



7 May 2020

Joint submission to the NSW Department of Planning, Industry and Environment, in response to its issues paper, *Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW*

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Dear Sir/Madam

The Sustainable Materials Research and Technology (SMaRT) Centre at the University of New South Wales Sydney (UNSW) and the NSW Circular Economy Innovation Network (NSW Circular) are pleased to provide this joint submission to the issues paper 'Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW' to help shape the development of the NSW Government's 20-Year Waste Strategy.

Professor Veena Sahajwalla is Director of both the SMaRT Centre and NSW Circular, and her respective teams have particular expertise in materials science and engineering, reducing waste through recycling science and the SMaRT's Microfactorie™ technology, as well as a track record in collaborating with industry sectors and businesses to research and develop innovative, 'circular' solutions that reuse and reform waste into value-added materials and products. This has led to the development of multiple prototype products and opportunities that are involved in various pilot projects and industry partnerships.

The NSW Government and its agencies are to be applauded for their ongoing work to address waste and recycling challenges. It is essential we strive to develop a circular economy in which we keep materials in use for as long as possible and establish new business supply chains, to better manage waste as a resource and create new jobs, along with other economic, social and environmental benefits.

Various technologies and capability are now already available right here in NSW to reform much of this unwanted material into new products and manufacturing feedstock to help reduce the need for landfill, as well as reduce the need for mining and production of 'virgin' materials. But currently there is little commercial incentive to adopt this capability because much of this material is seen as having no or little value and supply chains are often based on the principles of lowest cost and maximum convenience.

Direction 1: Generate less waste

Waste often contains complex materials that can be captured and reformed for use in manufacturing processes and become part of new local and larger supply chains. We must realign the way we think about these materials to see them as valuable and not as waste to be discarded.

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Option 1.2 Designing out waste

Reducing waste generation is key to a sustainable waste and resource recovery sector. There are many opportunities for NSW to support industry to 'design out' materials which are complex to recycle, including multi-material plastics for which there are examples in industries where this is already occurring. NSW Circular and the UNSW SMaRT Centre have been involved in numerous pilot projects in this area and, for example, one involved construction and development firm Mirvac which revealed how building developments can adopt greater sustainable practices for the long term right from the design phase (see <https://www.nswcircular.org/marrick-co-by-mirvac/>) using waste plastics and other common waste materials. Importantly, though, feedback through NSW Circular pilot projects show that end markets benefit most from a 'design thinking' approach that considers the end product to ensure product appealability and its ultimate commercial adoption.

Ensuring sectors are required to design for when a product is no longer wanted or useful removes from the consumer or end user the sole responsibility around disposal. The 'design out' phase involves actively working with companies and organisations seeking to embrace circular economy principles into their operations so they can adopt the principles and interact with the other participants to help create new supply chains which can also account for when their own products are determined 'end of life' and no longer wanted.

It's time to rethink attitudes towards all of the materials we design, produce, use and discard, to see them as renewable resources if we want to reduce our reliance on finite resources and create important positive environmental and economic impacts. Strict quality controls around waste streams to check on contamination is needed to ensure a greater level of recycling and 'reformation'. Reforming is the fourth "R" to join Reduce, Reuse and Recycling.

Option 1.3 Awareness and behavioural change

A shift is needed in our thinking, to move away from classifying items as waste, towards instead conceiving of these items as containing the basic elements to be used as input materials for manufacturing.

Traditionally, when people have finished using an item or have removed packaging from a product, they discard it in the rubbish bin. That waste is collected by a contractor to local government, and then either sorted for recycling, taken to landfill, shipped offshore, stockpiled or burned. These traditional solutions are costly, unproductive, and in the case of burning waste, contribute to carbon emissions and harm the environment, let alone destroys the 'resource' for ever and prevents a circular economy.

Australians need to shift their view on waste so that instead of valuing the product which has reached the end of its productive life, they value the material from which the product is made and recognise that the material can be recycled or reformed into value-added materials. These 'renewable materials' greatly eliminate the need for waste to be burned or buried by being brought back into supply chains.

