



# Discrepancies in regulations governing C&D waste and recommendations for reforms

## Research Report No. 1

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# TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	5
1 INTRODUCTION .....	7
2 METHODOLOGY .....	8
2.1 Data collection, processing and analysis.....	8
2.2 Context of study .....	8
3 RESULTS OF REVIEW .....	9
3.1 Overview of the Australian Construction Industry .....	9
3.2 C&D waste generation and management in Australia.....	9
3.3 The main decision makers in C&D waste management and regulation .....	11
3.4 Overview of jurisdictional waste legislation and guidelines .....	14
3.5 Waste strategy policy in Australia.....	19
3.6 Strategies supporting revision of the existing C&D waste regulatory framework .....	27
3.7 Waste recycling .....	29
3.7.1 Current and target rate of C&D waste recycling .....	30
3.7.2 Legislative support for use of recycled C&D waste materials .....	31
3.7.3 Opportunities for use of recycled C&D waste .....	34
3.7.4 Application of C&D waste in road pavement projects .....	35
3.8 Waste energy recovery .....	36
3.8.1 EfW Technologies .....	37
3.8.2 Waste Energy Recovery rate.....	37
3.8.3 An overview of energy recovery activities in Australia .....	38
3.8.4 Jurisdictional regulatory framework to support EfW .....	42
3.8.5 How to improve EfW in Australia .....	46
3.9 Waste disposal .....	47
3.10 Who is responsible for management and regulation of landfill sites .....	50
3.11 Disposal levy fees .....	50
3.12 How landfill levy revenues are distributed .....	51
3.13 Harmony in jurisdictional landfilling regulations .....	52
3.14 Illegal dumping.....	53
3.15 Infrastructure plan .....	58
3.16 Application of c&d waste regulations in practice .....	59
3.16.1 Perceptions of imposition of landfill levy in Australia .....	59
3.16.2 Perceptions of the proximity principle .....	62
4 RECOMMENDATIONS.....	63
4.1 State specific reforms.....	63
4.2 Nationwide reforms .....	64
5 CONCLUSION .....	66
6 GLOSSARY.....	67
7 REFERENCES .....	71
8 AUTHOR BIOGRAPHIES .....	74

## LIST OF TABLES

Table 1. C&D waste generation and management trends in Australia. ....	10
Table 2. C&D waste disposal and management in different jurisdictions in 2016-17.....	10
Table 3. Jurisdictional waste legislative and management framework.....	16
Table 4. Summary of waste strategy documents in different jurisdictions.....	21
Table 5. Strategies supporting improvements in regulatory framework .....	27
Table 6. C&D waste recycling rate in Australia.....	30
Table 7. Future target proposed for the recovery of C&D waste in different jurisdictions .....	31
Table 8. Recycled and non-recycled C&D waste materials potential uses.....	34
Table 9. Example projects of recycled C&D waste materials in road pavement applications.....	36
Table 10. Waste fate in different countries.....	37
Table 11. Examples of EfW facilities in Australia.....	40
Table 12. National regulatory framework with an indirect impact on energy recovery .....	42
Table 13. Regulatory framework (key documents) to guide energy recovery activities in different jurisdictions. ....	43
Table 14. Number of waste management facilities in different jurisdictions .....	48
Table 15. Rate of tax imposed on C&D waste at landfills.....	51
Table 16. Illegal dumping definition and relevant regulations.....	54
Table 17. Penalties enforced by the EPA (except in Qld) on illegal dumping in different jurisdictions .....	55
Table 18. Strategies proposed to reduce illegal dumping.....	56
Table 19. The evidence of effectiveness of landfill levies in Australia .....	60
Table 20. Unexpected results from implementation of landfill levies in Australia .....	60

## LIST OF FIGURES

Figure 1. Trend of recycling and dumping masonry materials in Australia. ....	11
Figure 2. Agencies that contribute to C&D waste management legislation.....	13
Figure 3. Waste hierarchy adopted by waste strategy documents across Australia.....	19
Figure 4. Waste strategy documents.....	20
Figure 5. Procurement hierarchy.....	32
Figure 6. National map of waste management facilities (landfill sits, transfer stations, composting facility, solid waste store facility and resource recovery facility) distribution in Australia .....	49
Figure 7. Levy fees for C&D waste disposal in different.....	51

## EXECUTIVE SUMMARY

The construction industry in Australia has grown significantly in the past two decades in the wake of population growth, migration and expansion in the tertiary education industry. The growing population has necessitated extensive property development, better public transport and improved infrastructure. All these activities have resulted in a substantial growth in construction and demolition (C&D) waste. However, the amount of C&D waste generation and the way it is being dealt with differs across eight Australian jurisdictions. The main cause of different levels of C&D waste management in Australia is believed to be jurisdictional regulations governing C&D waste. In order to achieve the first objective of this research, this report seeks to identify the inconsistencies in regulations and standards governing C&D waste in eight states and territories. The key inconsistencies identified in the study states and territories are as follow:

- Inconsistent enforcement of landfill levy.
- Management of illegal dumping activities including varying penalty fees.
- Involvement of authorities and policy makers in the study states and territories.
- Level of legislation.
- C&D waste management targets and objectives outlined in jurisdictional waste strategy documents.
- Level of commitment to improving C&D waste related regulations.
- Approach to using recycled C&D materials.
- Waste data management systems including data collection, analysis and reporting.
- Level of commitment to extracting energy from residual C&D waste.
- Distribution (re-investment) method of landfill levy revenue.
- Level of providing technical information for establishment of state-wide waste and resource recovery infrastructure.
- Implementation of sustainable procurement in relation to use of recycled C&D waste.

This report also presents 30 key recommendations drawing on the review of regulations and other sources, as summarised in Section 1.4; these recommendations are applicable to certain jurisdictions. Furthermore, 21 more reforms are suggested to be actioned and coordinated by the Australian federal government. Some of the key national level reforms that are applicable to all study jurisdictions and particularly relate to the federal government's role in management of C&D waste include:

- Harmonise specifications of recycled materials to be used in road pavement, increase in use of recycled materials to avoid data gaps and data bias; this provides an opportunity to better aggregate and report waste data.
- Provide incentives to encourage industry professionals to invest in industrial waste sorting and more waste recycling; in particular, federal government can encourage jurisdictions to invest in facilities for sorting mixed C&D waste through landfill levy revenue.
- Develop a nation-wide waste and recycling infrastructure plan that stipulates the minimum design and construction requirements; this will improve development, management and operation of protected sites for landfills, energy recovery sites, composting sites and all forms of recycling activities.
- Provide consistent guidelines for waste auditing that are applicable throughout Australia.
- Provide uniform reporting of waste data to better aggregate and report waste data. The first step is for the Commonwealth government to implement the 65 agreed improvements to the National Waste Report, as established by Blue Environment's Improving National Waste Data and Reporting report.
- Approximate waste levies as an impetus for greater recycling, reduction of interstate waste transportation, forcing of companies to invest more in efficient technologies to recover waste,

reduction in the amount (cost and volume) of waste land filled, and to prevent unnecessary waste transfer.

- Revisit Australia's building codes to facilitate use of recycled materials in buildings.
- Simplify regulations to provide greater clarity, remove unnecessary regulatory burden and remove clauses that are no longer required.
- Provide legislative support for the use of technologies such as remote sensing, GIS and drones.

# 1 INTRODUCTION

The construction industry in Australia has grown significantly in the past two decades in the wake of population growth, migration and expansion in the tertiary education industry. The growing population has necessitated extensive property development, better public transport and improved infrastructure. The range of construction activities initiated in response include the businesses that are involved in creating residential and non-residential buildings (including renovations and additions), engineering structures, and associated trades and services (ABS, 2006). The industry is identified as the fourth largest contributor to growth domestic product (GDP) (Trading Economics, 2018); more than 1 million people work in the industry. Unsurprisingly, this volume of construction brings about a huge volume of waste, known in the industry as ‘construction and demolition (C&D) waste’. In 2016-17, approximately 20.4 Mt of C&D waste was produced in the Australian construction industry, which accounts for 38% of the total core waste<sup>1</sup> generated in Australia (NWR, 2018).

Due to its substantial impact on the economy, society and environment, generation of C&D waste has been a source of concern for Australians for many years (Udawatta et al., 2015, London et al., 2013). This has resulted in state governments paying more attention to this growing issue. For instance, in the late 1990s, citizens of Canberra demanded the state government consider a ‘no waste policy’ to manage C&D waste. In 1996, this demand resulted in implementation of the first zero waste strategy of its kind for a city (Zero Waste, 2007). Due to improvements in public awareness about the environment, Australian state governments have become increasingly pressured to tackle this issue. The community also expects construction companies to manage the waste they generate (EPA Victoria, 2004). Consequently, more state governments have shown interest in launching a number of construction waste reduction projects and in facilitating multiple strategies to avoid, reduce, recycle and re-use C&D waste (Park and Tucker, 2017).

A number of studies in Australia have highlighted that, among the main factors dictating the effective management of C&D waste, regulations play a decisive role (Park and Tucker, 2017, Udawatta et al., 2015, Udawatta et al., 2018, Teo and Loosemore, 2001). Governance of C&D waste issues occurs within the three tiers of government: federal, state or territory and local. However, the federal government is not directly involved in regulating C&D waste unless the regulations set by the other two tiers are in conflict with international treaties (e.g. Agenda 21, Basel Conventions, and Stockholm Conventions) or impose threats to the environment that are of national concern. In other words, there is no constitutional authority to regulate waste nationally (Wainberg, 2012). The majority of legislation occurs at the state and territorial government level. Therefore, C&D waste management in each state/territory builds on the specific regulatory framework that prevails in that state. As such, the method typically implemented by the Australian Government is one of multi-stakeholder engagement and the introduction of multi-party agreements. These may be supported by legislative measures in instances where all parties support the need for such fall-back legislation at a jurisdictional level (Laviano et al., 2017). Experts argue that inconsistencies at the jurisdictional level can hinder effective management of C&D waste and inflict multiple issues (Hyder, 2011).

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<sup>1</sup> Solid non-hazardous waste and hazardous waste including liquids, and generated in the municipal, C&D and C&I sectors, generally excluding primary production.

## **2 METHODOLOGY**

### **2.1 Data collection, processing and analysis**

This review study is based on the secondary data that are publicly available. The document analysis technique was conducted to identify differences in jurisdictional regulatory frameworks and practices in Australia. The sources reviewed include acts, policies, regulations and strategies that are mostly administrated by the Environment Protection Authority (EPA) and other state-specific authorities (e.g. Sustainability Victoria in Victoria), plus reports and initiatives prepared for C&D waste management in Australia. In total, 62 documents that provided information about C&D waste legislation in Australia were analysed. It is worth bearing in mind that amendments to C&D waste regulations and acts occur periodically; therefore, information provided in this paper is considered valid at the time of writing. On this basis, the regulations that are not in force and or have been repealed are excluded from the review. Descriptive analysis is used to analyse and present the data collected. Quantitative results are mostly presented using analytical measures such as frequency and arithmetic average. Microsoft Excel V. 2016 is used to analyse the data and visualise results.

### **2.2 Context of study**

Australia is a large country with a low population and density. The majority of the population of 25 million is settled in capital cities. Significant growth in migration and population in Australia have generated demands for more construction activities. As a result, more infrastructure and new housing are needed to meet the requirements of this ever-increasing population (IBISWorld, 2019a). A more detailed overview of the construction industry is provided in the results section. The statistics have shown that construction activities generate a large quantity of C&D waste (NWR, 2018). Despite having no physical shortage of landfill sites, there is a high level of community environmental awareness; this means that it is difficult to open new landfill sites and incineration is not tolerated (Wainberg, 2012). As such, the state governments attempt to regulate C&D waste management through enforcing relevant legislation.

### **3 RESULTS OF REVIEW**

#### **3.1 Overview of the Australian Construction Industry**

Construction in Australia comprises several activities; from general construction to the construction of pipelines, railroads and river works, it also involves irrigation projects, and the construction of water, gas, electricity and sewage infrastructure. According to the Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006 (Revision 2), the Construction industry (Division E) involves three subdivisions: 'Building Construction', 'Heavy and Civil Engineering Construction' and 'Construction Services' (ABS, 2006). Each of these subdivisions is further divided into various 'groups' and 'classes' with certain activity definitions. Although there has been a slight negative annual growth in this industry from 2014 to 2019 in general, it is projected that the construction industry will enjoy a 2.4% annual growth between 2019-2024 (IBISWorld, 2019a).

Analysis of different construction subdivisions reveals a constant annual growth rate. For instance, the historic data from the Australian Bureau of Statistics (ABS) indicates that the value of work done in building construction activities has progressively increased by 33% from 2012 (22,099,416) to 2018 (29,428,494). During this period, the Australian population has grown by 11% (ABS, 2018b). These two trends clearly demonstrate the industry's attempt to keep up with the growing population. In the residential sector, approximately 18,000 dwelling units were approved for construction monthly in 2017 (Martek et al., 2019). In the Heavy and Civil Engineering Construction subdivision, the annual revenue was estimated to be \$394.3 bn, which provided over 1 million jobs in Australia. Road and bridge construction was recorded to benefit a 5.3% annual growth and \$28.9 bn revenue (IBISWorld, 2019a). In the construction engineering sector, the annual value of work commenced (all subdivisions) had an average annual growth rate of 19.9% from 2015 to 2018 (June) (ABS, 2018a). This increase is reported to be significantly larger in some states such as Victoria (up to 80%) and Western Australia (39%).

#### **3.2 C&D waste generation and management in Australia**

The existing pace in construction activities in Australia is also indicative of the generation of more C&D waste. According to the National Waste Report (2018) prepared for the Australian Department of the Environment and Energy, in 2016-2017 Australia generated 831 Kg of C&D waste per capita (NWR, 2018), which has increased by 2% per capita over a 11 year period (2007-2017). The total waste generated has steadily increased by 1.9% from 2007 to 2017 (Table 1) and reached 20.4 Mt, which represents the largest source stream (43%) of all waste types. C&D waste is mostly recycled and then disposed of in landfills. Hence, C&D waste management is important from economic and environment perspectives. C&D waste accounts for a significant proportion (26.9%) of the solid waste collection and recycling services industry in Australia, an industry that produces \$5.2 bn in revenue and enjoys 3% annual growth. This industry is influenced by two major factors: construction/demolition activities and population growth, both of which are projected to increase in the coming years (IBISWorld, 2019b). Another source, The Waste Management Association of Australia (WMAA) reported that the industry employs 50,000 individuals and contributes \$50 bn per annum to the Australian economy (Environment and Communications References Committee, 2018). Modelling by the Centre for International Economics (2017) indicates that a 5% rise in the recycling rate could add \$1 billion to Australia's gross domestic product. Other external factors that alter the industry's performance are number of households, level of urbanisation and public concerns over environmental issues. In Australian jurisdictions, C&D has recently attracted attention due to its economic potential and, as a result, more demand has created social and environmental benefits that the authorities and wider community can enjoy through proper management.

In terms of waste fate, statistics showed that, between 2016 and 2017, more than 6.7 Mt of C&D waste was transferred into landfills (NWR, 2018). Despite the growth in C&D waste generation, the annual average of waste disposal during the period of 2007 to 2017 remains largely unchanged. However, the waste disposal per capita rate shows a different trend, with a 1.6% annual drop (Table 1). Conversely, the quantity of waste recycled has significantly improved during this eleven-year period. Recycling of C&D waste has increased by 3.4 Mt or 34%.

**Table 1. C&D waste generation and management trends in Australia.**

C&D waste	2007	2009	2010	2011	2014	2015	2016	2017	Average annual growth rate (%)
Generated - total (Mt)	16.9	18.5	18.4	18.4	17.9	19.4	20.1	20.4	1.9
Generated- per capita (t)	0.82	0.86	0.84	0.83	0.77	0.82	0.84	0.84	0.2
Disposed of (Mt)- total	6.6	7.3	7.0	6.2	6.2	6.7	6.4	6.7	0
Disposed of (Mt)- per capita	0.32	0.34	0.32	0.28	0.27	0.28	0.27	0.27	-1.6
Recycled (Mt)	10.1	11.1	11.3	12.1	11.5	12.4	13.5	13.6	3
Recycled- per capita (t)	0.49	0.52	0.51	0.54	0.49	0.53	0.56	0.56	1.3
Recovery rate (%)	60	60	62	66%	65	65	68	67	1.1

Source of data: National Waste Reporting 2018. This report acquired data from different EPAs across Australia.

Analysis of C&D waste data in different jurisdictions demonstrates unequal proportions of waste disposal in landfills (Table 2). In 2017, the largest quantity of waste disposed was registered in Qld (2,312 Mt) followed by NSW (1,969 Mt) and Vic (1, 549 Mt). It seems that the quantity of waste disposed in each state does not correspond to population and some other factors such as levy rate and availability of proper recycling facilities are potentially involved. From Table 2 it can be noted that recovery rate within different jurisdictions differs significantly. The greatest recycling rate is in SA (91.1%), followed by in Vic (82%) and NSW (69%<sup>2013</sup>). Each of these three states has a better recycling performance than the national average (67%).

**Table 2. C&D waste disposal and management in different jurisdictions in 2016-17.**

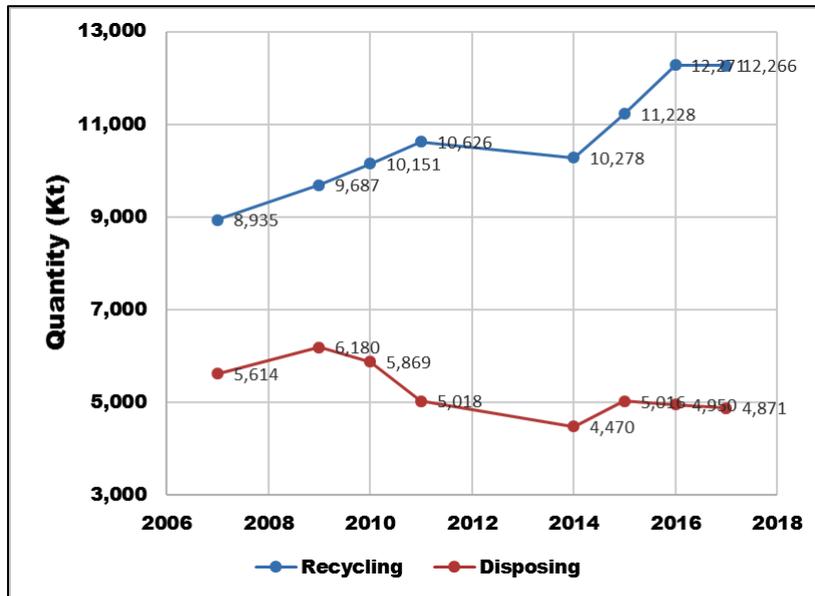
C&D waste	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	AUS
Waste disposal (Kt)-total	180	132	1,969	2,312	151	39	1,549	374	6.71
Current recycling rate (%)*	na	69 <sup>(2013)</sup>	1 <sup>(2011)</sup>	51	91.1	1	82	64	67
Population (thousands:’000)	406	7,798	245	4,884	1,717	519	6,244	2,568	

Source of data: National Waste Reporting 2018. This report acquired data from different EPAs across Australia.

\*Source of data: data is extracted from various reports produced by jurisdictional authorities.

In 2016-2017, the quantity of C&D waste recycled was 13.6 Mt, accounting for 43% of the total core waste recycled; this represents the largest source of core waste in Australia. In the same period, C&D waste was reported to hold an energy recovery rate of 0%, a recycling rate of 67% and a total recovery rate of 67% (Table 2). The average annual growth rate of recovery of C&D waste is estimated to be 3%

and 1.3%, respectively, for the period of 2007 to 2017 (NWR, 2018). NWR (2018) reported that the proportion of recycling of masonry materials (e.g. asphalt, brick, concrete, rubble, plasterboard and cement sheeting) progressively increased, with a 3.2% average annual growth rate, while landfilling has decreased (Figure 1).



**Figure 1. Trend of recycling and dumping masonry materials in Australia.**

Source of data: NWR (2018).

By way of comparison, the rate of recovery of C&D waste was 89.9% in the UK<sup>2</sup>, 49% in the US in 2014<sup>3</sup> and 94% in Denmark in 2015 (Statistics Denmark, 2015). In 2014 and 2015, the recovery rate in Australia was about 64%. A European Landfill Directive (Ref 1) promulgated by the European Commissions (EC) in 1999 caused significant changes in the treatment of residual waste in Europe. The Directive is mainly concerned with ensuring that landfill and waste acceptance standards are uniform across the EU, to avoid dumping of hazardous waste into low standard sites. In Hong Kong, a 3-year levy scheme (2006-2008) demonstrated that C&D-specific waste levy taxes can influence construction's behaviours regarding C&D waste, resulting in a significant reduction in solid waste disposal<sup>4</sup>. The recycling rate of C&D waste differs significantly between countries, owing to different levels of economic development and technology. In another study in the Australian context, it was found that an increase in the landfill levy causes waste service providers to invest in resource recovery facilities, governments to initiate infrastructure funding and education programs, and businesses to prioritise recycling over landfill<sup>5</sup>.

### 3.3 The main decision makers in C&D waste management and regulation

The first difference in C&D waste management between jurisdictions is the variation in the number and type of agencies involved in making policy and authorising waste management practices. Historically, the main authority to regulate C&D waste in jurisdictions is the EPA (Figure 2). In 2009,

<sup>2</sup> Department for Environment Food and Rural Affairs, 2018. UK Statistics on Waste. In: AFFAIRS, D. F. E. F. A. R. (ed.). London.

<sup>3</sup> United States Environmental Protection Agency, 2018. Advancing Sustainable Materials Management: 2015 Fact Sheet.

<sup>4</sup> Yu, A. T. W., Poon, C. S., Wong, A., Yip, R. & Jaillion, L. 2013. Impact of construction waste disposal charging scheme on work practices at construction sites in Hong Kong. *Waste Management*, 33, pp. 138-146

<sup>5</sup> MRA Consulting Pty Ltd. State of Origin of Waste – NSW v QLD. North Sydney, NSW: Alex Sergio, 2015.

however, Queensland's EPA ceased to regulate C&D waste independently and became a part of the Department of Environment and Resource Management. Gradually, EPAs have engaged other specialised agencies in the process of decision-making, policies and strategies development. The focus of these agencies is on the effective management of C&D waste, maximising waste recovery and raising awareness in the public and the construction industry to reduce waste generation. For instance, in WA, the Waste Authority, previously known as the Waste Management Board, has become the main authority that provides policy on waste avoidance and recovery. In Vic, Sustainability Victoria, previously known as EcoRecycle Victoria, has worked closely with EPA Vic and other partners to develop an industry standard on waste management. In SA, Green Industries SA, previously known as Zero Waste, has a statutory requirement (Zero Waste Act 2004) to develop a waste strategy in SA. These agencies operate in close collaboration with local governments in developing C&D waste policies.

Technically, local governments provide waste collection and recycling services, manage and operate landfill sites, deliver education and awareness programs, and provide and maintain recycling infrastructure<sup>6</sup>. From a more holistic perspective, as outlined by the Department of the Environment and Energy website, waste management and resource recovery are not just the responsibilities of governments but also a range of industries and businesses, as well as communities, and individuals that are involved. Figure 2 displays the various authorities that govern C&D waste in different jurisdictions.

