisher is taking a multi-pronged approach to achieving net-zero emissions by 2050.

INFRASTRUCTURE

240+
net-zero projects identified

45
site energy assessments completed

ENERGY

100+
sites globally powered by renewable electricity

100%
Current U.S. electricity to be sourced from wind and solar

PRODUCTS

60+
greener product lines

500+
ACT labeled products*

250+
ENERGY STAR-certified products

*The ACT Environmental Impact Factor Label provides clear, third-party verified information about the environmental impact of laboratory products, emphasizing Accountability, Consistency and Transparency (ACT) around manufacturing, energy and water use, packaging, and end-of-life.

How We Design for Sustainability

Thermo Fisher helps pharma and biotech companies reduce their environmental footprints while delivering life-saving medicines to patients all over the world.

Our Approach
By incorporating sustainability principles into the design of our greener product alternatives, we can help customers advance sustainability.

Product Choice
Our Greener Choice program makes it easy for customers to find lab products with a lower environmental impact, offering more than 6,000 qualifying products from various brands.

Product Packaging
Packaging design is integral to maintaining product quality and performance during shipping and storage, while maximizing freight density and minimizing our environmental impact.

Greener Offerings

250+ ENERGY STAR- certified products

60+ **Greener Product** lines

500+ My Green Lab ACT labeled products, making it easier to make greener purchasing decisions

Read more about our sustainable product design process.

Operations Environment

MEETING REPORT

Two fossil fuel free sites

Bremen (DE) & Germering (DE)

- Bremen achieved in 2023:
  - Renewable energy –
    - 80 kW solar PV since 2023
    - 100% green energy since 2022
  - Replaced gas heating –
    - Heat pumps - thermal process heat recovery
    - Electric heaters
  - Demand reduction –
    - LED lighting, advanced controls & sensors
- Germering achieved in 2021:
  - Renewable energy –
    - 50 kW solar PV since 2021
    - 100% green energy since 2022
  - Replaced gas heating –
    - Heat pumps - thermal process heat recovery from server rooms and process heat
    - Groundwater cooling
  - Demand reduction –
    - Building management system
    - LED lighting, advanced controls & sensors

Taking steps towards Design for Sustainability

~90% Vanquish systems manufactured in fossil fuel free site	**Design for Sustainability** • Electronic manuals from 2021 • Increasing proportion of recycled steel, aluminium and titanium materials • Reducing overall weight to transport • Increasing proportion of recycled packaging material
HPLC Factory Certified Program Returned instruments are thoroughly refurbished and tested to meet our and our customers' high requirements for quality and performance. Prevents waste, reduces resource depletion.	**Reduced energy consumption by 90% during standby mode and by 24% during standardized analysis conditions** Continued interest in energy consumption reduction *How important is this to our customers?*

Charlotte Hands PHARMARON

SUSTAINABILITY IN MS WORKSHOP
MIB MANCHESTER 09 MAY 2023

Sustainability at Pharmaron Biologics

May 2023

Dr Charlotte Hands - Analytical Sciences

Laboratory Services | Chemistry, Manufacturing and Control | Clinical Development | Biologics & CGT

Confidential

Centre of Excellence for Gene Therapy

Pharmaron is a Contract Research Organisation and Contract Development and Manufacturing Organisation *(CRO+CDMO)* providing drug development and manufacturing services to the pharmaceutical industry.

The Liverpool site is Pharmaron's CDMO focusing on Gene Therapy.

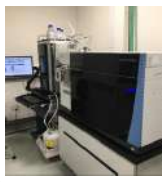
Confidential 2

MEETING REPORT

Charlotte Hands PHARMARON

Mass Spectrometry Platforms

Scientist in Characterisation team


Lumos Tribrid Orbitrap


Xevo G2-XS QTof


Vion IMS QTof


BioAccord Tof


Synapt G2 QTof


QTRAP 6500

Sustainability Team

Members from all departments including:

- EHS
- Engineering
- Facilities
- Procurement
- Lab users
- Quality Assurance
- Production
- Warehouse

MEETING REPORT

Charlotte Hands PHARMARON

Certifications

My Green Labs Gold certification

my green lab.

Stage I audit of environmental management system certification ISO 14001 complete. Stage II Audit 2023.

ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001

36 tons of CO_2 saved annually with #Lab Energy Savings Survey

#LESS

SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Net-Zero by 2050

GHG emissions commitment signed by our CEO in 2022

Key Areas of Focus

- Community
- Recycling & Waste Reduction
- Resource Management
- Purchasing
- Green Chemistry & Green Biologics
- Water
- Fume Hoods
- Cold Storage
- Large Equipment
- Infrastructure Energy
- Plug Load
- Travel

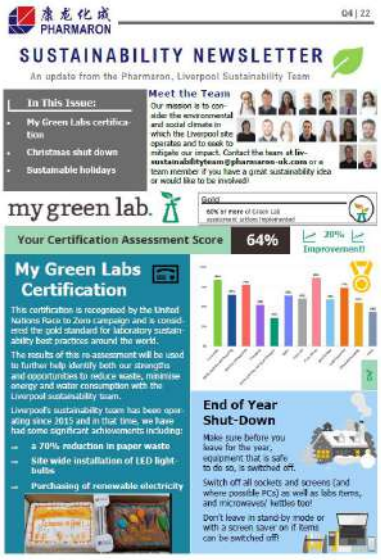
my green lab certification.

MEETING REPORT

Charlotte Hands PHARMARON

Staff Engagement – Newsletters

Community



Staff Engagement- Adopt a Pot

MEETING REPORT

Charlotte Hands PHARMARON

Waste Reduction

Recycling & Waste Reduction

120 plastic bottles a year saved by swapping to Ocean Saver cleaning sprays

38 Tons of landfill per year prevented by swapping to hand-dryers

28 trees since 2018 through paper saving initiatives, digitalization and printer management

Take-back Schemes including pipette racks, solvent bottles and temp-tale monitors

Swapped Fairy to ECOver Made with recycled plastic bottles and biodegradable detergents

Facilities optimization

Infrastructure Energy

100% renewable energy for entire Liverpool site

98 Tons CO_2 saved per year due to chiller deck replacement

62% less CO_2 emitted with the installation of new fly control units (LEDs instead of mercury)

11,000 kWh saved during our engineering Christmas shutdown

112,320 kWh per year due to A/C improvements

37,669 kWh saved by optimisation of air handling units

MEETING REPORT

Charlotte Hands PHARMARON

Sustainability in Mass Spectrometry?

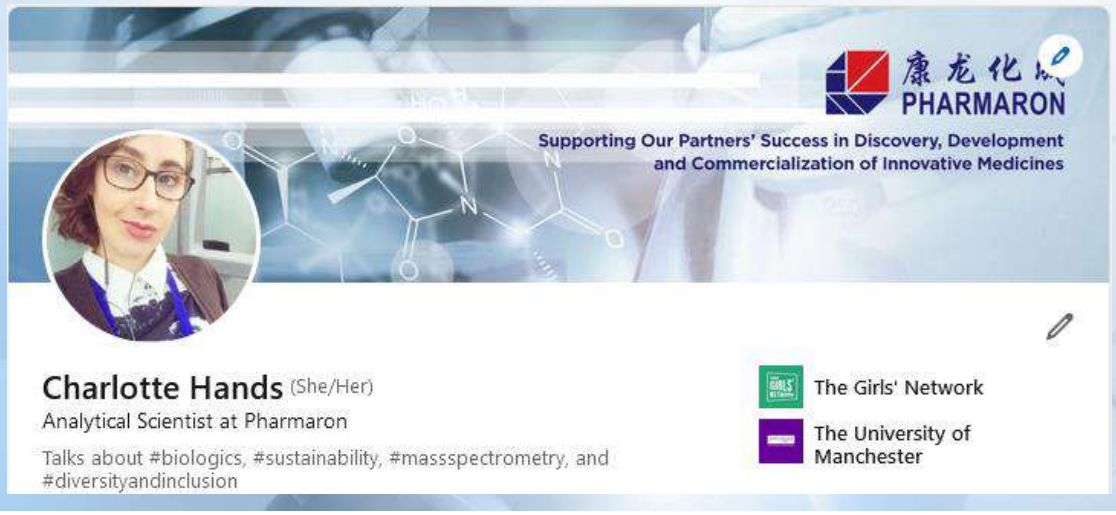
Positives
- Swapped our HPLCS for UPLC or Nanoflow
- Swapped gas tanks for nitrogen generators

Potential future successes
- Donation or sell-back for LC-MS
- Oil free vacuum pumps?

Areas for improvement
- Ways to recycle old columns and consumables
- Take-back schemes for consumables / instrument parts from Preventive Maintenance (PM)
- Improved Energy Efficiency

Thank you

charlotte.hands@pharmaron-uk.com



MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

Sustainable Sustainability?

Championing design

Britain Can Make It (1946)

We curated this exhibition a month after the end of WWII. A showcase of the best of industrial design at the V&A, it received 1.5M visitors over 2 months.