NSW Circular has a pilot project with The Bower (see <https://www.nswcircular.org/e-waste-plastics-transformed-into-value-added-products/>), an environmental not-for-profit community organisation committed to reducing landfill through the reuse and repair of unwanted household goods, by finding innovative new ways to use these materials and to create greater community awareness about circular economy benefits. Another pilot project is with Hunters Hills Council (see <https://www.nswcircular.org/pop-up-library-to-showcase-circular-economy-solutions/>) to showcase innovative use of common waste materials in a new pop

up library and to provide a demonstration and community awareness space to highlight circular economy in action and inspire the community.

At present, there is a focus on waste management at one end of the supply chain, with an emerging recycling and manufacturing industry at the other. New supply chains need to link the two together to achieve the desired solution of recycling the elements of waste products so that they can be reformed in our manufacturing industries.

For example, through SMaRT's recycling science and Microfactorie™ technology, discarded textiles, paper and glass can be reformed into floor tiles, ceiling tiles, or sound-absorbing wall tiles, while discarded plastics and e-waste such as laptops and smart phones can be converted into materials for use in metals and industrial grade ceramics, and plastic filaments for 3D printing.

With new supply chains that conceive of waste in this way, new economic opportunities will be created that offer the possibility of creating jobs, including in regional communities or any place where waste is stockpiled. Government targets, rules and regulations should be subject to widespread information campaigns for all stakeholder categories to ensure the shared responsibility and ownership aspects of waste in a circular economy.

Both NSW Circular, as a network promoting circular solutions, and the SMaRT Centre, as a world leading materials research centre on recycling science, would each be willing to be part of a coordinated awareness and behavioural change campaign.

Direction 2: Improve collection and sorting (maximise circular outcomes at lower cost)

It is crucial to help avoid waste at source so it doesn't become waste but can be diverted for meaningful assessment around the reuse of the materials it contains. For example, kerbside collection of non bin waste is often lumped together and not grouped into material types to enable better sorting, recycling and reformation. We need better management of these materials at the source of collection. If people know about more meaningful collection and recycling of discarded materials, such as through the few community recycling centres (CRCs), then they would be more willing to use and embrace these methods (see community attitudes data below). Mandated or enforced requirements around this may be required.

Option 2.4: Waste benchmarks for the commercial sector

Private sector waste management providers need incentives (whether economic or regulatory) to recover, re-use and recycle waste. Without incentives, they can be expected to pursue the cheapest and easiest option for waste management, which will not necessarily align with State (or Commonwealth/COAG) public policy goals or the broader public good.

However, at present there is a lack of clarity around the major players in the waste management cycle. There is currently no distinction between an organisation which collects waste and sends it to landfill to those that collect waste to reform and up-cycle, thereby adding value to the material and reducing waste for landfill.

We would like to see a tiered system introduced so that councils and the community can discern between waste management systems and waste management providers who just dispose of waste and those that add-value, for example:

- Tier 1: companies/organisations that up-cycle and reform waste for new materials and products;

- Tier 2: companies/organisations that collect waste products and pass them on to other companies for up-cycling and reforming;
- Tier 3: companies/organisations which send waste to stockpiles, landfill or for incineration.

This would provide the community with information about the role of companies in the waste management cycle and about the waste management system being used by their local government, and empower consumers to act in the best interests for society.

This would also provide the opportunity for communities to advocate for a different waste management system if they are unhappy with the approach currently in use by their local council. UNSW SMaRT's own [survey on community attitudes to waste and recycling](#) found that:

- 65.4% of people believe recyclables put into council bins goes to landfill (69.5% female, 51.4% aged 18-34, 75.1% aged 65-plus);
- 49% of people believe green and ecofriendly efforts will not have an effect in their lifetime, and 63.8% of those aged 65-plus see no benefits being realised;
- 72.4% of people would recycle more if the material was reliably recycled;
- 91.7% of people say it is very or somewhat important for Australia to invest in technology to 'reform' most common waste into re-usable 'high-value' materials;
- 80.4% support government investment in this technology to reduce landfill and create jobs.

Option 2.5: Innovation and 'waste-tech'

We must reconsider how we conceptualise and define waste. For example, in accordance with the definition of waste under New South Wales' Protection of the Environment Operations Act 1997 anything made from waste (including plastic melted and remodelled to make a new product) remains waste.

This definition is out-of-step with the technology which allows waste to be reformed and become part of a new value-chain. It will be difficult to fully realise the concept of a circular economy, which values resources by keeping products and materials in use for as long as possible, if the concept of waste is not redefined to recognise the value of products made from recycled or repurposed materials.

