Disclaimer

Information in this document is current as at October 2015. While all professional care has been taken in preparing this document, Sustainability Victoria accepts no liability for loss or damages incurred as a result of reliance placed upon its content.

The data and modelling referenced in this prospectus are mainly sourced from the Statewide Waste and Resource Recovery Infrastructure Plan (state infrastructure plan) and the suite of government initiatives. The 2011–12 figures used in the state infrastructure plan have been updated to the latest figures (2013–14) where possible. Exceptions to these data sources are noted.

All dollar amounts in this document are expressed in Australian Dollars.
Victoria leads Australia in the development of its waste and resource recovery sector. In 2013–14 the state recovered 70% of its waste. The sector generates over $2.2 billion in annual revenues and provides jobs to more than 8,000 Victorians. It also manages the environmental impact of waste and helps our communities to maintain and improve their quality of life.

But we can, and must, do better.

To do so, we need the advanced technologies, innovative business processes and new business models that investment brings. Whether from existing waste and resource recovery operators, new market entrants, councils, waste generators or the financial sector, new investment is critical to Victoria achieving its ambitions for waste and resource recovery.

Protecting Victoria’s natural environment is key to maintaining our enviable quality of life. Reducing our reliance on landfills and increasing the recovery of valuable resources will help us achieve this aim.

Victoria’s population growth continues to be the fastest in Australia. We are expected to grow from 5.7 million to as many as 9 million residents by 2044, with annual, per capita waste generation expected to grow from 2.1 tonnes to 2.5 tonnes. Our challenge is to manage this growth so that public amenity and health is maintained and improved. The waste and resource recovery sector is fundamental to doing so.

To achieve this, Victoria has a plan for waste and resource recovery. The Statewide Waste and Resource Recovery Infrastructure Plan is the first of its kind in Australia. It details current and projected waste material flows, from generation to reprocessing, linking them to transport infrastructure. It is a 30-year roadmap for government, industry and the community that supports Victoria’s broader planning policy framework. It provides the necessary detail of waste and resource recovery to inform public policy investor business cases.

Strategically planning for this essential service drives growth in innovation and technology, and strengthens our economy by creating new jobs and fostering markets for recovered resources. It balances the need to develop an advanced industry sector with the needs of our communities, our environment and our commitment to reduce greenhouse gas emissions.

This Prospectus presents the significant opportunities for waste and resource recovery infrastructure in Victoria. It highlights the principle material streams, particularly those of particular importance to the state, including tyres and rubber waste, organic waste and electronic waste. It provides crucial data and projections, and offers insights into the local market.

Victoria’s strong and transparent governance and regulatory framework, clear policy direction and coordinated cross-government efforts to support the sector to succeed are crucial elements of Victoria’s offering to investors. Combined with our advanced transport, communications and utilities infrastructure, our operating environment is amongst the best for aspiring investors.

Our planning has enabled us to forecast the gaps in infrastructure. As a result, Victoria actively supports growth in waste and resource recovery sector investment. We aim to grow our resource recovery to over 80% by 2044, generating up to $5 billion in opportunities for infrastructure investment.

The Victorian Government’s specialist investment facilitation service for the waste and resource recovery sector will connect investors with the people, data, insight and expertise they need to inform their decisions and deliver the best possible outcomes for our environment, communities and economy.

I invite you to be a part of Victoria’s future as we drive the development of new and innovative solutions in our waste and resource recovery sector.

Lisa Neville
Minister for Environment, Climate Change and Water
## Glossary and terms

### Term Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land-use planning</td>
<td>The management of land development in an efficient and ethical way that prevents land-use conflicts and balances the needs of the community with the built and natural environment, cultural significance and economic progress.</td>
</tr>
<tr>
<td>Landfill levy</td>
<td>A levy is directly paid by those who dispose of waste in a landfill. A different levy is applied to different materials. Levy rates differ between metropolitan Melbourne and regional landfills, and depend on the type of material being disposed.</td>
</tr>
</tbody>
</table>

### Waste Sectors

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal solid waste (MSW)</td>
<td>Solid waste generated from municipal and residential activities, including waste collected by, or on behalf of, a municipal council. Note that MSW does not refer to waste delivered to municipal disposal sites by commercial operators or waste from municipal demolition projects.</td>
</tr>
<tr>
<td>Solid industrial waste (SIW)</td>
<td>Solid, inert waste generated from trade, commercial and industrial activities.</td>
</tr>
<tr>
<td>Construction and demolition (C&amp;D)</td>
<td>Solid, inert waste generated from residential and commercial construction and demolition activities.</td>
</tr>
</tbody>
</table>

### Waste Facilities

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incinerators</td>
<td>A site that disposes of waste by burning it, generally without producing a useful end product.</td>
</tr>
<tr>
<td>Landfill</td>
<td>Discharge or deposit of solid wastes onto land that cannot be practically removed from the waste stream; may include a RRC/TS or resale shop.</td>
</tr>
<tr>
<td>Materials recovery facility (MRF)</td>
<td>A facility that receives and sorts household and business commingled recyclables, compacting, baling or consolidating materials then sent to reprocessing facilities.</td>
</tr>
<tr>
<td>Organic reprocessing facilities</td>
<td>A facility that biologically reprocesses organic matter, yielding a variety of products including stabilised organic residues; includes both windrow and in-vessel technologies.</td>
</tr>
<tr>
<td>Resource recovery centres (RRC)</td>
<td>Facilities established to receive and/or recover re-useable and recyclable materials that would otherwise be destined for disposal. Can be combined with a transfer station and may include resale centres.</td>
</tr>
<tr>
<td>Transfer stations (TS)</td>
<td>A facility allowing the drop-off and consolidation of waste and a wide range of recyclable materials; can be combined with a resource recovery centre and may include resale centres, but does not undertake processing activities.</td>
</tr>
<tr>
<td>Energy-from-waste facilities (EfW)</td>
<td>A treatment process and technology used to generate a usable form of energy (electricity, gas or heat) from waste materials. The terms “energy recovery from waste”, “waste-to-energy (WtE)” or “energy-from-waste” can be used interchangeably.</td>
</tr>
</tbody>
</table>