At the national level, there is a greater variation of influencers. Fourteen authorities and associations are involved in the development of C&D waste management strategies and policy by submitting to the Department of Energy and Environment inquiry. The majority of these have contributed to development of National Waste Policy (NWP) 2018 (less waste, more resources). Among these, the Australian Local Government Association (ALGA) has a key role in developing NWP through facilitating assemblies in which state and territory environment ministers/officials, along with business and industry associations and non-government organisations, provide an input on priority issues.

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<sup>6</sup> Australian Government, National Waste Policy 2018. Less Waste, More Resources.

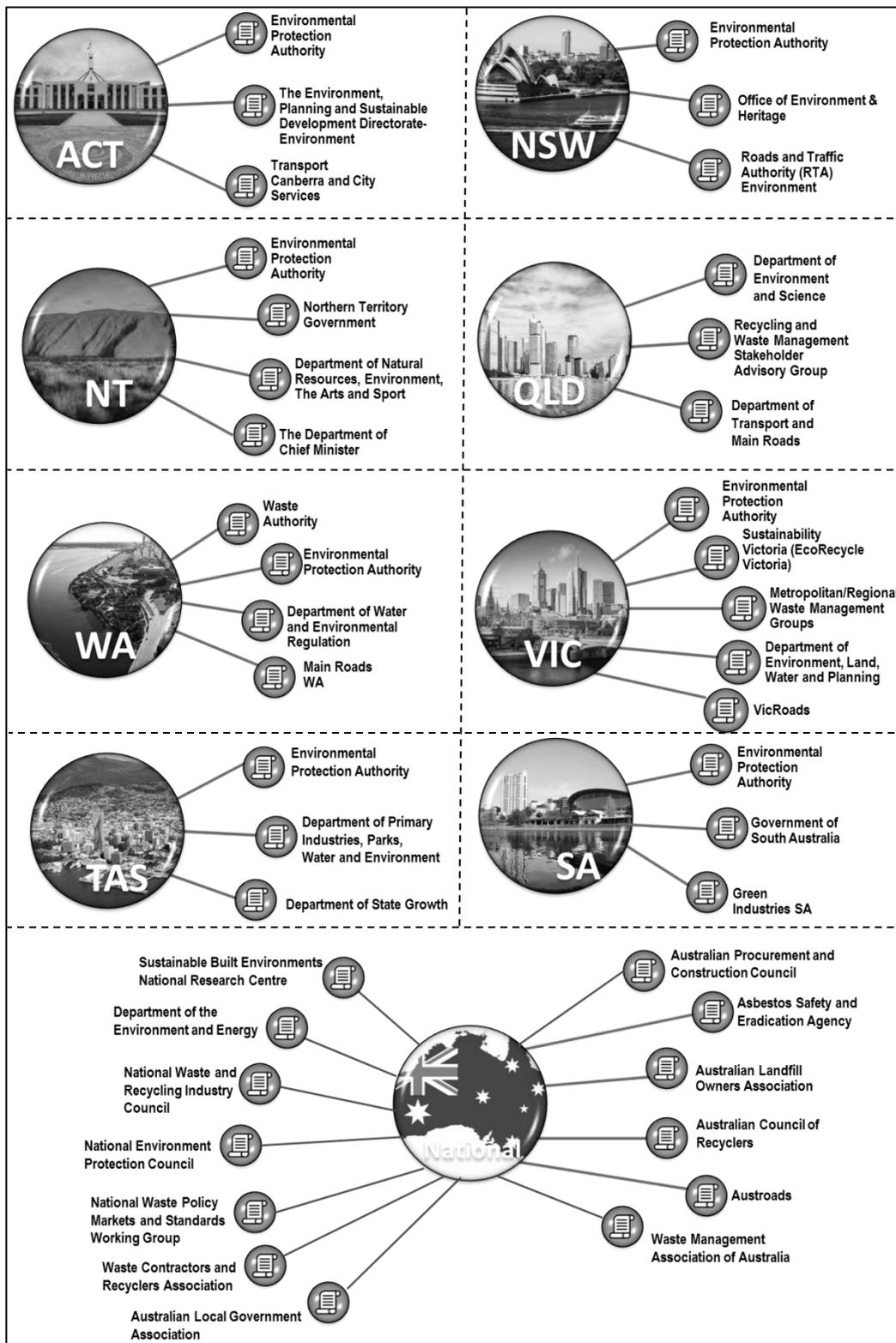


Figure 2. Agencies that contribute to C&D waste management legislation

Furthermore, the number of contributors to making decisions on C&D waste varies between the jurisdictions. Among the jurisdictions, with five actors, Vic has the largest number of entities guiding C&D waste management practices. In most jurisdictions, a state department that governs environment is engaged in overseeing C&D waste management.

At the national level, there is a greater variation of influencers. It was found that 14 authorities and associations are involved in the development of C&D waste management strategies and regulation; the majority of these have contributed to development of the National Waste Policy (NWP) 2018 (Less Waste, More Resources). Among these, the Australian Local Government Association (ALGA) has a key role in developing NWP through facilitating assemblies in which state and territory environment ministers/officials, along with business and industry associations and non-government organisations, provide an input on priority issues.

### **3.4 Overview of jurisdictional waste legislation and guidelines**

State and territory legislative frameworks governing waste and recycling are complex and involve multiple pieces of legislation and policy instruments. The primary pieces of legislation for C&D waste management in each jurisdiction are the acts that are produced and administered by EPAs, with the exception of Qld, where the overarching act is produced under the Department of Environment and Science (Table 3).

Most of these acts are updated regularly to meet current and changing industry and public demands and issues. Among the jurisdictions, Vic and WA have the largest number of acts in place, followed by the ACT, NSW and SA with 3, and Tas and NT with only 1 act. In some jurisdictions, other authorities and departments have also produced acts that contribute to regulation of C&D waste or amend the primary EPA acts. In the ACT, in addition to EPA produced acts, Transport Canberra and the City Services Directorate enforced an act (Waste Management and Resource Recovery Act 2016) that informs C&D waste management. In SA, Green Industries SA has enacted the Green Industries SA Act 2004, which promotes innovation and business activity in the waste management, resource recovery and green industry sector in the State. In Vic, Sustainability Victoria developed an act (Sustainability Victoria Act 2005) to promote waste avoidance, waste reduction and recovery, reuse, recycling of resources and best practices in waste management. In WA, the Department of Water and Environment Regulation developed two acts (Waste Avoidance and Resource Recovery Act 2007; Waste Avoidance and Resource Recovery Levy Act) to regulate waste.

These acts and subordinate regulations primarily contain critical information about waste levy, licensing requirements for waste facilities and activities, and penalties for illegal dumping related offences. They also regulate activities, products, substances and services that may cause environmental harm from pollution or production of waste. Some of the acts in use are set to promote waste minimisation through avoidance, reduction, recycling and re-using. Among the jurisdictions, six (i.e. ACT, NT, NSW, Qld, Tas, WA) have released acts that are specifically intended for waste management (Table 3).

In each of the jurisdiction's subordinate regulations, policies and codes have been established to clarify and/or extend the scope and objectives of the overarching acts. WA has 3 subordinate regulations, followed by ACT, NSW, Qld, Tas and Vic, which enforce 2 regulations. Another layer of waste management are waste strategy documents that are also published in jurisdictions to specify targets, strategies and priorities in management of waste management. Vic is yet to develop a holistic waste strategy that facilitates implementation of C&D waste related regulations. Among Australia's jurisdictions, only NSW has provided specific documents (Standards for Managing Construction Waste in NSW) that further clarify the requirements of state regulations to manage C&D waste.

At the national level, there are 3 pieces of legislation that can inspire and inform C&D waste management regulatory frameworks in the study jurisdictions. These include the National Environment Protection Council Act 1994, the Hazardous Waste (Regulation of Exports and Imports) Act 1989 and the Product Stewardship Act 2011. The Environmental Protection Council Act 1994 indicates the responsibility of polluters (i.e. waste producer) and the users of goods and services in relation to the cost associated with waste generation. Similarly, the Product Stewardship ACT 2011 is a strategy with an environmental management focus that declares that whoever is involved in production and consumption of a good should take responsibility for reducing its environmental impact. The NWP 2018 is probably the most relevant document. It leads C&D waste management activities across Australia by setting 14 strategies that provide a framework for waste management improvements. This document is a benchmark against which jurisdictions can upgrade and align their regulations. It also assists in the development of jurisdictional waste strategies that are consistently developed documents to achieve uniform goals. The Guide to Pavement Technology Part 4E: Recycled Material is a national guideline presenting the acceptance requirements of recycled materials, including C&D waste, to be used in road pavement projects across Australia.

**Table 3. Jurisdictional waste legislative and management framework**

	<b>Key legislation documents</b>	<b>Strategies/guidelines</b>
<b>ACT</b>	Environment Protection Act 1997 Waste Management and Resource Recovery Act 2016 Environment Protection Regulation 2005 Waste Management and Resource Recovery Regulation 2017	ACT Waste Management Strategy: Towards a sustainable Canberra 2011-2025 Waste and Recycle Management Code for the Act Sustainable Procurement Policy 2015
<b>NSW</b>	Protection of the Environment Operations Act 1997 No 156 Protection of the Environment Administration Act 1991 No 60 Waste Avoidance and Resource Recovery Act 2001 No 58 Protection of the Environment Operations (Waste) Regulation 2014 Environmental Planning and Assessment Regulation 2000	Waste Levy Guideline Waste Avoidance and Resource Recovery Strategy 2014-2021 Reducing Waste: Implementation Strategy 2011-2015 Extended Producer Responsibility (EPR) Environmental Guidelines Solid waste landfills Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage 2010 NSW Illegal Dumping Strategy 2017-2021 Management of Wastes on Roads and Maritime Services Land Management of road construction and maintenance wastes: Technical Guide Standards for managing construction and demolition waste in NSW Waste and Resource Recovery Infrastructure Strategy 2017-2021 –draft Sustainable Procurement Guide: for local government in NSW
<b>NT</b>	Waste Management and Pollution Control Act 1998 Waste Management and Pollution Control (Administration) Regulations	Territory 2030 Strategic Plan 2009 Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory 2003 Waste Management Strategy for the Northern Territory 2015-2022

	Key legislation documents	Strategies/guidelines
QLD	<p>Environmental Protection Act 1994  Waste Reduction and Recycling Act 2011  Environmental Protection Regulation 2008  Environmental Protection (Waste ERA Framework) Amendment Regulation 2018</p>	<p>Queensland’s Waste Reduction &amp; Recycling Strategy 2010–2020  Queensland Waste Avoidance and Resource Productivity Strategy (2014–2024)  Transforming Queensland’s Recycling and Waste Industry  Queensland’s Waste Strategy 2010-2020  Recycling and waste in Queensland 2017  The proposed Queensland Regulated Waste Framework  Landfill siting, design, operation and rehabilitation  Transport and Main Roads Specifications MRS35 Recycled Material Blends for Pavements</p>
SA	<p>Environment Protection Act 1993  Development Act 1993  Green Industries SA Act 2004  Environmental Protection Regulations 2009  Environment Protection (Waste to Resources) Policy 2010</p>	<p>South Australia’s Waste Strategy 2015–2020  Waste-derived materials—guiding principles for determining approval processes and product standards  Standard for the production and use of Waste Derived Fill-2013  Recycled Fill Materials for Transport Infrastructure - Operational Instruction 21.6  Specification: Part 215 Supply of Pavement Materials  ESD Guide Note Planning, Design and Delivery of new and refurbished buildings  SA Sustainable Procurement Guideline  Standard for the production and use of Refuse Derived Fuel  South Australia’s Waste and Resource Recovery Infrastructure Plan 2018</p>
Tas	<p>Environmental Management and Pollution Control Act 1994  Litter ACT 2007  Litter (Infringement Offences) Regulations 2011  Environmental Management and Pollution Control (Waste Management Regulations) 2010  Environmental Management and Pollution Control (Controlled Waste Tracking) Regulations 2010.</p>	<p>The Tasmanian Waste and Resource Management Strategy 2009  Waste and Resource Management Strategy</p>

	Key legislation documents	Strategies/guidelines
Vic	<p>The Environment Protection Act 1970  The Environment Protection (Resource Efficiency) Act 2002  The Environment Protection (Amendment) Act 2006  Sustainability Victoria Act 2005  Environment Protection (distribution of landfill Levy) Regulations  Environment Protection (Industrial Waste Resource) Regulations 2009  Waste Management Policy (Movement of Controlled Waste Between States and Territories)  Waste Management Policy (Siting, Design and Management of Landfills) 2004</p>	<p>Siting, design, operation and rehabilitation of landfills  VicRoads Standard Specifications for Roadworks and Bridgeworks  State-wide Waste and Resource Recovery Infrastructure Plan (2016-2046)</p>
WA	<p>Environmental Protection Act 1986  Environmental Protection (Landfill) Levy Act 1998  Waste Avoidance and Resource Recovery Act 2007  Waste Avoidance and Resource Recovery Levy Act 2007  Environmental Protection Regulations 1987  Environmental Protection (Controlled Waste) Regulations 2004  Waste Avoidance and Resource Recovery Regulation 2008  Waste Avoidance and Resource Levy Regulation Administration Policy 2009</p>	<p>Extended Producer Responsibility Policy Statement  Waste Strategy 2030: Western Australia's Waste Strategy  Western Australian Waste Strategy: Creating the Right Environment  Waste Strategy 2030  Main Roads Western Australia Specification 501 – Pavements  Guide to Sustainable Procurement 2017</p>
National	<p>National Environment Protection Council Act 1994  Hazardous Waste (Regulation of Exports and Imports) Act 1989  Product Stewardship Act 2011</p>	<p>National Waste Policy 2018  Environmental Sustainability Policy  National Environment Protection (Movement of Controlled Waste between States and Territories) Measure  Sustainable Procurement Guide  Guide to Pavement Technology Part 4E: Recycled Material</p>

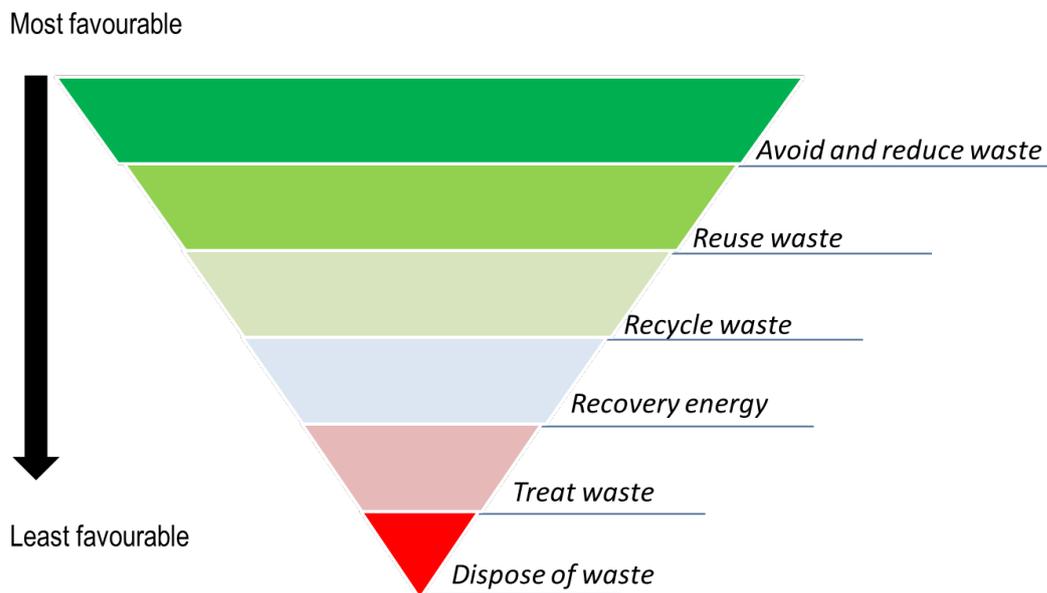
\*These pieces of legislation are subject to change; an updated copy of some of this legislation can be found on the legislation website of each state/territory (e.g. [www.legislation.qld.gov.au](http://www.legislation.qld.gov.au))

### 3.5 Waste strategy policy in Australia

Most jurisdictions have a strategy document that guides government organisations and industries in improving waste management over the strategy period. In many cases, strategies set targets for resource recovery or other waste performance indicators. Table 4 specifies the current strategy documents and any targets within them.

Waste strategy documents are an important part of waste management governance in Australia. Despite not having statutory power, they guide efforts to improve waste management in different jurisdictions. On the one hand, they are required to be developed under relevant jurisdictional acts. On the other hand, they also have a significant impact on the jurisdictional legislative framework, through objectives, targets and reforms proposed for implementation in primary and secondary waste related legislations. For instance, in WA, the Waste Avoidance and Resource Recovery Act 2007 under Division 1- Waste strategy (Part 4-Management documents) commissioned the Waste Authority to prepare a draft waste strategy containing a long-term strategy for continuous improvement of waste services, waste avoidance and resource recovery.

The primary framework underpinning waste strategies followed by Australian jurisdictions is the waste hierarchy. The waste hierarchy is a nationally and internationally accepted concept used to prioritise and guide efforts to manage waste. This framework, as shown in Figure 3, contains six levels of waste management. The least preferable option is waste disposal and the most desirable is to collectively avoid and reduce waste. The waste hierarchy also plays an important role in waste related acts and regulations by contributing to setting regulations objectives that aim to achieve waste management goals. Some examples of its application include regulations and acts enforced in ACT<sup>7</sup>, NSW<sup>8</sup>, WA<sup>9</sup>, Qld<sup>10</sup>, SA<sup>11</sup> and Vic<sup>12</sup>. However, its application (e.g. the modification in the levels of hierarchy) differs greatly.



**Figure 3. Waste hierarchy adopted by waste strategy documents across Australia**

<sup>7</sup> Waste Management and Resource Recovery Act 2016 – ACT.

<sup>8</sup> Waste Avoidance and Resources Recovery ACT 2001 – NSW.

<sup>9</sup> Waste Avoidance and Resources Recovery ACT 2007 – WA.

<sup>10</sup> Waste Reduction and Recycling Act 2011 – Qld.

<sup>11</sup> Environment Protection Act 1993 / Green Industries SA ACT 2004 – SA.

<sup>12</sup> Environment Protection Act 1970 – VIC.

In addition to this framework, each strategy provides principles and objectives that determine actions to manage waste within each jurisdiction. The following table summarises the main principles enshrined in the waste strategy document for each jurisdiction. Comparisons between these strategies can reveal the inconsistencies that exist between the strategies taken in different jurisdictions. It also provides the opportunity to improve the actions and strategies being advised, according to successful outcomes in jurisdictions that have led by example. In order to keep the review relevant to the context of C&D waste, only strategies that have directly or indirectly impacted on C&D waste management activities are described.



Figure 4. Waste strategy documents

Table 4. Summary of waste strategy documents in different jurisdictions

	Objectives and Strategies	Document
ACT	<p><b>(1) Less waste generated- target: reuse of goods expands in the ACT</b>            -Awareness, education and action            -Promote reuse through ACT business and charities            -Encourage on-site reuse for C&amp;D waste</p> <p><b>(2) Full resource recovery- target increase resource recovery rate over 85% by 2025</b>            -Promote education and active recycling            -Government procurement            -Develop markets for recyclable materials and strengthen regional connections            -Disincentives to landfill including appropriate pricing and regulation</p> <p><b>(3) A clean environment- target: ACT leads Australia in low illegal dumping and protection of ACT environment</b>            -Reduce litter and dumping through laws and raising awareness            -Development of the Hume Resource Recovery Estate            -Maintain a safe and environmentally responsible landfill to meet the ACT’s future needs.            -Manage hazardous waste            -Increase soil reuse and rehabilitation</p> <p><b>(4) Ac carbon neutral waste sector- target: ACT waste sector is carbon neutral by 2020, energy produced from waste doubles by 2020</b>            -Expand bioenergy generation and investigate new energy-from-waste technologies to generate energy            -Increase recycling to avoid greenhouse gas emissions            -Ensure energy efficient waste collection and transport solutions</p>	-ACT Waste Management Strategy 2011-2025
NSW	<p><b>(1) Avoid and reduce waste generation- target: reduce the rate of waste generation per capita</b>            -Economic incentives            -Behaviour change            -Product stewardship            -Industrial ecology</p> <p><b>(2) Increase recycling- target: increase recycling rate for C&amp;D waste to 80% by 2021-2022</b>            -Develop markets and encourage innovation            -Build capacity for developing regional recycling plans</p> <p><b>(3) Divert more waste from landfill- target: increase the waste diverted from landfill to 75% by 2021-2022</b>            -Co-fund large-scale infrastructure for viable resource recovery projects energy-from-waste projects</p>	-NSW Waste Avoidance and Resource Recovery Strategy 2014–21 -NSW Illegal Dumping Strategy 2017–21

Objectives and Strategies	Document
<ul style="list-style-type: none"> <li>-Manage problem wastes better</li> <li>-Reduce litter</li> <li>-Reduce illegal dumping- target: 30% reduction</li> <li>-Establish partnership with key stakeholders to increase opportunities to for people to care about their own environment</li> <li>-Building capacity at local level for key stakeholders to increase their knowledge and expertise to implement practical regional solutions</li> <li>-Strengthen compliance and enforcement activities to detect, investigate and prosecute illegal dumping consequences</li> <li>-Organising education campaign to raise community awareness about illegal dumping repercussions</li> <li>-Building a robust evidence based through data collection and analysis on illegal dumping incidents, attitudes and behaviour to help key stakeholders identify, prioritise and target local needs as well as monitor and evaluate the effectiveness of their actions</li> </ul>	
<p style="text-align: right; margin-right: 10px;"><b>NT</b></p> <p><b>(1) Engagement and education:</b></p> <ul style="list-style-type: none"> <li>-Promote community awareness and understanding of resource efficiency, waste avoidance and resource recovery;</li> <li>-Provide best-practice guidance materials for handling and disposing of commercially generated wastes including contaminated soils and concrete</li> <li>-Facilitate and promote product stewardship programs for recycling and treating nationally significant waste streams</li> <li>-Collaborate with the Waste and Recycling Industry of the NT (WRINT) to identify emerging trends and issues requiring multi-faceted solutions;</li> <li>-Facilitate coordination of localised waste arrangements in regional development projects</li> <li>-Work with local government and the NT Government to coordinate local efforts to prevent litter and illegal dumping</li> <li>-Work directly with local and regional Councils and local service authorities to monitor, detect and reduce community exposure to the risks of poor waste management</li> </ul> <p><b>(2) Improve waste management:</b></p> <ul style="list-style-type: none"> <li>- Develop and guide waste avoidance and reduction programs</li> <li>- Support proposals by regional councils to consolidate recycling infrastructure at central locations</li> <li>- Facilitate opportunities to connect waste recovery and reuse markets with key waste producers (e.g. organics, green waste construction and demolition waste and commercial and industrial waste);</li> <li>-Work with industry and government agencies to demonstrate the economic incentives available through improved waste management and resource recovery, including options for reducing greenhouse gas emissions from landfill</li> <li>-Assess the status of landfill sites in the Territory to: prioritise high environmental risk sites requiring operational improvement, impact monitoring or rehabilitation, including in a remote context; regulate landfills in accordance with the objectives of the WMPC Act;</li> </ul>	<p><b>-Waste Management Strategy for The Northern Territory 2015–2022</b></p>

