



Newsletter – Sept 2019

RRfW programme news

RRfW programme draws to a close

The RRfW programme officially draws to a close at the end of this month. We would like to say a big thank you to everyone who has worked so hard to make it a success, including all our researchers, partners, the wider community that has worked with us, and our funders.

RRfW was set up to deliver the strategic science needed to support a radical change in the waste management landscape, driven by benefits to the environment and human health rather than by economics alone.

Since the programme's inception we have made great strides forward.

- We have built an active community of researchers and a network of stakeholders, which remains ready and able to deliver RRfW solutions (see our [community](#) and [network](#) web pages).
- The highly diverse themes, people and projects brought together by RRfW resulted in radical new visions, approaches, tools and technologies in response to the global challenge of resource management, as summarised in our [end-of programme brochure](#).
- We have significantly progressed the state-of-the-art in resource recovery research, with around 100 peer-reviewed publications (and counting), a Research Topic on the Frontiers journal platform and a forthcoming Resource Recovery from Waste book. Find updated details on our [publications](#) and individual [project](#) web pages.
- We engaged with organisations from government to industry and the third sector to co-created responses and embed them in policy and business activities: a summary of our policy outputs can be found on our [policy web page](#), and outputs from our co-creation work on our [publications](#) page.

None of this would have been possible without everyone pulling together - thank you.

Setting the future agenda for resource recovery and circular economy

RRfW has achieved a lot in its time, but there is still much more left to be done. With this in mind, RRfW and NERC held a joint workshop in March to identify research and innovation spaces where further investments in resource recovery and circular economy may be valuable.



The workshop identified 11 main challenge areas, out of which designing out waste and changing human behaviour were considered the most pressing. Similarly, prioritised solution-directions were found to cluster around four themes: changing consumption systems; resource repositories and resource recovery systems; business model innovation; and material & product data systems. The results were shared with the research councils to aid their planning and led to a submission for a NERC Highlight Topic.

For further details and to read the full workshop report, please see our [workshop blog](#).

Continuing the good work: other projects taking RRfW forward

During its time, the RRfW programme also helped to create new research projects that will directly advance the aims of the programme. A number of these are listed below:

- [Greenhouse Gas Removal in the Iron and Steel Industry](#): investigations into the ability of waste slags from iron and steel production to remove CO₂ from the atmosphere (2017-18).
- [RECIRCULATE: Driving eco-innovation in africa: capacity-building for a safe circular water economy](#): new partnership-based approaches to building a circular water economy in Africa (2017-21).
- [Formulating novel fertilisers and land conditioners from bioenergy wastes](#): to develop commercially viable, high quality, consistent, sustainable fertilisers from bioenergy residues (2018-19).
- [ACTUATE: Accelerating the adoption of circular sanitation demonstration systems for improved health outcomes](#) GCRF Global Research Translation Award starting in October 2019 to 2021.
- [Liquid Fuel and bioEnergy Supply from CO₂ Reduction](#): bio-electrochemical systems (BES) technologies to convert CO₂ into liquid fuels using energy from biomass and wastewater (2016-20)
- [ToOLTuBES: Toxicity & Organic Load Tracking using BioElectrochemical Systems](#): to develop BES technology for use as sensors in wastewater treatment (2017-19)

In addition, a number of smaller impact acceleration projects have been developed to take RRfW results further:

- **Copper recovery and valorisation of distillery wastes using biogenic magnetic nanoparticles:** the [Manchester Geomicro group](#) has obtained funding through an EPSRC and BBSRC Impact Acceleration Award to continue to investigate the potential for biogenic nanoparticles to recover copper from distillery by-products in partnership with Chivas Brothers. Apr 2019 - Dec 2019.

- [The social, economic, technical and environmental values of North Sea oil & gas decommissioning for local communities and companies](#): impact acceleration project to apply CVORR approach to North Sea oil & gas decommissioning, [funded by ESRC](#). Jul - Dec 2019.
- **Key metrics for supporting national and local government waste policy improvements**: working with Defra, the project applied the CVORR approach to identify local, regional and national intervention points in the plastic packaging system in England, and identify key metrics that can be used to track and assess sustainability progress. Jul 2018 - May 2019.

RRfW develops the government use case for National Materials Datahub

The Office for National Statistics (ONS) is leading on the development of a National Materials Datahub (NMDhub), with plans to map all resource stocks and flows in the UK. A better insight into our resources is critical to make better use of materials and to reduce waste.