### Victorian Government agencies linked to waste and resource recovery or investment

<table>
<thead>
<tr>
<th>Agency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability Victoria (SV)</td>
<td>Delivers integrated waste management and resource efficiency programs to maximise resource recovery and facilitate investment in waste and resource recovery infrastructure.</td>
</tr>
<tr>
<td>Environment Protection Authority Victoria (EPA)</td>
<td>Established under the auspices of the Environment Protection Act 1970. EPA Victoria is the agency responsible for regulating waste and resource recovery infrastructure, works approvals and environmental regulatory enforcement.</td>
</tr>
<tr>
<td>Department of Environment, Land, Water and Planning (DELWP)</td>
<td>A Victorian Government department providing policy planning, preparation of legislative amendments, leadership, coordination and oversight of the environment portfolio.</td>
</tr>
<tr>
<td>Waste and Resource Recovery Groups (WRRGs)</td>
<td>Seven statutory authorities established under the Environment Protection Act 1970 responsible for planning for waste and resource recovery infrastructure (and supporting local governments) within each of the seven regions; responsible for preparing the Regional Waste and Resource Recovery Implementation Plan for their region.</td>
</tr>
<tr>
<td>Invest Victoria</td>
<td>The lead investment promotion and facilitation agency for Victoria, representing all industry sectors of the state.</td>
</tr>
</tbody>
</table>
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Introducing

Victoria is Australia’s second most populated state, with an advanced and diversified economy that generates considerable opportunities for investment.

This prospectus introduces Victoria’s waste and resource recovery sector. It describes its key attributes and features unique to Victoria, alongside current and emerging opportunities for infrastructure investment across the state.
A service essential to all Victorians

Victoria’s waste and resource recovery system provides services essential to the community to effectively manage its waste streams, mitigate the environmental and social impacts of waste and maximise its economic benefit.

Resource recovery supports the effectiveness of our waste management system. It stimulates the development of more advanced resource recovery infrastructure that captures the economic value of our waste materials and creates jobs.

Victoria is planning for its future waste and resource recovery infrastructure needs. This will ensure an accessible, advanced and effective waste management system that maximises viable resource recovery to realise the potential environmental, community and economic benefits.

Our vision for waste and resource recovery

The Victorian Government’s vision is of a better managed and more integrated waste and resource recovery system that ensures only unrecoverable waste is disposed to landfill.

The objective is to minimise the environmental and social impacts of waste while realising its considerable economic potential and increasing Victoria’s already enviable quality of life.

Our plan for waste and resource recovery

The Victorian Government has a plan for waste and resource recovery. The Statewide Waste and Resource Recovery Infrastructure Plan (the state infrastructure plan) is Victoria’s 30-year roadmap to develop the sector’s infrastructure. It identifies waste stream volumes, their compositions and geographic spread, as well as the transport and utility hubs that support the sector.

As the first of its kind in Australia, the state infrastructure plan informs and supports government policy, land-use planning and investors’ business cases, enabling policy that supports investment in the sector while helping investors to identify and realise the opportunities available in Victoria.

Waste and resource recovery planning will be integrated with the state’s land-use planning frameworks, helping to secure the land required for resource recovery facilities.

The state infrastructure plan supports investment in the right type of resource recovery infrastructure for Victoria in the right place and at the right time. It envisages maximising the recovery of waste resources where it is viable to do so.

Victoria is undertaking a suite of initiatives to:

› stimulate the market for recovered resources
› improve the quality of our waste flows
› enable aggregation of waste feedstock
› generate community support
› ensure the investment landscape in Victoria continues to be favourable.

These initiatives help to address barriers to investment, thereby reducing investment risk. This will increase the amount and efficiency of investment in the kind of advanced technologies and practices that improve resource recovery and grow Victoria’s economy.

Our investment facilitation service

Sustainability Victoria is helping to develop the waste and resource recovery sector by offering an investment facilitation service that attracts and enables investment in the sector. We seek to address the barriers to investment, thereby reducing the risk to investors and increasing the likelihood of a successful investment outcome.

We facilitate investment throughout the life of a project, from initial enquiries and business case development to the commissioning of a facility, in addition to aftercare for established operators. We provide a reliable and valuable service that is coordinated across relevant Victorian Government agencies to inform your investment decision.

Sustainability Victoria helps you by:

› providing data and information on local waste streams
› providing insight on the local market
› informing you of environmental issues across the state
› advising on engaging with local communities
› helping you understand government priorities and policies
› helping you understand Victoria’s system of governance
› coordinating your whole-of-government relationship
› identifying potential support mechanisms
› facilitating introductions with interested parties across industry, government, regulators and the community.
Growth and opportunities

Victoria is a lucrative opportunity for investors in waste and resource recovery:

› With nearly 6 million residents and GDP of $353 billion in 2014, Victoria is the second largest state in Australia by population and economic output. It is expected to grow to as many as 10 million residents by 2050.

› As our capital city, Melbourne, has 4.3 million residents and is expected to grow to over 8 million residents by 2050, surpassing Sydney as Australia’s largest city.

Victoria is generating substantial waste streams available for reprocessing into commercially viable products for reuse as raw material.

› Victoria generates a quarter of Australia’s waste and accounts for 22% of national GDP ($353 billion).

› In 2013-14, Victorians generated 11.1 million tonnes of waste. This is estimated to rise to nearly 21 million tonnes per year by 2044.

› Annual waste generation per person is expected to increase from 2.1 tonnes to 2.5 tonnes by 2044.

› In 2013-14, over 7.7 million tonnes of waste was diverted from landfill for recycling/recovery, a recovery rate of 70%.

- Of this recovered material, 1.1 million tonnes (14%) is exported for reprocessing overseas.

- Over 3.3 million tonnes (30% of total waste generated) is still sent to landfill each year.

Sales of products made from recovered materials generated revenues of over $800 million in 2013-14. Combined with gate fees, landfill payments, energy generation, transport costs and exports, the sector generates over $2.2 billion in annual revenues.