Design Magazine (1944-1999)

We published this monthly magazine on the best of design practice and manufacturing methods.

Millenium Products (1999)

In collaboration with British Council, this touring exhibition showcased over 1K products and was launched in 1999 at the Millenium Dome by Tony Blair.

MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

Supporting good design

Prince Philip Designers Prize (1959-2011)

The longest running design prize used to reward well designed consumer products. The Brompton bike received this award in 2009.

Swingtag (1964-1980s)

A quality kitemark and label that was used to support thousands of well-designed products.

Spark product innovation fund (2014-19)

A £1.8M incubator programme which supported 150 designers to get their product to market.

Working with clients

Reducing violence and aggression in A&E: Through a better experience (2015)

Working with NHS England to reduce aggression through research, **improved signage prototypes** and successful pilots with University Hospital Southampton NHS Foundation Trust and St George's Healthcare NHS Trust.

MEETING REPORT

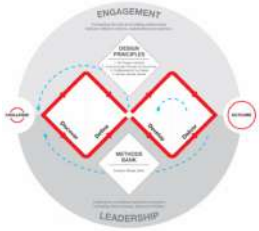
A. Deschamps-Sonsino DESIGN COUNCIL

Our Research

Tools & methods

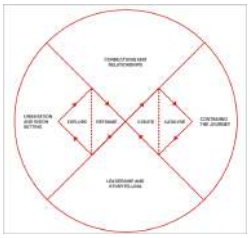
Double Diamond (2004)

A widely adopted description of the design process which helps designers structure client work.



Framework for Innovation (2019)

Including the Double Diamond as part of agile innovation processes.



Systemic Design Framework (2021)

Including the environmental, social and systemic implications of design into a project.

Design Value Framework (2022)

Using holistic (social, planetary, financial and democratic values) to think about a design project.

MEETING REPORT

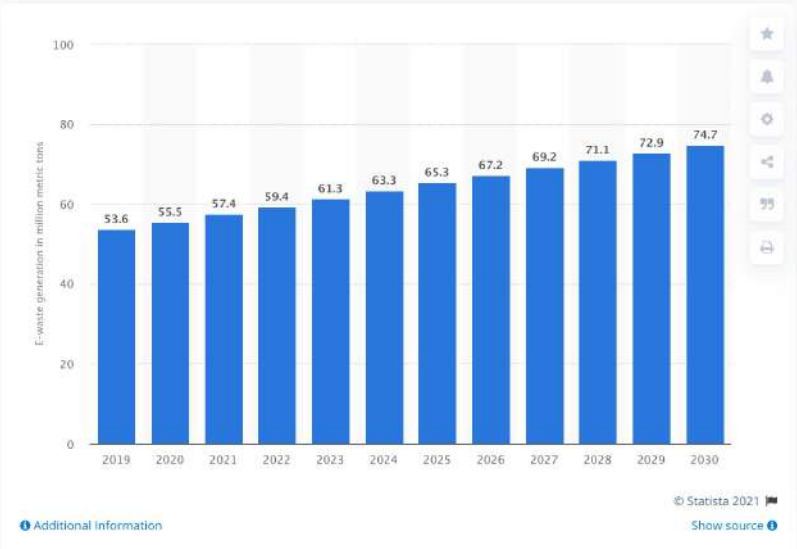
A. Deschamps-Sonsino DESIGN COUNCIL

Design for Planet Festival

October 16th-18th 2023
hosted online and at the
University of East Anglia.

DESIGN FOR PLANET

Expected global e-waste generation



MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

An ecology

- Founders with a crowdfunding campaign
- Small teams in an incubator
- Startups with seed funding
- Scaleups with venture funding
- Scaleups acquired by a corporation
- Corporations with innovation groups
- Corporations with design partners
- Service providers (design, engineering, security, cloud)

An ecology

- Service providers have a role to play in how things are connected/disconnected, used/mis-used and discarded.
- They are not held liable in the eyes of the laws that protect consumers or the environment.
- UX, or design failures, prototypes and pilot projects turn into e-waste.

MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

Better IoT (betteriot.org)

- Privacy
- Transparency
- Ownership
- Security
- Lifecycle
- Interoperability
- Openness

Interoperability

- How easy is it to transfer the product to be used by someone else's service if the company fails or the product terms of service expire?
- Are APIs available so that others can build on top of the product?

