



**NSW  
Circular**

# The circular economy opportunity in NSW

NOVEMBER 2020





# Contents

1. Introduction: What is the Circular Economy?	3
1.1 An unprecedented opportunity	4
1.2 The case for a circular economy for NSW	5
2. The state of play	7
2.1 Australia	7
2.2 New South Wales	9
3. Value of the circular economy	11
3.1 Economic value	11
3.2 Environmental value	13
4. Value of circular materials	15
4.1 The opportunity	15
4.2 High potential	17
4.3 Future stars	20
5. Summary	22

# 01

## Introduction:

# What is the Circular Economy?

**Circular Economy is a systematic approach to economic development that benefits business, society and the environment. A circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources. It is an accelerator to a zero-carbon sustainable economic recovery.**

## Circular Economy:

Moves away from a 'take-make-waste' economy, to a 'take-make-recreate' economy, where economic growth is not based on finite resources, but through circular systems. This new economy disrupts linear approaches that encourage us all to flush and throw away valuable resources.

Keeps resources in use for as long as possible. Extracts the maximum value from resources whilst in use, then recovers materials at the end of their life to be used again in a new form. A continuous cycle of reinvention.

Provides limitless opportunities for materials through a circular system, where waste and pollution are 'designed out'. Utilities - energy, waste, water - are decentralised, and natural systems are regenerated.

Systems are transformed by shifting the focus from ownership to 'as-a-service', sharing and reuse models. Products become services that allow us to use what we want, when we need it, saving money, resources and protecting our environment.



## 01

# \$210 billion to Australia's GDP & 50,000 NSW jobs

## 1.1 An unprecedented opportunity

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CHIEF EXECUTIVE  
OFFICER



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CHIEF CIRCULAR  
ECONOMIST



NSW Circular's first report *The Circular Economy Opportunity* sets out the evidence for why transitioning from a linear to a circular economy will be vital for job creation and economic recovery post-COVID-19. It creates a snapshot of the circular economy, highlighting how NSW can unlock a jobs, growth and a resource boom to be the powerhouse of circular economy innovation in Australia.

This report demonstrates a circular economy can generate up to 50,000 jobs in NSW over the next five years as the circular economy grows and is embraced by industry. If we expand the circular economy opportunity in key sectors including health, water, transport, the built environment, electronics, solar energy and manufacturing - we can generate tens of thousands more jobs.

The Circular Economy Opportunity is the first of a series of reports NSW Circular will be releasing to engage governments, businesses, researchers and citizens on the biggest opportunity we have to build back our economy and tackle the critical issues of our time: the climate, consumption and biodiversity crises.

If we don't transition to a circular economy, we will continue to lose valuable resources that generate new jobs and industries, build sustainable supply chains, and are key to our economic recovery. To realise the economic opportunity we need more data on the value of waste thrown into landfill.

This report begins NSW Circular's work to expose the economic potential in materials like e-waste, solar panels, plastics and glass, to spotlight investment and policy opportunities and drive Australia's migration to the circular economy.

Developing thriving and self-sustaining markets for recycled products in particular will help grow the competitiveness of the Australian manufacturing sector, and help de-risk our supply chains by reusing our own recycled materials.

NSW Circular will be releasing monthly market spotlights on how much materials are worth to the market, along with helping create new marketplaces and bringing together new circular supply chains.



## 01

# The case for a circular economy for NSW

## 1.2

## The current state:



### We consume a lot of resources...

Australia is the largest materials user per capita in the region and Australians have the 2nd highest material footprint per capita in the OECD. NSW generates almost 3 times the global average CO2 emissions per capita.



### But we don't do enough with them...

Australia has the 3rd lowest rate of material productivity and the lowest manufacturing self-sufficiency in the OECD. We generate only US\$1.28 of economic output for every kg of materials consumed, under half the OECD benchmark of US\$2.90.



### So we discard a lot of valuable resources.

Australia landfills 20 million tonnes of its core waste each year, by 2040 that waste would fill Sydney Harbour. Metropolitan Sydney alone flushes out to our waterways enough wastewater to fill Sydney Harbour each year.

## without moving to a circular economy...



We will continue to lose valuable resources that could generate new jobs and industries and build more sustainable supply chains.



We will only get halfway to NSW's goal of net zero emissions by 2050, even with a transition to renewable energy



Our long-term water security remains under pressure from climate change, population growth, and rising non-residential water use



The quantity and cost of waste will continue to rise, with average NSW household waste charges rising over 60% over the next 15 years.



## 01

# The economic opportunity is significant and critical to our future

## The Opportunity:



Circular economy initiatives in the Australian food, transport and built environment sectors alone can add

**\$210 billion**  
to Australia's GDP by 2048

Circularity can be a growth driver by saving costs, regenerating resources and creating resilient jobs.