Resource recovery rates have grown steadily over the past 10 years due to strong markets for particular material streams. However, Victoria’s existing waste and resource recovery infrastructure lacks the capacity and capability to meet projected generation rates or fully realise the economic value of waste materials.

However, some waste material markets, such as metals, are robust and function well, with strong processing infrastructure, clear links to commodity prices and proven reuses. These will likely continue to be sufficiently managed in Victoria.

Increasingly constrained landfill capacity and the rising cost of diverting waste to landfill necessitates, and will drive, even higher resource recovery.

For investors, the opportunities in Victoria are significant, with an estimated requirement of $550-810 million in new waste and resource recovery infrastructure and $3.1-4.2 billion in the upgrade and expansion of existing facilities over the next 30 years.

This equates to $120-167 million in annual infrastructure investment opportunities in financing technology, infrastructure and expertise to significantly improve Victoria’s resource recovery.

With this level of investment in advanced infrastructure that maximises viable resource recovery, Victoria’s resource recovery rate could increase from a projected 73% to over 80%, or 16.5 million tonnes, per year by 2044.

Victoria’s strong economy, robust and transparent legal and political systems, and increasing community awareness and support for waste minimisation create the ideal conditions for investment in the sector.

CASE STUDY: Tyrecycle

Tyrecycle reprocesses end-of-life tyres in Victoria alongside facilities in each Australian state. With an established operation at its Somerton facility in the northern edge of Melbourne, it identified an emerging opportunity to access the growing tyre stockpiles around Victoria as well as those supplied by the mining sector.

The cost of doing so, however, affected the viability of their collection, transport to Somerton and subsequent reprocessing.

An innovative solution was needed and Tyrecycle has invested in a portable manufacturing unit that is capable of processing tyres into products of the same quality and specification that are produced in its permanent facilities. “With this unit there is no reason why any stockpile of whole tyres should still exist as they can all be recycled”, says Tyrecycle CEO, Jim Fairweather.

Crucially, Jim points to the relationship with Victoria’s Environment Protection Authority (EPA) in the success of the business: “State and local government are always supportive of our initiatives and EPA Victoria has been outstanding to clean up the industry and support investment.”

For the full case study and further examples, go to www.sustainability.vic.gov.au/invest.

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### Victoria’s economy

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Gross Domestic Product (GDP)</td>
<td>$353 billion</td>
</tr>
<tr>
<td>10 year annual average GDP</td>
<td>2.9%</td>
</tr>
<tr>
<td>Credit rating</td>
<td>AAA</td>
</tr>
<tr>
<td>Exports valued at over</td>
<td>$36 billion per year</td>
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<tr>
<td>5 year annual average GDP</td>
<td>2.9%</td>
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<tr>
<td>Jobs</td>
<td>Over 8,000 jobs</td>
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<tr>
<td>Annual revenues</td>
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### Victoria’s waste and resource recovery sector

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<tr>
<td>Recovery rate</td>
<td>70%</td>
</tr>
<tr>
<td>Annual revenues</td>
<td>$2.2 billion</td>
</tr>
<tr>
<td>Waste and resource recovery businesses</td>
<td>Over 590</td>
</tr>
<tr>
<td>Households generated</td>
<td>2.3 million</td>
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<tr>
<td>10 year annual average GDP</td>
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<tr>
<td>Gross Domestic Product (GDP)</td>
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Increasing waste generation

Victoria’s waste projection model\(^3\) estimates that by 2044 the state’s per capita waste generation will increase to over 2.5 tonnes each year with a 73% resource recovery rate. That means by 2044, there will be:

- 21 million tonnes of waste generated each year for Victoria to manage (see Figure 1)
- recovery of over 15 million tonnes (73%) of materials from waste each year
- disposal of over 5.5 million tonnes to landfill each year

The model also identifies waste generation by source. Solid industrial waste (SIW) is made up of construction and demolition waste (C&D) and commercial and industrial waste (C&I) and annual generation is projected to surge over the next 30 years, growing to 16.5 million tonnes by 2044 (see Table 1 and Figure 2).

Increasing resource recovery infrastructure

To improve resource recovery to 16.5 million tonnes each year by 2044, 1.5 million tonnes above projected trends, Victoria needs the appropriate infrastructure so that the majority of this waste can be reprocessed locally and more of its economic and environmental value are realised. The state infrastructure plan estimates that to achieve this increase in resource recovery by 2044, Victoria requires investment of $550-810 million investment in new resource recovery infrastructure and $3.1-4.2 billion in the maintenance, upgrade and expansion of existing waste and resource recovery infrastructure (including landfills).

Table 1  Waste by sector 2013–14

<table>
<thead>
<tr>
<th>Municipal solid waste (MSW)</th>
<th>Commercial and industrial (C&amp;I) waste</th>
<th>Construction and demolition (C&amp;D) waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% of Victorian market</td>
<td>37% of Victorian market</td>
<td>39% of Victorian market</td>
</tr>
<tr>
<td>2.74 million tonnes generated each year</td>
<td>4.07 million tonnes generated each year</td>
<td>4.33 million tonnes generated each year</td>
</tr>
<tr>
<td>44% recovery rate</td>
<td>73% recovery rate</td>
<td>83% recovery rate</td>
</tr>
<tr>
<td>Main materials: Paper and cardboard, food waste and plastics</td>
<td>Main materials: Metals, paper and cardboard</td>
<td>Main materials: Concrete, brick and asphalt</td>
</tr>
</tbody>
</table>

\(^3\) A waste projection model was created to determine future waste generation for the next 30 years based on government population projections and the relationship between population and waste generation in the past.
D&R Henderson is the only particleboard manufacturer in Australia that uses 100% recycled timber and is the first in Australia to strategically invest in a cleaning tower to enable the shredding and reprocessing of recycled wood waste. With potential changes to traditional wood sources for particleboard, the company took a calculated risk of investing in technologies seen in Europe to access alternative sources of wood fibre.

According to Managing Director David Henderson, approximately 130,000 tonnes of recycled wood have been diverted from landfill to the company’s Benalla facility in regional Victoria for reprocessing: “It is fair to say it has paid for itself already.”

