Towards the circular economy: The Waste Account, Australia, Experimental Estimates 2016-17

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ABSTRACT:

The Waste Account, Australia, Experimental Estimates, 2016-17 is the result of a collaboration between the Australian Bureau of Statistics and the Department of the Environment and Energy. It was developed as part of the National Strategy for Environmental Economic Accounting and to support national waste policy. The account provides a more detailed analysis of waste types and the industries that generate and manage waste, alongside economic and trade data. This account is the first to be released under the Common national approach to environmental-economic accounting in Australia, and represents a first step in improving the information-base of waste material flow for waste management and waste policy in Australia.

Introduction

Australia is moving towards a circular economy, rather than the traditional linear 'take, make, use and dispose' approach, with businesses and governments recognising the opportunities waste materials provide and the economic value they retain. Critical for this transition is the development of our domestic waste and recycled material markets. Australian Governments have developed a new National Waste Policy[1] with a central aim of building the capacity of the waste and recycling sector. In the past, however, policy and industry decision-making has been hampered by a lack of information on domestic waste and recycling flows, and the value of those flows, within the economy. The Waste Account, Australia, Experimental Estimates, 2016-17 – a result of collaboration between the Australian Bureau of Statistics (ABS) and the Commonwealth Department of Environment and Energy (DoEE) – is a first step in improving the information base available for policy and industry investment decisions.

Utilising existing data sources, the Waste Account, Australia, Experimental Estimates, 2016-17, presents physical waste data paired with monetary data, from a whole-of-economy perspective, within the United Nations System of Environmental-Economic Accounting (SEEA) framework[2]. The ABS have previously produced estimates of waste flows across industry and their management, but there has not been an Australian national waste account since 2010-11. This account is also the first to be released under the Common national approach to environmental-economic accounting in Australia, and marks a significant milestone in developing accounts through collaboration between a national statistics organisation and a policy department.

DoEE releases the National Waste Report[3] every two years, which provides a range of data on the topic of waste. The waste account aligns with the National Waste Report (a key data source) but builds on that data by increasing the detail in material and industry breakdowns, and by including waste imports and exports. Physical waste data is presented alongside monetary data from the ABS' National Accounts. This paper aims to discuss the key methods and findings of the Waste Account, Australia, Experimental Estimates, 2016-17 (the account) in relation to the circular economy. The physical and monetary supply and use tables, along with a waste summary table, are presented in Appendix 1.

Australia's recycling activity and reliance on landfill are recognised as major challenges in waste management and barriers in the transition to a more circular economy. Indeed, these challenges are faced globally, as addressed in the UN Sustainable Development Goals[4]. Issues with Australian domestic recycling management were highlighted in recent years when China ceased imports of Australia's recyclable waste. Other markets for recyclable materials (India, Malaysia, and Indonesia) are following, or are likely to follow China's lead[6], and earlier this year the Council of Australian Governments agreed to establish a timeline for banning the export of certain waste materials entirely[7].

Waste and recycled materials have the potential to hold significant economic value, as identified in previous cross-institutional projects such as *Wealth from Waste*[8], and internationally by the World Bank[9]. Reassessing our waste management strategies presents an

opportunity to both avert issues with landfill and stockpiling as well as capitalise on the economic value of waste. However, achieving this likely requires greater capacity in our domestic materials reprocessing infrastructure and the implementation of advances in material technology. At present there are no comprehensive or up-to-date data on capacity in the waste management sector, or indeed, capacity for the domestic manufacturing and construction industries to incorporate recycled material over virgin material.

Key methodology points

Waste Account, Australia, ABS

The account is primarily composed of physical supply and use tables presenting detailed physical data on solid waste in the Australian economy for the financial year 2016-17. See Appendix 2 for the list of solid waste materials in scope for this account. Primary production waste, waste managed entirely on-site (own use of waste), liquid waste (including liquid hazardous waste), radioactive waste and emissions were out of scope. Several industries were highlighted in the account (Appendix 3) for their waste generation and management. Industry classifications followed the Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006[11].

The account complies with the SEEA Central Framework (SEEA CF), which is a conceptual framework using a systems approach to organise environmental and economic information. This covers the stocks and flows that are relevant to the analysis of environmental and economic issues, applying the accounting concepts, structures, rules and principles of the (SNA). The SEEA CF (paragraph 3.269) defines solid waste as: "...discarded materials that are no longer required by the owner or user. Where the unit discarding the materials receives no payment for the materials then the flow is considered a residual flow of solid waste. Where the unit discarding the materials receives a payment but the actual residual value of the material is small - for example in the case of scrap metal sold to a recycling firm - this flow is considered a product flow of solid waste."