**There are 3.3 times more jobs in recycling for every job in landfill.**

If half of Australia's wastewater discharged into our waterways is recycled, its potential value would be

**over \$1 billion**

The circular economy will unlock new industries and opportunities that we aren't even aware of yet.

For example, once we begin to better capture our waste streams, we are likely to uncover valuable materials which can be turned into high value products.

Circular economy interventions are necessary to NSW's strategy to achieve net-zero emissions by 2050, and could halve Greater Sydney's emissions from energy, transport and waste in the next 15 years

Even a 5% improvement in materials efficiency would add

**\$24 billion**  
to Australia's GDP,  
**\$10 billion**  
to NSW's GSP and  
increase real wages by  
**2.8%**



## 02

# The state of play

## 2.1 Australia

Australia consumes significantly more material per capita than most of the OECD and the region.

It also has lower materials productivity and lower domestic supply chain sufficiency than most of the OECD and the region.

In addition to our high use of scarce resources, Australia landfills more of its waste than other developed economies like the UK, Netherlands, Singapore and Japan.

- **Australia is the largest material user per capita in the region, and second largest in the OECD after Chile.** We consume 38 tonnes of resources per person each year, nearly double the OECD benchmark.
- We also have the **second highest material footprint per capita in the OECD after Luxembourg.** However, **Australia has the third lowest material productivity in the OECD after Chile and Estonia.** We generate only US\$1.28 (AUD \$1.80) of economic output for every kilogram of materials consumed. This is less than half the OECD benchmark of US\$2.90 (AUD \$4.09) and significantly less than the rates of US\$5-6 (AUD \$7.00) for the UK, Netherlands and Switzerland. (1)
- **Manufacturing makes up only 6% of Australia's economy** compared to the OECD average of 16%. This is the second lowest rate in the OECD after Luxembourg. (2)

### AUSTRALIA



is the largest user of materials per capita in the region



has the 3rd lowest rate of material productivity in the OECD

(1) OECD.Stat, [https://stats.oecd.org/Index.aspx?DataSetCode=MATERIAL\\_RESOURCES](https://stats.oecd.org/Index.aspx?DataSetCode=MATERIAL_RESOURCES) (Accessed 21 Aug 2020). Refers to materials originating from natural resources that form the material basis of the economy: metals, non-metallic minerals, biomass and fossil energy carriers

(2) OECD, Material productivity (indicator). doi: 10.1787/dae52b45-en (Accessed on 13 August 2020)



## 02

## 2.1 The state of play: Australia cont.

- Australia has the lowest manufacturing self-sufficiency in the OECD, producing only two-thirds as much manufactured output as it consumes. Australia uses \$564 billion worth of manufactured products but produces only \$380 billion each year. Less than a million people currently work in the manufacturing sector, accounting for 6.9% of jobs, but 26% of all R&D spending. (3)
- Australians produce over 500kg of municipal solid waste per capita, which is 9% more than comparable nations. (4)
- Australia still landfills 20 million tonnes or 27% of its waste each year, compared to 2-3% in the Netherlands. (5,6)

## AUSTRALIA



has the lowest  
manufacturing self-  
sufficiency in the  
OECD



still landfills a  
large proportion  
of its waste



Photo Credit: Unsplash

(3) Stanford, J., A Fair Share for Australian Manufacturing: Manufacturing Renewal for the Post-COVID Economy, The Centre for Future Work at the Australia Institute, July 2020.

(4) Blue Environment, National Waste Report 2018, commissioned by the Department of the Environment and Energy, November 2018

(5) Australian Bureau of Statistics, Waste Account, Australia, Experimental Estimates, 2018-19

(6) Kaza, S., Yao, L.C., Bhada-Tata, P., Van Woerden, F., What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, World Bank, 2018

## 02

# The state of play

## 2.2 New South Wales

NSW is a state with high resource consumption and waste disposal rates, and average to poor recirculation/recycling rates.

EVERY YEAR, ON A PER CAPITA BASIS IN NSW:



x100

uses enough energy to power an electric car 100 times over



x3

generates almost 3 times the global average CO2 emissions



generates waste equivalent to the weight of two mid-sized cars

- Around 94% of the energy used in NSW comes from non-renewable sources such as oil, coal and gas, although use of renewable energy is growing rapidly.
- The NSW transport sector alone accounts for 45% of total energy use, followed by the industrial sector (36%), households (11%) and commercial sector (8%). Transport's share of energy use has been steadily increasing over time, from 39% of total energy use in 2005–06.
- NSW generated 132 Mt of CO2 in 2016: a quarter of Australia's total emissions. The state emits 17 tonnes CO2 per capita, below the national average (22 tonnes per capita) but almost triple the global average (6.6 tonnes per capita, 2014 figure). The stationary energy (mostly from electricity generation) and transport sectors represent 72% of total NSW emissions. (7)
- Only 7% of metropolitan Sydney's total water supply is recycled, leaving an opportunity for 93% of Sydney's water to be recycled. 7% of the water supply translates to 44,000 megalitres of recycled water annually. (8)
- Sydneysiders alone produce nearly 500 billion litres of wastewater each year which is discharged into our waterways: enough to fill Sydney Harbour (9). Although this usage rate has been relatively constant over the last decade, water supplies have come under upward pressure from hotter and drier weather conditions, population growth, and increases in non-residential water use in recent years.