Not only does D&R Henderson now have access to an alternative source of wood fibre, it is also able to offer a recycling service to its customers by accepting their timber waste as an alternative to landfill: “This is seen as a real win-win,” says David. “Recycling is the future. Businesses must use sustainable resources to ensure their ongoing success.”

For the full case study and further examples, go to www.sustainability.vic.gov.au/invest.

Victoria’s landfill levy is directly paid by those who dispose of waste in a landfill and is a key determinant in the business case for resource recovery. It is collected by landfill operators alongside the ‘gate fee’, the price charged by landfill operators for each tonne or unit of waste entering their facility.

The landfill levy has increased by over 20% since 2012. The Victorian Government is intending to review the efficiency of existing landfill levy rates.

Landfill levy rates are prescribed by the Environment Protection Act 1970.

Approximately 60% of licenced landfills in Victoria are owned by councils.

In 2014-15, Victoria’s landfill levy was:

- $58.50 per tonne of municipal/industrial waste in metropolitan and regional landfills
- $51.30 per tonne of industrial waste and $29.30 per tonne of municipal waste in rural landfills.
Opportunities across Victoria

Waste and resource recovery varies in volume and composition across Victoria, reflecting population densities, consumption and land-use patterns, local industry, transportation costs, the distance to landfill and landfill levy costs. These factors can influence the viability of the infrastructure to manage waste streams in different regions.

Victoria is divided into seven geographic regions for waste and resource recovery purposes, comprising 79 local councils (see Figure 3). This includes metropolitan Melbourne where 75% of the state’s waste is generated and 86% of Victoria’s total resource recovery is undertaken.

Regional Victoria generates the remaining 25% of the state’s waste (see Table 2). While generation and recovery in the regions is smaller than in the metropolitan area, there are opportunities to access considerable material-specific waste streams such as agricultural organics and food packaging that can be aggregated to support infrastructure investment.

Table 2 Waste by waste and resource recovery region in 2013-14 (million tonnes)

<table>
<thead>
<tr>
<th>WRR region</th>
<th>Generated(^a)</th>
<th>Recovered(^b)</th>
<th>Landfilled(^c)</th>
<th>% of state generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan</td>
<td>8.33</td>
<td>5.79</td>
<td>2.54</td>
<td>75%</td>
</tr>
<tr>
<td>Barwon South West</td>
<td>0.72</td>
<td>0.50</td>
<td>0.22</td>
<td>6%</td>
</tr>
<tr>
<td>Gippsland</td>
<td>0.51</td>
<td>0.35</td>
<td>0.15</td>
<td>5%</td>
</tr>
<tr>
<td>Goulburn Valley</td>
<td>0.36</td>
<td>0.25</td>
<td>0.11</td>
<td>3%</td>
</tr>
<tr>
<td>Grampians Central West</td>
<td>0.47</td>
<td>0.33</td>
<td>0.14</td>
<td>4%</td>
</tr>
<tr>
<td>Loddon Mallee</td>
<td>0.51</td>
<td>0.35</td>
<td>0.16</td>
<td>5%</td>
</tr>
<tr>
<td>North East</td>
<td>0.23</td>
<td>0.16</td>
<td>0.07</td>
<td>2%</td>
</tr>
<tr>
<td>Totals</td>
<td>11.13</td>
<td>7.74</td>
<td>3.39</td>
<td>100%</td>
</tr>
</tbody>
</table>

\(^a\) Modelled data.
\(^b\) Based on tonnes of materials entering reprocessing facilities in each region.
\(^c\) Revised landfill levy data (as at June 2014) was used to determine the regional tonnes. As a result the total state tonnes generated and landfilled is different to the figure quoted in material streams tables.
Population growth, industry development and localised landfill management issues are critical drivers in location-specific investment opportunities. Growth is concentrated in specific areas of both regional and metropolitan Victoria. The Metropolitan Planning Authority is responsible for managing and planning for this growth and Sustainability Victoria can provide assistance with identifying regions with high forecast growth rates.

There are significant quantities of materials available across Victoria that lack the supporting infrastructure needed to recover or reprocess them. Each region will have different priorities for infrastructure needs which will be determined in the Regional Waste and Resource Recovery Plans.

Work is already underway to reduce the number of landfills and ensure the remainder are better managed. Landfill closures will increase the need for alternative management of waste and incentivise resource recovery further.

By 2017, approximately 13 of Victoria’s 83 licenced landfills will have closed as a result of strategic, landfill-levy funded investments to improve resource recovery and protect the environment. Many of these landfill sites will present opportunities to transition to resource recovery centres or transfer stations.

The following landfills are scheduled to close in the near future:

- Barwon Southwest (multiple landfills – Alvie, Anglesea, Portland)
- Clayton/Kingston servicing the metropolitan region
- Eaglehawk landfill (servicing Bendigo in the Loddon Mallee region)
- Loddon Mallee (multiple landfills)
- Mornington Peninsula (multiple landfills – Rye and Devilbend)
- East Gippsland (multiple landfills – Mallacoota, Orbost, Bendoc and Lakes Entrance)
- Hard Hills landfill (servicing Grampians Central West)

**CASE STUDY: RPM Pipe**

RPM Pipe is located in the Goulburn Valley region of northern Victoria, a largely rural area with a concentration of agricultural and food production. The business reflects its regional origins, using plastic waste from local suppliers to recycle into an alternative to concrete and virgin plastic piping.

“We had the idea and we jumped straight in. We had no background in plastics recycling; we just thought we would give it a go and see if it worked out” reflects Terry Kay, CEO of RPM Pipe, illustrating the company’s fortuitous experimentation with plastics recycling that is now paying dividends.

Terry recalls: “Through the first two years, we did so much R&D. We developed our techniques to make a really strong pipe”.

RPM started by selling pipes to farmers in the local area. “Being located close to the farms meant that the farmers could visit and see our products,” says Terry. “This was really important at the time due to the negative perception of recycled products.”

Today, RPM Pipe has expanded its product range and supplies its unique offering to satisfied customers across Australia.

