



Fuel for thought

The Circular Economy

After dominating the industrial revolution for more than 150 years, 'linear' models of production and consumption, which are characterised by a 'make, use and dispose' approach to products, are expected to give way to more sustainable models which aim to better recover and regenerate products and materials at the end of their lifecycle.

The linear, or one-way, production economy is an industrial system in which goods are made from raw materials, sold, used and then discarded as waste. It is typified by products with a single-use design and finite life cycle.

In contrast, **a circular economy** demands a substantial improvement in resource performance across its industrial system. It does this by rethinking our approach to the design of products, systems and business models towards the use of renewable energy, discarding the use of toxic chemicals which impair reuse and return to the biosphere, while aiming for the elimination of waste.

It is regarded that a shift towards the circular economy will build long-term resilience across economies, generate unique business and economic opportunities, while delivering greater environmental and societal benefits.

RECYCLING AND THE CIRCULAR ECONOMY

The circular economy, at its core, aims to eliminate the creation of waste through product improved design and resource optimisation within a cycle of disassembly and reuse. By this definition, it is set apart from processes which involve disposal and even recycling:

RECYCLING

Recycling seeks to recover useful material from generated waste, focusing efforts at the end of the lifecycle of a product. This is done largely isolated from the rest of the product's value chain, most notably its design stage.

That being said, recycling is a necessary component of a circular economy, though only once there are no alternatives for reuse, remanufacture or repair.



THE CIRCULAR ECONOMY

The circular economy starts at the design stage of a product, where focus is on developing a product for multiple reuse, while ensuring that energy and resource use is minimised, with ingredients being non-toxic and possibly even beneficial to the biosphere. For complex and technical products, like engines or computers, these can be designed for future upgrade which extend their lifecycle.

THE RICOH EXAMPLE

Japanese electronics manufacturer Ricoh, best known for its printers and copiers, established its Comet Circle initiative in 1994 as part of their commitment towards embracing the circular economy. Comet Circle looks at the reuse of products at the end of their lifecycle - via refurbishment and remanufacturing - while also focusing on minimising the materials used. It also looks to reduce the time taken to return the product to use, with the overall aim of lowering costs.

Under this initiative, the company produces its Greenline range of products, which are designed and manufactured such that they can be recycled or reused. Ricoh has seen the Greenline range grow into six major European markets, while earning margins 1.5 to 2 times higher than other new and similar products. Moving towards the circular economy has created a competitive advantage for the company, enabling it to reach non-traditional market segments while providing an alternate offering for traditional enterprise clients.

U.N. SUSTAINABILITY DEVELOPMENT GOALS

Developed by the United Nations in 2015, member countries adopted a set of goals to end poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. Within this framework, the circular economy plays a critical role in the delivery of multiple development goals - in particular: Industry, Innovation and Infrastructure; Sustainable Cities and Communities, and; Responsible Consumption and Production.

WASTE DIVERSION

The diversion of waste away from landfill is a common policy approach to encourage greater levels of recycling or source reduction activities. Several countries, including Germany and the Netherlands, already have had some form of outright landfill ban in place since 2005. Other countries set a landfill diversion rate, which specifies the percentage of waste to be processed in a way other than landfilling. Such approaches are typically implemented together with a levy on landfilling.

Australia has national resource recovery targets for each waste type, though these vary by state or territory. South Australia and the ACT have the most ambitious targets and are most advanced in meeting them. Queensland, the state furthest from its targets, has re-introduced a landfill levy to drive up recovery rates, commencing at \$70 per tonne for general waste.

THE CHALLENGE OF LANDFILL

There are generally three ways to deal with waste - incineration, landfill or recycling. Overwhelmingly, the majority of generated waste ends up in landfill sites.

The challenge of landfill lies in the creation of large amounts of greenhouse gases generated via the breakdown of organic matter, while water passing through toxic or hazardous waste picks up contaminants and becomes leachate, polluting the surrounding land and water.

Each year the world produces around 7 to 10 billion tonnes of waste, which can be roughly classified into three major streams: construction and demolition (C&D), commercial and industrial (C&I) and municipal solid waste (MSW) - though no standard definitions or classifications are universally adopted².

Annual generation of MSW is estimated at 1.9 billion tonnes with almost 30% of this remaining uncollected. Of the collected MSW, 70% is led to landfills and dumpsites, 19% is recycled or recovered and 11% is led to energy recovery facilities (for incineration). Landfilled material is comprised of organic, paper, plastic and glass waste. For all plastic waste, only 14% is recycled, and the rest either ends up in landfill, else eventually makes its way into our waterways and oceans.

The vast majority of global C&D waste is assumed to end up in landfill. Recycling rates of C&D waste range enormously by country, with advanced economies such as the US reporting 40% and EU countries reporting a range of between 30% to 60% on average².