(7) NSW Environment Protection Authority, NSW State of the Environment Report, 2018

(8) Sydney Water, Water Conservation Report 2018-19

(9) Calculated from Sydney Water statistics of 1.3 billion litres of wastewater collection per day



## 02

## 2.2 The state of play: NSW cont.



Photo Credit: Unsplash

## NSW STATE OF PLAY



Only 7% of Greater Sydney's water supply is made up of recycled water



Greater Sydney discharges enough wastewater each year to fill Sydney Harbour, or 1000 Olympic-size swimming pools each day



Around 35% of the 20 million tonnes of waste generated in NSW each year goes to landfill, costing households and businesses over \$750 million p.a. in waste levies

- NSW generates over 20 million tonnes of core waste each year, enough to fill 8,000 Olympic-sized pools.
- Of this, 35% goes to landfill, costing households and businesses over \$750 million in waste levies alone a year.
- NSW's resource recovery rate has plateaued at around 65% in recent years. This is low compared to other states with waste levies such as South Australia (82%) and Victoria (72%) The only other waste-levying state with a lower recovery rate is Western Australia (57%) (10,11).
- Over the next 20 years, NSW waste generation is projected to grow from its current 21 million tonnes to over 31 million tonnes (12). Waste-related freight in NSW is projected to rise by 43% by 2036. (13)
- A circular economy would reduce the negative effects of waste generation and its transportation through **better land use planning** and **better industrial ecology mapping**. Place-based planning approaches in particular are well suited to this.

(10) As of November 2018. Since then, Queensland and the Australian Capital Territory have introduced new waste levies and Tasmania is proposing to introduce this.

(11) Department of Agriculture, Water and the Environment, National Waste Report 2018, Nov 2018

(12) NSW Department of Planning, Industry and Environment, Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW Issues Paper, March 2020

(13) Transport for NSW, NSW Freight Commodity Demand Forecasts 2016 – 2056, 2018

## 03

# Value of the circular economy

## 3.1 Economic value

- The circular economy has been identified as a major commercial opportunity. Accenture Strategy estimating its value at \$4.5 trillion globally by 2030, and up to \$25 trillion by 2050. (14)
- Think-tank Beyond Zero Emissions' Million Jobs Plan estimates that decarbonisation initiatives can add over 200,000 ongoing jobs to the Australian economy. Circular economy initiatives in the built environment, transport, manufacturing and recycling industries alone can create some 150,000 ongoing jobs across Australia by 2025. (15) Based on NSW's share of Australia's GDP, this suggests that these circular economy initiatives could create nearly 50,000 ongoing jobs in NSW.
- A 2020 KPMG study estimates that implementing circular economy initiatives in the Food, Transport and Built Environment sectors alone will lead to an economic benefit of \$23 billion to Australia's GDP by 2025, and \$210 billion to GDP by 2048. Most of these benefits come from more energy efficient buildings, followed by reduced food waste and better use of space in new buildings, and more efficient use of water. (16)

**\$210  
BILLION**



**For Australia, Circular Economy initiatives in the food, transport and built environment sectors can contribute \$210 billion p.a. to GDP by 2048.**

(14) Lacy, P., Rutqvist, J., Accenture Strategy, Waste to Wealth – The Circular Economy Advantage, New York/London: Palgrave Macmillan, 2015

(15) Beyond Zero Emissions, The Million Jobs Plan, June 2020

(16) KPMG Economics, Potential Economic Pay-off of a Circular Economy, commissioned by CSIRO, April 2020