Investment opportunities

Victoria’s waste is full of valuable materials including metals, rubber, textiles, paper, glass, plastics, concrete and organic materials such as timber, food and garden waste. The value of these materials derives from their potential next-use as recycled or reprocessed commercial products.

Identifying investment opportunities in resource recovery infrastructure is more often apparent by considering the specific material streams available (see Figure 4). The following waste streams have been identified as investment opportunities in Victoria due to high volume generation, potential environmental impact and / or unrealised economic value:

- e-waste
- organics
- tyres
- timber
- glass
- plastics
- textiles
- paper and cardboard.

Due to the unrealised economic value and potential environmental impacts of the following materials, Victoria has identified the following materials as priorities for resource recovery:

- e-waste: releases hazardous toxins and contains valuable earth metals; a Victorian Government statewide ban on e-waste in landfills is expected in the short term
- tyre stockpiles: fire hazards that pose a considerable risk to public safety and the environment, particularly in regional Victoria
- organic waste: produces leachates and gases when it decomposes in landfill that are harmful to the environment, public health and surrounding communities.

Figure 4: Main materials generated, recovered and landfilled in 2013–2014 (tonnes)*

* Note that e-waste is not separately identified in these material streams as it is a composite of other waste streams, including glass, plastics and metals.
E-waste (or “electronic” waste) is a fast-growing waste stream in Victoria, reflecting the trend towards shorter-life span products due to faster turn-over of technology, consumer demand for more frequent upgrades and lower consumer prices. Victoria accounts for approximately 25% of total e-waste generation in Australia.

Television and computer waste generated in Australia is projected to grow from 131,000 tonnes in 2014 to 223,000 tonnes in 2024, increasing pressure on our waste management infrastructure.

The Victorian Government is pursuing mechanisms to increase the recovery of e-waste, including introducing a ban on e-waste to landfills. These changing market conditions will necessitate additional resource recovery infrastructure to collect, sort and reprocess e-waste materials. Generally, existing infrastructure in the state is unable to extract the full economic value of e-waste and will benefit from the introduction of advanced technologies.

Investment opportunities include:

› collection, sorting and reprocessing facilities that can service multiple areas across the state
› higher technology solutions that are mechanically capable of dismantling, sorting and separating components and materials, particularly precious metals and hazardous materials
› disassembly technology within reprocessing facilities that can keep pace with quickly changing products
› increased televisions and computer recycling facilities to manage the only items currently covered by the National Television and Computer Recycling Scheme
› accessing e-waste material streams not currently captured by the National Television and Computer Recycling Scheme.

4 Australian Government, Department of the Environment, National Television and Computer Recycling Scheme; Operational Review, November 2014.

MARKET SNAPSHOT

2013–14 Victoria’s share of annual e-waste generation in Australia

25%

Victoria’s share of Australian e-waste processors

27%

Forecast annual revenue growth to 2020

8.2%
In Victoria the landfilling of whole tyres is banned, requiring alternative management of this considerable resource. Over 90,000 tonnes of tyre waste was generated in Victoria in 2013–14.

Existing tyre reprocessing infrastructure includes shredders and mills to recover the metal component and process the rubber into shred, granules, crumb and powder. This can then be used to make products such as soft surfaces for playgrounds and sports fields, civil engineering fill applications, industrial explosives, road surfaces, tyre-derived fuel (TDF) or whole tyres can be exported for reuse overseas.

In 2013–14, 12% of the end-of-life tyres used in Victoria were recycled, 77% were exported and 11% were stockpiled or disposed of without record.\(^5\) The considerable volumes exported present an opportunity for increased local processing.

A particular challenge for Victoria is the recovery of tyres from old stockpiles that pose an environmental hazard but contain valuable materials that can be recovered.

The availability of tyre and rubber feedstock combined with established international markets and proven reprocessing systems makes tyres a considerable reprocessing opportunity.

Investment opportunities include:

- facilities to produce tyre-derived fuel (TDF) to replace fossil fuels in cement kilns, power plants, smelters and paper mills
- facilities to produce non-fuel, tyre derived products (TDP) of crumb and shred that has applications in adhesives, sports fields, industrial explosives and asphalt additives.


**MARKET SNAPSHOT**

<table>
<thead>
<tr>
<th>2013–14</th>
<th>Waste generated</th>
<th>Recycled</th>
<th>Exported</th>
<th>Stockpiled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90,000 tonnes</td>
<td>12%</td>
<td>77%</td>
<td>11%</td>
</tr>
</tbody>
</table>
Organics

The high nutrient and energy content in organic materials can be transformed to generate widespread environmental and economic benefits, such as improving soil conditions for the agricultural sector.

In Victoria an estimated 1.6 million tonnes of organic waste (comprising food, plant and agricultural waste) is available for reprocessing each year. Yet approximately 60% of all materials in landfill are organic waste. Investment in infrastructure can provide localised solutions to recover organic materials, particularly in agricultural communities.

Food waste is the second largest recoverable material being sent to landfill in Victoria. Over 800,000 tonnes of food waste is generated each year and only 3% is recovered.

Victoria’s extensive agricultural sector provides a large opportunity for securing sufficient feedstock and transforming organic waste into a commercial product.

Investment opportunities include:

- accessing currently under-utilised commercial and industrial organic waste streams that have low contamination levels and are consistently available
- producing energy solutions on-site in industrial precincts and existing waste and resource recovery facilities
- co-location with facilities that can utilise the by-products of organic decomposition such as farms (especially dairy and piggeries) that need steam, heat and power
- advanced processing technologies to improve the agricultural benefit from mixed, kerbside organic waste or source-separated kerbside waste
- in-vessel composting opportunities that produce a higher grade of compost and mulch, while reducing the processing time and impact on the surrounding community.