The best options for reducing waste are those that don't conceive of an item as waste following the end of a product's life, but rather as a resource or component in the manufacture of a future product. Therefore, the optimal solutions to waste management will be those that re-use or recycle products rather than burying them in landfill, or incinerating waste (including waste to energy proposals).

But innovative supply chains are ultimately needed to achieve this. Businesses and organisations generally rely on traditional supply chains where reformed materials are usually not part of the chain. But we need to ensure alternative solutions to current common supply chain practices adopt new and local supply chains that incorporate the use of resources made available from our waste resources.

Solutions are available such as those identified by UNSW researchers at SMaRT which are peer reviewed, piloted and now recognised as world leading, and supported by the Australian Research Council (ARC) which funded the Green Manufacturing Hub in 2015, and again in 2019 when the ARC approved SMaRT's Microrecycling of Battery and

Consumer Waste Industrial Transformation Research Hub, set to commence in the latter part of 2020.

Option 2.6: Joint local council procurement

We need to reconsider how waste management services are currently procured by local councils. Procurement of waste management services needs to be done in a way that allows sufficient flexibility for councils to pursue new and innovative solutions when they are developed. At present, councils are locked into lengthy contracts with waste management businesses with no scope to consider new waste management solutions to recycle waste during the term of those contracts.

Direction 3: Plan for future infrastructure

Option 3.1: Long-term waste and resource recovery infrastructure

Mapping and planning of critical waste infrastructure is central to managing the immediate challenges facing the sector in light of the impending COAG-agreed waste export bans, which will see a ban on export of unprocessed glass by July 2020 and mixed plastics by July 2021. Government and industry have a role to play in planning and implementing adaptive and sustainable waste infrastructure which can facilitate the transition towards circular economy goals highlighted by the NSW EPA foresight analysis.

Not everyone has necessary infrastructure or funding for it to solve these challenges on their own. So, rather than it being known as waste infrastructure, it really is process infrastructure related to materials supply chains. State funded initiatives such as CRCs could be a model to pursue to advance a decentralised and laterally integrated infrastructure model for the benefit of all size businesses, regardless of location. New infrastructure needs to be decentralised and to laterally integrate sectors that are not normally connected, as indicated by the examples and reports below.

Special activation precincts are a good model for the infrastructure needed. The NSW Government is to be applauded for its Special Activation Precinct (SAP) policy, and leading the development of the Parkes SAP which will connect global freight markets to local businesses and agricultural producers. The SAP model could be specifically applied to waste and recycling, with an emphasis on recovering and reforming the materials to create new and localised supply chains, materials and products, offering economic and environmental benefits.

The Senate Environment and Communications References Committee Inquiry into Waste and Recycling Report 2018 found the importance of investment in infrastructure for the collection and processing of recycled material and diverting waste from landfill. It said “this infrastructure is needed both to enable regions to participate in recycling programs and to reduce contamination rates, and the report noted evidence that “to reduce the contamination rate of recyclable materials, investment in material recovery facilities (MRFs) is required”. That report also highlighted the benefit of the Microfactorie™ concept.

Furthermore, the COAG Waste Ban Response Strategy released March 2020 added weight (p16) to the argument of centralised support for new and innovative processes and infrastructure, saying “significant challenge raised in industry consultation is the ability for businesses to secure investment for facilities and equipment upgrades, and to develop and test new technologies for creating value-added products from waste”. It went on: “Governments have a role to play in ensuring that viable proposals from start-ups and small and medium enterprises receive the support they need to scale up, achieve

commercialisation, and compete in the open market. Support offered could involve access to test facilities, expert knowledge, and seed funding for cross-sectoral approaches to solving waste challenges. All governments opportunity: Investigate opportunities for regional microfactories, to enable regional and remote areas to process locally generated waste resources into useful value-added products for community benefit.”

The above references to microfactories relates to the technology / infrastructure mentioned earlier in this submission (Microfactories™) developed by the SMaRT Centre through its first ARC hub. Its second ARC hub, the ARC Microrecycling of Battery and Consumer Waste Industrial Transformation Research Hub (see <https://newsroom.unsw.edu.au/news/general/unsw-sydney-tops-arc-research-hub-grants>), aims to develop battery and other waste recycling and reformation technology / infrastructure / capability. Commercialisation of such technology / infrastructure will be slower than needed if left to market forces alone. Incentives from Government (regulatory and financial) will accelerate greater take up and rollout of existing capability across the value-chain.