In Australia, 42% of waste is sent to landfill, 55% is recycled and just 3% redirected for energy recovery (2015 figures). This compares favourably with the United States, where 55% of waste goes to landfill, just 33% gets recycled and 12% goes to incinerators.

The Federal Government estimates there are around 600 officially registered landfill sites, and up to 2,000 unregulated ones. The largest sites are generally run by private companies - with around 75% of landfilled waste goes to just 38 sites. Local councils remain responsible for landfills in their municipalities³.

In the Government's last National Waste Report 2016, it notes the trend in Australia is that we are generating less MSW and recycling more. However, we are also generating more C&D and C&I waste - though recycling a greater proportion of these as well.

BARRIERS TO THE CIRCULAR ECONOMY

The present reality is that barely 9% of the resources in today's global economy are cycled back into use.

The main barrier to adopting a circular production approach remains cost - with transition costs likely to be very high, there are a lack of economic incentives to support such a fundamental shift in the way of doing business. Without support from governments, these costs – spanning management, logistics, research & development, as well as physical and digital infrastructure – will be untenable for most companies.

In Australia, the lack of government targets for sustainable procurement, dictating higher levels of recycling and reuse, remains a key impediment to our transition towards a circular economy.

However, such barriers can be overcome if multiple players across business and research communities join to reconceive key material flows and manufacturing processes. Furthermore, should businesses consider the whole-of-product life cycle costs - including the cost to landfill and the depletion of natural resources, the benefits of reuse will become more commercially attractive.

Early movers in this space will likely innovate to either create attractive market positions or reduce the costs of transitioning, causing others to follow, with policy makers then playing catch up.

AUSTRALIA AND THE CIRCULAR ECONOMY

While Australia compares favourably to other countries in terms of waste management, recent policy changes in China limiting the import of waste from foreign countries, has the potential to negatively impact recent performance. While Australia ships only 3.5% of its total recyclable waste to China each year, this amounts to some 600,000 tonnes of waste. Without alternate destinations for this waste, Australia faces the scenario of sending more recyclable material to landfill at home – an unattractive prospect as most states look to increase their diversion rates^{4,5}.

Peak representative bodies for the Australian waste industry are calling for urgent implementation of a national strategy to deal with this challenge – proposing a \$150 million plan to 're-boot' the local recycling industry and spur the creation of a circular economy. They suggest setting Australia on the pathway towards a circular economy using the right policy frameworks, investment and planning. Recent polling indicates that Australians empathise with this approach and would support national coordination for improved recycling.

While these efforts focus more on recycling and sustainable behaviours in the treatment of waste, it is likely that a combination of macro-level forces combined with this scenario may accelerate Australia's transition towards embracing the circular economy.



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Downer's Role in the Circular Economy

Across Downer there are numerous businesses which are pulling us towards the circular economy. Some of these may be more obvious, such as in the delivery of solar and wind farms – the use of renewable energy sources in production is a cornerstone of circular models.

However, our new Reconomy business is emerging as a thought leader in the innovative diversion of landfill, with a focus on finding sensible reuse for the materials that result from some of our processes.

A newly built detritus processing facility in Rosehill will repurpose around 25,000 tonnes of waste in NSW, which is pulled from everyday waste streams such as street sweepings or stormwater drains. The collected waste is cleaned and separated into valuable products and materials that can be readily reused or sold, with the facility reaching a repurposing rate of 85% - setting a new benchmark in sustainability and innovation in Australia.

This detritus processing facility signals our most significant move towards embracing the circular economy – by pulling product and not pushing waste. In addition to the environmental benefits of diverting waste from landfill, the process delivers clear economic advantages via the extraction of valuable materials from a waste source, which then serve as inputs at the beginning of a new product's life cycle.

Reconomy intends to expand operations into other states, as well as broaden the types of waste streams and reusable materials it can process.



PLASTIPHALT

Following on the success of its TonerPave product, which repurposes waste material from the printing industry into new asphalt for roads, Downer has developed another innovative paving product which incorporates recycled soft plastics and glass into asphalt road construction.

In an Australian-first trial, soft plastics from approximately 200,000 plastic bags and packaging, and glass from approximately 63,000 glass bottle equivalents were diverted from landfill to construct a local road in Craigieburn, Victoria. With more than 25% recycled content, which also included repurposed toner and road material, the trial demonstrated the economic, social and environmental value for products that would more than likely end up in landfill, stockpiled, or as a pollutant in our natural environments.

Soft plastics from plastic bags, packaging and glass from recycled bottles are diverted from landfill and used in asphalt to construct roads, is an Australian-first for Downer.