**MARKET SNAPSHOT**

Generation by sector: food waste, 2013–14 (tonnes)

<table>
<thead>
<tr>
<th>MSW</th>
<th>C&amp;I</th>
<th>C&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>252,807</td>
<td>550,498</td>
<td>18,802</td>
</tr>
</tbody>
</table>

Generation by sector: other organic waste, 2013–14 (tonnes)

<table>
<thead>
<tr>
<th>MSW</th>
<th>C&amp;I</th>
<th>C&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>175,015</td>
<td>43,460</td>
<td>238</td>
</tr>
</tbody>
</table>

Generation by sector: garden waste, 2013–14 (tonnes)

<table>
<thead>
<tr>
<th>MSW</th>
<th>C&amp;I</th>
<th>C&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>103,116</td>
<td>442,946</td>
<td>26,050</td>
</tr>
</tbody>
</table>

**FAST FACTS**

Victoria’s agricultural sector accounts for a third of Australia’s food production and is spread across the state. There is however concentrated growing, production and manufacturing facilities in the Goulburn Valley, Loddon Mallee, Hume and Barwon Southwest.

2013–14

<table>
<thead>
<tr>
<th>2013–14 Food waste recovery rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Materials recovered</td>
</tr>
<tr>
<td>9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2013–14 Garden waste recovery rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Materials recovered</td>
</tr>
<tr>
<td>63%</td>
</tr>
</tbody>
</table>
Of the 357,000 tonnes of timber waste generated in 2013–14, 118,000 tonnes (33%) of timber was recovered for reprocessing.

There are a number of products manufactured in Victoria that are produced from recovered untreated timber despite the low recovery rate. These products include mulch, particleboard and animal bedding as well as products used for energy generation including biomass pellets, briquettes and dried wood chip.

Demand for recycled timber products is expected to grow further.

Investment opportunities include:

› the recovery and processing of untreated timber into:
  - briquettes or pellets for domestic and outdoor heating
  - pellets or a dry woodchip for use in industrial heating systems
  - fuel for energy from waste processes
› collection systems and sorting infrastructure to improve the quality of feedstock for recovered timber products
› localised re-use markets for high quality recycled timber, such as hardwood flooring and structural timber.

Timber waste is generated from the C&D and C&I sectors, and includes untreated timber, preservative treated timber, engineered wood products, coated or painted timber, timber packaging, sawdust and offcuts from manufacturing. It does not include forestry and harvesting residues.

MARKET SNAPSHOT

<table>
<thead>
<tr>
<th>2013–14</th>
<th>Waste generated</th>
<th>Recovered</th>
<th>Recovery rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>357,000 tonnes</td>
<td>118,000 tonnes</td>
<td>% Materials recovered</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>33%</td>
</tr>
</tbody>
</table>
Glass

Glass can be continuously reprocessed, increasing the likelihood of consistent and growing waste streams and the long-term viability of glass reprocessing infrastructure.

The recycled glass market is strong. However, the volume of reprocessing activity is particularly sensitive to price. When prices are low, it is common for materials to be stockpiled. There are currently large stockpiles of glass fines in metropolitan Melbourne, estimated to comprise over 300,000 tonnes.

Of the 232,000 tonnes of glass waste generated in 2013-14, approximately 164,000 tonnes was recovered, a 71% recovery rate. However, only 45% of recovered glass is recycled back into glass cullet for glass manufacturing. The remaining 55% is made up of glass fines and stockpiles, some of which are reprocessed into sand substitute e.g. asphalt, sand blasting, road sub-base construction and pipe embedment.

Investment opportunities include:

› colour sorting technologies that can sort to smaller sizes and reduce the generation of fines
› alternative glass-only collection systems to improve recovery of glass cullet and reduce contamination
› generating recycled-glass product for use in structural engineering applications by the fast growing construction industry
› expansion of local markets for crushed glass, particularly in regional Victoria where transport costs decrease the viability of recovery.

MARKET SNAPSHOT

2013–14
Waste generated
232,000 tonnes
Recovered
164,000 tonnes
Recovery rate
% Materials recovered
71%

Glass waste generated by sector 2013–14 (tonnes)

FAST FACTS

Glass cullet is the industry term for broken or waste glass that is ready to be re-melted into a new glass product.
Victoria is home to about half of Australia’s plastic reprocessing facilities and recycles a significant proportion of the nation’s recovered plastics. Yet just 31% (151,000 tonnes) of the plastic waste generated in Victoria is recovered each year, including the 18% of plastics that are exported overseas for reprocessing.

Recycled rigid plastics (found in the commingled bin) are mostly sorted, shredded, chipped and reprocessed into a range of recycled plastic products with a relatively robust market. Recycled flexible plastics are used as a substitute for virgin plastic or timber and used in a range of products including bollards, fence posts, speed humps and outdoor furniture.

Flexible plastics have a much lower recover rate at approximately 9%.

Investment opportunities include:

› the infrastructure required to collect, sort and reprocess:
  - rigid plastics recovered from renovations, refurbishment and demolition of residential and commercial buildings
  - flexible plastics used for consumer packaging and logistics (a rapidly growing sector)
› using high calorific plastics as feedstock for refuse-derived fuel (RDF) for energy plants
› research and development to help identify commercially viable reprocessing options where contamination and the size of plastic pieces make sorting difficult (including from residual waste streams)
› developing processes and facilities that collect and consolidate film plastics more effectively; film plastics and agricultural film are increasing in use and their tonnage is expected to grow significantly over the next five years.

Plastic waste generated by sector 2013–14 (tonnes)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Waste generated</th>
<th>Recovered</th>
<th>Recovery rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW</td>
<td>209,964</td>
<td>269,035</td>
<td></td>
</tr>
<tr>
<td>C&amp;I</td>
<td>13,946</td>
<td>151,000</td>
<td></td>
</tr>
<tr>
<td>C&amp;D</td>
<td>480,000</td>
<td></td>
<td>31%</td>
</tr>
</tbody>
</table>

Film plastic, also known as “plastic film”, is a thin, flexible plastic often used in packaging, plastic bags, labels, and film. Agricultural films are a film plastic used in green houses and to protect crops from weather.

Refuse-derived fuel (RDF) is a broad-ranging term that is applied to any fuel made from waste. RDF is used either in waste-to-energy process or as a substitute for fossil fuels in other industrial thermal systems.
Textiles

While Victoria generated 129,000 tonnes of textile waste in 2013–14, just 3,000 tonnes of this waste was recovered, representing a recovery rate of just 2%.