Direction 4: Create end markets

Decentralised infrastructure needed to create end markets as mentioned above in relation to perhaps expanding the number and capability of CRCs and SAPs so actual processing and reformation of waste materials is done locally and regionally. This creates new supply chains and markets while addresses waste issues. Importantly, though, feedback through NSW Circular pilots projects show that end markets benefit from a ‘design thinking’ approach to the end product to ensure appealability and ultimate adoption of new ‘green’ products, such as a [this built environment project](#) with Mirvac.

Option 4.1: Recycled content on government procurement; and Option 4.2: Standards for recycled content and materials

Local and state government policy and regulations could encourage councils to address the whole life-cycle of waste, going beyond waste collection to also include the creation of recycled products by supporting partnerships with manufacturing companies.

Reforms requiring for the use of ‘green materials’ would produce a shift in the market for green products, for example:

- Testing and regulation development ahead of mandatory targets for the inclusion of green products in construction and other manufactured items;
- Incentives for the retail sector to introduce recycling of packaging from their products sold;
- Incentives for the purchase of products made from recycled and repurposed waste products could be included in procurement guidelines/standards and enforced.

Option 4.3: Match suppliers with markets

A number of different initiatives are underway in NSW and other states and at national levels, to bring stakeholders together to address market gaps and ‘close loops’ around materials supply. This is disparate and across jurisdictions with little coordination. There is also little incentive to industry participants unless there is a demonstrable revenue benefit.

Greater incentive (regulatory or otherwise) and coordination may provide businesses with more confidence in participating in such schemes and to adapt manufacturing processes or introducing new processes to replace virgin materials with previously used but reformed materials.

Incentives are needed to ensure critical mass of suppliers and participants is reached for the benefits to emerge at scale. Businesses often work across State boundaries, so an integrated approach is needed. But there also needs to be localised networks/exchange platforms to cater for localised circular economy participants at a regional level.

Councils and local business chambers could play a role in being part of an integrated (mandated) approach thereby achieving a critical mass of participants, accounting for local, regional, state and national players.

Microfactories can enable the lateral integration of different industrial sectors to achieve the stated goals of COAG and the NSW issues paper, by recovering and reforming so-called waste materials to create new and localised supply chains, materials and products, offering economic and environmental benefits.

Option 4.4: Best-practice regulatory environment for energy from waste projects

As mentioned above, incineration of waste to generate energy should not be part of the solution when new, more effective and sustainable methods of dealing with waste are now available. The process of burning waste to create energy means that these materials are lost forever as forms of renewable resources. Waste to energy should be used only as a last resort and for those materials and items that can not be part of the circular economy or where there is no capability to reform them or alternative.

In conclusion

Given the severe impacts on global supply chains from COVID-19, the future of global manufacturing lies in small-scale, decentralised technology that will enable communities to produce many of the products, materials and resources they need locally by using resources largely derived from local materials that are unwanted or thought of as waste.

The science and technology we already have available can now make it possible for a complicated waste stream to produce value-added materials which can then feed into different industrial supply chains for manufacturing products.

This emerging model will profoundly disrupt today's centralised, vertically integrated model of production, where, for instance, a single material or part available only from an overseas supplier can disrupt the manufacturing process.

For example, already millions of tyres have been diverted from landfill, partially replacing coke in EAF steelmaking which is another example of lateral integration of sectors not normally aligned or connected, as mentioned above. Other materials, such as glass or e-waste are being transformed into tiles, metals and industrial grade ceramics and plastic filaments that are then used in 3D printing.

Many other technologies are also available, but market forces alone are extremely unlikely to ensure the take up of these to help meet the necessary targets expressed in the issues paper.

Ideally, waste disposal would be run as a distributed solution across the State with decentralised manufacturing close to the point of disposal working to recycle waste material into feedstock in conjunction with local manufacturers, supplier and businesses. This also represents an economic opportunity, especially in rural areas, where jobs could be generated through manufacturing new supplies and products, to help create, in the current COVID-19 world, what is called 'sovereign capability'.

Yours sincerely

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