## 03

## 3.1 Economic value cont.

- Based on NSW's share of Australia's GDP, this suggests that adopting circular economy initiatives in these three sectors could add up to \$7.6 billion to NSW's GSP by 2025, and up to \$69 billion by 2048. A more comprehensive analysis would provide a better estimate of the economic impacts for the state.
- Research commissioned by Green Industries SA indicates that **adoption of a circular economy in South Australia could create up to 25,700 jobs by 2030** (21,000 jobs through materials efficiency initiatives, and 4,700 jobs through energy efficiency and renewable energy initiatives) and reduce greenhouse gases by 27%, equivalent to 7.7m tonnes of CO<sub>2</sub>.
- Implementing targeted circular economy levers and reducing waste at the household level brings real cost savings. In 2017–18, NSW households paid \$1.3 billion in municipal waste charges. **The average NSW household pays \$391 in annual council waste charges, and these costs are estimated to reach \$642 by 2035–36, totalling \$2.5 billion statewide.** (17)
- Circular economy initiatives can be part of the solution to more cost-effective living in the long run. A 2015 McKinsey study on the impacts of circular economy initiatives in Europe estimates that undertaking circular economy initiatives in the transport, food and building sectors alone can drive down average household mobility costs 60-80%, food costs by 25-40%, and housing costs by 25-35% percent by 2050. (18)



**On current trends, average NSW household waste charges will rise from \$391 to \$642 p.a. in the next fifteen years, totalling \$2.5 billion p.a.**

(17) NSW Department of Planning, Industry and Environment, Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW Issues Paper, March 2020

(18) McKinsey Centre for Business and Environment, Ellen Macarthur Foundation and Deutsche Post Foundation, Growth Within: A Circular Economy Vision for a Competitive Europe, June 2015

## 03

# Value of the circular economy

## 3.2 Environmental value

- Transitioning to renewable energy will only get us halfway to meeting NSW's goal of net zero emissions by 2050. In NSW only half of all emissions come from energy generation. Transport, agriculture and industrial processes make up other major sources of emissions. (19) Research suggests that global greenhouse gas emissions in the atmosphere can only be decreased by 55% through transitioning to renewable energy and greater energy efficiency. The remaining 45% comes from other production processes and eliminating this must come from a transformation in how we produce and consume resources. (20)
- Circular economy interventions can potentially halve Greater Sydney's emissions from energy, transport and waste in the next 15 years. The Sydney metropolitan area contributes to approximately 38% of NSW's total greenhouse gas emissions. However, Greater Sydney can potentially halve its overall emissions from energy, residential transport and waste by 2036 through interventions targeted at building standards, renewable energy, transport infrastructure and increased waste diversion. (21)
- Shortages of fresh water require us to build more circular water systems. Recycled water remains a small percentage of water supply.



**Circular economy interventions are necessary to NSW's strategy to achieve net-zero emissions by 2050**



**Greater Sydney's greenhouse gas emissions will increase by 32% by 2036 if we do nothing**



**Circular water systems are needed to help meet NSW's long-term water security**

- In metropolitan Sydney, for example, only 44,000 ML of recycled water is produced annually: or less than 7% of total water supply (22). Analysis by the water industry in 2010 estimated that water consumption in Australia's six largest cities would increase by 39% by 2026 and 64% by 2056: equivalent to an increase of around 1,000 gigalitres each year (23). However, this may be an underestimation given that population projections have since exceeded those underlying the 2010 projections (24). Modelling of circular water initiatives estimates that California, for example, could nearly eliminate its future projected water shortages by introducing strategic measures to reduce, reuse and retain water for use. (25)

(19) NSW Department of Planning, Industry and Environment, Net Zero Plan Stage 1: 2020-2030, March 2020

(20) Ellen MacArthur Foundation, Completing the Picture, How the Circular Economy Tackles Climate Change, Sept 2019

(21) Kinesis, Exploring Net Zero Emissions for Greater Sydney, commissioned by the Greater Sydney Commission, Oct 2017

(22) Sydney Water, Water Conservation Report 2018-19

(23) Water Services Association of Australia, Implications of population growth in Australia on urban water resources, 2010

(24) Infrastructure Australia, Australian Infrastructure Audit 2019, p.607

(25) ING, Less is more: circular economy solutions to water shortages, Mar 2017



## 03

## 3.2 Environmental value cont.

- **Wastewater discharge into our waterways is one of the main causes of the deterioration of coastal water quality.** NSW has the most wastewater discharged into marine environments in Australia, with among the highest pollutant chemical loads. Recycling water will reduce the 1,350 gigalitres of wastewater that is discharged in Australia's waterways each year. If half of this amount was recycled, the potential value of this water would be over \$1 billion. (26, 27)
- **New and upcoming precincts in NSW's \$100 billion infrastructure pipeline are benefiting from circular design and credentials.** Barangaroo, as Australia's first large-scale carbon neutral precinct, includes centralised infrastructure such as Sydney Harbour water cooling, embedded electricity networks, recycled water treatment plants and on-site renewable energy generation. When completed, the whole precinct will be capable of exporting more recycled water than the amount of drinking water it uses, and divert over 80% of onsite business and residential waste from landfill (28). **Central Park Sydney** is home to one of the world's largest recycled water centres providing precinct residents with 50 percent of their water needs for non-drinking purposes. The local recycled water network also cools the precinct creating a low-cost water supply for the green walls. (29)
- **A circular economy is also a regional development strategy.** Regional economies are well suited to closed loop systems, with remote and decentralised industry, energy and water systems underscoring the benefits of local loops in materials and other resources. Agricultural and mining communities, in particular, are under pressure to adapt to climate change, resources tipping points, and high production costs (e.g. purchasing and transportation costs of energy, water and inputs, and waste removal and management). Regional circular economy planning can map resource inputs and outputs in the region, to maximise synergies and establish local loops. Special Activation Precincts like **Parkes** (which will be Australia's first UNIDO Eco-Industrial Precinct embedding the principles of circular economy and sustainability) are ideal pilots for embedding circular economy in precinct planning.