Objectives and Strategies	Document
<ul style="list-style-type: none"> <li>-Develop guidance to demonstrate best practice expectations: identify and develop guidelines to assist landfill operators in better managing their waste and resources</li> <li>-Develop a waste infrastructure mapping database to identify locations of accessible facilities and to assist strategic planning for the future requirements of the Territory;</li> <li>- Collaborate with local waste operators and industry bodies to identify and address the limitations to their delivery of waste management services.</li> <li>-Recommend waste reduction and waste management plans are developed and implemented on significant developments</li> <li>- Advise on specific infrastructure required to deal with liquid wastes generated locally</li> <li>- Highlight the need for early consideration of asbestos disposal locations across the NT, including in remote housing and infrastructure projects;</li> <li>-Assist local and regional councils and industry to identify key infrastructure needs and to identify appropriate land for future waste management sites;</li> <li>-Recommend that industry and government agencies seek innovative technologies as preferred waste solutions, to stimulate waste research and investment</li> </ul> <p><b>(3) Improve waste data collection, monitoring and analysis</b></p> <ul style="list-style-type: none"> <li>-Identify waste facilities that are not reporting waste data and develop an approach for capturing essential data from these sites;</li> <li>- Develop an improved system for recording and interpreting waste data required to be collected by the NT EPA;</li> <li>- Continue to participate and assist in the development of nationally consistent waste classification systems;</li> <li>- Prioritise targeted waste streams for an audit and compliance program, to ensure a complete tracking pathway from source to destination;</li> <li>-Assist industry to identify business opportunities where demand for waste treatment facilities is not being met;</li> <li>- Ensure relevant Government and Council agencies have access to waste data as required to inform strategic planning; and undertake an analysis of NT waste streams based on available data.</li> </ul> <p><b>(4) Improve the regulatory framework</b></p> <ul style="list-style-type: none"> <li>- Assess the waste-related components of current legislation administered by the NT EPA to determine their relevance and effectiveness as tools to improve waste management practices in the Territory.</li> </ul> <p><b>(5) Reporting and public reviews</b></p> <ul style="list-style-type: none"> <li>- Provide an update on progress in implementing each of this Strategy’s management actions in its annual report</li> <li>- Review the Strategy, and as appropriate, renew its content, within five years</li> </ul>	
<p><b>(1) Resource efficiency</b></p> <ul style="list-style-type: none"> <li>-Moving from a linear ‘extract-process-use-dispose’ resource use model towards ‘closing the recycling loop’ in a more cyclical system where resources are recovered and recycled again and again.</li> </ul>	<p><b>-Queensland’s Waste Reduction and</b></p>

Objectives and Strategies	Document
<ul style="list-style-type: none"> <li>- Making better use of finite resources (energy, water, materials) by encouraging waste avoidance and improving recovery through product stewardship or ‘take-back’ schemes.</li> <li><b>(2) Sustainability</b></li> <li>- Maximising the net benefits to all Queenslanders: environmental, social and economic.</li> <li>- Building on existing programs and achievements.</li> <li>- Facilitating sustainable local solutions for local issues</li> <li><b>(3) Engagement</b></li> <li>-Taking the views of all stakeholders into consideration</li> <li>- Achieving results through partnerships with the community, business and industry and government.</li> <li>-Facilitating and encouraging shared responsibility.</li> <li>- Taking into consideration relevant national and international trends in waste technologies, laws and policies.</li> <li><b>(5) Capacity building</b></li> <li>-Facilitating business and industry development and building sustainable local and export market capability, while recognising the different approaches needed for metropolitan, regional and remote areas.</li> </ul>	<p><b>Recycling Strategy 2010–2020</b></p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>SA</b></p> <ul style="list-style-type: none"> <li><b>(1) Developing a resource efficient economy</b></li> <li>-Promote green innovation (such as the development and uptake of new, cleaner technology).</li> <li>-Recognise the lifecycle of products and account for the resources used.</li> <li>-Develop and adopt innovative products and services that help reduce our ecological footprint to create comparative economic advantage.</li> <li>-Increase and maintain capacity of recycling systems and reprocessing infrastructure.</li> <li>-Identify new opportunities through developing and promoting innovative policy, reforms and solutions.</li> <li>-Avoid and reduce wasteful use of resources in production processes and products, such as leaner production, design for the environment and extended producer responsibility.</li> <li>-Encourage the greater use of products made from recycled materials.</li> <li><b>(2) Building a stable and efficient market for investors</b></li> <li>-Increase and maintain capacity of recycling systems and reprocessing infrastructure.</li> <li>-Implement policy settings and regulation that drives progress, and encourages long-term investment decisions.</li> <li>-Promote safe and equitable resource recovery and build upon the strong resource recovery reputation of South Australia.</li> <li>-Monitor and evaluate the effectiveness of appropriate price signals and legislative instruments.</li> <li>-Increase procurement by all levels of government of re-manufactured products.</li> <li><b>(3) Forming a culture enabling the South Australian community</b></li> </ul>	<p><b>-South Australia’s Waste Strategy 2015-2020</b></p>

Objectives and Strategies	Document
<ul style="list-style-type: none"> <li>-Develop and adopt innovative products and services that help reduce our ecological footprint to create comparative economic advantage.</li> <li>-Learn the importance of, and foster, attitudes and lifestyle choices that encourage us to live within nature’s limits.</li> <li>-Embed this new learning within our education systems.</li> <li>-Support consumers to make informed purchasing choices.</li> <li>-Implement regulation and other reforms that drive progress and long-term investment decisions.</li> <li>-Identify new opportunities through developing and promoting innovative solutions.</li> <li>-Generate new business opportunities through improving cross-industry resource efficiency (industrial symbiosis).</li> <li>-Support appropriate research and development.</li> </ul>	
<p><b>Tas</b></p> <p>-No current waste strategy</p>	<p>-No current waste strategy</p>
<p><b>Vic</b></p> <p>-No current waste strategy</p>	<p>-No current waste strategy</p>
<p><b>WA</b></p> <p><b>(1) Avoid (WA generates less waste): -target: 2025: 10% reduction in waste generation per capita</b></p> <ul style="list-style-type: none"> <li>-Coordinate consistent state-wide engagement and education on waste avoidance behaviours with an emphasis on focus materials.</li> <li>-Investigate, develop and publish, in collaboration with stakeholders, locally relevant actions for reducing waste generation with an emphasis on focus materials.</li> <li>-Lead collaboration between State Government agencies on actions that reduce the waste generation with an emphasis on focus materials.</li> <li>-Collaborate with decision-makers and opinion leaders to explore opportunities arising from circular economy approaches and communicate them publicly.</li> <li>-Develop mechanisms and platforms that enable the community to adopt avoidance behaviours, and explore reuse and low-waste alternatives</li> <li>-Provide support to community, government and industry initiatives that lead to waste avoidance and contribute to waste strategy targets with an emphasis on focus materials Introduce regulations to prevent unnecessary waste generation</li> </ul> <p><b>(2) Recover (WA recovers more value and resources from waste) -target: 2025 increase material recovery to 70%</b></p> <ul style="list-style-type: none"> <li>-Investigate options to recover and promote related local markets through State Government procurement actions with an emphasis on focus materials.</li> <li>-Develop better practice guidance and standards for waste derived products to build confidence in recycled products and ensure protection of the environment.</li> </ul>	<p>-Western Australia’s Waste Strategy: Waste Strategy 2030</p>

Objectives and Strategies	Document
<ul style="list-style-type: none"> <li>-Develop education and engagement resources to communicate the benefits of resource recovery and the use of recycled products, and to minimise contamination in collection systems.</li> <li>-Develop and publish better practice guidance to support increases in recovery with an emphasis on focus materials</li> <li>-Identify and implement options for collaboration between industry and the State Government to support market development and recovery</li> <li>-Investigate and improve reporting on material that is reused (as distinct from recycled) to better monitor the state’s move toward becoming a circular economy.</li> <li>-Establish mechanisms, including funding approaches to support investments in local infrastructure for recovery with an emphasis on focus materials.</li> <li>-Provide funding to promote the use of priority recycled products and support the establishment of local markets with an emphasis on focus materials.</li> <li>-Support community, government and industry initiatives that promote resource recovery through grant programs.</li> <li>-Develop a legislative framework to encourage the use of waste derived materials, including product specifications, to build confidence in recycled products, increase their demand and develop relevant markets while protecting the environment</li> <li>-Implement measures and policies that support sustainable government procurement practices and outcomes that encourage greater use of recycled products support local market development.</li> <li><b>(3) Protect (WA protects the environment by managing waste responsibly)- target: 2030- no more than 15% of waste produced in Perth and Peel regions is landfilled, all waste manage and/or disposed at better practice facilities</b></li> <li>-Detect, investigate and prosecute illegal dumping.</li> <li>-Review and update the regulatory framework for waste to ensure it is appropriate and reduces the environmental impacts and risks from waste management</li> <li>-Revise waste classifications and definitions to reflect current knowledge to ensure waste materials are managed according to their risk and are treated and/or disposed of appropriately</li> <li>-Develop and revise legislative frameworks to encourage the use of waste derived materials and build confidence in recycled products</li> </ul>	

Furthermore, it is worth understanding how C&D waste is prioritised in different jurisdictions. Some jurisdictions have acknowledged how precious C&D waste materials are and have considered them as priority materials due to their financial advantage. In WA, C&D waste is among the ‘focus materials’; in Tas it is in the ‘priority material’ category; and in SA it is one of the three subcategories of ‘Waste Derived Fill’.

### 3.6 Strategies supporting revision of the existing C&D waste regulatory framework

Development of jurisdictional waste strategy documents and relevant regulations go hand in hand. Ideally, objectives outlined in waste strategies inspire amendments to regulatory frameworks; some of these objectives recommend reforms according to the practical outcome of waste management regulations. However, evaluation of alignments between legislation and these strategies sometimes demonstrates fundamental differences in the study jurisdictions. These differences imply that, while the issues are identified and solutions are outlined in waste strategies documents, there is little legislative support to achieve the solutions. Therefore, it is worth examining how these strategy documents propose reforms to the existing regulatory framework in each jurisdiction. Notably, most of these strategies were written a few years ago and, therefore, care must be taken to exclude the strategies, actions, and objectives that are already achieved and reflected in the jurisdictional regulatory frameworks. Table 5 summarises the strategies that support modifications in existing waste regulations.

**Table 5. Strategies supporting improvements in the regulatory framework**

Objectives and Strategies	
ACT	<p><b>ACT Waste Management Strategy 2011-2025</b></p> <p><b>Challenges and opportunities:</b></p> <ul style="list-style-type: none"> <li>-The safety and health risks arising from landfill gas emissions are managed across all landfills through appropriate regulation and licence requirements.</li> </ul> <p><b>Strategies and actions:</b></p> <ul style="list-style-type: none"> <li>-Disincentives to landfill including appropriate pricing and regulation</li> </ul>
	<p><b>-NSW Waste Avoidance and Resource Recovery Strategy 2014–21</b></p> <p><b>-NSW Illegal Dumping Strategy 2017–21</b></p> <p><b>Challenges and opportunities:</b></p> <ul style="list-style-type: none"> <li>-Regulation and enforcement help to change behaviour, protect the environment and reduce health risks</li> <li>-Local councils usually regulate small-scale dumping, while the EPA regulates larger incidences</li> </ul> <p><b>Strategies and actions:</b></p> <ul style="list-style-type: none"> <li>-EPA Provide clear and consistent regulations for waste disposal, recovery and recycling</li> <li>-Building the regulatory capacity of councils and public land managers</li> </ul>
NT	<p><b>-Waste Management Strategy for The Northern Territory 2015–2022</b></p> <p><b>Challenges and opportunities:</b></p> <ul style="list-style-type: none"> <li>-Existing regulation is not sufficient to provide incentives for innovative waste solutions or to deter inappropriate waste practices</li> </ul> <p>Further review and implementation of the available environmental legislation will improve the NT PA’s capacity to measure and reduce the impacts of waste handling activities and to steer practice towards achieving the preferred hierarchy of waste management options</p> <p><b>Strategies and actions:</b></p> <ul style="list-style-type: none"> <li>-EPA will assess the waste-related components of other legislation administered by the NT EPA to determine their relevance and effectiveness as tools to improve waste management practices in the Territory</li> </ul>

<b>Objectives and Strategies</b>	
	<p>-EPA is conducting a review of the WMPC Act and the Litter Act. This will provide the public, industry, government and local government with a discussion paper examining the deficiencies and strengths of the Acts in providing soundly managed waste issues</p>
Qld	<p><b>-Queensland's Waste Reduction and Recycling Strategy 2010–2020</b>  <b>Challenges and opportunities:</b>            -Queensland's waste management legislation is out-dated and is not trying to stop waste being generated in the first place.            -New legislation is needed to underpin the strategy, including promoting waste reduction and resource recovery and diverting potential resources from landfill. It also helps achieve the goals and targets of the strategy, provide a more flexible approach that can readily keep pace with changes in technology, help to regulate illegal activities more effectively and provide a level playing field for legitimate and responsible, help manage priority wastes more effectively, ensure more consistency with other states facility operators, manage priority wastes more effectively, ensure more consistency with other states  <b>Strategies and actions:</b>            -The government will deliver a new Act and regulations, and amend and strengthen existing laws</p>
	<p><b>South Australia's Waste Strategy 2015-2020</b>  <b>Strategies and actions:</b>            -Identify new opportunities through developing and promoting innovative policy, reforms and solutions.            -Implement policy settings and regulation that drives progress, and encourages long-term investment decisions            -Monitor and evaluate the effectiveness of appropriate price signals and legislative instruments</p>
SA	
Tas	<p><b>LGAT Waste and Resource Management Strategy 2017- A submission to LGAT</b>  <b>Challenges and opportunities:</b>            -The absence of regulatory controls for the development and operation of privately operated inert landfills has provided for unregulated the establishment of these landfills that do not collect levies and are thus a market barrier to the implementation of recycling facilities for C&amp;D material            -Lack of a policy and guidelines to realise how the proposals for Energy from Waste (EfW) facilities design and establishment are to be assessed according to the relevant state legislations.            -Low landfill levy is a financial barrier to recycle, invest in resource recovery and implement practices which reduce waste generation  <b>Strategies and actions:</b>            -Working towards a circular economy - establish clear objectives, performance indicators and targets for waste and resource recovery            -Provide additional resources to bolster the capability of the regulator to provide improved regulation and compliance. (e.g. via landfill levy)</p>
Vic	<p><b>No current waste strategy</b></p>
WA	<p><b>Western Australia's Waste Strategy: Waste Strategy 2030</b>  <b>Challenges and opportunities</b>            -State government can provide waste management leadership and influence waste behaviours through legislation, regulation, policies and programs that align with national approach            -Regulation and policy – to provide a level playing field and deliver efficient and effective waste management outcomes</p>

## Objectives and Strategies

### Strategies and actions:

- Contribute to national waste policy and programs aimed at waste avoidance, resource recovery and environmental protection.
- Review the scope and application of the waste levy to ensure it meets the objectives of Waste Strategy 2030.
- Review and revise regulations and policies to achieve a level playing field for industry, which ensures entities that are compliant and apply best practice are not disadvantaged.
- Introduce regulations to prevent unnecessary waste generation.
- Review and update the regulatory framework for waste to ensure it is appropriate and reduces the environmental impacts and risks from waste management.
- Revise waste classifications and definitions to reflect current knowledge to ensure waste materials are managed according to their risk and are treated and/or disposed of appropriately.

Among the jurisdictions, Vic is the only one that has not published a waste strategy as of the time of writing. The Tas waste strategy is out-dated but not excluded from this comparison. It seems that the most frequently indicated strategy across jurisdictions is the review of waste regulations for their effectiveness, including checking their consistency, relevance, and strength. The second-ranked demand is to revise existing levy arrangements to make sure they are a disincentive to landfilling. ACT, SA, Tas, and WA are the jurisdictions that proposed this revision. Other revisions include providing legislative power to other agencies (NSW), community engagement (NT), development of a new act and regulations (Qld), building capacity in regulations to inform long-term investment decisions and to provide a level playing field for industry (SA and WA), contribution to the development of a national waste policy (WA), and revising waste classifications and definitions to reflect current knowledge about waste management activities (WA).

### 3.7 Waste recycling

Waste recycling is the third most favourable option in the hierarchy of waste management. Waste recycling has numerous benefits, including a reduction in waste being sent to landfill, positive environmental results, creation of jobs, and potentially saving energy, waste and other resources that would have otherwise been used to extract or produce new products. However, the benefits of recycling activities need to be tangible to motivate those who are involved in the process of generation of waste to provide its re-use or disposal. The factors that are most influential in determining the extent of effective recycling are found to be the value of materials to be recycled<sup>13</sup>, technical capabilities<sup>14</sup>, level of stakeholder commitment, and government policies and regulations<sup>15</sup>. Several pieces of research have indicated that government plays a considerable role in paving the way for waste recycling activities through setting sound policies and regulations that provide opportunities for re-use of recycled materials. For instance, since 2002, a regulation (Aggregates Levy<sup>16</sup>) has been imposed in the UK to make recycled C&D waste more competitive relative to the virgin aggregates. The levy is a tax (£2 per tonne) on the commercial exploitation of rock, sand, and gravel, and it aims to adjust the price of virgin aggregates to better reflect their intrinsic environmental costs. The tax is

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<sup>13</sup> Lu, W., Yuan, H., Li, J., Hao, J.J., Mi, X. and Ding, Z., 2011. An empirical investigation of construction and demolition waste generation rates in Shenzhen city, South China. *Waste management*, 31(4), pp. 680-687.

<sup>14</sup> Tran, V. 2017. Evaluating the Economics of Construction and Demolition Minimisation and Zero Waste in the New Zealand Construction Industry. PhD thesis. Faculty of Design and Creative Technologies. Auckland University of Technology.

<sup>15</sup> Au, L.S., Ahn, S. and Kim, T.W., 2018. System Dynamic analysis of impacts of government charges on disposal of construction and demolition waste: A Hong Kong case study. *Sustainability*, 10(4), p. 1077.

<sup>16</sup> Aggregate Levy Manual.2014. <https://www.gov.uk/hmrc-internal-manuals/aggregates-levy>

further expanded to target imported materials. A similar tax has also been implemented in some EU countries including France, Denmark and Sweden<sup>17</sup>.

In Australia, reuse of recycled materials is strongly encouraged under Ecologically Sustainable Development (ESD) and Sustainable Procurement (SP) programs. At the national level, NWP 2018 sets a target to reduce waste generation through prevention, reduction, recycling and reuse. This policy has also emphasised the application of the principles of a circular economy to support better and repeated use of our resources. Two strategies to promote sustainable procurement in Australia are at the forefront of this policy: Strategy 8 (Sustainable Procurement by Governments) and Strategy 9 (Sustainable Procurement by Business and Individuals). These two strategies urge the public and private sectors to promote demand for recycled materials and products containing recycled content.

### 3.7.1 Current and target rate of C&D waste recycling

Statistics indicate that the recycling rate has increased at a slow pace in Australia, with an annual growth rate of 3% during the last decade. Table 6 represents the changes in recycling of C&D waste in Australia. According to submissions to the Australian Senate’s Environment and Communications References Committee and other previous reports, the four main factors that influence C&D recycling activities are price signal (i.e. landfill levy and illegal dumping penalty), enforcement, availability of required infrastructure in the proximity of the waste generation location and the development of a domestic market for recycled materials.

**Table 6. C&D waste recycling rate in Australia**

C&D waste	2007	2009	2010	2011	2014	2015	2016	2017	Average annual growth rate (%)
Recycled (Mt)	10.1	11.1	11.3	12.1	11.5	12.4	13.5	13.6	3
Recycled- per capita (t)	0.49	0.52	0.51	0.54	0.49	0.53	0.56	0.56	1.3
Recovery rate (%)	60	60	62	66%	65	65	68	67	1.1

Source of data: National Waste Reporting 2018. This report acquired data from different EPAs across Australia

As a result of support from different entities in Australia, a race has begun between waste management authorities in different jurisdictions to increase the recycling rate. The first step in this race was to set a target rate for recycling. However, among the jurisdictions, NT, Tas and Vic have not specified a target for C&D waste recycling. The rest have set a target, although, in some cases, (e.g. Qld and WA) it seems to be too ambitious. Currently, only SA has achieved the target rate (90%) that is set for 2020; this state has the highest C&D waste recycling rate (91.1%), followed by Vic (82%). The lowest recycling rate for C&D was registered in NT and Tas. Table 7 shows the current and target rate for recycling C&D waste. It is worth keeping in mind that these varied rates are the product of various factors, including an increase in the waste generation rate (NSW), interstate waste transfer (Qld), lack of obligatory disposal levy (Tas) and the lack of an effective waste data management system (NT).

<sup>17</sup> Hyder Consulting. 2012. Construction and demolition waste status report. p. 43.

**Table 7. Future target proposed for the recovery of C&D waste in different jurisdictions**

	Date	Target Rate (%)	Current rate (%)	Document
<b>ACT</b>	2020	85%	na	CT Waste Management Strategy: Towards a sustainable Canberra 2011-2025
	2025	90%		
<b>NSW</b>	2021-2022	75-80%	69% <sup>(2013)</sup>	NSW Waste Avoidance and Resource Recovery Strategy 2014-21
<b>NT</b>	✘	✘	1% <sup>(2011)</sup>	Waste Management Strategy for the Northern Territory 2015-2022
<b>Qld</b>	2020	75%	51%	Queensland Waste Avoidance and Resource Productivity Strategy 2014–2024 Recycling and Waste in Queensland 2017 Queensland’s Waste Reduction and Recycling Strategy 2010–2020
	2024	80%		
<b>SA</b>	2020	90%	91.1%	South Australia’s Recycling Activity Survey 2016-17 Financial Year Report
<b>Tas</b>	✘	✘	1%	The Tasmanian Waste and Resource Management Strategy 2009 Rethink Waste Tasmania Fact Sheet
<b>Vic</b>	✘	✘	82%	State-wide Waste and Resource Recovery Infrastructure Plan (2016-2046)
<b>WA</b>	2020	75%	64%	Western Australian Waste Strategy: Creating the Right Environment (2012)
<b>National</b>	✘	✘	67%	

### 3.7.2 Legislative support for use of recycled C&D waste materials

At the jurisdictional level, different local governments have initiated projects to reuse and recycle C&D waste materials. For instance, the ACT government promotes reuse of C&D waste on-site through the ACT Smart Business Recycling program, which allows business owners to efficiently recycle their waste. In WA, the Waste Authority provides members of the Master Builders Association Western Australia with information and tools to reduce waste, and increase reuse and recycling. The Australian Building Codes Board (ABCB) enforces the Building Code to implement sustainable building practices.