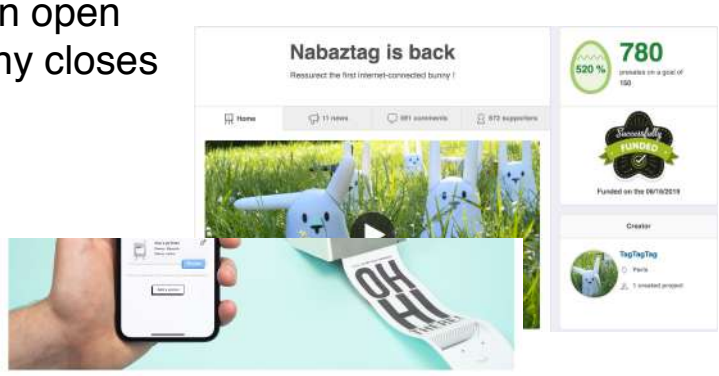
MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

Openness

How much is published under an open source license once the company closes down?

- the firmware?
- the hardware?
- the backend?



Data governance

How clear is it for users that the product is tied to connectivity?

Do they understand the legal ramifications of disconnecting it?

MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

Permissions and ownership

What happens to the customer's data when a consumer gifts a product or sells it on?

What happens when they move house?

Does the consumer understand their GDPR rights in this context especially when most people are not very data literate?

Security

Are 'secure by design' approaches part of the business process?

Is security connected to the service, hardware and firmware design process?

Are updates communicated clearly?

MEETING REPORT

A. Deschamps-Sonsino DESIGN COUNCIL

Lifecycle

Is the product easy to fix with common household tools and open documentation?

Are spare parts provided by default?

Is it designed for easy disassembly?

Certification schemes

Are they adopted at scale?

What is the weighing for each criteria?

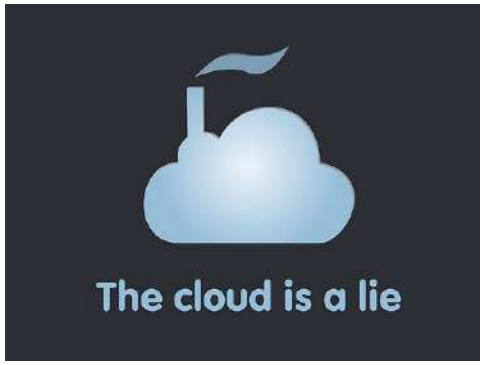
Are they letting you get away with doing less?

MEETING REPORT

The toilet assumption

‘The notion that unwanted matter, unwanted difficulties, unwanted complexities, and obstacles will disappear if they’re removed from our immediate field of vision.’

-Philip Slater



Laddering your engagement

A. Deschamps-Sonsino DESIGN COUNCIL

Thank you!

alex.deschamps-sonsino@designcouncil.org.uk

MEETING REPORT

Virtual Discussion Group 1

Charlie to facilitate

PERDITA BARRAN MAY 05, 2023 01:20PM UTC

Energy Management

ANONYMOUS MAY 09, 2023 02:24PM UTC

'Smart meters' - Energy and gases

ANONYMOUS MAY 09, 2023 01:27PM UTC

Reduce cooling requirements

Separation of pumps (heat emitting) and MS instruments (require cooler, constant temperature)

ANONYMOUS MAY 09, 2023 01:29PM UTC

Cooling and Heating

Separate vacuums from instruments, means you don't have to cool them too

Recycling heat produced for, ie. cell culture hoods

ANONYMOUS MAY 09, 2023 01:00PM UTC

Additional level of standby needed

Can we reduce the vacuum requirement, when instruments aren't in use?

ANONYMOUS MAY 09, 2023 12:56PM UTC

Best practise

end of run standby?
Need software updates to be able to allow us to automatically put our instruments into standby

ANONYMOUS MAY 09, 2023 01:07PM UTC

pushing to, as a building, using renewable energy (TRUE renewable energy not trading of REGO)

ANONYMOUS MAY 09, 2023 12:52PM UTC

Mass specs: how much energy does an instrument require to run?

10kwph (rough internal factors) to run
Often never turned off, so runs 365 days a year, 17.5 tonnes of carbon a year to run, approximately equivalent to a year in the life of one person

Net zero electricity

Consumables

ANONYMOUS MAY 09, 2023 01:37PM UTC

Can consumables be reused - Do they really need to be 'consumable'

Such as ESI chips, reusable tips, reuse glass bottles.

ANONYMOUS MAY 09, 2023 01:35PM UTC

can lab plastics be decontaminated in some way to allow them to be more easily recycled?

ANONYMOUS MAY 09, 2023 01:33PM UTC

What is classed as contaminated waste?

Can we decontaminate? Lots of things are going to contaminated waste, that really don't need to.