(26) Based on the \$2.12/kL charge for recycled water by Sydney Water.

(27) Clean Ocean Foundation, The National Outfall Database Summary Findings, 2018

(28) NSW Government, The Barangaroo Project, <https://www.barangaroo.com/the-project/progress/sustainability/> (Accessed 13 Aug 2020)

(29) McLean, L. & Roggema, R., Planning for a Prosumer Future: The Case of Central Park, Sydney. Urban Planning. 4. 172. 10.17645/up.v4i1.1746, 2019



Photo Credit: Unsplash

## 04

# Value of circular materials

## 4.1 The opportunity

- Modelling by the Centre for International Economics (CIE) has estimated that even a 5% improvement in resource recovery would add \$1 billion to Australia's GDP and \$644 million to NSW's GSP. <sup>(30)</sup>
- Improving materials efficiency brings an even larger benefit than resource recovery, because the former engages the whole economy while waste recovery is related only to waste activity. The CIE study also estimated that a 5% improvement in material efficiency would add \$24 billion to Australia's GDP and over \$10 billion to NSW's GSP. It would increase household welfare with an estimated increase in NSW household consumption by \$6 billion, increase the real wage rate by 2.8% and reduce waste by 2.6%.
- In either case, NSW would benefit disproportionately more than other states from these improvements as it has both high material use intensity and a high share of waste-related activity. And in both cases, the modelling indicates that real wages and household consumption will increase, and waste intensity (measured by the amount of waste generated per unit of GSP) decreases.



**A 5% improvement in resource recovery would add \$1 billion to Australia's GDP and \$644 million to NSW's GSP, and increase real wages by 0.12%.**



**A 5% improvement in materials efficiency would add \$24 billion to Australia's GDP and \$10 billion to NSW's GSP, and increase real wages by 2.8%.**



**Recycling can be the principal growth driver of future manufacturing and waste services jobs. Even in 2009, every 10,000 tonnes of waste supported 9.2 recycling jobs but only 2.8 landfill jobs. In other words, there are 3.3x more recycling jobs for every job in landfill.**

(30) Centre for International Economics, Headline economic value for waste and materials efficiency in Australia, commissioned by the Department of the Environment and Energy, Oct 2017



# 04

## 4.1 The opportunity cont.

- Another estimate puts the opportunity in NSW at over \$2 billion a year in recovered resource value and avoided landfill levy alone. (31) However, more detailed analysis of the key areas for circular economy initiatives would provide a better estimate for the economic impacts for NSW.
- Recycling and remanufacturing create more jobs than lower order waste fates. A 2009 analysis found that every 10,000 tonnes of waste supports 9.2 recycling jobs and 2.8 landfill jobs; i.e. there are 3.3 times more recycling jobs for every landfill job for a given amount of waste. (32)
- Beyond Zero Emissions' Million Jobs Plan estimates that moving to 90% recovery of materials would require \$5.6 billion in investment to create additional recycling capacity in Australia. This is estimated to create 28,000 new ongoing jobs in 5 years in addition to the significant ongoing commercial opportunity for private investors. (33)

Photo Credit: Unsplash



The potential opportunity for specific materials is summarised below, under the following categories:



### High Potential:

High-volume waste materials with large environmental impacts and challenges in contamination and processing, and where current recycling is still far from realising the full value of the materials stream, e.g. plastics, textiles and organics.



### Future Stars:

Complex high-value waste products with strong growth projections but very limited recycling options (often ending up in landfill), and where innovation and investment in design, recycling and materials productivity can realise significant value, e.g. e-waste, lithium-ion batteries and solar panels.