Victoria’s textile waste includes discarded clothing (including uniforms), end-of-life furniture and manufacturing offcuts.

Much of the waste that is sent to landfill is pre-consumer textile waste that is a by-product of manufacturing and a relatively uncontaminated waste stream that costs industry to dispose.

The sheer quantity of textile waste that is sent to landfill represents a considerable opportunity for investors to secure supplies that would justify a large-scale facility.

Investment opportunities include:

› reprocessing of high calorific value, woven textiles as a RDF
› technologies that reduce combined textiles to their constituent fabrics
› collection and reprocessing of mattresses.

Textile waste generated by sector 2013–14 (tonnes)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Waste Generated</th>
<th>Recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW</td>
<td>75,335</td>
<td></td>
</tr>
<tr>
<td>C&amp;I</td>
<td>43,995</td>
<td></td>
</tr>
<tr>
<td>C&amp;D</td>
<td>9,317</td>
<td></td>
</tr>
</tbody>
</table>

Textiles is one of the fastest growing waste streams and one of the most recyclable, with over 95% able to be recycled or reused, but just 2% recovered in Victoria.

MARKET SNAPSHOT

2013–14
Waste generated
129,000 tonnes

Recovered
3,000 tonnes

Recovery rate
% Materials recovered
2%
The range of products that paper fibre can be used in, and its established record of use, means paper fibre is a sufficiently valuable commodity to warrant recovery. Recovered paper and cardboard can also be economically transported over considerable distances for reprocessing.

In 2013-14, Victoria generated over 1.8 million tonnes of paper and cardboard waste, of which 1.4 million tonnes was recovered.

Of that recovered total, 626,000 tonnes of paper and cardboard were exported overseas for reprocessing. A considerable opportunity exists to capture that exported raw product locally.

Close links with commodity prices can lead to volatility in the paper and cardboard waste stream. The recent strengthening in global prices has driven a rebound in cardboard and paper recovery rates in Victoria, currently 78%.

Investment opportunities include:

- sorting capacity of infrastructure at materials recovery facilities (MRFs) to improve separation from commingled recyclable streams
- building the capacity of MRFs to separate paper and cardboard from C&I sector streams.

### MARKET SNAPSHOT

#### 2013–14

<table>
<thead>
<tr>
<th>Waste generated</th>
<th>Recovered</th>
<th>Recovery rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8 million tonnes</td>
<td>1.4 million tonnes</td>
<td>78%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Composition of paper recovered 2013-14 (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other (mixed paper)</td>
</tr>
<tr>
<td>Printing &amp; writing paper</td>
</tr>
<tr>
<td>Cardboard / packaging paper</td>
</tr>
<tr>
<td>Newsprint / magazines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Paper/cardboard waste generated by sector 2013–14 (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW</td>
</tr>
<tr>
<td>1,358,506</td>
</tr>
</tbody>
</table>
Mixed waste streams

The following opportunities do not represent or rely upon a single waste material stream but instead involve mixed or multiple streams within the waste sector. The specific technology solutions are varied and the supply of waste material is reliant on multiple sources.

**Energy-from-waste**

Energy-from-waste (EfW) is an exciting and potentially lucrative long-term investment in Victoria’s waste and resource recovery infrastructure. However, Victoria’s comparatively low wholesale electricity prices complicate the short-term viability of a grid-supplying EfW facility.

Current opportunities for EfW in Victoria include:

- Generating electricity, heat and steam for onsite (non-grid) use
- Generating heat and steam for offsite use

The capture of energy from organics in our waste streams is of particular importance to Victoria, with plentiful organic supplies and heightened awareness of their impact on the environment and public health.

Best practise landfill management requires landfills to capture gas emissions. However, dedicated EfW plants have considerably higher recovery rates than gas capture at landfills, further improving the environmental benefit.

Already, there are examples of small-scale facilities in Victoria, such as wastewater utilities, hospitals and agricultural waste generators producing their own electricity, steam and heating from their waste.

Forecast increases in electricity and gas prices, combined with population and economic growth, indicate a more favourable climate for larger-scale EfW facilities in the long-term.

Potential investment opportunities include:

- Smaller-scale, onsite electricity generation
- Anaerobic digestion for steam and heating
- Waste water, onsite power generation
- Methane offtake from landfill

**CASE STUDY: Berrybank Farm**

Berrybank Farm is a family-owned piggery that has been converting pig waste into energy, potting mix and fertiliser using innovative EfW technology for 25 years. In 1989, the family invested two million dollars in an ambitious and innovative project to collect methane from piggery waste to generate electricity for the farm and improve management of its waste.

Today, the farm’s waste management system consists of an anaerobic digester, which converts the effluent from the piggery into bio-gas to generate electricity. The waste is then reused and sold as an odourless organic fertiliser and the nutrient-rich water is recycled for irrigation purposes.

So the farm saves money on power and water, has created new stable revenue streams and also addressed community amenity concerns by eliminating odour. “It is replacing traditional chemical fertiliser,” says Jock Charles, Managing Director at the 20,000-sow piggery. “And our crop is vastly superior to what we used to be able to grow.”

“A lot of things we didn’t envisage at the start have stemmed from it, which is often the case when you outlay capital,” notes Jock. “Work closely with your providers so that you pick up on things that are specific to your type of waste and you know how to manage the system over the long term.”

For the full case study and further examples, go to www.sustainability.vic.gov.au/invest.
Mixed residual waste (MRW)

MRW is the vast mix of materials that remain after all source separation or reprocessing activities have been undertaken. It is effectively that which remains after viable recovered materials have been extracted, and is subsequently sent to landfill.

In 2013–14, 30% of Victoria’s waste stream (3.4 million tonnes) went to landfill as MRW. It contains a considerable amount of useful material, particularly for application as a refuse-derived fuel (RDF) which can substitute for fossil fuels in some applications.

Landfill owners and operators, including both councils and private industry, are well positioned to pursue these opportunities or supply investors seeking to further process MRW.