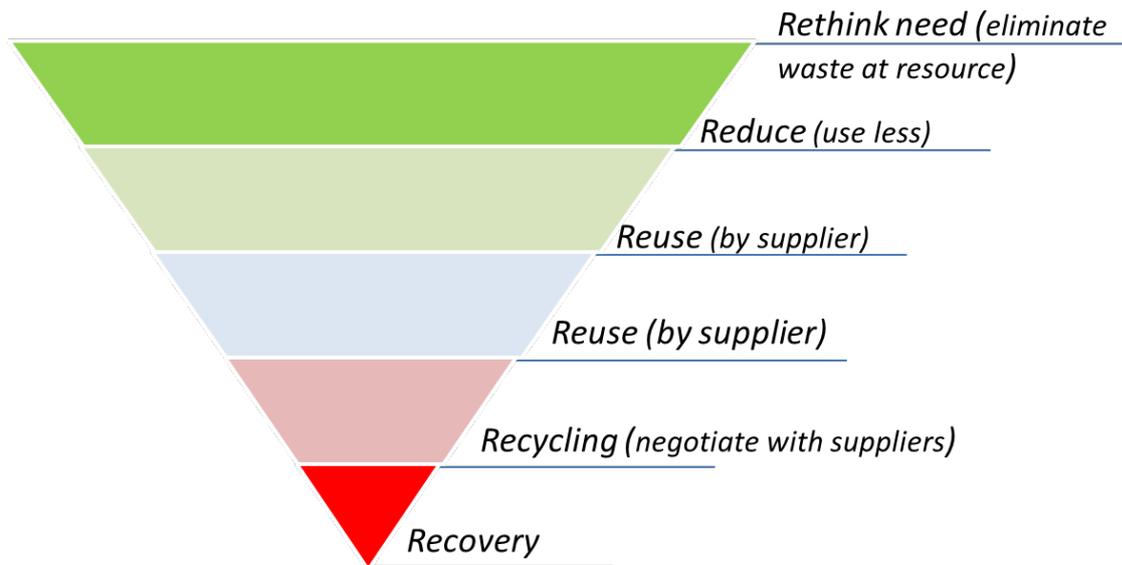
As mentioned above, the NWP 2018 encourages the use of recycled C&D waste through sustainable procurement. The other strong motivation for using recycled materials is the adoption of sustainable procurement principles by government agencies, business and individuals (Strategy 8 and 9- National Waste Policy 2018). The definition of Sustainable Procurement accepted by the UN, the UK government and the Australasian Procurement and Construction Council (APCC) is:

*‘A process whereby organisations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organisation, but also to society and the economy, whilst minimising damage to the environment’.*<sup>18</sup>

The Australasian Procurement and Construction Council, Australia and New Zealand Government Framework for Sustainable Procurement is implemented by the federal government to pursue three aims when procuring goods, services, works and utilities. These aims involve reduction of environmental impacts, social impacts and economic impacts through the procurement process. This framework also shares some premises with the circular economy in considering alternatives to the ‘take, make and dispose’ approach. According to this framework, government has a decisive role in providing a market driver for increased use of recycled materials in the goods and works that it

<sup>18</sup> Commonwealth of Australia. 2013. Sustainable Procurement Guide, p. 8.

procures. Therefore, the federal government and some local governments developed SP guidelines to coordinate their decisions and actions towards SP and the purchasing of recycled materials. In 2012, South Australia’s local government was the first authority to release a Sustainable Procurement Guide<sup>19</sup>. One year later, in 2013, the federal government also released the first Australian guideline on SP<sup>1</sup>. This work was further complemented by state specific guidelines to tailor sustainable procurement requirements in the ACT<sup>20</sup> (2015), NSW<sup>21</sup> (2017) and WA<sup>22</sup> (2017). In the context of waste management, the national guideline uses a procurement hierarchy to benchmark it against the waste hierarchy (Figure 5).



**Figure 5. Procurement hierarchy**

Source: adopted from Commonwealth of Australia. 2013. Sustainable Procurement Guide p. 21.

The levels in the procurement hierarchy represent opportunities to minimise waste generation and are outlined as follows:

- A. avoid or reduce consumption;
- B. identify whether there is a more sustainable alternative readily available;
- C. rethink and revise specifications in order to improve sustainability outcomes.

The jurisdictional SP guidelines, however, do not provide specific information about C&D waste materials. In the ACT, the SP policy has suggested directorates to incorporate the practice of sustainability into the procurement of goods, services and construction. In WA, the WALGA procurement toolkit has been prepared for different categories, including the ‘Provision of Construction Works’, to identify the materials impact and detail how sustainability objectives are integrated into the procurement process. The next version of the SP guidelines can improve by following the procurement hierarchy, with the aim of explaining how the recycled C&D materials should be used in projects running in each state and territory. This may include a range of examples, from the use of raw material in one project to the reuse of recycled waste in another project.

<sup>19</sup> SA Government. 2012. Sustainable Procurement Guideline.

<sup>20</sup> ACT Government. Sustainable Procurement Policy 2015.

<sup>21</sup> NSW Government. 2017. Sustainable Procurement Guide for Local Government in NSW.

<sup>22</sup> WA Government. 2017 WALGA Guide to Sustainable Procurement.

In this section, the waste strategy documents of different jurisdictions were reviewed to provide an understanding of how states and territories have designed their plans for recycled waste materials. The following are the results of this review, as presented for each jurisdiction.

In the ACT<sup>23</sup>, Strategy 1.7 (Encourage on-site reuse of C&D waste) proposes that there is an opportunity for temporary on-site facilities in new suburban developments in the ACT where several homes are being built concurrently. These facilities will encourage local recycling of waste into products that can be used, through the development and exchange of surplus C&D waste materials within the development site. This strategy also aligns with Strategy 2.6 (Government procurement), which encourages government purchasing and use of recycled products where possible. The government, as part of this strategy, should also review the specifications used for government tendering to identify where recyclable alternatives can replace non-recyclable materials.

In NSW<sup>24</sup>, the '*Waste less, recycle more*' initiative (2017-2021) financially supports the establishment of a network between C&D companies to adopt industrial ecology. This network promotes buying products that are recycled, recyclable, repairable, refillable, reusable or biodegradable. This initiative also provides a fund for the establishment of new markets for recycled waste materials and innovation in recycling technology. The waste strategy outlines the duties that different stakeholders can fulfil, including specifying and purchasing recycled materials (local government), separating recycling states at source to ensure that waste and recycling is handled by legitimate operators (industry and businesses) and improving the efficiency of recycling activities to expand their recycling facilities to cover more waste materials (waste recycle industry).

The main recommendations made in NT's<sup>25</sup> waste strategy include 'facilitate opportunities to explore technologies for the beneficial re-use of wastes', 'collaborate with the Waste and Recycling Industry of the NT (WRINT) to identify emerging trends and issues requiring multi-faceted solutions', 'facilitate opportunities to connect waste recovery and reuse markets with key waste producers', 'work with industry and government agencies to demonstrate the economic incentives available through improved waste management and resource recovery' and 'support proposals by regional councils to consolidate recycling infrastructure at central locations'.

In Qld<sup>26</sup>, the waste strategy emphasises investment in regional recycling infrastructure and developing markets for recycled products. It encourages local government to engage with the C&D sector to support research and improved best management practices, and to identify opportunities for recycling and incentivise purchase of recycled-content products. A significant strategy for encouragement of further recycling in Qld is to revise policies about price signal through landfill levy. Development of new markets for recycled material is also proposed as an effective enabler towards more waste recycling. The strategy states that businesses should modify consumer behaviour by marketing recyclable and recycled-content products.

In SA<sup>27</sup>, a number of strategies have been set out to increase waste recycling activities, including 'encourage (reduce the barriers to) the greater use of products made from recycled materials', 'encourage and promote the development of sustainable local, national and international markets for re-manufactured and recycled products', 'increase procurement by all levels of government of re-manufactured products through SP', 'attract and encourage business to develop and grow new, high value-added, re-manufacturing enterprises' and 'setting procurement policies and practices that

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<sup>23</sup> ACT Waste Management Strategy 2011-2025 – ACT.

<sup>24</sup> NSW Waste Avoidance and Resource Recovery Strategy 2014–21 – NSW.

<sup>25</sup> Waste Management Strategy for The Northern Territory 2015–2022 – NT.

<sup>26</sup> Queensland's Waste Reduction and Recycling Strategy 2010–2020 – Qld.

<sup>27</sup> South Australia's Waste Strategy 2015-2020 – SA.

support the use of re-manufactured products’. Regarding C&D waste, this strategy highlights the need to ‘encourage salvaging and re-use of building materials’ and ‘Promote source separation wherever practical’.

In Tas<sup>28</sup>, stimulating the right market conditions for recycled waste materials and implementing an obligatory and consistent landfill levy across the state are the two main strategies to promote an increase in recycling activities.

In WA<sup>29</sup>, six strategies are documented in WA’s waste strategy that can improve recycling activities. It appears to be the most well thought out plan among the jurisdictions. Its strategies include ‘implementing sustainable procurement practices’, ‘development of standards for waste derived products’, ‘provide funding to promote use of recycled material and development of new markets’, ‘develop legislative support to increase use of recycled materials’ and ‘implement supportive measures and policies for local market development and government SP’.

### 3.7.3 Opportunities for use of recycled C&D waste

The majority of C&D waste is recyclable if properly separated at source with minimum contamination. The scientific literature has indicated the potential use of recycled C&D waste for many purposes such as concrete<sup>30</sup>, asphalt mixture<sup>31</sup> and insulation<sup>32</sup>. The following table shows other potential for use of different C&D waste recycled materials.

**Table 8. Recycled and non-recycled C&D waste materials potential uses**

Waste material	Reuse & Recycling
Brick	Clean and/or render over for reuse; crushed fill, levelling materials, drainage layers
Cardboard	Cardboard recycling
Concrete	Crushed fill, levelling materials, drainage layers, road pavement subbase, and irrigation and landscape applications.
Crushed rock and stone	Road pavement subbase, drainage, irrigation and landscaping applications
Ferrous and non-ferrous metals	Recycled back into metal products
Hardwood	Reuse as floors, roof framing, fencing or furniture
Other timber (not CCA treated pine)	Reuse as formwork, bridging, propping, blocking, chip (mulch) for use in landscaping
Plasterboard	Crush and use in compost or soil conditioner or as a gypsum replacement
Roof tiles	Reuse off-site; crushed for landscape or drainage use
Reclaimed asphalt pavement	New asphalt mixture
Soil	Soil conditioners or mixed with organic material to improve soil structure
Synthetic and recycled rubber (e.g. carpet underlay)	Used in manufacture of safety barriers, speed humps

<sup>28</sup> LGAT Waste and Resource Management Strategy 2017- A submission to LGAT – Tas.

<sup>29</sup> Western Australia’s Waste Strategy: Waste Strategy 2030 – WA.

<sup>30</sup> Behera, M., Bhattacharyya, S.K., Minocha, A.K., Deoliya, R. and Maiti, S., 2014. Recycled aggregate from C&D waste & its use in concrete—A breakthrough towards sustainability in construction sector: A review. *Construction and Building Materials*, 68, pp. 501-516.

<sup>31</sup> Akbulut, H. and Güner, C., 2007. Use of aggregates produced from marble quarry waste in asphalt pavements. *Building and Environment*, 42(5), pp. 1921-1930.

<sup>32</sup> Leiva, C., Solís-Guzmán, J., Marrero, M. and Arenas, C.G., 2013. Recycled blocks with improved sound and fire insulation containing construction and demolition waste. *Waste management*, 33(3), pp. 663-671.

### 3.7.4 Application of C&D waste in road pavement projects

In Australia, one widespread use of recycled C&D waste materials is in road pavement projects. This application is supported both at the national and jurisdictional level. In 2009, Austroads, which is the association of Australian and New Zealand Road Transport and Traffic Authorities, published the first national road pavement guidance (Guide to Pavement Technology Part 4E: Recycled Materials). This guideline provides the specification of recycled materials accepted for road pavement. In addition to this guideline, different jurisdictions also prepared specific guidelines. In NSW 'the Roads & Transport Directorate'<sup>33</sup>; in Qld 'the Department of Transport and Main Roads'<sup>34</sup>; in SA 'Department of Planning, Transport and Infrastructure'<sup>35</sup>; in Vic 'Vicroads'<sup>36</sup>; and in WA 'Main Roads'<sup>37</sup> have established the guidelines to specify the requirements for using recycled C&D waste for road pavement projects and other construction activities. In NSW, an Environment Fact Sheet EFS-709<sup>38</sup> was developed by the Department of Transport and Main Roads to guide potential off-site reuse of excavated, recovered and C&D waste materials. Furthermore, in 2010, the Office of Environment and Heritage (then known as the Department of Environment, Climate Change and Water NSW) contracted the Institute of Public Works Engineering Australia (NSW division) to improve the specification for the use of recycled materials in a range of public works (e.g. pavements, earthworks and drainage)<sup>39</sup>. In Vic, a partnership program<sup>40</sup> between Sustainability Victoria, the Municipal Association of Victoria, the Australian Road Research Board and VicRoads was initiated in 2009. The aim of this program was to use recycled products in road construction projects in partnership with local government. This program seeks the following objectives:

- (a) reduction in stockpiles of crushed concrete, brick and glass
- (b) changing the procurement practices of local government in relation to road construction, and delivering major CO<sub>2</sub> emission reductions
- (c) achieving more sustainable uses of current quarry reserves and reducing the number of new quarries opened

Sustainability Victoria conducted research<sup>41</sup> on application of C&D recycled waste materials in a road construction project and found that it can reduce the total quantity of material required and lead to a reduction in reflective and fatigue cracking, an increase in longevity of the roads and a decrease in traffic noise.

In addition, some of the jurisdictions are investigating the development of a domestic market for re-used waste and recycled materials. This market should be inspired by the principles of circular economy. Below are the examples of application of C&D recycled waste materials in road construction projects in Australia:

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<sup>33</sup> Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage 2010.

<sup>34</sup> Transport and Main Roads Specifications MRS35 Recycled Material Blends for Pavements- 2018.

<sup>35</sup> Specification: Part 215 Supply of Pavement Materials- 2017.

<sup>36</sup> VicRoads Standard Specifications for Roadworks and Bridgeworks.

<sup>37</sup> Main Roads Western Australia Specification 501 – Pavements -2012.

<sup>38</sup> Re-use of waste off-site, Transport Roads and Maritime Services.

<sup>39</sup> Environment, Climate Change & Water. Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage 2010.

<sup>40</sup> About the Recycled Roads to Zero Waste Project. 2009.

[http://zerowasteroads.org.au/wp-content/files/2015/01/fact\\_sheet\\_about\\_the\\_recycled\\_roads\\_to\\_zero\\_waste\\_project.pdf](http://zerowasteroads.org.au/wp-content/files/2015/01/fact_sheet_about_the_recycled_roads_to_zero_waste_project.pdf)

<sup>41</sup> Sustainability Victoria. 2016. The business case for using recycled materials in roads.

<https://www.ipwea.org/blogs/intouch/2016/06/24/the-business-case-for-using-recycled-materials-in-roads>

**Table 9. Example projects of recycled C&D waste materials in road pavement applications**

	Project(s)
NSW	<ul style="list-style-type: none"> <li>❖ Waverley Council substituted 15 tonnes of glass cullet into the road projects, 7.5 tonnes into asphalt and 7.5 tonnes into concrete.</li> <li>❖ The City of Canning has been using recycled road base for the past 10 years and currently buys around 9,300 tonnes of the material each year and builds 100 per cent of its roads out of recycled product.</li> </ul>
SA	<ul style="list-style-type: none"> <li>❖ On the Northern Expressway project, 12,000 tonnes of RAP plus 5,000 tonnes of waste asphalt were reused in the asphalt laid on site.</li> <li>❖ Projects that have used recycled C&amp;D waste in structural pavement layers include the Port River Expressway where approximately 90% of 620,000 tonnes of fill used in Stage 1 was recycled material.</li> </ul>
Tas	<ul style="list-style-type: none"> <li>❖ Rosny Tennis court car park was constructed using– base/ pipe embedment material, kerbing and asphalt. It also used 53 tonnes of crushed glass.</li> </ul>

### 3.8 Waste energy recovery

Waste recovery is the fourth most desirable option in the management of waste, according to the waste hierarchy. By definition, waste recovery is *'to make use of a waste material, including recycling of waste matter and recovering energy or other resources from waste'* (National Waste Policy, 2018, p. 18). Energy recovery is a valid pathway for residual waste in contexts in which further material recovery through other methods is not cost effective or technically practical, there is community acceptance of the processes involved in energy waste, a consistent supply of feedstock and the intended materials have a high calorific value. It has the potential to deliver renewable or low carbon energy in a cost-effective way. However, there are a number of globally known issues that deter adoption of this waste management method. These include public resistance, the cost associated with the establishment of required facilities (e.g. capital and operational costs), the commitment to provide feedstock fulfilled by long-term contract, diverting activities from recycling to energy recovery, feedstock scarcity in relation to C&D waste, air pollution and stench, and ongoing amenity issues.

One pressing issue for Energy from Waste (EfW) uptake and development concerns social acceptance and community attitude towards EfW. The relevant literature labels this issue the Not-in-My-Back-Yard (NIMBY) attitude syndrome (Wolsink, 1994). In the past, there have been some instances of public resistance (protest) against establishment of EfW facilities (Lober and Green, 1994, Li et al., 2012, Kikuchi and Gerardo, 2009). However, the most recently published studies indicate a higher rate of social acceptance of EfW in countries such as China (Ren et al., 2016), Canada (Nielsen, 2014), Greece (Achillas et al., 2011) and Australia (Genever, 2017). The relatively lower rate of resistance against EfW in the more recent studies might be explained by improvements in EfW incinerator technologies (Baxter et al., 2016) and raised public environmental awareness. Several research studies have conducted a social cost-benefit analysis of EfW compared to other waste management options (Miranda and Hale, 1997, Vollebergh, 1997, Jamasb and Nepal, 2010, Porter, 2010, Dijkgraaf and Vollebergh, 2004, Cucchiella et al., 2017) and demonstrate the social benefits of energy recovery.

In a study in China during 2016, it was found that a community's opinion about waste derived energy recovery in their neighbourhood proximity was optimistic. The factors affecting risk perception were education level, previous experience of stench and gender. The interesting part of this study's results was related to the insignificant impact of distance to risk perception, implying the important role of knowledge and information about EfW and the notion that effective risk communication results in reduction of psychological resistance to EfW (Ren et al., 2016). In addition, a different study provided the root causes of resistance against EfW, including stench and other air pollution (Ren et al., 2016), property value (Li et al., 2012) and health issues (Johnson, 2013, Miranda and Hale, 1997).

One of the barriers to expansion of waste incineration activities is related to EfW facility establishment cost implications. Projects involving EfW require significant capital investment and operating costs, which typically require investment contribution from governments. In terms of operational costs, some previous research studies demonstrated that EfW is more expensive than landfilling (Funk et al., 2013, Miranda and Hale, 1997, Vollebergh, 1997, Luoranen and Horttanainen, 2008) but can become more reasonable when social costs are accounted (Porter, 2010, Jamasb and Nepal, 2010). Funk et al. (2013) reported that the estimated cost of EfW is about \$58 per tonne in Boulder (US), which is higher than the typical landfill levy imposed across the US. Furthermore, through advances in technology used for recovery energy activities, there are opportunities to improve its efficiency and cost effectiveness. For instance, Yano and Sakai (2016) reported that, with some technological modifications, compared to the current situation, the electricity produced in energy recovery facilities can be improved by 60% by 2030 in Malaysia.

In order to take advantage of the economy of scale, a long-term contract is required for sustainable operation of EfW facilities. These contracts are prevalent and guarantee waste supply to EfW facilities (Vollebergh, 1997). The long-term commitment to provide ongoing feedstock, however, gives rise to other issues, such as diversion from recycling activities that are more preferred options in the hierarchy of effective waste management (Genever, 2017).

The last known issue is the uncertainty about feasibility of continuous procurement of feedstock for EfW facilities for C&D waste. It will take several decades until a large quantity of construction materials come to their end of life status and become an input for EfW.

### 3.8.1 EfW Technologies

The main technologies used to perform energy recovery are either based on ‘thermal treatment’ or ‘biological processing’ of biodegradable waste:

- Combustion that produces heat
- Gasification that produces a combustible syngas
- Pyrolysis that produces syngas, oil or char
- Anaerobic digestion/fermentation that produces biogas
- Mechanical sorting and processing that produces combustible refuse derived fuel

### 3.8.2 Waste Energy Recovery rate

Basically, Australia and other countries have not prioritised energy recovery as an option in waste management. The following table compares the proportion of energy recovery between different countries:

**Table 10. Waste fate in different countries**

Rate (%)	Australia	Denmark	Norway	UK	US
Energy recovery rate (%)	4	26	37	1	4
Recycling rate (%)	58	68	41	74	45
Disposal (%)	38	6	22	25	51

Source: Blue Environment Pty Ltd. National Waste Report. 2018, p. 36. Data presented for different countries are from different years within the 2014-2017 period.

In Denmark and Norway, the high rate of energy recovery reflects their reliance on thermal energy from waste. In Australia, attitudes about waste and resource management have changed; the value of resources and embodied energy in waste are now more appreciated than before. The figures from a 10-year period (2007 to 2017) show that energy recovery in Australia has fluctuated over time yet

have experienced a positive annual growth rate of 0.8%<sup>42</sup>. According to the NWP 2018 Strategy 7 (Increasing industry capacity), policy makers and authorities should identify and address opportunities across different waste streams for improved collection, recycling and energy recovery to make continuous improvements in diversion from landfill<sup>43</sup>. Furthermore, the second principle of this policy (improve resource recovery) necessitates having the right infrastructure facilities and rules (developed based on common approaches) in place to improve recycling and resource recovery.

In the Australian regulatory and reporting context, resource recovery typically refers to all activities that maintain the value of waste, including reusing, recycling and energy recovery. However, this is not always the case; for instance, in NSW, the main environmental act<sup>44</sup> separates energy recovery from resource recovery. Hence, confusion may be created when reporting energy recovery activities. Sometimes the quantities are reported for resource recovery, which includes recycling and energy recovery. Among the waste fates, the energy recovery rate is estimated to be 4%, preceding the recycling (58%) and disposal (38%) rates (NWR, 2018). During the period 2006–07 to 2014–15, energy recovery also increased markedly from about 1.4 Mt to 2.3 Mt, or an average of 6% per year. However, there appears to be a continuous decline in the growth rate. According to the most recent estimations, between 2016 and 2017, about 1.97 Mt of core waste underwent EfW processes, of which 90% was through landfill gas collection (NWR, 2018). With the exception of Qld (3%), the energy recovery rate in 2017 was 4% across all Australian states and territories.

According to the latest statistics (2016-2017)<sup>45</sup>, the share of C&D streams in the amount of energy recovery is negligible (2.3%) compared to MSW (62.1%) and C&I (35.6%) streams. The waste recovery rate (recycling + energy recovery) for C&D waste material has grown by 7% from 60% in 2007 to 67% in 2017 (Table 1). There is no data available for C&D waste energy recovery in different jurisdictions; however, the calculated energy recovery rates for all waste streams show varying trends in Australian territories and states. Among the jurisdictions, only NSW and Vic have a positive annual growth rate<sup>46</sup> (2007-2017).