The National Waste Report (NWR) 2018 compiles waste data provided by the states, territories and industry for the 2016-17 financial year. It presents data on solid waste sent for recycling, energy recovery from solid waste, and the disposal of solid waste to landfill. The report presents data by material category and material type, but data were not complete for each waste type in each waste category. Where the data sources were not available for a given waste fate or jurisdiction, estimates were derived using the proportions from the available data. The level of imputation varies between product types, depending on available data. All product types sum to their respective group totals. State and territory data was then aggregated to the national level.

Physical waste supply (generation) – Deriving industry allocations

The NWR presents physical waste data for each waste type at state/territory level, for the waste generation streams: Municipal Solid Waste (MSW), Commercial and Industrial (C&I) and Construction and Demolition (C&D). The MSW stream was used to estimate household

waste. It also includes a small portion of C&I waste where local governments provide (directly or indirectly) a collection service that covers businesses and households. As data on the exact portion of this is not available this portion was not removed from the MSW (households) waste stream. It is generally considered to be small.

The Australian National Accounts: Input-Output Tables (Product Details), 2015-16 (cat. no. 5215.0.55.001) were used to allocate waste generation to industries, with the exception of the Construction industry. In these tables, each product balance describes the supply (domestic output and imports) and the use (intermediate consumption and final demand) of the product at a detailed level. The intermediate use of specific products were aggregated to certain waste flow categories for specific industries. This assumes that intermediate use of a product is proportionate to waste generation in the material type of that product. For example, higher intermediate use of clay bricks by an industry results in higher waste generation of bricks by that industry. For the construction industry C&D data was used directly from the NWR.

Physical waste use (management) – Beyond the waste management industry

The NWR presents physical waste data for each waste fate (use): landfill, recycling, energy recovery, treatment, and other disposal. These are presented at state-level for each waste generation stream. These streams and states were aggregated to the national level, to represent total physical volumes of each waste type, sent to each waste fate.

We know that waste management is not solely provided by the waste management industry, but rather that other industries are also involved. In the past, this data was collected in an ABS survey on waste management. As the survey has not run in a number of years, that data in now considered out of date. Instead, product supply in the Australian National Accounts: Input-Output Tables, 2016-17 (cat. no. 5209.0.55.001), specifically supply of the product 'Waste Collection, Treatable and Disposal Services', was used to calculate the proportion of waste management services supplied by all industries. The totals in the NWR for each waste fate were allocated across industry according to these proportions.

Several assumptions were made in this process – primarily that one industry is not more likely to manage some waste materials than others. Beyond that, it was assumed the construction industry does not engage in energy recovery, and that households and the mining industry have no use of waste products. The mining industry receives income from the supply of Waste Collection, Treatment and Disposal Services, but after consultation with National Accounts we believe this income is for land reclamation and the treatment of mining waste, rather than the use of the waste products.

Waste imports and exports

Imports and exports of waste products are components of the physical supply and use tables, as a measure of the amount of waste (physical and monetary) entering and exiting Australia. Imports and exports classified as waste were based on a reference list used by ABS to provide

monthly waste export data to DoEE. Data for import and exports from all states and territories for these codes were summed to the national level, for each material.

Export data were subtracted from recycling totals for use by the Waste Collection, Treatment and Disposal Services industry. It is understood that some waste exports may occur outside of what is managed by the Waste Collection, Treatment and Disposal Services industry (i.e. prior to collection) and thus would not be fully represented in the NWR. Therefore when exports were greater than recycling totals, it was assumed 100% of the recycling stream for that material is exported and the additional tonnage was added to the supply table totals.

Imports are additional to what is reported in the NWR. In the physical use table, use of imported non-hazardous waste was allocated to industries using the proportions of intermediate use of the various Input-Output product codes (IOPCs) by industry, with the exception of the Waste Collection, Treatment and Disposal Services industry. It was assumed the Waste Collection, Treatment and Disposal Services industry does not import non-hazardous waste products, and that it is the only industry that imports hazardous waste products (for treatment).

Monetary supply and use, waste summary tables

The monetary supply tables illustrate the income generated by the supply of waste management services. The monetary use tables present overall expenditure on waste management services. These tables present time-series data from ABS Supply-Use tables for Waste Collection, Treatment and Disposal Services (IOPC 2901) for industry groups in basic and purchasers' prices. It is currently not possible to split the income from and expenditure on the sale of recycled materials, due to a lack of data.

The waste summary table, presents expenditure on waste services, waste generation and waste intensity, across key industries. Total waste generation is given in tonnes and gross value added (GVA) in millions of dollars ($m). Waste intensity is then calculated for each industry as waste generation divided by GVA (t / $m).