ANONYMOUS MAY 09, 2023 01:32PM UTC

Packaging...!

Take-back of pipette tip racks, reduction of packaging etc.

ANONYMOUS MAY 09, 2023 01:09PM UTC

Expiry Dates

Looking at expiry dates of solvents
consumables
e.g. Calibrant solution (short expiry date - but calibrates instrument fine)

ANONYMOUS MAY 09, 2023 01:00PM UTC

Tracking instrument consumables

How can we track the quantity of nitrogen and helium we use on a daily basis: large buildings can do this on an institution level

have an end of run LC set ups to reduce consumption of solvents

Equipment

ANONYMOUS MAY 09, 2023 01:41PM UTC

Sustainable funding

Prioritise funding for second hand instruments, upgrading old instruments, retrofitting etc

ANONYMOUS MAY 09, 2023 01:36PM UTC

Conversion of Helium CID to Nitrogen

Can we retroactively change the collision gas for instruments that currently use Helium. This would be a much more sustainable. And might keep older instruments in use, considering the current scarcity/supply issues.

ANONYMOUS MAY 09, 2023 01:05PM UTC

Can instrument robustness be improved - Turning off instruments during down time

Would it be possible to make instruments more robust to being turned off/vented for Christmas/time when projects do not require use

ANONYMOUS MAY 09, 2023 01:05PM UTC

What is the most energy efficient way of running an instrument

Need to discuss with suppliers how can we run our instruments in the most energy efficient way

Currently suffering from a lack of data on usage on a day to day basis

People

ANONYMOUS MAY 09, 2023 01:44PM UTC

Prioritise Sustainable People

Do we always need the shiniest newest instrument?

How do we make people more sustainable

ANONYMOUS MAY 09, 2023 01:36PM UTC

Education

processes for ensuring people can make good decisions.
Training courses?

ANONYMOUS MAY 09, 2023 01:17PM UTC

Red Tape

It seems difficult (in my experience) for industry to gift unused instruments to academia etc. due to H&S, insurance? transport etc.
So many instruments end up in storage or thrown if they are not included in part-exchange

ANONYMOUS MAY 09, 2023 01:10PM UTC

The order of priorities when it comes to balance sustainability and productivity

How to manage the priorities??

ANONYMOUS MAY 09, 2023 01:18PM UTC

Build in the sustainable, low carbon goal into service contracts

Service contracts to include advice and implementation on best practices etc. to ensure a more sustainable use phase

ANONYMOUS MAY 09, 2023 01:09PM UTC

Dedicated sustainability teams

need to have one person who heads this
Basically LEAF usage

Waste

ANONYMOUS MAY 09, 2023 01:37PM UTC

Recycling

How can we accurately identify contamination, which allows us to not have our recyclable waste identified as "contaminated"

Unpack things outside the lab so they're not labelled as contaminated? Then need extra space for that, many facilities have space shortages

ANONYMOUS MAY 09, 2023 01:18PM UTC

Reusable consumables

There are certain consumables that seem to be disposable purely for profit. From a sustainability perspective, it would be good if we could return these to the supplier and purchase a refurbished/cleaned product.

ANONYMOUS MAY 09, 2023 01:14PM UTC

How long is sample turnaround time

What is the minimum sample time to get the information you need
what is the wastage of a long LC gradient

Funding

ANONYMOUS MAY 09, 2023 02:20PM UTC

Sustainability improvement budget built into grants

Have a pot of money within each grant to be spent on sustainable causes - Purchase of second hand equipment, recycling of old, upgrading of current facilities, funding a sustainability manager etc.

ANONYMOUS MAY 09, 2023 01:44PM UTC

Can we benchmark sustainability?

ANONYMOUS MAY 09, 2023 01:45PM UTC

UKRI/funder policies and priorities

Can we apply pressure and reduce the drive towards buying new instrumentation and instead prioritise projects that make use of existing equipment, perhaps with sustainability focused upgrades or retrofitting new features.

******

Sustainability in MS - Breakout Group 1

Facilitated by Sarah Shepherd and Niklas Geue

PERDITA BARRAN MAY 08, 2023 01:02PM UTC

Section 1

Objective 7

Open Access Data Deposition (mandatory and consistent). Mandate for data files to be accessed with different softwares, potentially between vendors.

Objective 6

More resilient instrumentation (less power usage, power stops should be easier to handle, standby mode (pumps?) that uses considerably less power).

Objective 5

Global efforts for consistent legislation, consistent metrics; taking into account the instruments and the supply chain.