Investment opportunities include:

› increasing capacity to pre-sort and screen materials at landfill sites to maximise diversion of materials with economic value or of high environmental risk

› resource recovery and transfer station infrastructure to support consolidation of material streams prior to transporting to regional processing centres; in some situations localised reprocessing may be viable onsite

› transitioning suitably located sites with landfills exempt from licensing, and landfills scheduled for closure over the next 10 years, to best practice resource recovery and consolidation activities where it is economically viable

› material recovery facilities (MRFs) that are technologically capable of sorting through mixed residual streams, particularly from the C&I sector, enabling the reprocessing of homogenised materials into RDF of sufficient quality to meet industry needs in export markets.

Shredder floc

When automobiles, air conditioners, refrigerators and major household appliances (principally “whitegoods”) are at the end of their useful life, the pollutants are removed, material is dismantled and shredded metal collected, and the remaining material is known as shredder floc. This by-product includes a mix of materials including plastics, glass and rubber.

Victoria currently lacks any reprocessing infrastructure to manage shredder floc and almost all of it is sent to landfill in Victoria (some used-vehicle shredder floc is compressed for export). Only one landfill in Victoria accepts shredder floc, increasing the challenge and cost of disposal.

Every year 160,000 tonnes of shredder floc is generated in Victoria. This is a significant component of the tonnes landfilled by the C&I sector.

Potential investment opportunities include:

› recovering energy from shredder floc – the mix of plastics, glass and rubber left over from reprocessing cars and white goods has a high calorific value and can be a valuable source of RDF material

› facilities to sort, recover and reprocess the materials in shredder floc

› joint-ventures with local industry to develop end-products using shredder floc.

CASE STUDY: Close the Loop

Close the Loop is a Melbourne-based resource recovery and recycling company with a business model based on continuously investing in research and development (R&D), regularly investing 5% of annual revenues in R&D to identify innovative ways to improve resource recovery and create new end-products for industry.

“We have many patented processes that we’ve developed to keep our ‘zero waste to landfill’ brand promise and this has created a very innovative culture at Close the Loop – one that requires constant R&D to maintain,” says founder and Executive Director Steve Morriss.

Close the Loop recognised early on that R&D does not exist in isolation – there must be an end market for your product and it must make financial sense to industry to use it.

Steve explains: “It doesn’t matter how good a technological breakthrough you think you’ve made – if the market doesn’t agree with you, it’s all for nothing.”

It is equally important that sustainability benefits are matched by the economic component. “Being green is not enough,” Steve observes. “Without a financial incentive for your industry partners your business will not grow.”

Combined with its partnerships across industry, most notably with multinational infrastructure firm Downer, Close the Loop continues to demonstrate the value of R&D and innovation in delivering long-term returns in resource recovery.

For the full case study and further examples, go to www.sustainability.vic.gov.au/invest.

MARKET SNAPSHOT

<table>
<thead>
<tr>
<th>MRW landfilled in 2013–14</th>
<th>Shredder floc generated in 2013–14</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4 million tonnes</td>
<td>160,000 tonnes</td>
</tr>
</tbody>
</table>
Advanced material markets

Some material markets are particularly active in Victoria, with sufficient infrastructure to manage the waste stream and maximise resource recovery. These waste materials benefit from strong, international commodity markets that provide clear price signals, and have established applications in commercial products, helping to generate next-user demand.

Despite the high recovery rates for these materials, their comparatively high volumes and projected growth in the next 30 years indicate they will continue to play an important role in Victoria’s waste generation.

Concrete, brick and stone

Facilities that reprocess concrete, brick and asphalt in Victoria mostly crush and screen it to produce recycled aggregate materials that are then blended for end uses such as road base, drainage, irrigation and landscaping.

The market for recycled brick, stone and concrete is continually developing as new applications, supported by product specifications, become more widely accepted and implemented.

The comparatively uncontaminated waste streams and abundant volumes (as a result of a thriving construction sector) further enhance the opportunity for reprocessing.

Approximately 83% of the 4.3 million tonnes of concrete, brick and asphalt generated in Victoria are recovered, but with increasing market acceptance of recycled material this number has considerable potential for growth.

As Melbourne’s population grows, especially in the south east (Cardinia and Casey Councils) and north and west (Whittlesea, Hume, Melton and Wyndham Councils), there is likely to be considerable growth in the quantity of this waste stream.

Metals

Industry has invested in the recovery infrastructure needed to keep pace with the growth in generation of waste metals. This growth is expected to continue for the foreseeable future, due to the high commodity value of metals. Exports account for a considerable portion of metal recovery, with South Korea the primary destination.

In 2013–14 over 1.6 million tonnes of metal waste was generated in Victoria, with 96% recovered, including 25% of total generation exported. Just 4% of waste metals generated in Victoria were landfilled.

End-of-life vehicles are a considerable source of metal waste and their disposal will be a key determinant in Victoria’s management of its waste metals sector.

MARKET SNAPSHOT

Concrete, brick and asphalt waste generated 2013–14

- 4.3 million tonnes
- Recovered: 83%

Metals waste generated 2013–14

- 1.6 million tonnes
- Recovered: 96%

FAST FACTS

Concrete, brick and stone is the single largest material stream in Victoria’s waste. It is generated more than twice as much as any other material.

Analysis of 10-year volatility and trend data suggests that while recovered volumes of brick have been relatively stable, both stone and concrete recovery have had steady growth over the past 10 years.

Generation of this waste stream is directly tied to the C&D sector as it makes up 92% of the C&D waste generated.
Victoria needs the advanced technologies, business models and innovation that will help to significantly increase our resource recovery in the next 30 years.

Sustainability Victoria is committed to developing and maintaining relationships with all types of investors seeking to expand or establish infrastructure that increases our recovery rates – councils, current operators and financers, and prospective investors not yet in the market.

Sustainability Victoria offers a dedicated service to investors seeking to pursue advanced waste and resource recovery opportunities in the state. This free service helps you to coordinate your relationship with the Victorian Government and provides you with data, information, advice and insight into the local market to inform your investment decision.

We can also link you to our growing network of Victorian Government Business Offices in Asia, Europe, the Middle East and the Americas.

Contact us for more information.

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