The NMDhub is currently in the early stages of establishing feasibility and defining requirements. RRfW has been contributing to this by developing the use case for government, working with ONS, Defra and BEIS, and drawing on the extensive evidence developed by the RRfW programme. This use case is now available as a briefing paper, covering the governance landscape for materials, the role of government in supporting industry to make better use of material, challenges in creating a governance context that encourages circular economy uptake, and the added value of the emerging NMDhub for the governance of materials.

Read the [full briefing paper \(pdf\)](#), or see [our recent blog](#) for an overview.

RRfW submits response to WEEE inquiry

Our submission to the Environmental Audit Commission's [electronic waste and the circular economy inquiry](#) has now been published.

In it we say that the most critical action the Government must take is to dispel the notion that an investment ecosystem focused solely on energy from waste (EfW) will deliver a circular economy. Balanced investment across multiple and diverse physical waste infrastructures, plus a focus on reduced consumption and more reuse and repair, repurposing, remanufacturing, and recycling of WEEE is required; not more EfW. The response also highlights that a lack of data on WEEE arisings and treatment routes makes it difficult to set feasible collection targets and for reprocessors to be certain on the scale of facilities required.

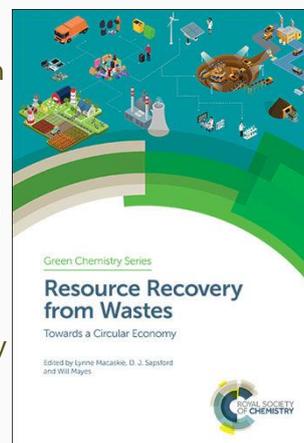
[Read the full response here.](#)

Publications

Resource recovery from waste book

The RRfW book 'Resource Recovery from Wastes: Towards a Circular Economy' is due to be released on 31 October 2019. The book is edited by Lynne Macaskie, Devin Sapsford and Will Mayes, and authored by researchers from across the RRfW programme. The broad range and cross-disciplinary nature of the topics in this book will make it a valuable resource for those working in circular economy research, green chemistry and waste and resource management.

It is being published by the Royal Society of Chemistry as part of their green chemistry series. Please see the publisher's website for [further details and content listing](#).



RRfW Research Topic in Frontiers journals

The first seven papers are now published as part of the Resource Recovery from Waste Research Topic with the Frontiers family of journals, with others in the pipeline. The Research Topic aims to raise visibility and drive momentum in the resource recovery from waste area by bringing together research in this area. Papers can be viewed at [Frontiers RRfW Research Topic](#).

RRfW programme publications

The following RRfW research and reports have been published:

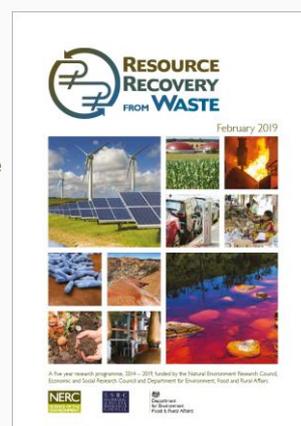
Circular economy and the matter of integrated resources. Velenturf *et al.* (2019).

Circular economy has gained momentum in government and industry as a way to both address limited resources and excess waste. The Ellen MacArthur Foundation 'Butterfly diagram' has been very influential, with its separate biological and technical resource flows shaping actions. But organic and inorganic elements are integrated in natural and engineered resource flows. This article proposes a new diagram for sustainable circular economy embedded in natural processes, integrating organic and inorganic resource flows. This new conceptual space will support development of effective circular economy technologies, business models and policies. The paper is also discussed in a recent [RRfW blog](#).

Resource Recovery from Waste end-of-programme brochure.

Purnell *et al.* (February 2019).

The end-of-programme brochure outlines the strategic purpose of the programme and highlights the advances made towards these goals. A combination of the diverse themes, people and projects brought together by RRfW offered a fertile context for the radical ideas and discoveries presented in the brochure to emerge. The brochure also summarises the work on co-producing a vision for a circular economy with academia, industry and government, and the overarching policy recommendations from the programme (for a quick view of these recommendations, see the following [RRfW blog](#)). [View brochure](#).



For the full list of RRfW publications, please see our [publications page](#).