Objective 4

We need more funding for replacement kit and second-hand instruments. Funding cycles need to be suitable for instrument lifetime cycles, plans need to be made for instrument usage after funding period ends. In general more sustainability mandates from funders.

Objective 3

Manufacturers need to make a plan on how instruments are maintained after they are commercially not longer available. Considering publishing materials, open-source software (taking into account IP) etc.

Objective 2

Manufacturers could design instruments more modular/easier, enabling customers to fix and maintain instrumentation easier (less and more targeted service). Software that recognises errors more precisely.

Objective 1

We need to baseline where we are, where costs and carbon footprint come from in the life cycle (manufacturing, running, supply chain etc.). Define life cycle components consistently; collaboration between users and manufacturers to assess this. Differences between research and routine labs, understanding what users need (technological knowledge, financial situation, scientific demands).

******

Sustainability in MS Breakout Discussion Group 3

Facilitated by Andy Pitt

PERDITA BARRAN MAY 08, 2023 01:26PM UTC

Consumables

Diffficulty of transferring methods in pharma to low flow - needs change in approaach to SOPs.

Energy/gas/solvent/etc recovery - using the waste heat, recoveing gases, recovering solvents.

Gas consumption, He/Ar/N

recycle gas e.g., Helium

Gas consumption can be very high for high flow. Rigidy of the SOPs etc often make moving to lower flow difficult.

Disposal and reuse of components done by supplier.

Reuse (or recycling) of packaging

Instruments

Other instrument types are much better at sharing resources than MS is. Make academia log use, see how instruments are used, make sharing more geographically diverse locations more the norm.

Vendors could assist with recycling instruments

Transparency in information - repalcement of parts by user, upgradeability etc.

who has the knowledge re lifespan of instruments?

parts of instruments may be subject to patent.

Balancing the efficiency of older equipment vs disposal needs information that we don't have.

Choosing the right instrument - is this based on fit for purpose or the best I can get (consumerism culture). Need to be better at identify equiment that has capacity and making use of this.

Edwards pumps

service/training exchange

Data

Easy and fast data transfer to a universal format.

Electrically "dead" data storage that is easy to reaccess.

Dealing with massive file sizes - some form of compression?

Sharing of manufacturing data for interoperability

General

Need links between sectors - today quite academic focussed. Link with medical, commercial, CRO, pharma.

Communication of sustainability goals to engineers, installers, users etc

Carrot and/or stick approach?

Do we have a framework that we can measure against? How do we appraise where we are so that we can measure progress.

******

MEETING REPORT

Sustainability in MS Breakout Group 4

Facilitated by Rachelle Black and Neil Oldham

PERDITA BARRAN MAY 08, 2023 01:19PM UTC

Audit

Undertake audit of the energy costs associated with MS manufacture and usage (with LEAF and manufacturers). 2 years

Scale

More robust nanoflow to allow reduction in scale, or even faster chromatograph to reduce solvent/gas.

Shared Facilities

Regional instrument sharing of high end specialist instrumentation (e.g. proteomic, environmental, where sample can be transported) by 2 example themes 5-10 year time frame

Modularity

Modular, interchangeable mass spectrometer sources/functionality coming on the market 10-20 years

Standardisation of common components, e.g. vacuum fittings with 5 years.

Reuse

Return to vendor! Manufacturers to take old columns and other consumables for recycling. Scheme in place by 5-10 years.

Scheme for distribution of instruments to the wider community (beyond current ad hoc). 100 institutions signing up in 5 years

Introduction of greener plasticware, use of solvents that are biproducts of other processes/greener in the next 5 years, to replace all plastics by 20 years.

Passive, more efficient cooling of rotary pumps. Use of heat for other purposes.

******

MEETING REPORT

Sustainability in MS Breakout Discussion Group 5

Facilitated by David Knight and Mark McDowall

PERDITA BARRAN MAY 08, 2023 01:28PM UTC

Efficient MS/resource usage

KPI: Users to take responsibility to learn efficient usage/community training schemes

KPI: Responsible purchasing - don't buy unnecessary equipment

KPI: Pre experiment data repository checks become routine

Careful selection of what is retained wrt the cost of keeping

Keeping proper records so can establish quality/value of data

Don't repeat experiments that have already been performed - research data management

Vacuum pump usage

More effective stand by

Scheduling usage

Recycling consumables

KPI: Minimising packaging for delivery/minimising excess parts shipped

Modular MS design

Enabling upgrades

Impact per sample

KPI: Minimise the environmental cost per sample

Community cooperation

Security risk for openness in software

KPI: Ability for equipment to work together

Equipment longevity

KPI: Collaboration to develop a strategy for multi-owner lifecycle eg equipment passport, licensing considerations

There are rule sets in big companies that don't allow donation of equipment

Controlled by operating system support - can't use for more than 5-10 years due to OS

Metrics for sustainability

KPI: Obtain accurate assessments of environmental costs for every step in life cycle

Do we know where the costs are for each unit of activity eg acquiring a sample vs storing data for 50 years

Business models

Moving away from a buy once model of commerce

Choices made for robustness vs performance

Can there be a business model that doesn't require a constant flow of new equipment?