### **3.8.3 An overview of energy recovery activities in Australia**

#### **People's perception and support**

Studies that provide a clear picture of Australians' perceptions on EfW are limited. In 2012, Wainberg (2012) claimed that incineration is not tolerated among the public due to their environmental concerns. The Australian Council of Recycling suggested that Australia has to take a cautious approach to EfW and pointed out that, while the industry is not advocating EfW, it believes it has a place (Environment and Communications References Committee, 2018). The public concerns about the consequences of energy recovery facilities are detailed in some other documents (ACT NoWaste, 2018, Act Government, 2018). However, this perception is expected to gradually change in a few years; for instance, the findings of a feasibility study for EfW facility in Vic (Genever, 2017) portrayed a milder picture. The study showed that there is a broad but conditional support from the public for EfW as an alternative to landfilling in Melbourne. How the relevant technologies work, the risks involved in the project and how the hazardous output would be dealt with were the main concerns. Currently, several jurisdictions (e.g. Vic and ACT) have initiated community consultation for energy recovery. In 2018, EPA released the findings of a review of the literature on potential health effects associated with air

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<sup>42</sup> Blue Environment Pty Ltd. National Waste Report.2018, p. 91.

<sup>43</sup> Above n, p. 14.

<sup>44</sup> EPA Protection of the Environment Operations Act 1997 No 156.

<sup>45</sup> Blue Environment Pty Ltd. National Waste Report 2018.

<sup>46</sup> Above n, p. 94.

emissions from EfW facilities in local communities (EPA Vic, 2018). The results are available to the public and may play an important role in social acceptance of EfW.

### **Energy recovery activities in different jurisdictions**

In Australia, the waste and resource recovery industries are slowly adopting new technologies to efficiently extract energy from waste. At the same time, the Australian government together with state and territory governments have recently realised the environmental, social and environmental benefits of EfW activities and begun to support, regulate and fund EfW activities. Several funding schemes have been announced to assist in the establishment of modern energy recovery facilities; the source of funding in some jurisdictions such as Qld and NSW is landfill levy revenue. Federal government also receives and funds large EfW plant proposals on a case-by-case basis.

Historically, the main approach to recovering energy from waste in Australia is to capture gas from landfills. Among the jurisdictions, Vic has the leading energy recovery system in Australia, with more than 23 active landfills. Two financial measures of EfW performance typically used to build a case for establishment of a new/upgrade EfW facility are 1) the capacity of power supply and 2) the number of jobs it would create during construction and operation. Table 11 shows some examples of EfW facilities and activities across Australia.

**Table 11. Examples of EfW facilities in Australia**

	<b>Status quo and future plans</b>	<b>C&amp;D waste</b>
<b>ACT</b>	The only energy generated from waste is achieved through two close landfill cells. A proposal was made to build a 200 million EfW facility that will produce up to 30 megawatts of electricity <sup>1</sup> . It would also burn waste shipped in from NSW through rail lines.	ACT began thermal processing of C&D waste (e.g. wood) in 2015.
<b>NSW</b>	In 2017, the federal government announced that, through the Clean Energy Finance Corporation, it would lend \$30 million to ResourceCo to build two EfW plants to transform non-recyclable waste into processed engineered fuel <sup>2</sup> .	No known activities
<b>NT</b>	A landfill site (Shoal Bay Waste Management Facility,) commissioned in 2005, can capture methane and produce 789 MWh, which can supply the electricity demand of more than 1000 households <sup>3</sup> .	No known activities
<b>Qld</b>	In 2018, a proposal put forward the construction of a \$400 million EfW facility in Qld that can provide electricity for 50,000 households <sup>4</sup> .	No known activities
<b>SA</b>	The SITA-Resource Co facility at Wingfield is Australia’s first Refuse Derived Fuel (RDF) manufacturing plant in Australia.	C&D derived wood waste is used by SITA-Resource Co to produce processed engineered fuel
<b>Tas</b>	Some efforts were made to include waste wood in the Renewable Energy Target for energy recovery and power supply across the state <sup>5</sup> .	Wood waste is used to help power a pulp mill
<b>Vic</b>	Landfill gas capture is a mature technology and is a common practice in Victoria. In 2004, there were 23 landfill sites that capture methane. A plan for building an energy recovery facility in Melbourne’s west is being considered by the EPA. It is anticipated that this plant could convert 200 Kt of residual waste to provide electricity for 20,000 houses. This state also provides funds for WtE infrastructure establishment, with the target to generate 8,003,422 kWh electricity <sup>6</sup> .	No known activities
<b>WA</b>	This state has an active plant for EfW (Richgro) from C&I organic waste to produce renewable energy and pewter that is exported back into the grid. This facility was finally supported by different authorities, including state and commonwealth governments and the Clean Energy Finance Cooperation. The state approved two EfW facilities for MSW in 2015. Both are in the south of the metropolitan area and in close proximity to Rockingham and Kwinana <sup>7</sup> . The first Australian big EfW plant is scheduled to be built in Kwinana Industrial Area around 40 km south of Perth that can convert up to 400 Kt of unrecyclable waste for generating power that is enough for 50,000 households <sup>8</sup> .	No known activities

1. ACT Government. Waste to Energy 2019. <https://www.yoursay.act.gov.au/waste-energy>
2. Department of the Environment and Energy. 2017. Turning Waste into Fuel. <http://www.environment.gov.au/minister/frydenberg/media-releases/mr20170504.html>
3. City of Darwin. 2018. <https://www.darwin.nt.gov.au/live/waste-recycling/shoal-bay-waste-management-facility/renewable-energy-facility/>
4. Waste Management Review. 2018. REMONDIS intends to develop \$400M QLD waste to energy facility. <http://wastemanagementreview.com.au/remondis-intends-develop-400m-qld-waste-energy-facility/>
5. ABC news.2015. <https://www.abc.net.au/news/2015-07-19/tasmanian-forest-industry-fired-up-about-biomass/6628822>
6. Sustainability Victoria. 2018. Waste to energy infrastructure fund: <https://www.sustainability.vic.gov.au/About-us/Grants-and-funding/Waste-to-energy-infrastructure-fund>
7. Waste Authority. 2017. Waste Avoidance and Resource Recovery Strategy: Consultation paper.
8. Renew Economy. 2018. <https://reneweconomy.com.au/australian-first-big-waste-to-energy-plant-reaches-financial-close-in-w-a-59064/>

## **Opportunities**

The main opportunities for EfW development are the products generated following EfW activities (i.e. electricity, heat and processed-engineered fuels), reduction in waste going to landfill, securing of some environmental benefits, including reduction of greenhouse gas emission, and job creation. In Australia, waste and landfill services account for 2% of greenhouse gas emissions (Department of the Environment and Energy, 2017). Submissions to the Environment and Communications References Committee (2018) from local governments advised that EfW can provide opportunities to assist with power supply, and create manufacturing and operation related jobs. For instance, in WA, it is projected that an EfW facility can create 800 job opportunities during construction and 60 full time jobs during operation. According to projections stipulated in proposals for establishment of EfW facilities across Australia, they can supply power for between 1000 (NT) and 50,000 (Qld, WA) households.

## **Technological inadequacies**

While the technology for energy recovery has been around for decades and has been thoroughly road-tested in certain parts of the world (e.g. Europe and Asia), it is still at an early stage of development in Australia. There are very few instances of EfW facilities presently in operation within Australia (Table 1). Traditionally, the main current technology used in Australia is landfill gas collection and energy recovery (EPA SA, 2018). The existing facilities, however, have limited acceptance of waste and barely use residual C&D waste. Certain jurisdictions (i.e. Qld, NSW, Vic, WA and SA) have undertaken some form of investigation into the potential for EfW industry development. The focus of these investigations has mainly been on thermal technologies. In 2013, the WA Authority commissioned ESP Environmental to review the state-of-the-art EfW technologies (WSP Environmental, 2013b). This study presented 15 case studies from around the globe that have successfully achieved EfW.

## **Industry perspective**

The waste and resource recovery industry in Australia is the frontline in energy recovery in Australia. They have the determining influence on EfW and need motivation to operate and develop their EfW activities. One feasibility study project in Australia reported that industry suggests that a minimum 20-year contract is required for expansion and sustainable operation of EfW facilities in Vic (Genever, 2017). They also advised that cost disparity between landfilling and energy recovery should be properly addressed. The other concern raised by the industry in a SA consulting study (EPA SA, 2018) is the need for the development of a domestic market for energy recovered from waste, particularly since China's National Sword Policy has been implemented whereby import of waste is banned. There is evidence for operation of this yet to be fully developed market in SA, NSW and Tas (Table 1). Regarding C&D waste, the industry consultees of SA's study also raised the issue of uncertainty about on-going availability of feedstock due to the long lifecycle of construction materials.

## **Australian Government**

The Senate's Environment and Communications References Committee (2018) acknowledged that regulatory and financial support from federal government is required to expand EfW activities. The lack of regulatory and financial support is mentioned in several other resources (ACT NoWaste, 2018, Genever, 2017). On 27 April 2018, the Minister for the Environment and Energy announced that the Australian Government has tasked the Clean Energy Finance Corporation and the Australian Renewable Energy Agency with prioritising EfW projects. By law, the Australian government is not directly involved in regulation of waste unless there is a threat to the environment that is of national concern. If not managed properly, however, energy recovery can become an environmental issue of national concern. Hence, Australia's government can and should take a more proactive role in

governing EfW activities by setting a sound national policy. State governments can then adopt the national policy. Currently, there are several nationwide regulations that have relevance to EfW, its benefits and adverse effects. Table 12 summarises these regulations:

**Table 12. National regulatory framework with an indirect impact on energy recovery**

<b>Piece of Legislation</b>	<b>Relevance to energy recovery</b>
<b>National Environment Protection Council Act 1994</b>	Outlines an agreed consistent national approach for protecting or managing particular aspects of the environment.
<b>The National Waste Policy 2018</b>	Provides direction for Australia to produce less waste for disposal and manage waste as a resource to deliver economic, environmental and social benefits.
<b>Renewable Energy (Electricity) Act 2000</b>	Provides a legislative basis for the uptake of renewable energy within Australia. It does this by legislating for the recognition and accreditation of renewable energy producers. It determines what is included in the definition of renewable energy.
<b>National Pollutant Inventory (NPI)</b>	Provides information on the types and amounts of certain substances being emitted to the environment.
<b>The National Greenhouse and Energy Reporting (Measurement) Determination 2008</b>	Supports the aims of the Clean Energy Act 2011 and the National Greenhouse and Energy Reporting Act 2007.
<b>National Environment Protection Measure for Ambient Air Quality</b>	Establishes ‘monitoring investigation levels’ for five specified air toxics. Monitoring data gathered under the Air Toxics NEPM will inform future decisions on the management of these pollutants.
<b>Environment Protection (Air Toxics) Measure</b>	Sets national standards for the key air pollutants to which most Australians are exposed. Under the Air NEPM, all Australians have the same level of air quality protection.
<b>Environment Protection and Biodiversity Conservation Act</b>	The Act is the primary Commonwealth legislation directed to protecting the environment in relation to Commonwealth land and controlling significant impacts on matters of national environmental significance.

Source: adopted from WSP Environmental (2013a)

On the other hand, there are some concerns that the federal government support should not aim to replace recycling with energy recovery and that recycling has to remain the main policy priority; if it does not take priority, the public will lose the community commitment to recycling (Environment and Communications References Committee, 2018).

### **3.8.4 Jurisdictional regulatory framework to support EfW**

Most of the regulations in states and territories in Australia follow the waste hierarchy, in which energy recovery is preferred over landfilling. Despite this theoretical regulatory support in legislation, there is a need to set sound and easy-to-follow policies that can boost EfW in Australia, particularly in certain jurisdictions.

In addition to this framework, each strategy provides principles and objectives that determine actions to manage waste within each jurisdiction. Comparisons between these strategies can reveal the inconsistencies that exist between the approaches taken in different jurisdictions. It also provides the opportunity to improve the actions and strategies being advised, according to successful outcomes in

jurisdictions that have led by example. In order to keep the review relevant to the context of C&D waste, only strategies that have directly or indirectly impacted on C&D waste management activities are described.

**Table 13. Regulatory framework (key documents) to guide energy recovery activities in different jurisdictions.**

	Document(s)	C&D waste
<b>ACT</b>	Planning and Development Act 2007 Waste feasibility study roadmap and recommendations 2018 Information Paper: Waste to Energy (WtE) in the ACT 2018	No specific information about C&D WtE
<b>NSW</b>	<b><i>NSW Energy from Waste Policy Statement 2018</i></b> Protection of the Environment Operations Act 1997 No 156	Specific information for C&D waste is provided
<b>NT</b>	No specific document	No specific information about C&D WtE
<b>Qld</b>	Waste—Everyone’s responsibility Queensland Waste Avoidance and Resource Productivity Strategy (2014–2024) Transforming Queensland’s Recycling and Waste Industry 2017	No specific information about C&D WtE
<b>SA</b>	Enhancing resource recovery and discussing the place of energy recovery 2018	No specific information about C&D WtE
<b>Tas</b>	Environmental Management and Pollution Control (Waste Management) Regulations 2010 No specific document	No specific information about C&D WtE
<b>Vic</b>	Environment Protection Act 1970 Getting Full Value Policy 2013 Environment Protection (Scheduled Premises) Regulations 2017 State Waste and Resource Recovery Infrastructure Plan 2017 <b><i>EPA’s Energy from Waste Guidelines 2013/2017</i></b>	No specific information about C&D WtE
<b>WA</b>	<b><i>WtE Position Statement</i></b>	No specific information about C&D WtE

In the **ACT’s** waste strategy document (ACT Government, 2011), it is estimated that, as of 2010, new EfW technologies are able to produce power for about 6% of the ACT’s needs. The ACT is considering the development of a new market for energy recovered from C&D waste. On this basis, in 2009, the ACT government commissioned URS-Eco Waste to provide a list of potential materials for the development of a market for EfW. According to their findings, the ACT can use 10-20% of volume constituted by all waste streams for EfW. The waste strategy document proposes one strategy for EfW activities: Strategy 4.3 (Expand bioenergy generation and investigate new energy-from-waste technologies to generate energy).

The ACT government does not have a specific guideline for EfW and the proposals for energy recovery projects are regulated under the Planning and Development Act 2007. The ACT is working to produce an EfW policy in winter 2019. In doing so, some suggestions will be provided; these include consideration of feed-in tariffs and carbon price mechanisms (ACT NoWaste, 2018). Furthermore, it is advised that the ‘community support and ‘buy-in initiative’ are critical factors for successful development of EfW policy (Transport Canberra and City Services, 2018).

In **NSW**, a policy statement describes the requirements for waste energy recovery for general waste (NSW, 2018). This policy covers thermal EfW technology, sets out resource recovery criteria and provides a list of eligible (low-risk) waste fuels. According to this document, the percentage of residual waste allowed for energy recovery of C&D waste material is only up to 25% of the waste stream

received at the processing facility. Although the policy presents regulatory certainty to industry through setting the minimum requirements for establishment of EfW facilities, there is evidence provided by the Hunter Joint Organisation of Councils that the current Waste to Energy Policy presents barriers to the development of EfW facilities (Environment and Communications References Committee, 2018). In the Protection of the Environment Operations Act 1997, the definition of energy recovery refers to two categories: 1) from general waste and 2) from hazardous and other waste. The Act recognises an energy recovery practice when there is recovery of more than 200 tonnes of waste.

In the **NT**, there is no specific policy or plan to guide activities on energy recovery.

In **Qld**, a strategy document (Queensland Government, 2014) revealed the opportunities in the state's waste management, including new technologies to take advantage of energy recovery activities. Under this opportunity, the need for development of specific policy is emphasised. Interestingly, Qld has released a Direction Paper (Transforming Queensland's Recycling and Waste Industry 2017) that considers energy captured from landfill gas and incineration material loss. This contradicts the End of Waste framework premises, in which there is a baseline determining when a waste is not waste anymore and becomes a source. However, this state is exploring the potential of EfW, which is meant to develop a policy to promote the safe and sustainable delivery of waste-to-energy. Along these lines, the state government has committed to funding of \$5 million for EfW projects for its 2018-2019 budgets, sourced from the landfill levy revenue (Queensland Budget, 2019).

**SA** is a pioneer in implementing EfW practices, beginning in February 2010 when the first Australian Standard for the Production and Use of Refuse Derived Fuel (RDF) was released. These standards, which are aligned with the objectives of the primary waste related act (Environmental Protection Act 1993) and the Environmental Protection (Waste to Resources Policy 2010), outlines a risk-based approach to address the issues and considerations of producing and using RDF.

In SA, the EPA has initiated efforts to develop policy guidance for EfW facilities. A document (EPA SA, 2018) published as a result provides advice on how to grow this industry in the state. In 2018, the EPA SA invited the relevant stakeholders to comment on the considerations regarding the establishment of EfW position statement. SA's Waste Strategy document (2015-2022) indicates the issue of residual waste in SA and provided advisory support for adopting new technologies and processes to effectively manage residual waste streams.

In **Tas**, while a specific guideline on EfW is yet to be developed, in the Environmental Management and Pollution Control (Waste Management) Regulations 2010, energy from waste is considered as a waste management method. Furthermore, there have been some unsuccessful discussions about using wood waste to generate power at the state level (Rothe et al., 2015). Efforts were put in to the revision of the Tasmanian Renewable Energy Target (RET) to include waste wood. In 2017, a Local Government Association Tasmania report on waste management (MRA Consulting Group, 2017) identified the need to establish EfW policy and guidelines; however, this action is proposed as low priority for the long-term.

In **Vic**, the state government recognises that EfW has the potential to play an increasing role in the future waste management of the state. The primary legislation, the Environment Protection Act 1970 (No. 8056), determines the duties of Victoria's Environmental Protection Authority to facilitate increased environmental resource use efficiency or decreased disposal of waste off-site. It requires persons who undertake certain activities that impact on the environment or any segment of the environment—as a result of high and potentially inefficient use of environmental resources (including water and energy) or disposal of waste off-site—to make an assessment of opportunities to improve environmental resource use efficiency and to reduce the disposal of waste off-site. It also requires such individuals to develop and implement an Environment and Resource Efficiency Plan, which

includes financially viable actions to improve environmental resource use efficiency and reduce the disposal of waste off-site; and report on environmental resource use and the disposal of waste off-site and implementation of Environment and Resource Efficiency Plans (p. 42). Under Part I of this act, there are number of principles in management of environment in Victoria, of which 11 are used to assess energy recovery proposals across the states. These principles are: waste hierarchy, integrated environmental management, integration of economic, social and environmental considerations, improved valuation, pricing and incentive mechanisms, and product stewardship.

This EPA produced act supports the Metropolitan Waste Management group, whose objectives focus on maximising the sustainable recovery of materials from waste for reuse, recycling, reprocessing and energy recovery. Under this Act, the Metropolitan Plan (metropolitan Melbourne) must include a strategic analysis of existing infrastructure and services for waste management and resource recovery of materials and energy (p. 264). Sustainability Victoria, which was founded under the Sustainability Victoria Act 2005, is responsible for coordination of efforts towards resource efficiency and renewable energy, but does not provide enough information and plans regarding EfW. The Environment Protection (Scheduled Premises) Regulations 2017 (No. 45) is another set of regulations that govern EfW activities; it presents the exemption requirements for financial assurance and works approval.

In 2000, Vic EPA published an information bulletin (EPA VIC, 2000) on the options available for landfill site owners to manage waste, including energy recovery (capture) from methane gas generated. Victoria's State Waste and Resource Recovery Infrastructure Plan (SWRRIP) (2017) also emphasises energy recovery when it does not remove the opportunity for recycling. The plan advises that there is a need for investment in infrastructure, securing long-term feedstock supply and market for energy generated, and the development of a business case that is competitive with the landfill levy. SWRRIP also provide a categorisation model for different infrastructure, including an EfW facility. In 2017, the EPA produced a guideline, Energy from Waste (No. 1559), to display how the legislation in Vic is applied to the assessment of proposals that recover energy from waste. The scope of this guideline is to establish a connection between the new EfW technology likely to emerge in the Victorian market and corresponding regulatory updating. This guideline also encourages applicants to engage community from the initial stage of construction of the EfW facility. It provides information about thermal efficiency, siting, design, construction and preparation of energy recovery facilities and requirements for waste acceptance and preparation for EfW.

Three statutory documents primarily govern any proposal related to EfW: the Environment Protection Act 1970, the Energy from Waste Guidelines and the Getting Full Value Policy. EPA takes the primary Act's 11 principles mentioned above into consideration when assessing EfW facility establishment and operation. The Energy from Waste Guideline also provides four key criteria for assessing proposals: (1) suitability of EfW as an option, (2) waste acceptance and preparation for energy recovery, (3) siting, design, construction and operation of EfW facilities, and (4) thermal efficiency of EfW plants. The guideline leaves the responsibility of demonstrating that EfW is the best waste management option to applicants. This can be done through conducting a cost-benefit analysis of different options. The other set of principles are outlined in the Getting Full Value policy (Victorian Government, 2013).

In 2018, the state government undertook a consultative process to examine how the EfW option can best provide opportunities for state-wide and regional economies. Furthermore, a feasibility study in Vic (Genever, 2017) revealed that a significant cost disparity between the landfill levy and EfW activities gate fee exists and impedes development of EfW activities in this state. The consultees of this study also indicated that lack of support from landfill levy redistribution is another major barrier. The study found that EPA Vic, as the main regulator of EfW, should take the following steps in order to better manage energy recovery activities:

- Provide clear guidance to the market for energy recovery products

- Establish genuine engagement between the regulator and the sector on the critical approvals processes, including planning and works approvals, and land acquisition of suitably zoned sites
- Work proactively with the industry to identify beneficial reuse options for waste to energy by-products through market development funding for research and reuse opportunities

Lastly, local government launched a community consultation opportunity (Turning waste into energy) to seek feedback from community, industry and other stakeholders about EfW.

In **WA**, there is not much support for energy recovery practices. The only relevant benefit espoused regarding waste related regulations is the exemption provided for the waste that is received at landfill for collecting and sorting purposes and will later be used for energy recovery. This exemption, enshrined in the *Waste Avoidance and Resource Recovery Levy Regulation 2008*, exempted landfill owners, by application, from paying the levy. In the waste strategy of this state, a target has been set to make sure that energy recovery practices are only applied to residual waste by 2020; this limitation reflects a commitment to following the most favourable options in the waste hierarchy. WA also released an EfW position statement in 2013 that contained general information about energy recovery potential in the state. It also recognised the need for significant developments in policies, regulations and technologies. In the same year, WSP Environmental Co was tasked with conducting a literature review on the regulatory framework, available technologies and other matters related to EfW. At the conclusion of those tasks, some recommendations were made to the WA's Minister of Environment to consider developing the EfW industry in the state (WSP Environmental, 2013a).