(31) Barker, K., quoted in Advantage NSW: Creating value in the circular economy, NSW Office of Environment and Heritage, 2014

(32) Access Economics, Employment in waste management and recycling, commissioned by the Department of Environment, Water, Heritage and the Arts, July 2009

(33) Beyond Zero Emissions, The Million Jobs Plan, June 2020

## 04

## 4.2 High potential

## Plastics

- NSW consumes over 1 million tonnes of plastic annually. 32% is packaging and 23% comes from the automotive and built environment sectors (34). NSW generates **800,000 tonnes of plastic waste each year but recycles less than 10% of this**. Of the amount recycled, approximately 70% is sent offshore for recycling, with only 30% actually recycled in Australia (mostly within the state). (35)
- There has also been an observed increase in **medical plastic waste** over the years, further highlighted by the Covid-19 pandemic response. Plastic is prevalent throughout modern healthcare systems for hygiene, cost and adaptability reasons. These range from personal protective equipment (PPE) to packaging, medical equipment and fitouts. In Australia and New Zealand, over 100 hospitals participate in a PVC recycling program set up in 2009 (36). However anecdotal evidence indicates that large quantities of recyclable non-clinical plastic items (often polyethylene or polypropylene) continue to be disposed in both general and clinical waste streams, resulting not only in greater environmental costs but potentially higher waste management costs as well.
- Creating a step change in how plastic is used and disposed can create significant value for NSW. And this value grows as the opportunity to reuse the material moves up the value chain. For a tonne of plastics, landfilling it in NSW can cost more than \$200 in upfront costs alone (37). More detailed modelling shows that **every tonne of plastic recycled produces a net benefit of \$29**, as opposed to -\$420 if it is landfilled (38). For example, recycling can help offset not just the environmental costs of virgin material, but also the cost of virgin plastic resin.
- Australia's ability to process and recycle its plastic waste needs to grow by 400% when COAG's waste export bans gradually come into effect over the next three years, and to meet Australia's 2025 National Packaging Targets. (39)
- This is an opportunity to grow Australia's domestic plastic manufacturing industry (NSW itself has 17 plastic recyclers and remanufacturers) which currently employs about 85,000 people and is 10% of Australia's manufacturing activity. (40)

Photo Credit: Unsplash



(34) PwC, NSW Waste Sector: Situational Analysis, commissioned by the NSW Environment Protection Authority, 2020

(35) NSW Department of Planning, Industry and Environment, Cleaning Up Our Act: Redirecting the Future of Plastic in NSW Discussion Paper, March 2020

(36) Vinyl Council of Australia, PVC Recycling in Hospitals, <http://recyclinginhospitals.com.au/> (Accessed 20 Aug 2020)

(37) NSW Office of Environment and Heritage, Advantage NSW: Creating value in the circular economy, 2014

(38) Centre for International Economics, Costs and Benefits of Banning Exports of Waste, commissioned by the Department of Agriculture, Water and the Environment, Feb 2020

(39) Sustainable Resource Use, Recycling Market Situation: Summary Review, commissioned by the Department of the Environment and Energy, Sept 2019

(40) NSW Department of Planning, Industry and Environment, Cleaning Up Our Act: Redirecting the Future of Plastic in NSW Discussion Paper, March 2020



## 04

## 4.2 High potential cont.

## Textiles

- **Textile production has a large environmental impact.** It takes around 7,000 litres of water to make a typical pair of jeans, and the industry accounts for 20% of global wastewater. Textile dyeing alone accounts for 20% of global water pollution (41). Washing clothes further releases half a million tonnes of microfibres into the ocean every year. The textiles production industry accounts for 10% of global carbon emissions, exceeding the impacts of the international flight and shipping industries. (42)
- **Australia is ranked second in the world for textile disposal.** Households account for nearly 90% of our textile waste. As a nation we threw away some 300,000 tonnes of textiles in 2018-19. Of this, over 90% was landfilled for disposal (of which around two-thirds are likely synthetic fibres that may never biodegrade) and energy recovery, and a smaller amount is exported (mainly to developing countries). (43,44)
- **At this disposal rate, in metropolitan Sydney textile disposal could cost up to \$8 million in waste levies alone each year.** Local councils, waste management services and charities often face significant challenges and cost in managing large volumes of textile waste due to the scarcity of recycling options.
- **Globally the textile recycling rate is 13%.** 12% is mechanically shredded for reuse as fill, insulation or rags, and under 1% is chemically recycled back to reusable textiles and other products such as construction material. (45)
- **We need a circular textile industry to address this growing economic and environmental problem.** Reusing old textiles is the preferred option, but this is often not possible. Recycling technology exists (including Australian-grown technology) but is not yet available on a large-scale basis. Further policy efforts are necessary to help develop markets for the products manufactured from recycled textiles, which may be textiles or other products such as packaging, building materials or consumer materials. The creation of these new markets would then allow for flow-on economic and environmental benefits on an ongoing basis.