Sustainability in MS Breakout Discussion Group 6

Facilitated by Don Jones and Matt Russell

PERDITA BARRAN MAY 08, 2023 01:32PM UTC

Reduce

Reduce consumables

1. Stop sending physical software or documentation. "Digital by Default"
2. Reduce solvent use.
3. Some measure of input use CO2, plastic or whatever per data unit output.
4. Green Guide showing various consumable elements to enable comparisons.

see objective 6 5 3 1

Community mass spec data standards

1. Agreed methods to expose metadata to facilitate discard of unnecessary data.
2. Replace mzXML etc with compressed binary data format.
3. Switch to targeted analysis.
4. Measure of data hunger of instrument.

see objective 5

Smart Logistics

1. Group non-urgent delivery.
2. Smaller, shared or reused packaging.

smart process to deliver packages in single box, also more appropriate size packaging.

see objective 1 and 3

Eliminate Plastic Packaging

see objective 1 and 3

Replace

Common Data Format

The reasons this might be useful are:

1. A single data format to curate simplified IT infrastructure.
2. A commonly supported software supports continued use of instruments (re-use) as new analysis software, for newer PCs and OSs will support the single format.

We recognise the issues for manufacturors and software.

Perhas a renewed comunity focus on a compressed binary representation to replace mzXML might be a middle ground.

As an less comertially difficult approach, perhaps all vendors could support a mechanism to expose metadata to a single common program. Thus IT infrastructure could trivially query data files for their metadata and data removal rules could be based on them.

see objective 5

Reuse

"Fairphone" Model Upgradable Instruments

Something like this was covered in the Shimadzu talk.

see objective 4

Interoperability for mass spec parts

To enable innovation within older instruments replacing quad with thrid party development for example.

Certification

Consumable Supply Chain Manufacture and Delivery CO2

see objective 1

Specified sustainable part delivery policy

See objectives 1 2 3

Labs Procedures to Document Sustainability

Each lab to post sustainability assessment.
Possibly accreditation of standard to be put on papers in same way as ethics.
Perhaps such statements require external review.

see objective 5 and 6

Digital by Default

For delivery of documentation and software to suport instruments.
Perhaps this should go along with a commitment to continue to supply legacy software and manuals to support ongoing use of instruments after official support ends. Possibly this requires a comunity maintained repository. Perhaps legasy software should have simplified or open licensing after a certain point.

See objective 3

Per instrument sustainability index

Comparable standard tabulation of environmental perfomance per sample.

see objective 4

Objectives

Objective 6

Evaluate regularly the sustainability of methods.
Could be done through SOP evaluation revision within GCLP and regulated labs?

Objective 5

Data
Implementation of a data reduction strategy.
To include acquisition, transfer, storage, disposal and shift to repositories?

Might include a reduced-data format for long-term storage, perhaps inspired by methods used in particle physics comunity. This might store features and discard "noise". There may be regulatory issues with discarding raw data.

Objective 4

Establish a sustainable index for instruments
to include (not exhaustive)
Energy use, heating, cooling, gases, recyclability and interoperabilility.
This would enable purchasing decisions based on lifetime sustainability considerations.

Objective 3

Digital conversion
Ensure all materials are digital by default e.g. software, manuals and lab books.

Objective 2

Eliminate single use plastic packaging

Objective 1

Evaluate the materials that go into landfill.

This is about gathering data that can inform future decision making and prioritisation. If we could understand the quantity and nature of materials including:
Initial Delivery Packaging
Parts and consumables packaging
Documentation
Spare plugs, software CDs etc
Discarded parts and consumables themselves

Then as as a comunity we could focus on the most effective change.

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Sustainability in MS Breakout Discussion Group 7

Facilitated by Stephen Holman and Caroline Gauchotte-Lindsay

PERDITA BARRAN MAY 08, 2023 01:32PM UTC

Primary aim 1 - Education, knowledge and sharing

How to use the instrument in the most sustainable way

Primary aim 2 - Consumables

Supply & demand behaviours

Primary aim 3 - Case study in data acquisition, management, access, storage & retention

Best practice in how data is utilised

Lab consumables

What are "big ticket" items? Sample preparation - vials, pipette tips etc.