### 3.8.5 How to improve EfW in Australia

As a new method in Australia, EfW is still a contentious topic that raises differing perceptions toward its adaptation. This is reflected in the negligible share of EfW (4%) in the current waste management system. However, as outlined above, there is certainly room to improve in this area. In order to improve EfW status in Australia, a number of steps have to be taken to ensure that EfW becomes a viable waste management option that is socially accepted and environmentally beneficial. These steps are mainly related to the state and federal government's role in regulation and supporting EfW technologies. Some of the steps revealed by the review findings are discussed below.

The federal government, as one of the main players in the field of EfW, can perform some key measures to ensure improved energy recovery in Australia. These measures include:

- 1) Encouraging local governments to support EfW in each state or territory through platforms such as the Australian Local Government Association and National Environment Protection Council;
- 2) Developing a harmonised, specific and national policy for EfW, in keeping with social and environmental concerns across Australia;
- 3) Providing funding for the establishment of suitable EfW infrastructures;
- 4) Commissioning research studies that inform EfW policy and provide an overview of the energy recovery status quo in Australia and other parts of the world;
- 5) Stimulating domestic and foreign investment in EfW technologies;
- 6) Cultivating interest in EfW in the Australian waste and recycling industry; and
- 7) Setting reimbursement incentives that will maintain the economic welfare of residents, such as tax relief or reduction of utility bills.

This review study revealed substantial differences in regulation and adaptation of EfW in different jurisdictions. Among the jurisdictions, only Vic and NSW have published guidelines for EfW; WA

released a position statement that has not been upgraded to a clear guideline or policy at time of writing. These inconsistencies are a barrier towards successful implementation of an energy recovery system in Australia. According to the review results, these differences are attributed to various factors that are outlined below. These factors can guide the steps that need to be taken by local governments to improve energy recovery:

(1) Lack of uniform understanding of energy recovery, (2) insufficient support or underestimating EfW by some state governments, (3) lack of proper infrastructures, (4) the cost disparity between landfill levy and EfW associated costs, (5) lack of programs to educate the wider community, (6) lack of regulatory support from the EPAs and other relevant agencies and (7) lack of a robust waste data management system in some jurisdictions.

The other assistance required from jurisdictional regulatory frameworks is related to the way that different jurisdictions regard a waste material during different phases of waste management. Currently, except for in Qld, all other jurisdictions are subscribed to the idea that 'once a waste, always a waste'. In Qld, the concept of the end of waste framework was introduced in regulations to determine when waste ceases to be waste and becomes a source. Some other jurisdictions, such as WA, SA and Vic, provide some regulatory exemptions for materials that are to be recovered.

Establishing sound policy benefits from evidence-based practices that draw on empirical research studies. This review found that there are some areas that need to be further explored in order to change the EfW status quo. Research is needed on people's acceptance of EfW activities in their neighbourhood. It is also necessary to regularly review the state-of-the-art technologies operating in different countries, which will lead to recommendations for the selection of technologies suitable to the Australian context. Market development research for EfW can provide the basis for further legislation and making informed decisions. Lastly, empirical research is needed to shed light on the potential of residual C&D waste energy recovery in Australia. Currently, there are only research studies published on EfW on other waste streams and materials, such as food waste (Lou et al., 2013, Florin et al., 2009), wood waste (Rothe et al., 2015) and oil (El Hanandeh, 2015).

### 3.9 Waste disposal

Waste disposal at landfill sites is the least favourable level of hierarchy of waste management (Figure 3). According to the NWP 2018's Principle 4: *Better Manage Material Flows to Benefit Human Health, the Environment and the Economy*, the new way of thinking about waste aims to keep materials cycling in productive use rather than being lost to landfill or escaping to the environment and oceans through irresponsible disposal. However, waste disposal has historically been a key element of waste management in Australia. The primary task of landfill is to accept waste that cannot be avoided, reduced, reused, recycled or recovered. However, a global trend has commenced that aims to reduce the number of landfills, due to social, economic and environmental issues<sup>47</sup>. For instance, the European Commission has initiated a Circular Economy Package, which includes a set of measures to shift to a circular economy, including promoting economic instruments to discourage disposal<sup>48</sup>.

According to analyses of waste management objectives and targets, there is consensus among Australia's jurisdictions that waste disposal (as the last option based on the waste hierarchy) should be removed entirely from Australia's waste management system<sup>49</sup>. Under Strategy 7 (Increasing

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<sup>47</sup> Paul Klymenko. 2018. Landfill is not a long-term solution for waste management in Australia. Planet Ark.

<sup>48</sup> EU Action Plan for the Circular Economy. 2018. Circular Economy Package: [http://ec.europa.eu/environment/circular-economy/index\\_en.htm](http://ec.europa.eu/environment/circular-economy/index_en.htm)

<sup>49</sup> Lavino, H. J Barlow, M Ton, N. Dawood. 2018. An Inquiry into the Waste and Recycling Industry In Australia. Submission to the Senate Inquiry (Environment and Communications References Committee. p. 13.

industry capacity) in the National Waste Policy 2018<sup>50</sup>, identification of opportunities to deliver ongoing improvements in diversion from landfill is set as a priority.

In Australia, the main issue with landfill according to submissions to a Senate inquiry is related to the inability of this method to recover resources from the waste efficiently<sup>51</sup>. At the time of writing, none of the jurisdictions have provided a plan detailing a waste management system wherein the need for landfill is removed. Indeed, due to financial (the need for receiving levy fees) and technological (systematic lack of modern technologies to recover waste) reasons, this target seems to be ambitious.

There is limited access to valid and current national data about the number of landfill sites (licenced and un-licenced) in different regions of Australia. According to the latest statistics, there are 1,168 landfill sites operating across eight jurisdictions. Table 14 provides estimated statistics on waste management facilities by jurisdictions in Australia in 2013.

**Table 14. Number of waste management facilities in different jurisdictions**

	Landfill site	Resource recovery facility
<b>ACT</b>	1	6
<b>NSW</b>	369	121
<b>NT</b>	118	10
<b>Qld</b>	265	88
<b>SA</b>	117	247*
<b>Tas</b>	19	14
<b>Vic</b>	92	233
<b>WA</b>	187	86
<b>Total</b>	1,168	806

<sup>1</sup> - Includes 153 container deposit recycling depots in SA

Source: compiled by Rawtec/WCS based on jurisdiction's input- 2013 August

According to a more updated but speculative estimate<sup>52</sup> drawing on national databases (e.g. the National Pollution Inventory or the National Greenhouse and Energy Reporting Scheme), Qld has the greatest number of sites, followed by NSW and WA. In terms of size of these facilities, Vic and Tas have a high percentage of large-to-medium sites, while NSW has the largest sites, representing its relatively large population. Qld, WA and SA hold a comparatively high numbers of small sites, matching their widely dispersed populations. Landfill sites differ in size and range from small, trench-based facilities with a capacity of 1000 tonnes of waste per year, to large, engineered facilities receiving more than 100 K tonnes per year. Most of the waste produced in Australia goes to a small number of large sites. However, the majority of Australia's landfills are small, accepting annually less than 20,000 tonnes of waste<sup>53</sup>. Figure 5 shows the distribution of waste management facilities across Australia.

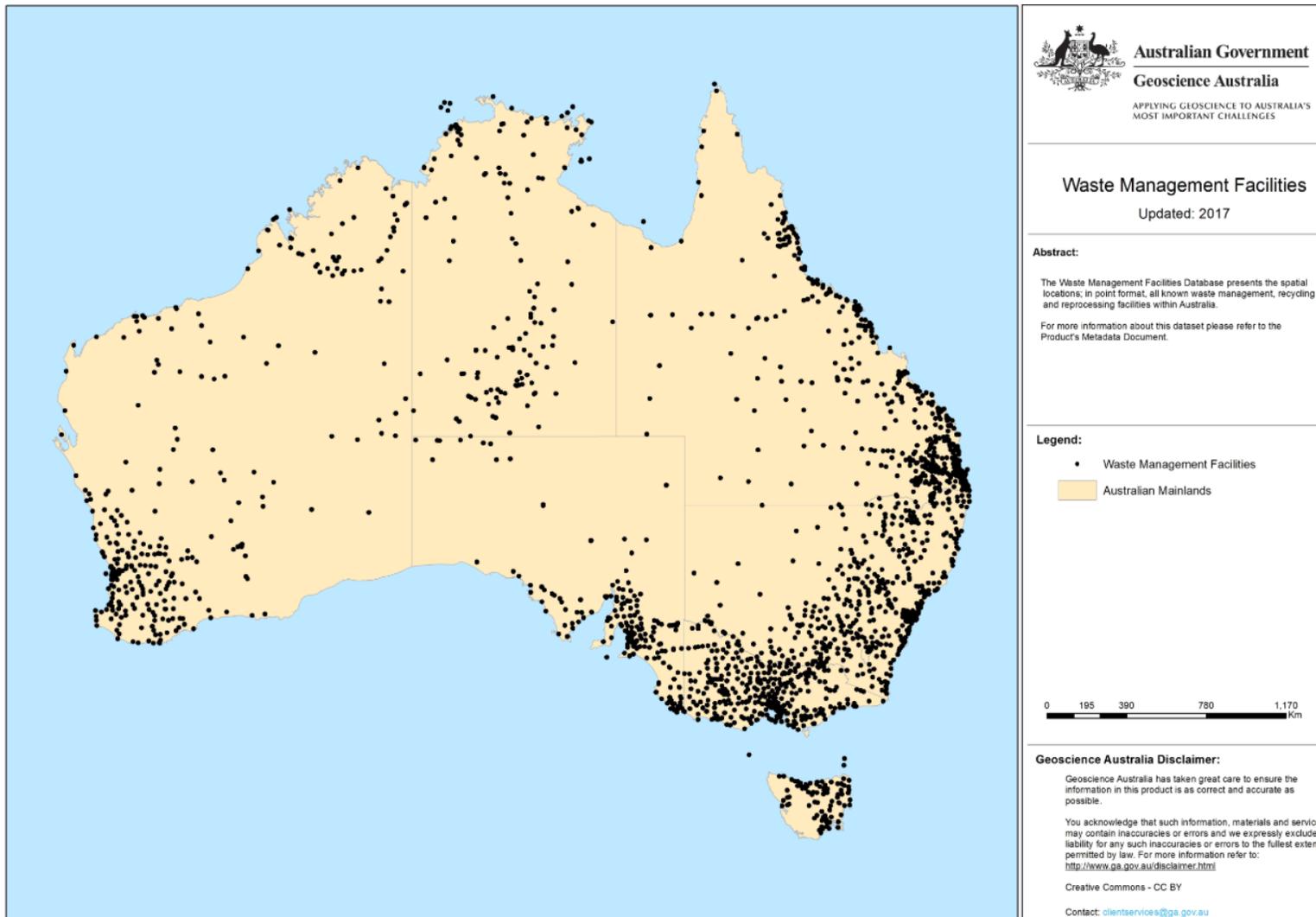
<sup>50</sup> Australian Government, National Waste Policy 2018. Less Waste, More Resources.

<sup>51</sup> Environment and Communications References Committee. 2018. Never waste a crisis: the waste and recycling industry in Australia.

<sup>52</sup> McCabe B., and W. Clarke, 2017. Explainer: How much landfill does Australia have? *The Conversation*:

<https://theconversation.com/explainer-how-much-landfill-does-australia-have-78404>

<sup>53</sup> Ibid.



**Figure 6. National map of waste management facilities (landfill sits, transfer stations, composting facility, solid waste store facility and resource recovery facility) distribution in Australia**

Source: Geoscience Australia 2017

### 3.10 Who is responsible for management and regulation of landfill sites

In Australia, local councils, together with private companies, are responsible for landfilling activities in their areas; however, state governments and EPA regulate these sites within each jurisdiction. In Tas and NT, companies do not operate landfills due to these jurisdiction's small populations and lack of economic advantage. There are fundamental discrepancies in the approach taken by the jurisdictions: some states adopt a forethoughtful approach and set complicated regulations for landfills to make sure restricted and environmentally friendly waste management arrangements are implemented, whereas other jurisdictions take a more relaxed approach. Qld and NT are the two with the least amount of regulation and restrictions over their landfills. Vic, on the other hand, has heavily regulated landfills compared to other states within Australia<sup>54</sup>.

### 3.11 Disposal levy fees

Authorities in Australia have encouraged the construction industry to further recycle C&D waste by imposing landfill disposal levies. The aim of these levies is to set a price on waste disposal that is higher than the cost of recycling, such that recycling becomes a more attractive endpoint.

Except for NT, all of Australia's other jurisdictions have introduced landfill levies; however, levies are imposed differently (Environment and Communications References Committee, 2018). The differences originate in the distinction between metropolitan areas versus regional areas, levy rate, being obligatory versus voluntary and having or not having levy zones. As displayed in Figure 6, some jurisdictions (ACT, Qld, Tas and WA) differentiate the levy rate between metropolitan and regional areas, offering a lower rate in regional areas. The voluntary levy in Tas is between 0 and \$ 7.5 per tonne. In ACT, there is no C&D waste specific levy and the same fee that applies to commercial and industrial waste (C & I) is followed, which ranges from \$ 146.2 to \$ 199.2 (waste with less than 50% of recyclable materials). NSW, Vic and WA have levy zones that are limited to specific areas of the state, while South Australia considers the entire state as the levy zone<sup>55</sup>.

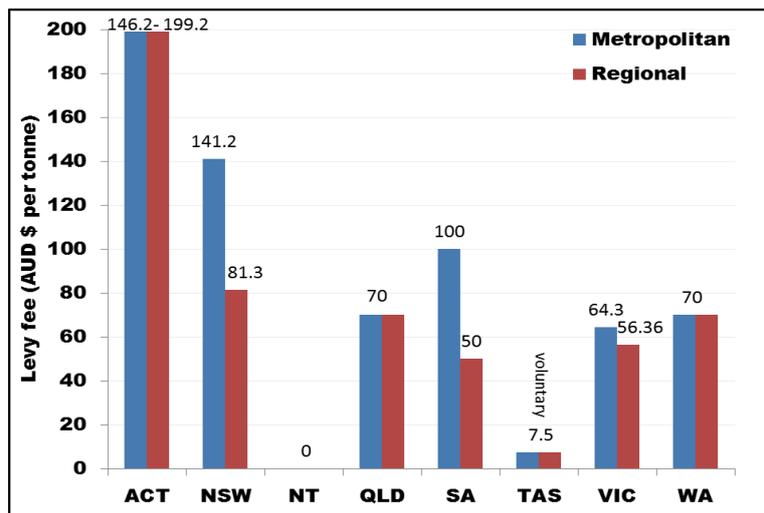
Another interesting pattern that arose previously is the link between the proportion of levy fee and the quantity of waste disposed of in Qld. Furthermore, in a report that investigated the transport of waste to Queensland, it was found that lower levies in this state have facilitated interstate transport of waste to Queensland's landfills (Queensland Government, 2017). On average, 60,000 tonnes of predominantly C&D waste is being transported from metropolitan Sydney to South East Queensland each month<sup>56</sup>. In the wake of issues faced in Qld, the Queensland's Environmental Protection Agency (EPA) plans to introduce new levy rates in March 2019.

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<sup>54</sup> Lavino, H. J Barlow, M Ton, N. Dawood. 2018. An Inquiry into the Waste and Recycling Industry In Australia. Submission to the Senate Inquiry (Environment and Communications References Committee). p. 13.

<sup>55</sup> Waste Reduction and Recycling (Waste Levy) and Other Legislation Amendment Bill 2018, Explanatory note, p. 9

<sup>56</sup> Environment and Communications References Committee. 2018. Never waste a crisis: the waste and recycling industry in Australia.



**Figure 7. Levy fees for C&D waste disposal in different jurisdictions**

Source: EPA in each of Australia's jurisdictions.

SA, Vic and WA impose the levy only at waste facilities that include a landfill, whereas NSW charges at any waste management facility and the levy is rebated if it is then transferred to another facility. In WA, the levy is not charged until the waste is actually disposed to landfill at the site, whereas the levy is charged on delivery to the site in other jurisdictions<sup>57</sup>.

While it is a fact that the levy rate for C&D waste disposal is a product of many factors such as the time and cost, size of the construction industry, available lands, financial situations, regulatory environment and shortage in recycling facilities<sup>58</sup>, it is worthwhile to compare these rates across the world. Table 15 presents landfill tax rates imposed on C&D waste in a few exemplary countries.

**Table 15. Rate of tax imposed on C&D waste at landfills**

Country	Levy rate in the given currency per tonne	Levy rate in AUD \$ * per tonne
Canada	\$ 90 CAD	\$ 95
China	¥ 25	\$ 5.11
England	Two rates apply: £ 88.95 GBP standard rate £ 2.8 GBP *applies to C&D waste with less polluting waste	\$ 159.3 \$ 5
European Union	€ 3-100	\$ 4.8 – 160.8
Hong Kong	HKD 446	\$ 80
New Zealand	NZD 10	\$ 10

\*the exchange rate is driven from a trusted currency authority: [www.xe.com](http://www.xe.com) seen on 10.01.2019

### 3.12 How landfill levy revenues are distributed

Landfill levies not only discourage waste generators from disposing of their waste, but also contribute to effective management of C&D waste through funding state environmental initiatives. Technically, a part of revenue earned from waste disposal is used to improve enforcement and compliance, development of sound policies and to fund actions and strategies that contribute to waste

<sup>57</sup> n Above. p. 9

<sup>58</sup> Menegaki, M. & Damiagos, D. 2018. A review on current situation and challenges of construction and demolition waste management. Current Opinion in Green and Sustainable Chemistry.

minimisation. In Australia, there is no nationally prescribed method for distribution of levies for such purposes and each local government does so according to its priorities and the objectives outlined in its waste strategy document. This section compares how levies are budgeted for distribution in the search for better waste management in different Australian jurisdictions.

In NSW, local government has launched an initiative, Waste Less, Recycled More to re-invest levy revenue with the aim of increasing the effectiveness of resource recovery and reduction in litter and illegal dumping activities during the 5 years from 2017 to 2021<sup>59</sup>. This initiative provides \$ 337 million grants for 9 programs: *a.* Local Government Waste and Resource Recovery Program, *b.* Illegal Dumping Prevention and Waste Enforcement Fund, *c.* Household Problem Waste, *d.* Waste and Recycling Infrastructure Fund, *e.* Organics Infrastructure Fund and Program, *f.* Litter Prevention and Enforcement Fund, *g.* Business Recycling Program, *h.* Recycling Innovation Fund and *i.* Heads of Asbestos Coordination Authorities programs. A small part of this grant (\$5 million), under the Business Recycling Program, is dedicated to industrial ecology networks in C&I and C&D sectors throughout NSW.

In Vic, in 2010, the EPA enacted regulations<sup>60</sup> to determine the share of levy revenue to be received by each state agency. In this state, during the 2015 financial year, the levy revenue was distributed to the following agencies: the EPA received 18%, Sustainability Victoria received 12% and Waste and Resource Recovery Groups (Councils) received 5%. Similar to Vic, WA has a piece of primary legislation<sup>61</sup> that specifies the arrangement of levies imposed and that the money collected through levies are used by the Environment Minister to<sup>62</sup> (a) fund certain programmes relating to the management, reduction, reuse, recycling, monitoring or measurement of waste and (b) fund a person or body to conduct the activities mentioned in (a).

Other local governments, however, have not revealed a firm plan that determines how the levies charged at landfill sites should be distributed; in this situation, funding has been granted on a case-by-case basis and according to waste jurisdictional strategy objectives. For instance, the NT waste strategy document indicates that government will fund and support campaigns to encourage the community to generate less waste, and also to maximise use of current waste collection systems so waste going to landfill is minimised where possible and practical<sup>63</sup>. In SA, the waste strategy (2015-2022) declared that more than \$ 80 million sourced from levy revenue had been invested into industry during the past decade; the fund allegedly was used by Zero Waste to build capacity and improve industry competitiveness<sup>64</sup>. This strategy also indicated that 50% of the levy is transferred to the Waste to Resources Fund. In Qld, in 2018, the Waste Reduction and Recycling (Waste Levy) and Other Legislation Amendment Bill 2018 was presented to discuss how the state's levy revenue should be spent. The Bill proposes that it *'will be used to fund implementation of a state-wide waste and resource recovery strategy and complementary sustainability and environment initiatives. Surplus funds from the levy may benefit the entire Queensland community'*<sup>65</sup>.

### 3.13 Harmony in jurisdictional landfilling regulations

Inconsistencies in management of landfills in Australia are evident in the varying levy rates, designs of landfill sites, complexity of waste disposal requirements, classification methods of waste and standard waste treatment performed in each jurisdiction. These inconsistencies for regulating landfilling activities have impeded productive and environmentally sensitive management of waste in Australia. In reality, waste generators from jurisdictions that have more restricted waste regulations in place are

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<sup>59</sup> NSW Government. 2017. Waste Less, Recycle More.

<sup>60</sup> Environment Protection (Distribution of Landfill Levy) Regulations 2010.

<sup>61</sup> Environmental Protection (Landfill) Levy Act 1998 – WA.

<sup>62</sup> Environmental Protection Act 1986 – WA.

<sup>63</sup> ACT Waste Management Strategy (2011-2025). Towards a sustainable Canberra. ACT.

<sup>64</sup> South Australia's Waste Strategy, 2015-2020, p. 10.

<sup>65</sup> Waste Reduction and Recycling (Waste Levy) and Other Legislation Amendment Bill 2018, Explanatory note, p. 4.

exploiting landfill sites located in jurisdictions with relaxed regulations. To ensure regulatory measures are successful and unavoidable, legislation must be consistent across all jurisdictions. A relatively consistent regulatory framework in all jurisdictions will contribute to achieving sustainable waste management activities in Australia. In addition, and given the Australian waste management status quo, the Commonwealth government should take a more active role and introduce initiatives that target landfills, encouraging them to operate in a beneficial manner through recovering useful resources, instead of disposing all the waste collectively. This can assist them to reduce waste and increase the availability of resources.

### 3.14 Illegal dumping

Different types of people commit the offence of illegal dumping across Australia. However, due to data unavailability and poor data management practices, it is difficult to realise the overall extent of illegal dumping activities (Environment and Communications References Committee, 2018). This issue creates numerous ecological problems and can pose several direct and indirect risks for human health and well-being. Research has shown that illegal waste disposal and stockpiling accounts for a higher liver and lung cancer mortality rate in the long-term and congenital malformation in the short-term (Triassi et al., 2015); in severe cases, it can lead to leptospirosis outbreaks (Hayati et al., 2018). The unsegregated nature of waste being illegally disposed of can also pose the risk of toxic materials such as asbestos to Australian residents.

Illegal dumping presents a significant management issue for Australian governments through economic, social and environmental risks. Illegal dumping can occur in various forms, including illegal landfilling where waste is used as a fill with/without the consent of the landowner, or when disposal activities do not observe the necessary planning or licencing approvals and stockpiling. The Australian Sustainable Business Group (ASBG) identified three types of illegal dumping in Australia based on the location of incident and accessibility thereof:

- On publicly accessible lands (e.g. parks and roads).
- On private/public lands with limited access (e.g. industrial lands, residential lands governmental owned/managed lands).
- On waste landfill sites or recycling facilities (e.g. sites that dispose waste that is not meeting the acceptance criteria imposed by relevant regulation or policies).