The following publications have come out on the RRfW projects:

AVAnD

Co-fermentation of whey permeates and cattle slurry using a partitioned up-flow anaerobic digestion

tank. Fagbohunge *et al.* (2019). *Energy*. 185, 567-572. [doi:](#)

[10.1016/j.energy.2019.07.051](https://doi.org/10.1016/j.energy.2019.07.051), [Open access](#)

The effect of acidogenic and methanogenic conditions on the availability and stability of carbon,

nitrogen and phosphorus in a digestate. Fagbohunge *et al.* (2019). *Journal of Environmental*

Chemical Engineering. 7, 103138. [doi: 10.1016/j.jece.2019.103138](#), [Open access](#)

B3

Platinum and palladium bio-synthesized nanoparticles as sustainable fuel cell catalysts. Stephen *et al.*

(2019). *Frontiers in Energy Research*. *in press*. [doi: 10.3389/fenrg.2019.00066](#), [Open access](#)

Synthesis of Pd/Ru bimetallic nanoparticles by *Escherichia coli* and potential as a catalyst for upgrading

5-hydroxymethyl furfural into liquid fuel precursors. Gomez-Bolivar *et al.* (2019). *Frontiers in Microbiology*.

in press. [doi: 10.3389/fmicb.2019.01276](#), [Open access](#)

Characterization of palladium nanoparticles produced by healthy and microwave-injured cells of

Desulfovibrio desulfuricans and *Escherichia coli*. Gomez-Bolivar *et al.* (2019). *Nanomaterials*. 9(6), 857. [doi:](#)

[10.3390/nano9060857](https://doi.org/10.3390/nano9060857), [Open access](#)

CVORR

CVORR Practice Guide.

The CVORR Practice Guide will be available for download from the [CVORR project page](#) from 25th November 2019 onward. It will offer practitioners a simple guide on how to apply a CVORR framework analysis.

CVORR stands for Complex Value Optimisation and Resource Recovery, and the CVORR framework is an innovative approach for the analysis of physical material flows across complex systems (environmental, economic, social and technical). It is therefore an alternative to standard sustainability assessment frameworks, such as Life Cycle Analysis, but offers significant advantages.

The CVORR approach at a glance:

- Highly flexible in terms of its scope – can be applied to virtually any resource and/or waste-related system, either ‘locally’ and ‘globally’, for a wide range of issues related to physical material flows and resource recovery problems
- Straightforward to implement
- Minimal resource and technical requirements
- Looks at environmental and socio-economic aspects alike. It recognises that different domains of value might be captured only qualitatively rather than quantitatively and addresses this issue via its innovative use of metrics, which are applied at the modelling stage in conjunction with the Material Flow Analysis (MFA).
- Adopts a system of provision approach
- Applies a multi-dimensional conception of value – i.e. it explicitly rejects the unidimensional approach adopted by assessment frameworks such as LCA that reduce all types of value to a single unit (e.g. monetary)
- Is iterative in nature, which means that system boundaries and models keep getting constantly revised in the light of new information, removing thereby the rigidity of other assessment frameworks

INSPIRE

Access to critical materials. [POSTnote number 609, September 2019](#) Parliamentary Office of Science and Technology, Houses of Parliament. Contribution by Dr Dannielle Sinnett, University of the West of England

MeteoRR

Synthesis of copper catalysts for click chemistry from distillery wastewater using magnetically recoverable bionanoparticles. Kimber *et al.* (2019). *Green Chemistry*. 21, 4020-4024. [doi:10.1039/C9GC00270G](https://doi.org/10.1039/C9GC00270G), [Open access](#). RSC Chemistry World reported on this paper in their article: [Catalyst metal recovery adds greener notes to whisky production](#) (17 July 2019).

R3AW

A R3AW research bulletin was published by CL:AIRE describing the main outputs from the R3AW project. Resource recovery in the context of this research includes:



- recovery of e-tech metals that are both crucial for modern environmental technologies and simultaneously environmental pollutants (e.g. vanadium);
- enhancing carbon sequestration in alkaline wastes;
- promoting the broader re-use of bulk by-products without environmental impacts; and
- improving remediation strategies at alkaline residue disposal sites.