(41) Ellen MacArthur Foundation, A new textiles economy: redesigning fashion's future, 2017

(42) United Nations Environment Programme, Putting the brakes on fast fashion, 12 Nov 2018

(43) Pepper, F, Australia's obsession with new clothes and 'fast fashion' textiles hurting the environment, ABC News, 12 Jan 2017

(44) Australian Bureau of Statistics, Waste Account Australia, Experimental Estimates, 2018-19

(45) Ross, G, Australia recycles paper and plastics. So why does clothing end up in landfill? Published in The Guardian, 27 Aug 2019

Photo Credit: Unsplash



# 04

## 4.2 High potential cont.

### Organics



Photo Credit: Unsplash

- Organic waste produces **2.4% of Australia's greenhouse gas emissions** (46). Australian households throw away over **3 million tonnes** of food annually – equivalent to nearly 17,000 grounded 747 jumbo jets – spending **\$2,200-\$3,800 per household** each year on food that becomes waste. (47)
- A large proportion of waste in landfills across Australia is comprised of organics. There are **80 organics processing facilities** in NSW. Many are reported to be near their processing capacity, with healthy annual demand. (48)
- The organics recycling industry has estimated that increasing the national organics recovery rate to **90%** would generate an **extra \$542 million** in industry value-add, **3,624 extra jobs** and reduce **2.8 million tonnes** of greenhouse gas emissions: equivalent to 4.2 million trees planted or 656,356 cars taken off the road each year. (49)
- More widespread energy recovery using organics waste – including from wastewater treatment plants – could also help unlock Australia's **biogas potential**, estimated to be capable of meeting **9%** of Australia's total energy consumption. (50)
- The challenge for further growth remains in securing quality organics waste streams and wider adoption of organics as an alternative to chemical fertilizers in commercial farming. This may change in the coming few years with more councils transitioning to organics source separation and processing.

(46) Department of Industry, Science, Energy and Resources, Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2019

(47) Commonwealth of Australia, National Food Waste Strategy, 2017

(48) PwC, NSW Waste Sector: Situational Analysis, commissioned by the NSW Environment Protection Authority, 2020

(49) Australian Organics Recycling Association, The Australian Organics Recycling Industry At A Glance, May 2020

(50) Infrastructure Partnerships Australia, Putting waste to work: Developing a role for Energy from Waste, June 2020



## 04

## 4.3 Future stars

## E-waste

- Australians are among the largest generators per capita of e-waste in the world. We generate over half a million tonnes of e-waste per annum, or 22 kg per capita: among the highest among OECD countries. (51)
- E-waste is growing at three times the rate of general waste in Australia (52). Recycling estimates vary considerably but all indicate room for improvement. The National Waste Report 2018 estimates that about half of the nation's e-waste is recycled (mostly through metals recycling of white goods or similar, with smaller items mostly landfilled), while the Global E-Waste Monitor 2020 estimates that within the Oceania region, only 8.8% of e-waste is documented to be collected and properly recycled. (53,54)
- Mobile phones, for example, have considerable value embedded in their components such as gold, silver, and rare earth metals. Mining these materials from our e-waste presents a better alternative to continued reliance on mining these materials (or even processing recyclates overseas) that may present increasing supply chain challenges for Australia in the future, making it more and more costly to access these products. In Europe alone, 160 million discarded but uncollected devices represent a material loss of up to US\$500 million annually. The materials recovered would have significant value: 41 mobile phones can yield as much gold as one tonne of ore and 50,000 handsets can remove the need to mine 330 tonnes of precious metal ore. (55)

(51) OECD, Going Digital: Shaping Policies, Improving Lives, 2019

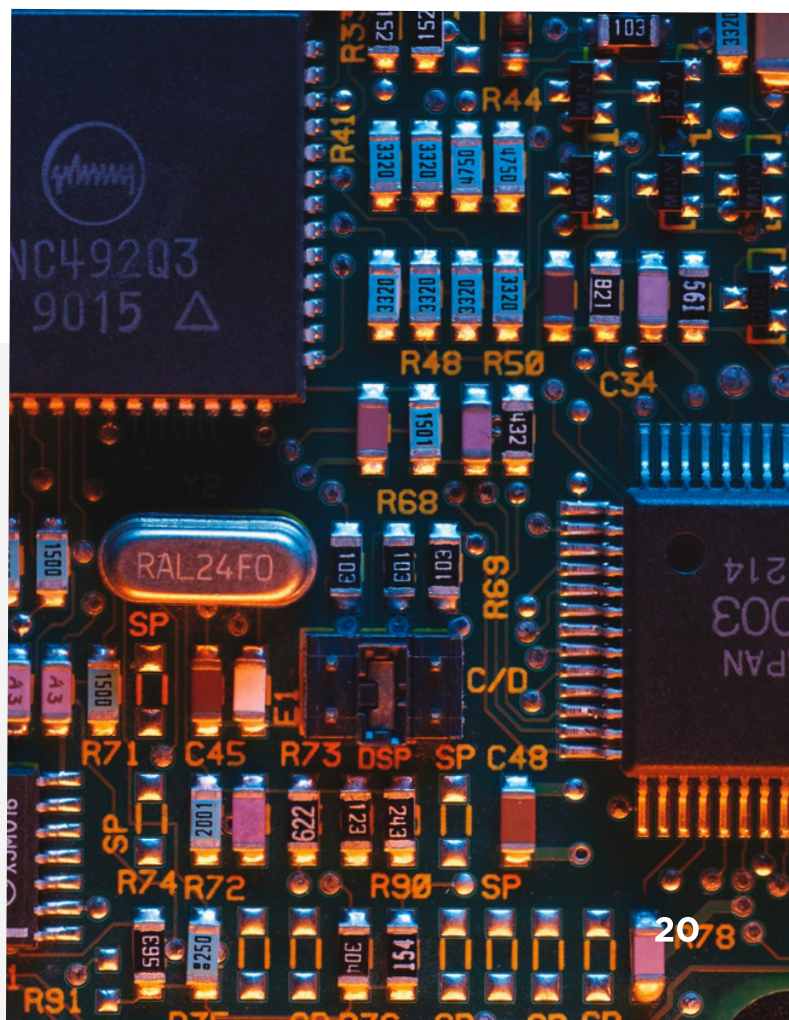
(52) Sustainability Victoria, <https://www.sustainability.vic.gov.au/campaigns/ewaste> (Accessed 18 Aug 2020)