The ASBG indicated that figures on illegal dumping only focus on the costs accrued by local councils in managing clean-up and supporting law enforcement associated with illegal dumping. Therefore, in addition to the environmental risk, illegal dumping is regarded as a financial burden on taxpayers. In NSW, conservative estimations made in 2015 suggested that annual illegal dumping management expenditure would be between \$ 20 and \$ 30 million (EPA New South Wales, 2015). In Qld, it was reported that, during 2016-2017, managing 8.5 t of illegally disposed waste cost local government \$18m, 20% of which was C&D waste. In Qld, 14.5 t of litter and illegally disposed waste cost local councils \$ 11m to manage. In NT, the City of Darwin and Crown Lands together spend \$100k a year to clean up illegally dumped material (EPA Northern Territory, 2015) and this cost is on an upward trend. In Vic, it is reported that the cleaning up of 27.4kt of dumped and littered waste cost \$12.5 million in 2016-17. Using an approximate estimate, it is safe to assume that, in the same period, Australia incurred about \$70 million to manage and control illegal dumping. Another report revealed that the approximate cost of illegal disposal of waste is \$670 per tonne (Laviano et al., 2017), which is about six times costlier than legal landfill management costs.

EPA Northern Territory (2015) listed four reasons that contribute to illegal dumping activities in Australia, including convenience, using organised networks that systematically operate for businesses, an unwillingness to pay landfill tax and an uncaring attitude. However, there is evidence that proves that inconsistent jurisdictional waste regulations play a role in creating this issue. The inconsistencies involve varying definitions of illegal dumping, inconsistent waste data management procedures,

different perceptions of activities regarded as illegal dumping, varied penalty rates plus different strategies and targets to address illegal dumping and key responsible stakeholders.

The unavailability of valid and comparable data is partially rooted in different measuring criteria and understandings of waste illegally disposed in different jurisdictions. Although there are some isolated statistics about illegal dumping, these are not consistently collected and presented. For many states, statistics on the frequency of incidents, the volume and the composition of waste being dumped do not exist. In SA, during 2016-2017, there were 346 illegal dumping reports. In Tas, it is noted that illegal dumping comprises up to 10% of reports to the pollution hotline (EPA Tasmania, 2017). In the ACT, several stakeholders have highlighted the high incidence of illegal dumping of C&D waste on privately owned lands (Hyder, 2011). Despite such evidence, according to the submissions made to the Environment and Communications References Committee (2018), these governments have indicated that illegal dumping is not a major concern in their jurisdictions. For instance, the SA Government submission<sup>66</sup> indicated that *‘there may be less concerning levels of inappropriate landfilling than is alleged in some other states’* and the government attributed this to landfilling requirements for licensing within SA.

This contradictory issue is partially caused by different understandings of activities that are considered as illegal waste disposal in Australian states and territories. It is thus useful to compare the definitions of illegal dumping across jurisdictions to understand how illegal dumping is being perceived and managed. Table 16 summarises the definitions of illegal dumping in jurisdictional legislation.

**Table 16. Illegal dumping definition and relevant regulations**

	<b>Illegal dumping definition</b>	<b>Relevant legislations</b>
<b>ACT</b>	a person commits an offence if— (a) the person intentionally dumps litter at a public place; and (b) either— (i) the volume or weight of litter is more than the amount prescribed by regulation; or (ii) the litter is larger than the size prescribed by regulation.	<i>Litter Act 2004</i> <i>Dangerous Substances Act 2004</i>
<b>NSW</b>	deals with the unlawful transporting, acceptance and depositing of waste state that the owner, transporter and person receiving the waste or allowing their waste to be received are committing a crime	<i>Protection of the Environment Operations Act 1997 (POEO Act) under Section 143 and 144</i>
<b>NT</b>	the unlawful disposal of any waste that is larger than litter to land or waters. Illegal dumping is where waste materials are dumped, tipped or otherwise deposited on private or public land	<i>Waste Management and Pollution Control Act</i> <i>Waste Management and Pollution Control (Administration) Regulations</i>
<b>Qld</b>	the unlawful deposit of any type of waste material that is 200 litres or more in volume	<i>Waste Reduction and Recycling Act 2011</i> <i>Section 103, 104, and 251.</i>
<b>SA</b>	disposal of waste on public or private land or into water without a licence, permit or approval from the relevant authority such as the EPA or local council.	<i>Environment Protection Act 1993; Section 36</i> <i>Environment Protection (Waste to resources) Policy 2010; under Clause 10</i>
<b>Tas</b>	(a) drop or throw litter in, on or into a place; and (b) leave litter in or on a place; and (c) put litter in such a location that it falls, descends, blows, is washed, percolates or otherwise escapes or is likely to fall, descend, blow, be washed, percolate or otherwise escape into or from a place; and (d) cause, permit or allow litter to fall, descend, blow, be washed, percolate or otherwise escape into or from a place	<i>Litter Act 2007</i> <i>Litter (Infringement Offences) Regulations 2011</i>
<b>Vic</b>	leaving waste on private or public land that is not licensed to accept such waste.	<i>Environment Protection Act 1970</i>
<b>WA</b>	unauthorised discharging or abandonment of waste and is an offence	<i>Environmental Protection Act 1986 (EP Act)- under 49A Section</i>

<sup>66</sup> Senate Standing Committees on Environment and Communications – submission 10: waste and recycling industry in Australia- Submission from the South Australian Government, 2017 p. 10.

In Tas and ACT, there is no specific definition for illegal dumping and relevant regulations only describe littering as an offense under Litter ACT<sup>67,68</sup>. This can create confusion, as there is a distinction between illegal dumping and littering activities, generally with different motivations, barriers, participants and locations. In Qld, it is the volume of waste that determines whether unauthorised waste disposal is an offense. Unlike other jurisdictions, in NSW, the definition of illegal dumping is expanded to hold responsible those who are involved in transporting, disposing and receiving waste, and landowners who allow waste to be dumped on their land.

Similarly, there is a major difference in the extent of the punishment of illegal dumping across Australian states and territories. Legislators in Australia’s jurisdictions have set different penalty fees for illegal waste dumping activities. The jurisdictions share a commonality in the fact that penalty arrangements separate individual and corporation offenses and each has a different penalty rate.

NSW administers the most detailed penalty system among the jurisdictions, with penalties applied at four thresholds: an on-the-spot penalty, maximum penalty, penalty for frequent offence and penalty for activities that have potential harm to the environment. This model, however, is barely established in other jurisdictions. NSW also imposes the most severe penalty fees, with offenders facing up to \$1m and \$5m and/or 7 years imprisonment for individual or corporation offenses, respectively. The next highest penalty fees are being charged in Vic and the NT. The lowest penalty fees are charged in the ACT and Tas. Table 17 shows the differences in penalties enforced in eight Australian jurisdictions.

**Table 17. Penalties enforced by the EPA (except in Qld) on illegal dumping in different jurisdictions**

	Individual				Corporation			
	On-the-spot (Basic) (\$)	Maximum penalty(\$)	Frequent offence(\$)	Potential harm to environment (Maximum) (\$)	On-the-spot (Basic) (\$)	Maximum penalty(\$)	Frequent offence(\$)	Potential harm to environment (Maximum) (\$)
<b>ACT</b>	Basic littering 1k Dangerous substances 200k			5k	Basic littering 5000 Dangerous substances 1m			5k and/or 25k and/or 6 months imprisonment
<b>NSW</b>	7,500	250k	250k + 60k daily	1m and/or 7 years imprisonment (wilful)- 500k and/ or 4 year imprisonment (negligent)	15k	1m	1m + 120k daily	5m and/or 7 years imprisonment (wilful) 2m (negligent)
<b>NT</b>	119			574K and/or 5 years imprisonment	656			2.9m
<b>Qld</b>	2,088- 2,611	53k- 130k	na	na	6,600- 9,800	53K - 130k	na	na
<b>SA</b>	120k + up to 2-years imprisonment				250k			
<b>Tas</b>	157	7,850	na	na	2,512	na	na	na
<b>Vic</b>	611k/ 7 years imprisonment				> 1.2m			
<b>WA</b>	62.5k				125k			

N.B: for ease of reading figures are rounded up.

<sup>67</sup> Litter Act 2007 – Tas.

<sup>68</sup> Litter Act 2004 – ACT.

In Australia, local government areas are the frontline for combating waste dumping; however, the regulatory arrangements, reporting and coordination of the efforts to tackle illegal dumping commonly occur in EPAs. Furthermore, some jurisdictions have dedicated specialised teams to monitor, enforce and battle illegal waste disposal activities.

In ACT, the City Rangers investigate illegal dumping. Furthermore, illegal dumping incidents are reported to Canberra Connect. In NSW, NSW EPA enforces relevant regulations and investigates illegal dumping under the POEO Act 1997 (under sections 143 and 144). In addition, there are regional illegal dumping squads (e.g. Hunter-Central Coast Regional Illegal Dumping Squad) specialising in fighting and preventing illegal dumping activities. This state also established the RIDonline database/reporting tool in 2015 through which people can report illegal dumping incidents.

In NT, the EPA regularly receives reports of illegal dumping (through the Pollution Hotline) from the community and actively investigates these to identify the offenders so that they can bear the cost of any clean up, as well as being prosecuted in court. In Qld, the Department of Environment and Heritage Protection (EHP), with the authorised local governments, are responsible for combatting illegal dumping. The Litter and Illegal Dumping Unit (LIDU) was established to provide oversight on the implementation of litter and Queensland’s Litter and Illegal Dumping Action plan.

In SA, the EPA has a dedicated team, the Illegal Dumping Unit (IDU), which targets, investigates and stops illegal waste activities using intelligence, covert surveillance and other investigative techniques to identify all parties that are involved in an illegal waste activity. In Tas, management of illegal dumping is spread between several agencies and stakeholders. The Litter Officer, EPA Division is mainly responsible, but its capacity is limited with respect to being able to adequately undertake compliance and enforcement activities along with the roles, responsibilities and resources available for land managers (i.e. local government and other state agencies). Citizens can report illegal dumping through an online form or the Litter Hotline.

In Vic, EPA’s illegal dumping Strikeforce program was established to reduce the risks to the environment from illegal waste management and to create a more level playing field. The program established a partnership with the Victorian Building Authority, WorkSafe, Consumer Affairs Victoria and Energy Safe Victoria to support stopping illegal dumping and appropriate management of C&D waste. In WA, the Department of Water and Environmental Regulation (DWER) is responsible for investigating and prosecuting illegal dumping under the Environmental Protection ACT 1986 (under Section 49 A) through DWER’s illegal dumping (pollution watch) program.

In addition to parental environmental protection acts and subordinate waste related regulations, various waste management strategies and targets have been proposed in different jurisdictions to navigate efforts towards illegal dumping reduction. These strategies are typically released under the title of Waste Strategy and cover a certain period. Table 18 presents the relevant strategies to reduce activities known as illegal dumping.

**Table 18. Strategies proposed to reduce illegal dumping**

	<b>Illegal dumping minimisation direct strategies/targets</b>	<b>Strategy document</b>
<b>ACT</b>	Reduce litter and dumping through laws and awareness raising (strategy 3.1) Participate in national approaches to litter management (Strategy 3.2). ACT leads Australia in low litter and incidents of illegal dumping (Target 3). No quantitative target is introduced	-ACT Waste Management Strategy 2011-2025
<b>NSW</b>	Reduce illegal dumping by 30% by 2020 compared with 2011	-NSW Waste Avoidance and Resource

	<b>Illegal dumping minimisation direct strategies/targets</b>	<b>Strategy document</b>
	Six approaches are proposed: (1) evaluation and monitoring, (2) education and awareness (3) stakeholder engagement and capacity building, (4) regulation and enforcement, (5) building and evidence base, (6) prevention, infrastructure and clean-up (6) evaluation and monitoring	Recovery Strategy 2014–21 -NSW Illegal Dumping Strategy 2017–21
<b>NT</b>	Work with local government and the NT Government to coordinate local efforts to prevent litter and illegal dumping (Action 7) No quantitative target is set	-Waste Management Strategy for The Northern Territory 2015–2022
<b>Qld</b>	Reduce the total amount of, and the environmental impacts from, litter and illegal dumping (Target 5) Reactive compliance and enforcement (Program 1) Education, engagement and awareness raising (Program 2) Hotspots—proactive compliance (Program 3) Data, research and evaluation (Program 4) Capacity building and networking (Program 5) No quantitative target is set	-Queensland’s Waste Reduction and Recycling Strategy 2010–2020 -Queensland’s Litter and Illegal Dumping Action Plan
<b>SA</b>	Decreased incidences and tonnages of illegal dumping No quantitative target is introduced	-South Australia’s Waste Strategy 2015-2020
<b>Tas</b>	No current waste strategy	-No current waste strategy
<b>Vic</b>	No current waste strategy	-No current waste strategy
<b>WA</b>	Move towards zero illegal dumping by 2030 (objective 3: protect) Identify and collect required data to monitor illegal dumping and allow better targeted monitoring and enforcement (strategy 23) Deliver a community engagement and education campaign to raise awareness of illegal dumping and its impacts (Strategy 24) Work with land owners and managers to build their capacity to tackle illegal dumping (Strategy 28) Provide relevant funding and guidance to prevent the illegal dumping of waste at charitable recycler waste collection sites (Strategy 31) Detect, investigate and prosecute illegal dumping (Strategy 33) No quantitative target is set	-Western Australia’s Waste Strategy: Waste Strategy 2030

Although the documents listed in Table 18 may have provided different strategies that can have indirect impacts on illegal dumping, only those strategies that exclusively target illegal dumping are presented. Furthermore, two of the eight jurisdictions (Vic and Tas) do not have current waste strategies and, therefore, their out-dated waste strategy documents are excluded from consideration. Two states, NSW and Qld, have developed a specific strategy and action plan for illegal dumping management. Aside from NSW (target: 30% reduction by 2020), none of the jurisdictions were able to define a quantitative target to reduce illegal dumping.

According to the waste strategies<sup>69,70,71,72,73,74</sup> and submissions by different organisations and agencies to the Australian Senate’s Environment and Communications References Committee, the main reforms proposed for better illegal dumping management are funding for education programs and enforcement through local government imposing waste levies. In terms of law enforcement, introducing a uniform levy across Australia, in particular, can reduce the motive for illegal dumping (Laviano et al., 2017).

Education has a decisive role in tackling illegal dumping in Australia. Most jurisdictions have formed teams dedicated to educating industry people as well as the wider community (NWR, 2018). Several non-governmental and industry organisations, such as Clean Up Australia, Keep Australia Beautiful and Rethink Waste, collaborate to minimise litter and illegal dumping through education. Furthermore, jurisdictional waste strategies have introduced initiatives to fund education programs aiming to reduce waste and illegal dumping. For instance, in WA, Waste Strategy 2030, under Objective 3: Protect, has introduced Strategy 24 to *‘deliver a community engagement and education campaign to raise awareness of illegal dumping and its impact’* (Waste Authority, 2018, p. 35). In Qld, Queensland’s Litter and Illegal Dumping Action Plan has proposed five programs to tackle illegal dumping. The second program’s (Education, Engagement and Awareness Raising) aim is to *‘initiate and drive behavioural change by removing excuses through awareness raising, sharing information and communicating to a wide audience about littering and illegal dumping’*.

In practice, detection of activities related to illegal dumping significantly contributes to lessening illegal activities. Using technologies such as remote sensing, GIS and drones that provide aerial images of vast areas with illegal dumping activities potential, can be helpful. Lega et al. (2012) conducted a comparative study between different aerial tools (e.g. airplane, drone, helicopter and satellite) in the field of environmental research and law enforcement in Italy. In Australia, a research project on mapping of potential illegal dumping activities found that GIS can be successfully used to map and predict the likelihood of illegal dumping on the Sunshine Coast (Glanville and Chang, 2015). In particular, drones are providing a cost-effective tool for monitoring, data collection and analysis in the field of waste management and their usage is on rise (Smith, 2015, Capolupo et al., 2014, Kiss Leizer, 2018). Until today, none of the study jurisdictions have systematically considered taking advantage of these technologies; hence, a fortiori relevant regulations have not been developed.

### 3.15 Infrastructure plan

Another discrepancy found between jurisdictions relates to having a state-wide infrastructure plan. According to Principle 2 NWP 2018<sup>75</sup> (improve resource recovery), for improvements in recycling and resource recovery, among other factors, Australia depends on having the right infrastructure, facilities and rules in place and making sure that they are economically sustainable. An infrastructure plan is quite helpful to achieve these goals. However, among the jurisdictions (at time of writing), only two states have developed such a plan: SA and Vic. The other jurisdictions are either in the process of developing such a plan or simply do not have one. Vic is the first jurisdiction in Australia to release a state-wide infrastructure plan<sup>76</sup> that provides a roadmap for a waste and resource recovery system for a 30-year period in this state. This plan, together with regional implementation plans that describe how this plan will be implemented at a local and regional level, aims to achieve the following:

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<sup>69</sup> ACT Waste Management Strategy 2011–2025.

<sup>70</sup> NSW Illegal Dumping Strategy 2017–21.

<sup>71</sup> Waste Management Strategy for The Northern Territory 2015–2022.

<sup>72</sup> Queensland’s Litter and Illegal Dumping Action Plan 2013.

<sup>73</sup> South Australia’s Waste Strategy 2015–2020.

<sup>74</sup> Western Australia’s Waste Strategy: Waste Strategy 2030,

<sup>75</sup> National Waste Policy. 2010. Less Waste, More Resources, p. 14.

<sup>76</sup> State-wide Waste and Resource Recovery Infrastructure Plan – Vic.

- (a) effectively manage the expected mix and volumes of wastes and materials;
- (b) support a viable resource recovery industry;
- (c) reduce the amount of available materials going to landfill; and
- (d) reflect environmental justice principles.

SA's state-wide infrastructure plan<sup>77</sup> also provides for the waste and resource recovery industry for the next 30 years. The objectives of this plan are as below:

- (a) Provide an evidence base that enables common understanding by all stakeholders of waste and resource recovery infrastructure types and needs across the State and the associated economic benefits, job creation and investment opportunities;
- (b) Provide a clear policy framework and a platform conducive to attracting investment, which allows for a well-coordinated and balanced approach towards waste and resource recovery infrastructure and capability building that promotes innovation and economies of scale;
- (c) Inform the State's land-use planning system enabling land use planning to provide for appropriate and essential waste and resource recovery infrastructure investment, including adequate provision of suitable sites and buffers; and
- (d) Support a viable resource recovery and re-manufacturing industry and foster industry capabilities in South Australia that can be exported.

In 2017, EPA NSW prepared a consultation draft for a state-wide infrastructure plan<sup>78</sup> that seeks to analyse the needs throughout the state and finalise a robust strategy that will help achieve NSW's waste strategy objectives. In WA, the Waste Authority has committed to developing an infrastructure plan. As a result, a Strategic Waste Infrastructure Planning Working Group has been established to support the development of the plan. The aim is to determine the waste management infrastructure needs and contribute to achieving waste strategy targets. In Qld, the Department of Environment and Science has commenced a process to develop a state-wide infrastructure plan.

### **3.16 Application of C&D waste regulations in practice**

In this section, the application of C&D regulations in Australia in practice is assessed using literature review technique. The literature used in this review includes relevant reports and submissions to the inquiries managed by authorities in different jurisdictions and Australian organisations. At the conclusion of the survey, more insights from different stakeholders will be added to the pool. The two main issues in the C&D regulations that are discussed in this section are: landfill levy and the proximity principle. This section will be expanded when the responses to the survey are obtained.

#### **3.16.1 Perceptions of imposition of landfill levy in Australia**

In 2011, a C&D supply chain guide<sup>79</sup> prepared for the Commonwealth Government of Australia reported that many stakeholders had indicated that landfill costs (landfill operation and levies) are a significant driver for the use of salvaged and recycled C&D waste. In 2018, various respondents to the call for submissions to The Senate's Environment and Communicates References Committee expressed support for continuous imposing of landfill levies (Environment and Communications References Committee, 2018). The submissions highlighted that levy schemes can act as a disincentive for waste disposal. Further, they concluded that the ensuing revenue is an important source of funding for

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<sup>77</sup> Green Industries SA. 2018 South Australia's Waste and Resource Recovery Infrastructure Plan.

<sup>78</sup> EPA. NSW Waste and Resource Recovery Infrastructure Strategy. 2017-2021 – Draft for consultation.

<sup>79</sup> Edge Environment. 2011. Construction and Demolition Waste Guide - Recycling And Re-Use Across The Supply Chain. The Commonwealth Government of Australia.

investment in waste and recycling management initiatives. The following table (Table 19) shows the examples of support from different submitters:

**Table 19. The evidence of effectiveness of landfill levies in Australia**

<b>Respondents</b>	<b>Indicative language</b>
<b>WA Government</b>	There has been a notable diversion from landfill for two waste streams (i.e. C&D and C&I) since 2011 when levy rates were considerably increased.
<b>Re.Group</b> ( <a href="http://www.re-group.com/">http://www.re-group.com/</a> )	NSW's relatively high recovery rate for two waste streams (i.e. C&D and household waste) has been driven by the landfill levy.
<b>SA Government</b>	Progressive increase of waste recovery (reduction in waste disposal) has been concurrent to continuous increase in levy fee. The increase was more than 20% in 2015-2016 (81.6%) compared to 2003-2014 (60%).
<b>The Western Australian Local Government Association</b>	There is evidence that the landfill levy has been responsible for diverting inert material from landfill; however, it is not known where this waste is being diverted.
<b>Envorinex</b> ( <a href="https://envorinex.com/">https://envorinex.com/</a> )	Landfill levies should be priced high enough to encourage major business to send their waste to recyclers and not to landfill sites.

Source: Environment and Communications References Committee (2018)

In addition to support from the submissions to this committee<sup>80</sup>, there are some concerns about the unintended consequences that emerge from improper design of levy schemes. These concerns express that the jurisdictional legislation levy should not give rise to unintended outcomes such as interstate waste transfer because of cost disparity, discouraging private investors from investing in recycling infrastructure, high administrative costs corresponding to the application of complex schemes, and stockpiling and illegal dumping.

In addition, some respondents provided evidence that shows that imposing a landfill levy did not achieve the intended goals (e.g. reduction in waste disposal or increase in waste recovery activities)<sup>81</sup>. Indeed, this evidence demonstrates that there are limits to what can be achieved through the imposition of a landfill levy. Table 20 summarises these challenges associated with landfill levies.