As well as the technical aspects of the project, the research has included the critical assessment of regulatory and governance frameworks that influence current alkaline residue management through stakeholder discussions and workshops. The open access research bulletin RB21: Resource Recovery and Remediation of Alkaline Wastes (R3AW) is now available to [download from the CL:AIRE website](#) .

Atmospheric carbon capture performance of legacy iron and steel waste. Pullin *et al.* (2019).

Environmental Science & Technology. 53 (16) 9502-9511. [doi: 10.1021/acs.est.9b01265](https://doi.org/10.1021/acs.est.9b01265), [Open access](#). This highlights the unfulfilled potential of legacy slag deposits for atmospheric carbon uptake as determined from the first of a kind drilling operation in north east England and was reported on by American Chemical Society Chemical and Engineering news in their article: [Steel plant waste could mop up CO2](#) (22 Aug 2019).

All project journal publications are listed on the RRfW project pages: [AVAnD](#), [B3](#), [CVORR](#), [INSPIRE](#), [MeteoRR](#), and [R3AW](#). You can also find further publications and presentations on our [Researchgate](#) page.

Other news

National Food Strategy - call for evidence

On 27 June, Defra's Secretary of State commissioned Henry Dimbleby to conduct an independent review to help the government create its first [National Food Strategy](#) for 75 years.

A [call for evidence](#) has been issued to gather inspiration to help transform our food system. It is looking for ideas that make food production more environmentally sustainable, create a flourishing countryside rich in wildlife, help farming, fishing and food businesses and communities thrive, and put England at the forefront of innovation and reshape our food system in the coming years.

Responses to the call for evidence can be submitted via an [online survey](#) by the 25 October 2019. Any queries can be sent to: foodstrategycallforevidence@defra.gov.uk



UK Resources Council extends deadline for Sector Deal consultation

The UK Resources Council has announced that it has extend the deadline for its consultation on a 'Sector Deal' between the UK resources sector and the government as part of the Industrial Strategy. It is hoped that the deal could provide a long-term framework for businesses handling waste and build on Defra's Resources and Waste Strategy.

The new deadline is 6pm on Friday 18 October 2019. The consultation survey is available via the [Sector Deal's website](#), with email support provided by sectordealsurvey@anthesisgroup.com

£35 billion needed for changes to resources and waste activity

A new report published by SUEZ suggests that the seismic shifts in resources and waste management required over the next 20-30 years will need investment of up to £35 billion.

The report, entitled [The Economics of Change in the Resources and Waste Sector](#), looks at current economic drivers in the sector and explores how future environmental policy target metrics related to CO2, natural capital and biodiversity will necessitate substantial additional investment and a major shift in mind-set by the sector to accommodate new services, products and revenue streams.

It indicates that investment will be needed into new technologies and facilities capable of converting residual waste into fuel and chemical molecules, as well as electrical energy; to overhaul logistics and container infrastructure; collect new or niche material streams, such as flexible packaging; develop new data collection and analytics systems; and invest in education and behavioural change communications campaigns.

We must consume less, says Ian Boyd

Prof Ian Boyd, former Chief Scientific Advisor to Defra, has called for cutting consumption as a key part of realising a circular economy that stays within planetary boundaries. The call comes in an article he wrote for [the Conversation](#), where he states that even if governments succeed in reaching net zero by 2050, it may do nothing significant to halt environmental decline due to rising demand for materials.

The article chimes with many of RRfW's key findings and policy recommendations including the need to include environmental and social costs of resource use alongside economic considerations, and for a cross governmental departmental structure to coordinate government action (you can read RRfW's full list of policy recommendation via our [policy web page](#)).

€10bn circular economy initiative from EIB & EU National Banks

A €10 billion initiative to accelerate the transition to a sustainable and circular economy was launched in July by the EU's largest National Promotional Banks and Institutions and the European Investment Bank (EIB). Over the next five years, the Joint Initiative on Circular Economy (JICE) will provide loans, equity investment or guarantees to eligible projects and develop innovative financing structures for public and private infrastructure, municipalities, private enterprises of different size as well as for research and innovation projects.

Funding calls

UKRI Interdisciplinary Circular Economy Centres and Coordinator

UK Research & Innovation invites proposals for Interdisciplinary Circular Economy Centres, each conducting interdisciplinary research that accelerates understanding and solutions to enable circularity of a resource flow (materials, material systems, products and/or services), including consideration of (multi-) sector contexts. The £30m programme will support up to five Centres for up to four years from 1 October 2020, and a Coordinator who will lead an integration hub.