Main findings

Findings from the Waste Account, Australia, ABS

In 2016-17, the Australian economy generated or imported 68.9 megatonnes (Mt) of waste, of which the largest contributors were the construction industry (20.4 Mt, 29.6%), households (13.8 Mt, 20.0%), the electricity, gas, water & waste services industry (12.7 Mt, 18.4%) and the manufacturing industry (10.8 Mt, 15.6%).

Of the industries highlighted in the account, those with the highest waste intensity (waste generated, tonnes, divided by gross value added, $ million) were the electricity, gas, water & waste services industry (291.0 t/$m) the construction industry (151.8 t/$m) and the manufacturing industry (105.6 t/$m). Waste generation for the electricity, gas, water & waste

services industry included 12.3 Mt of ash from coal-fired power plants which is the main driver of the industry's high waste intensity score (Figure 1).

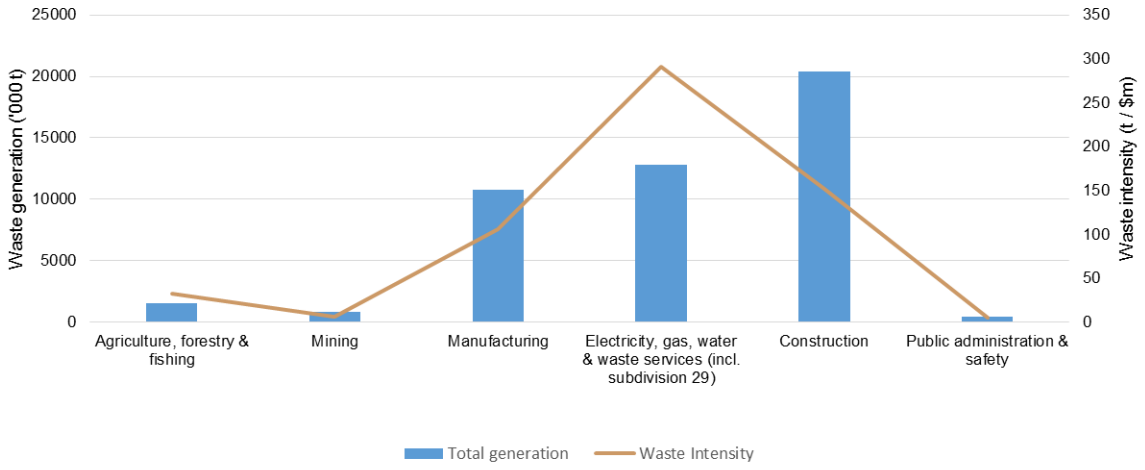

Fig. 1 Waste generation and waste intensity, selected industries

The account provides details, not previously available, on the components of major waste flows in Australia, and the major generators of those flows.

The construction industry generates the highest tonnage of waste (20.4 Mt per year), primarily composed of masonry materials and hazardous waste. The manufacturing industry generates the third highest tonnage of waste (10.8 Mt per year), composed primarily of steel, timber and hazardous waste, and uses 1.3 Mt of waste per year.

Masonry materials are the biggest waste category generated in Australia (17.1 Mt per year). From a policy perspective, the construction industry is also a potential waste user, although we require more data on waste use to detail this more thoroughly. Waste uses by the construction industry are often of a single-use, 'down-cycling' nature, i.e. using rubble in road-base.

Organics represents the second largest waste tonnage generated in Australia (15.1 Mt per year). Households are the biggest generator of organic waste with food waste and garden waste together making up 84% of organic waste generated by households. Only 35% of food waste is recovered. Food wastes in landfill are a major producer of methane.

Plastics, while not the largest waste stream by weight (2.6 Mt per year), are an environmentally destructive waste stream with a low domestic recycling rate (6%). Households are the biggest generator of plastic waste (1.2 Mt per year). HDPE (used in milk bottles, cleaning product containers and plastic bags) and PET (used in beverage bottles and plastic containers for products such as tomato sauce) are the two biggest plastic waste streams produced by households (68% of household plastic if combined).

Recycling rate (Figure 2) is calculated as ‘exported for recycling’ plus ‘collected for recycling by the waste management industry’ divided by ‘total waste generation’ for a given material. Of the waste categories: metals have the highest recycling rate with 72.5% sent for recycling; textiles, leather and rubber have the lowest recycling rate, with 11.6%.