**Table 20. Unexpected results from implementation of landfill levies in Australia**

<b>Submitter</b>	<b>Indicative language</b>
<b>The Law Council of Australia</b>	Landfill levies can encourage stockpiling and illegal dumping.
<b>GCS Consulting</b>	During the period when the amount of the metropolitan New South Wales levy doubled, the NSW C&D industry was found to have reduced its recycling rate, which is contrary to expected market behaviour and the efficacy of the levy as a pricing mechanism that was achieved when the levy was at much lower levels.
<b>Unspecified submitters</b>	Little effect on waste generation, as ratepayers have no direct financial incentive to reduce waste destined to landfill.
<b>Adelaide Hills Region Waste Management Authority</b>	Waste disposal levies do 'not act as a direct driver for the community to reduce waste generation or increase recycling habits' because any increase in waste levies is 'covered by general rate revenue'.
<b>The Australian Sustainable Business Group</b>	Highlighted that there is evidence that an increase in the landfill levy results in incurring additional costs for the recycling industry.
<b>National Waste and Recycling Industry Council</b>	A levy on the disposal of recycling residuals reduces the competitiveness of materials sold into the international market.

<sup>80</sup> Environment and Communications References Committee (2018).

<sup>81</sup> Ibid pp. 47-58.

<b>Centre of International Economics</b>	In NSW, the waste levy of \$120AU reduced the profit margin of metal recyclers in 2011.
<b>The Australian Council of Recycling</b>	When recyclers are liable to pay the levy for the disposal of contaminants that have entered the recycling stream, they see it as a disincentive towards being involved in the recycling industry and instead it encourages shipping unprocessed waste overseas.
<b>Re Group</b>	The disposal of residuals generally represents a significant cost for recycling facilities, which can obviously create commercial incentives to seek lower disposal cost options. It also justifies transport waste to interstate locations with a lower disposal rate.
<b>Visy, Owens-Illinois and SKM Recycling</b>	Landfill levies penalise the recycling industry for the disposal of residual rubbish that enters the recycling stream.

Source: Environment and Communications References Committee (2018)

Aside from the views tabulated above and beyond the scope of this report, several respondents indicated that levies have little impact on domestic waste generation patterns in Australian cities<sup>82</sup>. The findings indicate that, because councils charge households at a flat fee to recover the levy fees, which they pay on behalf of ratepayers, they have no motivation to reduce the amount of waste disposed. In other words, basically, the price signal is not passed on through the rates directly. There is a lesson in this causality that can be transferred to the context of C&D waste management; the levy should be accompanied by other financial incentives to effectively target waste generation at origin: for example, during the design and construction stages. A discussion on the concept of 'design out waste' is provided in section 2.2.2 of this report.

Several trends emerged in response to the call made by the WA Department of Waste and Environmental Regulation for submission to a discussion paper on landfill levy. Some of the submissions presented different issues that were not considered in the relevant regulations and policies. The following are a selection of their responses to the latest levy regime in WA:

*'A levy, by its nature, is a penalty/cost impost. In what way is the payment of a levy an incentive? Those paying the levy have less funds available to put into their own research and subsequent implementation of their own waste reform policies and systems'<sup>83</sup>.*

*'In addition, we are concerned that this appears to be revenue raising activity rather than a legitimate pursuit of better environmental outcomes for Western Australian'<sup>84</sup>*

Therefore, future design and implementation of regulations and policies should ensure that:

- 1) Any levy imposed should be articulated as the 'key environmental lever' not an 'economic policy lever'
- 2) A rebate system is put in place for those who are involved in landfill diversion
- 3) Alternative methods of calculating waste volumes, rather than just utilisation of weigh stations, are allowed.

Another barrier to effective enforcement of landfill levies discussed previously (Report 1) is to nationally harmonise gate fees. The support for harmonisation is abundant (Environment and Communications References Committee, 2018) and it is believed it can substantially minimise inter-jurisdictional waste transfer. However, it should be remembered that such an arrangement might not produce the best results. Simple harmonisation may overlook the existing contextual conditions in each jurisdiction. It may also interfere with the specific waste management system implemented in

<sup>82</sup> Ibid p. 51.

<sup>83</sup> Activa developments Pty Ltd. 2017. Comments on waste reform project

<sup>84</sup> Alcoa of Australia Limited. 2017. Comments on waste reform project

different states and territories. Hence, it is better to set up the levy fees in a way that ensures the negative impact on the effective management of C&D waste across Australia is minimised. For instance, a rate disparity should be calculated to the extent that it does not prompt unnecessary long-distance waste transfer.

### **3.16.2 Perceptions of the proximity principle**

This principle requires waste generators to send their waste to a facility that is located in a certain perimeter of origin. Several submissions to the Environment and Communications References Committee (2018) argued that the proximity principle (PP) can assist in preventing movement of waste between jurisdictions for the purpose of avoiding and minimising levy liabilities. A criticised example of implementation of PP is happening in NSW where waste generators are only allowed to dispose of their waste within a 150 Km perimeter. The Waste Contractors and Recyclers Association of NSW instead suggested that a national proximity principle would be more effective. In this respect, the Law Council of Australia (LCA) suggests that implementation of a national PP should align with Section 92 of the Constitution, which stipulates that trade and commerce among the states are to be regarded as absolutely free.

The submission from the Waste Management Association of Australia indicates that its members need to stop the practice of long-distance transportation of waste. This association argues that, *'...we do not agree with long-distance transportation; we actually agree there has to be a proximity principle in place to stop the excessive and unnecessary movement of waste across distances, particularly if there is the infrastructure in place. You can't actually invest and develop infrastructure if you haven't got certainty about what's coming through the front gate. In Europe you do have a proximity principle, so we need to solve how we do that'* (p. 59).

The other argument in regard to PP is that authorities have to be alerted to the consequences of implementation of such a policy. It is argued that there are some environmental benefits that come with waste transport that could be diminished by imposition of PP. In the case of development of a domestic market for C&D waste, the trade of recovered/unrecovered waste materials between different locations is necessary to sustain industries and businesses involved in the market. China's National Sword Policy is another driver for the wise adoption of PP in Australia. This policy forces the Australian waste and resource recovery industry to commit to the development of a sustainable domestic market for trading waste materials across Australia. For waste energy recovery, the need for sustainable waste feedstock is found to be the main barrier to development of Energy from Waste (EfW) facilities. It can be concluded that, until the full potential for waste management in proximity is fulfilled, a reasonable transportation distance of recovered/unrecovered waste materials should be allowed.

## 4 RECOMMENDATIONS

### 4.1 State specific reforms

Following the review of the waste related legislative and non-legislative documents in eight jurisdictions of Australia, some reforms are hereby suggested to address the inconsistencies between them. While some of the reforms below are specifically recommended for one jurisdiction, there are some recommendations that apply to more than one jurisdiction.

These recommendations primarily emerge from the following sources:

- 1) Review of national and jurisdictional legislations
- 2) Review of jurisdictional waste strategy documents and
- 3) Review of national and jurisdictional reports, consultation and review drafts, submissions to the Senate's Environmental Reference Committee

It is expected that these recommendations will be modified when the project has completed administration of a survey on different aspects of C&D waste management, and the resulting responses are gathered and analysed. Almost all of these recommendations can be incorporated in jurisdictional legislations and their benefits can be achieved when they are supported in primary legislation and subordinate regulations.

- 1) Differentiate between littering and illegal dumping, and provide of a specific definition and regulations for illegal dumping in ACT and Tas;
- 2) Set a quantitative target for reducing illegal dumping incident frequency in ACT, NT, Qld, Tas, Vic and WA;
- 3) Separate levies between metropolitan and regional areas in ACT, NT and Tas;
- 4) Increase penalty fees for illegal dumping in ACT, Qld and Tas;
- 5) Extend the legal liability of illegal dumping activities to those who transport, accept and allow waste to be illegally disposed of anywhere in ACT, NT, Qld, SA, Tas;
- 6) Prepare guidelines on siting, design, operation and rehabilitation of landfills that can best match the waste hierarchy objectives in ACT and Tas;
- 7) Make regulations, similar to Vic's (Environment Protection (Distribution of Landfill Levy) Regulations 2010, that outline how the landfill revenue is to be distributed in ACT, NSW, NT, Qld, SA, Tas;
- 8) Set specific regulations for supporting C&D waste (particularly) energy-to- waste (EfW) where further recycling is not technically and financially practical (NSW Energy from Waste Policy Statement is a good model to follow in this important step towards the Territory's target of sending zero waste to landfill by 2025 in ACT, NT, Qld, SA, Tas, Vic and WA);
- 9) Provide regulatory support for both fixed and mobile crushing and screening equipment that encourage equitable management of these two systems, potentially resulting in cost efficient C&D waste recycling practices in ACT, NSW, NT, Qld, Tas, Vic and NSW;
- 10) Develop regulations and strategies to manage emergency C&D waste in natural disaster incidents (i.e. earthquake, landslide or flood) in NSW, NT, Qld;
- 11) Develop or update the out-dated waste strategy in Tas;
- 12) Introduce a policy/guideline that is used to assess proposals for Energy from Waste (EfW) facility design and establishment according to the EPA administrated primary legislations and subordinate legislations in Tas;
- 13) Distinguish between litter and C&D waste in state regulations in NSW;
- 14) Implement or improve waste data collection, monitoring and analysis in Tas and NT;
- 15) Establish a policy that provides direction and guidelines for development of sustainable procurement, which will encourage confidence in recycling facility operators to produce products that meet end use requirements in NT, Tas and Qld;

- 16) Develop a procedure to determine levy and penalty fees in NT;
- 17) Consider management options against the waste hierarchy in NT and Tas;
- 18) Provide a clear process for determining licence requirements or exemptions based on environmental risk in NT;
- 19) Encourage product stewardship schemes through development of relevant regulations, policy and guidelines in Tas and WA;
- 20) Revisit levy fees to promote recycling and recovery of C&D waste and encourage investment in these areas, leading to the development of a market for recycled materials and curtailing of interstate waste transfer from NSW in Qld;
- 21) Revisit legislation to ensure better consistency with other states and territories to stop waste transfer to state and improve waste management activities performance in Qld;
- 22) Introduce a landfill levy for material disposed at state-wide landfills to encourage investment in resource recovery and recycling, and implement practices that reduce waste generation in Tas;
- 23) Increase the power of the Litter Officer, EPA Division to better enforce regulations in Tas;
- 24) Provide additional resources to bolster the capability of the regulator to provide improved regulation and compliance (e.g. via landfill levy) in Tas;
- 25) Establish a state-wide organisation to lead/champion and implement state waste and resource recovery strategies in Tas;
- 26) Develop a state waste and resource recovery infrastructure plan that provides a roadmap to meet the future waste disposal needs and resource recovery objectives of the state;
- 27) Support industry to use materials efficiently, reuse materials and to understand the business case to improve resource recovery, create jobs and boost the economy in Tas;
- 28) Create an alignment between state policies and national policies in Tas;
- 29) Make sure that gate fees are consistent between council and private operated facilities to avoid long distance travelling in WA;
- 30) Amend the Environmental Protection (Landfill) Levy Act 1998 to clearly outline in detail how the landfill revenue is to be distributed in WA.

## 4.2 Nationwide reforms

Similar to the reforms provided for each state, there are certain suggestions that can result in improved management of C&D waste nationally. These suggestions are based on previous reports, including submissions to the Senate's Standing Committee on Environment and Communications 2018 and a review of the regulatory framework in Australia. Due to their complex nature, these suggestions can only be implemented through a coordinated decision-making process supported by all states and territories. To achieve this, Environment Ministers at all levels of government should meet regularly to reach an agreement in principle.

- 1) Harmonise specifications of recycled materials to be used in road pavement, increase in use of recycled materials to avoid data gaps and data bias (this provides an opportunity to better aggregate and report waste data);
- 2) Provide consistency in the scope of waste related regulations and policies;
- 3) Give consistent guidance and training for all jurisdictions;
- 4) Develop a nation-wide waste and recycling infrastructure plan that stipulates the minimum design and construction requirements; this will improve development, management and operation of protected sites for landfills, energy recovery sites, composting sites and all forms of recycling activities;
- 5) Provide consistent guidelines for waste auditing that is applicable throughout Australia;
- 6) Increase the usefulness of shared information and improve assessment of outcomes of projects, policies, laws and business transactions in different jurisdictions;
- 7) Establish a robust and consistent national waste data management system that is obliged to improve assessment of outcomes of projects, policies, laws and business transactions in different jurisdictions;

- 8) Provide uniform reporting of waste data to better aggregate and report waste data. The first step is for the Commonwealth government to implement the 65 agreed improvements to the National Waste Report as established by Blue Environment's *Improving national waste data and reporting report*;
- 9) Set a policy to align jurisdictional data management and reporting procedures with international reporting requirements;
- 10) Approximate waste levies as an impetus for greater recycling, reduction of interstate waste transportation, forcing of companies to invest more in efficient technologies to recover waste, reduction in the amount (cost and volume) of waste land filled, and to prevent unnecessary waste transfer;
- 11) Set a policy that includes the minimum staff required to monitor and enforce waste regulation; provide for the availability of sufficient staff to minimise illegal dumping across Australia;
- 12) Show leadership through the urgent implementation of the 16 strategies established under the National Waste Policy;
- 13) Support jurisdictional educational programs that result in raised societal environmental awareness about waste management and further recycling;
- 14) Provide incentives to encourage industry professionals to invest in industrial waste sorting and more waste recycling; in particular, federal government can encourage jurisdictions to invest in facilities for sorting mixed C&D waste through landfill levy revenue;
- 15) Restructure the market towards greater domestic recycling and recovery of waste away from export reliance;
- 16) Revisit Australia's building codes to facilitate use of recycled materials in buildings;
- 17) Simplify regulations to provide greater clarity, remove unnecessary regulatory burden and remove clauses that are no longer required;
- 18) Provide legislative support for the use of technologies such as remote sensing, GIS and drones;
- 19) Introduce Commonwealth legislative targets for waste and recycling standards to transition towards a more circular economy in which materials are used, collected, recovered and reused;
- 20) Adjust product stewardship schemes established under the Product Stewardship Act 2011 to better represent real world conditions; and
- 21) Develop a Sustainable procurement policy specifically for recycled C&D waste materials to increase use of recycled materials.

## 5 CONCLUSION

This review demonstrates that there are fundamental discrepancies in legislative framework between Australian states and territories. It is believed that these discrepancies are hindering effective action. Many businesses operate in national markets and must fulfil different obligations in every jurisdiction. Indeed, national and common approaches can improve the efficiency of Australia's waste and resource recovery processes, and this in turn can contribute to growing markets for recycled waste materials. While some of these discrepancies are the direct product of contextual conditions and may be difficult to address urgently, there are areas of improvement for C&D waste management that can be gained through harmonisation. In an ideal world, harmonisation will bring many benefits as stated above, however, it is worth keeping in mind that any harmonisation needs support from all stakeholders affected. Currently, Australia lacks a 'level playing field' within which industry can operate and therefore, regulatory authorities must make sure that efforts for harmonisation will not adversely impact the key stakeholders in different jurisdictions. On this basis, this review provides specific reforms for each jurisdiction as well as for the whole country to ensure that these reforms provide the best benefits for every party involved in management of C&D waste.

## 6 GLOSSARY

<b>Term</b>	<b>Definition</b>
<b>ABS</b>	Australian Bureau of Statistics
<b>ACOR</b>	Australian Council of Recycling
<b>ACT</b>	Australia Capital Territory
<b>ALGA</b>	Australian Local Government Association
<b>ALOA</b>	Australian Landfill Owners Association
<b>APCC</b>	Australasian Procurement and Construction Council
<b>Asbestos</b>	The fibrous form of mineral silicates belonging to the serpentine and amphibole groups of rock-forming minerals, including actinolite, amosite (brown asbestos), anthophyllite, chrysotile (white asbestos), crocidolite (blue asbestos), tremolite, or any mixture containing one or more of the mineral silicates belonging to the serpentine and amphibole groups
<b>ASBG</b>	Australian Sustainable Business Group
<b>AWD</b>	Australian Waste Database
<b>AWT facility</b>	Advanced waste treatment facility
<b>C&amp;D waste</b>	Construction and Demolition: Waste produced by demolition and building activities, including road and rail construction and maintenance and excavation of land associated with construction activities
<b>C&amp;I waste</b>	Commercial and Industrial: the solid component of the waste stream arising from commercial, industrial, government, public or domestic premises (not collected as Municipal Solid Waste), but does not contain Listed Waste, Hazardous Waste or Radioactive Waste
<b>Circular economy</b>	An alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible – extracting the maximum value from them while in use, then recovering and reusing products and materials. Three core principles underpin a circular economy – design out waste and pollution; keep products and materials in use; and regenerate natural systems.
<b>Clean (waste) fill</b>	Raw excavated natural material (e.g. clay, gravel, sand, soil or rock fines) that: (a) has been excavated or removed from the earth in areas that have not been subject to potentially contaminating land uses including industrial, commercial, mining or intensive agricultural activities; and (b) has not been processed except for the purposes of: i. achieving desired particle size distribution; and/or ii. removing naturally occurring organic materials such as roots; and (c) does not contain any acid sulphate soil; and (d) does not contain any other type of waste. This definition
<b>Clean-up action</b>	Action to prevent, minimise, remove, disperse, destroy or mitigate any pollution resulting or likely to result from the incident, and (b) ascertaining the nature and extent of the pollution incident and of the actual or likely resulting pollution and (c) preparing and carrying out a remedial plan of action. It also includes (without limitation) action to remove or store waste that has been disposed of on land unlawfully
<b>COAG</b>	Council of Australian Governments
<b>Controlled waste</b>	waste types listed in Schedule 1 of the Environmental Protection (Controlled Waste) Regulations 2004

<b>Energy from Waste (EfW)/ Waste to Energy (WtE)</b>	is the process of generating energy in the form of electricity and/or heat from the primary treatment of waste, or the processing of waste into a fuel source. WtE is a form of energy recovery
<b>Energy recovery facility</b>	A facility that captures, on average, more than 20% of the embodied energy in the waste it receives for beneficial use
<b>EPA</b>	Environmental Protection Authority
<b>EU</b>	European Union
<b>Extended Producer Responsibility</b>	An environmental policy approach where the producers' responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle. Producers accept their responsibility when they design their products to minimize life cycle impacts and when they accept legal, physical and/or economic responsibility for the environmental impacts that cannot be eliminated by design.
<b>Fate</b>	The ultimate destination of waste within the management system. The fates of waste are recycling, energy recovery, disposal and long-term storage
<b>Focus material</b>	According to WA waste strategy it includes eight types of waste such as C&D waste, organic waste, metals etc.
<b>General waste</b>	materials or products that are unwanted or have been discarded, rejected or abandoned. Includes materials or products that are recycled, converted to energy, or disposed. Materials and products that are reused (for their original or another purpose without reprocessing) are not waste because they remain in use.
<b>Hazardous waste</b>	means the component of the waste stream which by its characteristics poses a threat or risk to public health, safety or the environment (includes substances which are toxic, infectious, mutagenic, carcinogenic, teratogenic, explosive, flammable, corrosive, oxidising and radioactive)
<b>Illegal dumping</b>	is leaving waste on private or public land that is not licensed to accept such waste
<b>Industrial symbiosis</b>	a central part of a circular economy, a model in which resources and energy are recycled and recovered instead of moving linearly from extraction to disposal
<b>Integrated waste management</b>	The management of the entire waste process including generation, storage, collection, transportation, resource recovery, treatment and disposal. Integrated waste management employs several waste control methods based on the waste hierarchy including avoidance, reduction, recycling, reuse, recovery, treatment and disposal, aimed at minimising the environmental impact of waste
<b>Level playing field</b>	a situation in which everyone including landfill owners, waste recovery and recycling facility operator, government, and community has a fair and equal chance of succeeding
<b>Levy</b>	the contribution aims to reduce the amount of waste being landfilled and promote recycling and resource recovery
<b>Listed waste</b>	Listed wastes are defined under Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations
<b>Litter</b>	Waste that is left in public places and not deposited into a bin.

<b>Material environmental harm</b>	(a) that is not trivial or negligible in nature, extent or context; or (b) that causes actual or potential loss or damage to property of an amount of, or amounts totalling, more than the threshold amount but less than the maximum amount; or (c) that results in costs of more than the threshold amount but less than the maximum amount being incurred in taking appropriate action to— (i) prevent or minimise the harm; and (ii) rehabilitate or restore the environment to its condition before the harm
<b>MSW</b>	Municipal Solid Waste: The solid component of the waste stream arising from domestic premises that is received directly from the public
<b>NEPC</b>	National Environment Protection Council
<b>NWP</b>	National Waste Policy
<b>Primary legislation</b>	These are laws Parliament has enacted. Sometimes Acts are called ‘Acts of Parliament’. Less often Acts are called ‘primary legislation’ to distinguish them from subsidiary legislation. Usually they each have the word ‘Act’ in their title.
<b>Recovery</b>	A process that extracts materials or energy from the waste stream
<b>Recycle/recycling</b>	Set of processes (including biological) for converting recovered materials that would otherwise be disposed of as wastes into useful materials and or products
<b>Recycled materials</b>	Materials recovered and manufactured into products
<b>Residual (residue) waste</b>	means the waste from a recycling activity that is commonly disposed of to landfill after the recoverable components have been removed from material
<b>Resource recovery</b>	In relation to waste, means: a. reusing the waste; or b recycling waste, recovering energy and other resources from the waste
<b>Reuse</b>	Using a waste product again for the same or a different purpose without further manufacture
<b>Solid Waste</b>	Any waste that is not gaseous and is not a Liquid Waste as determined by EPA Guideline, Liquid waste classification test (2003)
<b>Storage</b>	Accumulation of wastes in approved infrastructure such that materials are readily retrievable
<b>Subordinate legislation</b>	These are laws made by people using powers that Parliament, by means of its Acts, has given them. Sometimes these laws are called delegated legislation or subordinate legislation
<b>Sustainable Procurement</b>	A process whereby organisations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organisation, but also to society and the economy, whilst minimising damage to the environment
<b>SV</b>	Sustainability Victoria
<b>SWA</b>	Safe Work Australia
<b>Treatment</b>	The removal, reduction or immobilisation of hazardous characteristics through physical, chemical or biological processing of waste to enable the waste to be sent to its final fate (i.e. disposal or reuse) or further treatment

<b>Waste disposal</b>	A waste fate in which no material or resource recovery use is made of the waste. Includes disposal to landfill and to incineration without energy recovery
<b>Waste diversion</b>	The redirection of waste from a disposal facility to a recycling or energy recovery facility
<b>Waste diversion</b>	The act of diverting a waste away from landfill for another purpose such as re-use or recycling.
<b>Waste fate</b>	The ultimate destination of waste within the management system. The fates of waste are recycling, energy recovery, disposal and long-term storage
<b>Waste generation</b>	The process of producing waste. For data reporting purposes, waste generation is the sum of the quantities of wastes taken to waste management facilities or added to on-site stockpiles
<b>Waste hierarchy</b>	The waste hierarchy is a set of priorities for the efficient use of resources. The waste hierarchy includes avoid and reduce waste, reuse waste, recycle waste, recovery energy, treat waste, dispose of waste.
<b>Waste landfill</b>	A waste disposal site used for the controlled deposit of solid waste onto or into land
<b>Waste management</b>	The activities through which a waste is dealt with, in infrastructure approved to receive it
<b>Waste management method</b>	waste management method, which refers to the infrastructure that receives waste – landfill, compost facility, alternative waste treatment facility, etc.
<b>WMAA</b>	Waste Management Association of Australia

**Sources:** Waste definitions- Waste Guidelines- EPA 842/09- SA  
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