UKRI will hold two webinars to provide further information about both calls on 17 October and 22 October.

If you are interested in working with RRfW on this call, [please get in touch](#).

- **Call for Circular Economy Coordinator:** Expressions of intent by 31 October, first stage proposal by 19 November. [Further details](#).
- **Call for Interdisciplinary Circular Economy Centres:** Expressions of intent by 19 November, first stage proposals by 5 December. [Further details](#).

Global Challenges Research Fund – digital innovation for development in Africa

This Global Challenges Research Fund call focuses on the impact and application of digital technologies for development in Africa. Stage one will build networks that bring together academics, industry, NGOs, policymakers and practitioners from Africa with UK partners. The call includes the following theme of relevance to circular economy:

- smart communities – monitoring and management of terrestrial and coastal environmental services and pollution, including hazard forecasting and early-warning systems, inclusive circular economies, recycling and the management of industrial and municipal waste in urban environments, access, management and monitoring of drinking water and sanitation in rural and urban settings and urban traffic management and vehicle pollution.

The total budget for phase 1 is up to £3m, to support around 20 networks worth between £100,000 and £150,000 each over one year. In the second stage, competitive funding is available for a further six to eight projects, worth between £1m and £3m each over three years.

Deadline for stage one: 12 November 2019. [Further details](#).

COMING SOON: Smart sustainable plastic packaging – industrial strategy challenge fund wave 3

The following information is subject to change: The Industrial Strategy Challenge Fund smart sustainable plastic packaging challenge aims to respond to the global issue of single use plastics. Funding may be used to find ways to cut waste in the supply chain, develop new business models and create new new sustainable and recyclable materials.

The anticipated total budget is up to £209 million. [Further details](#).

Call for ideas for potential Strategic Priorities Fund programmes

NERC issued a call on 7 August seeking ideas that could form the basis of future bids to the Strategic Priorities Fund (SPF). The opportunity for NERC to bid for an SPF programme is only likely to arise following a spending review but ideas are being sought now to allow for early identification and development of potential programme proposals.

This call for ideas is focused on two of the three core SPF aims:

- Ensure that UKRI's investment links up effectively with government departments' research priorities and opportunities.
- Drive an increase in high-quality multi- and interdisciplinary research and innovation by encouraging and funding work in areas that previously may have struggled to find a home.

We are looking for ideas that address at least one of these aims. Ideas can come from any individual or group, and any interested parties, including from those who use environmental science, such as business, policymakers and non-governmental organisations. All ideas should have a strong environmental science component or challenge. [Further details](#).

Events listing

The Scottish Resources Conference. [1-2 October, Perth, UK](#).

29th ISWA World Congress. [7-9 October 2019, Bilbao, Spain](#).

World Resources Forum (WRF) 2019. [23-24 October 2019, Geneva, Switzerland](#).

CIWM Northern Ireland Conference 2019: Life beyond plastics? [24 October, Belfast, UK](#).

Circular Cities Week – Circular Economy Club. Hosted by cities around the globe. 28 October – 3 November 2019. [Find a city event near you](#).

European Biosolids & Organic Resources Conference. [19-20 November 2019, Manchester, UK](#).

Recycling critical nutrients into the food chain: from industrial wastes to innovative fertilisers.

21 November 2019, London, UK.

Organised by SCI, Stopford Energy and Environment and N8 AgriFood

This event will discuss the significant opportunity that UK industry presents as a source of alternative sustainable nutrients for use in agriculture. It will highlight innovative technologies that enable the recovery and reuse of these nutrients, from industrial residues, in line with the principles of the circular economy.

The event will also discuss the regulatory landscape both in terms of the protections required to ensure responsible practice in the use of emerging materials and the regulatory constraints that can inhibit the effective recovery and reuse of nutrients. It will seek to share best-practice and future opportunities to enable nutrient reuse efficiency.

Finally, the event will engage with practitioners that operate across nutrient supply chains with a view to discussing opportunities for further industrial and agricultural symbiosis in this area.

[Visit the event web page for more information and booking details.](#)



Interested in working with us on resource recovery and circular economy going forward,
please get in touch. Email S.J.Jopson@leeds.ac.uk

Join our network on [LinkedIn](#) and [Twitter](#) to keep in touch.