Can we use recyclable or rewashable ones?

MyGreenLabs - drive involvement from organisations?

Bag for pipette tips and reloading into trays, but not viable. Laser printed a tool for loading tips.

Challenges with sterility. Is cleaning and reuse environmentally-friendlier than buying new?

Vendors

Focus on pushing performance

Vendors inform customers on the lab environment required. But doesn't say what performance impact that will have if deviated from. Might be acceptable for users' needs to go outside this.

Heat outputs from instruments put demands on HVAC.

Vendors driven by outperforming competition rather than focussing on what customers needs. May be environmental e.g. energy, costs due to trying to get better performance.

Fridge and freezer usage

Is -80oC really needed?

Proper management and access to freezers

Would open source enable easier innovation and modularity?

Can vendors access each others systems

More common with software

"Walled gardens" but climbing the wall is high

"Lego brick" circuit boards

Vendors likely using same suppliers

If using "Lego brick" style boards, may be able to to change one component more easily rather than the whole board

Aspire to "universiality"?

Manufacturer improvements

Shipping

Manufacturing and distribution plants

Is it better to build plant for environment versus shipping stuff about

Legislation - as this changes, how does this impact things?

Spare parts

Power cables

Interchangeable parts

Publicising savings metrics

Energy saved due to putting into standby mode

Education on the impacts of changing settings

Auto-shutdown -> vendor to explain how to do this, users to understand the impacts of this

"Weekend" mode

Standards

Can vendors give guidelines on how to run instruments with the most sustainable settings for different applications?

Vacuum pumps

Can these be put into "standby"?

Data

What is "raw data"?

Do we keep things because we can?

What do the regulators need us to do in terms of retention of data? What do we retain? How long for?

Data sharing

Can we share data for reuse?

Energy consumption

Acquisition and processing

Storage -> can we make the data files smaller?

MEETING REPORT

Consensus Key Themes

1. PROACTIVELY MANAGE ENERGY CONSUMPTION

- Continuously question how consumption may be contained.
- Efficient laboratory design (*e.g.* remote vacuum pump location for natural cooling, *etc.*).
- Optimize intelligent instrument 'standby' duty cycles.
- Upgrade existing systems with high efficiency vacuum pumps.

2. INSTRUMENT LONGEVITY & LIFECYCLE

- Maximize instrument longevity (*e.g.* Recycle/Upcycle).
- Proactively share state-of-the-art MS resources within the community (*i.e.* avoid duplication).

3. REDUCE INSTRUMENT SHIPMENT & PACKAGING FOOTPRINT

- *e.g.* Minimize 'shipment kit' redundancy for new systems.

MEETING REPORT

Consensus Key Themes

4. CARBON OPTIMAL ANALYTICAL METHODS

- *e.g.* Optimize methods to reduce solvent consumption and instrument run time/energy usage.

5. REALISTIC CARBON FOOTPRINT FOR DATA STORAGE

- Prioritize what needs to be stored; *e.g.* focus on key data & meta data (*i.e.* avoid redundancy and unnecessary storage).

6. NERTURING A CARBON CENTRIC COMMUNITY

- Adopting a carbon centric approach to; STEM education/staff & student recruitment/employment induction/culture of continuous improvement for energy efficient lab & research practice.

7. CONSUMABLES MANAGEMENT

- Evaluation of lab ware usage *e.g.* throwaway plastic or recyclable glass?

8. RIGOROUS METRICS FOR SUSTAINABILITY

- Current practice and future improvements must be measurable against community agreed longitudinal metrics.

MEETING REPORT

Next Steps

1. **Report Workshop; “Work in Progress” at BMSS43 (Manchester UK) September 2023.**
2. **Meeting Report published to the BMSS website *(i.e.* this document).**
3. **Short Report published in the refereed literature.**
4. **Production of a ‘White Paper’ to underpin wider discussion.**
5. **Outreach to colleagues in our global network (*e.g.* IMSF, *etc.*).**
6. **International development of a consensus carbon reduction strategy.**
7. **Multinational development of a rigorous Mass Spec ‘Carbon Dashboard’ …to keep the community on track and be open to societal oversight.**

MEETING REPORT

THE BRITISH MASS SPECTROMETRY COMMUNITY

The 1st MEETING of the SUSTAINABILITY in MS WORKING GROUP UK

MANCHESTER INSTITUTE of BIOTECHNOLOGY
MANCHESTER 09 MAY 2023

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MEETING REPORT