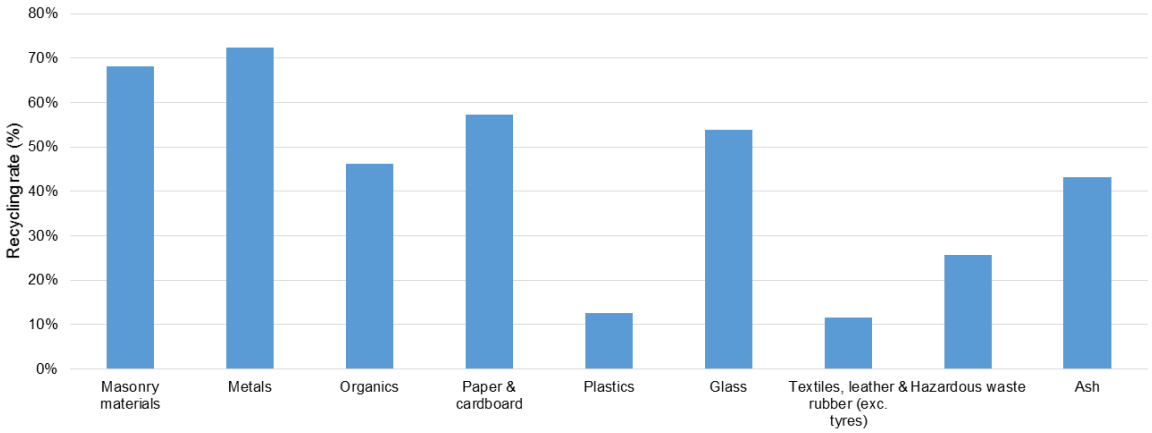

Fig. 2 Recycling rate percentage, by waste type

The future of waste accounting in Australia

The next steps for the waste account are to be developed in consultation with data end-users – specifically, the industries with high waste generation metrics, the waste management industry, and federal and state infrastructure and environment policy agencies. That being said, due to the high-profile nature of waste management in Australia at present, there is a lot of stakeholder interest in the ambitious development of waste and recycling accounts.

Future iterations of the waste account will use additional data sources such as ABS business survey questions, for selected industries, on waste generation and expenditure on waste services. The next National Waste Report will be released in 2020, and development of the next waste account will benefit from a tighter relationship during development. The timeliness of waste data reporting is consistently an issue, with end-users suggesting now is such a dynamic time for the waste management industry that by the time of publication, data is already out of date. One option for responding to this need, is to produce forecasts of waste management requirements, based on economic profile models of waste generation, and considering different policy settings. Options for creating time-series physical data for waste, which may include back-casting are also being examined. It is also hoped that future iterations of the waste account can provide additional detail on monetary supply and use of waste products in the economy.

Further to this, there is strong interest in state-based accounts, potentially fitting into a national framework. This would require far more detailed data on waste generation and recycling at the state-level, as well as data on interstate waste transfers.

Of course, better estimates to improve our understanding of the return of materials to further productive use, in the Australian economy or overseas, is the major puzzle piece missing in our capacity to use waste accounting as a tool in the transition to a circular economy.

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Appendix 2.

Coverage for both the Physical Supply and Use tables includes the following waste categories and materials:

Waste categories	**Waste types**
Masonry materials	Asphalt
	Bricks
	Concrete
	Rubble (including non-hazardous foundry sands)
	Plasterboard & cement sheeting
Metals	Steel
	Aluminium
	Non-ferrous metals (excluding aluminium)
Organics	Food organics
	Garden organics
	Timber
	Other organics
	Non-contaminated biosolids
Paper & Cardboard	Cardboard
	Liquid paperboard
	Newsprint & magazines
	Office paper
Plastics	Polyethylene terephthalate (PET)
	High density polyethylene (HDPE)
	Polyvinyl chloride (PVC)
	Low density polyethylene (LDPE)
	Polypropylene (PP)
	Polystyrene (PS)
	Other plastics
Glass	Glass
Textiles, leather & rubber (excluding tyres)	Textiles
	Leather & rubber (excluding tyres)
Hazardous waste	Tyres
	Other Hazardous Waste
Ash	Ash from coal fired power stations
Other	Other unclassified materials

Appendix 3.

Waste Account industries, following Australian New Zealand Standard Industry Classification (ANZSIC) 2006:

Agriculture, Forestry and Fishing

Mining

Manufacturing

Electricity, Gas & Water Services - Division D excluding Subdivision 29

Waste Collection, Treatment and Disposal Services - Subdivision 29

Construction

Public Administration and Safety

All Other Industries

All Other Industries consists of:

Wholesale Trade

Retail trade

Accommodation and Food Services

Transport, Postal and Warehousing

Information Media and Telecommunications

Financial and Insurance Services

Rental, Hiring and Real Estate Services

Professional, Scientific and Technical Services

Administrative and Support Services

Education and Training

Health Care and Social Assistance

Arts and Recreation Services

Other Services