

Towards sustainable growth, the circular economy, and designing out waste in the construction industry: thinking again.

Launch Event for *Zero Waste Scotland's (ZWS) guide for Designing Out Construction Waste*. At the Technology and Innovation Centre (TIC), University of Strathclyde Glasgow (3 Mar 2017)

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I have been delighted to be part of *Ricardo Energy and Environment's* team developing *Zero Waste Scotland's (ZWS) guide for Designing Out Construction Waste*.

We hope that the guide, which will be available from today, will contribute to a step change in the way that architects and designers in Scotland work with clients and contractors, and other members of the design team, in order to move away from the linear approach of using raw materials to make buildings (often, but not always, beautiful buildings) but then throwing away what we don't use, or think we don't need.

What the idea of the [circular economy](#) is telling us is that we need to think again. And in particular we need to think more carefully about waste, and what we do with it.

The past five years have seen a surge in activity among academics and business leaders in the UK and around the world, to forge collaboration and shape new agendas for what's being described as sustainable growth. And so it's particularly appropriate that we are hosting this launch event at our Technology and Innovation Centre (TIC) where we at Strathclyde are attempting to transform the way academics, business, industry, and the public sector work together to find solutions to challenges that matter.

Within the context of sustainable development, the circular economy, and the construction industry, I share with our partners and I'm sure many of you here today, the view that finding solutions to the challenges of designing out waste matters a great deal.

A former Vice Principal of this University, Professor Alan Hendry, (who sadly passed away in 2004, far too young) told me as a very green academic (many years ago) “David you need to consider how much waste is going to landfill”. I didn’t really get it then, back in the late 90s. But I do now. Twenty years later, and we still generate hundreds of millions of tons of waste each year in the UK, over half of this from construction, demolition, and excavation. And, although it’s been falling steadily from a baseline in 1995 (as household recycling rates have gone up, particularly in Scotland and Wales), about 23% of total waste is still today going to landfill (DEFRA, Government Statistic Service, Dec 2016). So we still have around 50 million tons each year of potential environmental hazard, releasing toxins into soil and groundwater, and through broken down organic material, releasing methane (a greenhouse gas over 20 times more potent than CO₂) into the atmosphere. The implications for Global Warming and Climate Change are enormous and, since landfill waste breaks down very slowly, this fallout from consumption represents a big problem for future generations. With 3 billion middle class consumers, like us, expected to enter the global market place by 2030, if we want to fix this, the need for changing our relationship with waste is urgent.

The idea of the *Circular Economy* (a term that many of us were unfamiliar with just a few years ago), has now caught the imagination of thought-leaders across the world, and is taking shape as a viable alternative to our culture of waste production and a linear economic model based on the notion of ‘take-make-dispose’. It also offers a practical response to the paradox within the notion of sustainable development.

Sustainable development is a term that, for the last 30 years, has embodied and mobilised a global movement towards rethinking and redesigning our future in equilibrium with the natural environment. So it has been a very important and useful rallying cry in this respect. But the term is hindered by contradiction. On one hand ‘sustainability’ speaks of balance and the setting of limits while, on the other, ‘development’ speaks of the expectation of more, and more.

The difficult question has been, after sustainable development what then? What concepts, what ideas? Where are the visions of a sustainable future?

Although progress has been made since 1987 when the World Conference on Environment and Development (WCED) asked us to reflect on the kind of development that could meet the needs of the present without compromising the ability of future generations to meet their needs things are far from clear on the direction of our travel, and where we're going.

Today we are still seeking reconciliation between our legitimate desires for progress and operating within limits that the environment can afford (or absorb), in effect grappling with limits to growth.

By presenting the framework of circularity as a tangible driver for industrial innovations and value creation for the 21st century, the *circular economy* responds to this contradiction in opening up ways to reconcile the outlook for growth and economic participation with that of environmental prudence and equity (social and inter-generational). The move from linear to circular offers an industrial system that is restorative or regenerative by intention or design. It offers a model of creative repair and renewal.

The circular system replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, and eliminates the use of toxic materials that would impair reuse and return to the biosphere. At its core it aims to *design out waste* through better products, systems, and business models.

So in the system waste does not exist. Products or components are designed and optimised in a tight cycle of disassembly and reuse, thus saving on large embodied energy and labour costs. A clear distinction is made between 'consumable' and 'durable' components of a product. In the circular economy consumables are made of biological ingredients (non-toxic, often beneficial) that can either go directly back to the biosphere or eventually back through a cascade of consecutive use. Durables, made of technical materials like metal and most plastics (that are unsuitable for the biosphere), are designed at the outset for reuse or upgrade.