(53) Blue Environment, National Waste Report 2018, commissioned by the Department of the Environment and Energy, November 2018

(54) Forti, V., Balde, C.P., Kuehr, R., and Bel, G., The Global E-waste Monitor 2020

(55) Accenture, Mining new value from the circular economy, April 2019

Photo Credit: Unsplash



# 04

## 4.3 Future stars cont.

### Lithium ion batteries

- Australia could potentially recover **\$813 million to \$3 billion** from lithium ion battery (LIB) waste by 2036. In 2016, 3,300 tonnes of LIB waste was generated but only 2% of this was collected and exported for offshore recycling. The rest was landfilled.
- Australian LIB waste is growing at over 20% p.a. – and forecasted to reach 100,000 to 188,000 tonnes by 2036 – due to the increasing use of portable and rechargeable electronic equipment and electric vehicles. (56)

### Solar PV systems

- Australia has the highest household uptake of solar globally: over 21% of homes have rooftop solar photovoltaic (PV) panel installations. As of June 2020, there are nearly 2.5 million solar PV panel systems installed in Australia. (57)
- Over a quarter of a million of these systems are 10-20 years old. (58) There is a growing number of panels that require disposal: some are damaged in transport and installation, a proportion are replaced for upgrades (often when storage batteries are added) and we are starting to see early installations now reaching the end of their lives.
- The average life span of a solar panel is approximately 20 years, and their battery storage systems between five and 15 years.
- There are now over half a million small-scale solar PV systems installed in NSW, of which over 88,000 are 10-20 years old. Commercial solar farms also need recycling provisions for when their systems reach end-of-life.
- Large quantities of solar panels and energy batteries will need to be treated and disposed of in coming years. It is estimated that **by 2035**, around 100,000 tonnes of PV panels Australia-wide will need to be recycled or otherwise disposed, with approximately **30,000 tonnes coming from NSW**. (59)
- The International Renewable Energy Agency (IRENA) has estimated the global value of materials that can potentially be recovered from solar panels by 2050 at around **US\$15 billion**. (60) There are valuable materials in solar panel systems including silicon, copper and silver that can be recycled. Other components like glass and aluminium frames also have recycling pathways. The current challenge remains in developing the product designs, technologies and markets for scalable and sustainable materials recovery from these systems.

(56) King, S., Boxall, N.J., and Bhatt, A.I., Lithium battery recycling in Australia, CSIRO Report EP181926, April 2018

(57) Department of Industry, Science, Energy and Resources, <https://www.energy.gov.au/households/solar-pv-and-batteries> (Accessed 20 Aug 2020)

(58) Analysis of data for small-scale installations published by the Clean Energy Regulator.

(59) UTS Institute of Sustainable Futures and Equilibrium, Scoping study for photovoltaic panel and battery system reuse and recycling fund, commissioned by the NSW Department of Planning, Industry and Environment, March 2020

(60) International Renewable Energy Agency, End-of-life management: Solar Photovoltaic Panels, June 2016

## 05

## Summary

The circular economy opportunity in NSW is significant and critical to our future. NSW has the capacity to lead Australia in:

- The innovation, processing and advanced manufacturing of valuable materials streams
- Circular economy planning in its substantial infrastructure development pipeline
- Demonstration projects in industrial and community circular economies
- Reducing greenhouse gas emissions with a comprehensive statewide circular economy strategy
- Circular economy performance benchmarking and tracking.

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