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OPINION In steel, the innovation economy is already here

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There's much more at stake at Australian steelmaker Arrium than today's jobs, writes Veena Sahajwalla.



Photo: Tamara Dean

OPINION: There's much more at stake at Australian steelmaker Arrium than today's jobs. If Australia is to have a real chance of transitioning from a largely mining and commodities-based economy to an innovation-led ideas boom, a buoyant Australian steel industry is essential.

We know this because a long list of research breakthroughs at the University of NSW's Centre of Sustainable Materials

Research and Technology are the result of more than a decade of research collaboration with Arrium. This is the kind of academic-industry partnership that, in the lead-up to a federal election, both sides of politics will be spruiking, rightfully, as the key to innovation and the future jobs and economic prosperity it promises.

Our groundbreaking research into transforming complex, problematic waste streams — such as used tyres, plastics and automotive waste — into valuable resources has not relied on industry as merely a source of additional research funding but on access to industrial-scale furnaces and to invaluable industry knowledge, experience and expertise.

The research outcomes and applications have surpassed our loftiest expectations. We've realised that high-temperature reactions can be leveraged to revolutionise recycling science to reduce costs for today's businesses and to create entirely new businesses and jobs while delivering environmental benefits.

Instead of laboriously separating waste and turning, say, waste glass back into more glass, we can envisage safely harnessing complex, difficult and even toxic waste streams such as e-waste to produce previously unimaginable new value-added green materials and resources, instead of shipping our waste offshore.

In doing so, we can change the industrial landscape so profoundly we may look back quizzically at today's simplistic linear flow charts, with their virgin raw materials in and new goods and residual waste and pollution out. Instead, whatever we produce or discard will connect us through innovative new networks of industries, each of which understands that resources are finite and too valuable to dump in landfill.

Our first research project with Arrium was so novel that the only outcome we confidently could predict was that we would learn something new. We wanted to investigate waste not in the form in which it was thrown away but at its micro level.

Waste tyres and various mixed plastics, for example, are technically very difficult to recycle but they are also potentially valuable sources of hydrocarbons. What if we could use high temperatures to trigger selective transformations to produce clean metals from waste? We discovered that by injecting a precisely optimised blend of coke and granulated waste tyres or plastics into an electric arc furnace, we could produce high-quality steel more efficiently.

We reduced the volume and cost of non-renewable coke, cut power usage and absorbed huge numbers of waste tyres; a serious global burden. The new process not only improved steelmaking in Australia but led to valuable Australian IP exports; "green steel" has been commercialised in Asia, Europe and Britain.

The more than two million tyres Arrium's Australian operations have since diverted from landfill are important, but they are just the tip of the iceberg. We've also been working with Moly-Cop, a business unit within Arrium. Moly-Cop is the world's leading supplier of high-performance steel used in grinding applications. We're investigating waste materials as an input at Moly-Cop's Newcastle plant to harden the steel's surfaces. The cost and environmental benefits are significant because the grinding balls don't have to be replaced as often.

And we are not just working with steel. We've recently shown in laboratory trials that automotive waste plastics and glass, containing silica and carbon, can be transformed into valuable alloys or used to reduce iron oxide to iron. Although metals are routinely recovered from vehicles, there is presently no viable recycling process for the growing mountains of this residual automotive waste.

Likewise, we are working with a range of industrial partners to investigate how our fastest growing waste stream, e-waste, can be safely reformed at high temperatures to harness the many valuable embedded resources while neutralising toxins and hazardous elements. Copper in e-waste, for example, is 10 to 20 times more concentrated than in mined ore.

Solutions such as this are built on fundamental research. Translating this research into commercially viable,

environmentally friendly applications promises to position Australia as a leader in high-value niche products.

We can achieve this only if researchers and industries work together. Imagine, then, a green materials flowchart of the future. It might have an e-waste processor at its centre, with many other industries and small businesses connected in a mutually beneficial web as suppliers of resources, in this case waste, or as customers for the resulting value-added outputs, such as precious metals and alloys and other value-added materials.

We are working with Australian businesses and local and regional authorities to process a variety of waste resources in just this way.

Globally, waste management is a vast and rapidly growing industry, rich with untapped opportunities. The UN Environment Program estimates global emissions could be reduced by 10 per cent to 15 per cent by reimagining waste as a resource and responding accordingly. Total savings to businesses could exceed \$US1 trillion (\$1.31 trillion) globally.

For Australia, there's much to be gained. Modelling by the NSW Environment Protection Agency estimates 0.46 jobs are created for every 1000 tonnes of domestic waste diverted from landfill and 0.33 jobs per 1000 tonnes of commercial and industrial waste. Then there's the considerable value of repositioning Australia as an innovator globally. If we can grab the new opportunities emerging from our R&D sector to deliver new green materials, new intellectual property and associated science and technology-based services, in collaboration with Australian industries, we can grow future jobs.

I don't mean to make this sound easy. Research is a long, slow, meticulous process and we could not do our work, or translate it into real benefits, without the Australian Research Council funding agency and strong industry partners committed to similarly bold vision.

I have worked with metallurgical industries worldwide, including Arrium, for many years. It is encouraging that the federal government is discussing procuring quality Australian steel for local projects, including the next-generation submarines, and that China is winding back steel production by 100 million tonnes in the next five years. But the debate over the future of Australia steelmaking has been framed far too narrowly. What Arrium's administrators and all the politicians and commentators may like to consider is just how far down the innovation pathway we've come and how important it is that we keep heading in the right direction.

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