So we take less, we make better, and we use again. Bounded by the laws of thermodynamics we are transforming materials (not destroying them), and then transforming them again. Of course we need energy to do this, and the energy used to fuel this cycle should be renewable to reduce resource dependency and increase the systems resilience.

There is also huge economic opportunity here. A 2014 report by the *Ellen MacArthur Foundation, the World Economic Forum, and McKinsey & Company* estimated that the move to an, 'advanced scenario' circular economy, could yield net material cost savings approaching \$630 billion per year. The highest benefits globally are predicted within the motor vehicle sector with an estimated saving approaching \$200 billion per annum (Ellen MacArthur Foundation et al, 2014).

But, in the UK the *construction industry* is the largest consumer of natural resources today, using over 400 million tonnes of material per year and each year sending about 25 million tonnes to landfill without any form of recovery or reuse.

There is a *need for cultural change across the industry* to bring both of these numbers down. *Collaboration and communication is key* to this change. The effort to use fewer natural resources and drive down waste in design and construction will need enhanced collaboration and stronger communications at a level that we have never considered before - a new ecology of architectural design, construction and urban & regional planning, that will require the sharing of knowledge and practice within and across design teams and construction professionals so that designers and their clients can incorporate approaches and strategies from inception of the project. *Zero Waste Scotland's (ZWS) guide for Designing Out Construction Waste* will support this process. New construction technologies and tools, yet to be developed, will also be needed to support this change but some are already available such as Environmental Management Systems (EMS), Environmental Impact Assessment (EIA), Life-cycle Assessment (LCA), and tools for energy and material flow analysis.

One building's waste can be another's resource. We need to learn from industrial ecology how to employ a systems-based multi disciplinary approach

to conceiving and developing areas of our cities that can operate as symbiotic complex urban systems, rather than individual buildings - a network of interdependent spaces that can support both the needs of the individual, and those of a decarbonized modern circular society.

Of course, as ever, [Research and Education has a central role to play](#) and the *Ellen MacArthur Foundation* has been leading the way here by building a global teaching and learning platform based on the circular economy framework and have been working identifying relevant bodies of research and address key research gaps. With an emphasis on Online Learning, the Foundation is working with an international network of HEIs to provide insights and content that will support education for circularity and the kind of systems thinking that will accelerate transition. Scotland was the first nation to join the Foundation's Circular Economy 100 programme (CE100) and at Strathclyde we are pleased be one other Foundations Network Universities, and one of our postgraduate students was recipient of a Schmidt MacArthur Fellowship in 2016 (CEE, Jack Barrie). To achieve the scale of social, environmental, and technological transition required all Universities, and many disciplines, must play their part. Here at Strathclyde, the Faculty of Engineering is playing its part. The Department of Civil and Environmental Engineering have a research *Centre for Water, Environment, Sustainability & Public Health* looking at waste, energy and the circular economy. The Department of Design, Manufacture, and Engineering Management hosts the *Scottish Institute of Remanufacture* bringing industry and academia together to advance remanufacturing in Scotland. Research groups in the Department of Mechanical & Aerospace Engineering are working on a number of circular economy relevant areas, including the potential to create more effective and recyclable flows for materials, most notably glass fibre composites. And in my own Department of Architecture we have a new postgraduate programme in *Architecture and Ecology* where students spend the second semester exploring issues of water and energy efficiency, and waste reduction at *Arcosanti*, an urban laboratory in the high desert of Arizona. And I'm pleased to be able to announce the launch of Scotland's first postgraduate programme in *Sustainable Engineering: Advanced Construction Technologies & Building Information Management (ACT BIM for short)* which, from October of this year, will provide students knowledge and skills of effective digital communication among all stakeholders to respond to complex and multidisciplinary challenges such as meeting waste reduction targets.

I'm confident that this level of activity in research, and teaching & learning will be generated across the Higher Education sector.

In closing - in just a few short years the idea of the Circular Economy has become an inspiration to CEOs, politicians, engineers, designers and the next generation of leaders around the world who are embracing the need to think again, and to come up with new ways of doing things. Our hope today is that, in offering an accessible guide for architects and designers on *Designing Out Construction Waste*, one that provides information on key principles and examples of how these principles can be applied in practice, the design and construction industry in Scotland can be better supported in their own efforts to build a better and more sustainable environment for us to grow and thrive in.

So in rethinking and reframing this built environment let's find ways of working together so that we don't let waste go to waste.

References

Towards the Circular Economy 3: Accelerating the scale-up across global supply chains, January 2014, Ellen MacArthur Foundation, World Economic Forum, and McKinsey & Company.

Local Authority Collected Waste Management, Annual Results, February 2017, DEFRA, Government National Statistic Service.