REPORT

www.TheCIE.com.au

Impacts of the waste levy on recyclers

Prepared for

NSW Office of Environment and Heritage

Centre for International Economics
Canberra & Sydney

August 2011

Contents

Boxes, charts and tables

Executive summary

The Waste and Environment Levy (the levy) is the NSW Government's key economic instrument driving waste avoidance and resource recovery. By making waste received at landfills more expensive, the levy provides an economic incentive to reduce waste sent to landfill in NSW. This encourages all options for diverting waste from landfill, including recovery and recycling in NSW.

The levy can have complicated and potentially unintended impacts on recyclers. On the one hand, recyclers may be able to obtain input materials at lower prices because the alternative of disposing of these to landfill is now more costly. On the other hand, recyclers themselves dispose of substantial amounts of material to landfill in the form of residual waste for which they have to pay the levy. The strength of these two impacts differs across different types of NSW recycling businesses (NSW recyclers) and largely determines whether the levy will increase or decrease their profitability.

While the levy may have negative impacts on NSW recyclers, it is unlikely to have negative impacts on recycling. Negative impacts on NSW recyclers, where they occur, reflect a shifting of recycling activity outside of NSW, with material continuing to be recycled. The one exception to this is in regional NSW, where the differentiated levy structure can provide a disincentive for recycling as a result of the levy. This disincentive may not always change recycling rates, as there may be little or no recycling currently occurring.

This report focuses on the financial impacts of the levy on three types of recyclers — metal recyclers, paper recyclers and AWT facilities that mechanically and biologically treat mixed municipal waste. Financial impacts have been examined by looking in as much detail as has been possible at the markets in which recyclers operate and the financial performance of particular recycling businesses.

Of these, the analysis of the markets in which recyclers operate is by far the most important for the impacts on recycling businesses. Table 1 summarises the alternative option open to those who supply input material (feedstock) to recyclers.

1 **Viability of alternatives to recycling for different waste types**

	NSW regulated landfill	*Export for recycling*	*Interstate recycling*
Metal		X	X
Paper	X	X	X
AWT	X		

Source: The CIE.

Where landfill is not in practice a viable alternative for waste materials, the waste levy will tend to have negative impacts on recyclers. Where waste material suppliers have more options for selling material outside of NSW (or storing material), these negative impacts will tend to be larger because there will a reduction in the volume of feedstock material available for recyclers.

At current metal prices, metals recyclers in NSW are not competing against landfills for material with almost all scrap metals recycled in NSW (and in other Australian states).

Metals recyclers in NSW are competing against metal recyclers interstate and overseas for scrap materials. Competition is not at this stage intense from these sources, with overseas exports of scrap, both unshredded and shredded making up somewhere around 10 per cent of recycled ferrous metals, and interstate exports following lowest transport cost routes to major cities rather than being determined by the levy. However, changes in the market are making competition more intense, with greater shredding capacity in China and low international transport costs available because of the one-way container trade between Australia and Asia.

This pattern of competition means that metals recyclers will be unambiguously worse off as a result of increases in the levy through higher residual waste costs, as they will face higher costs of disposing of residual material and will find it increasingly challenging to pass the levy in full through lower prices for input scrap. The magnitude of impact is likely much smaller than suggested by the metals recyclers, with our best estimate being a reduction in margins of around 1 percentage point from the scheduled increased in the levy from 2010-11 to 2015-16. This reflects that industry will most likely to be able to pass around 60 per cent of the levy increase up the supply chain through lower input prices for scrap.

Paper scrap is currently either sent to landfills or NSW recyclers or exported to recycling facilities in other jurisdictions (in other states or overseas). Currently 59 per cent of paper and cardboard scrap materials are recycled — 15 per cent of this is exported overseas for recycling with the rest being recycled in domestic paper mills. A substantial share of exported scrap paper is from Visy and Amcor, when supply exceeds their processing needs.

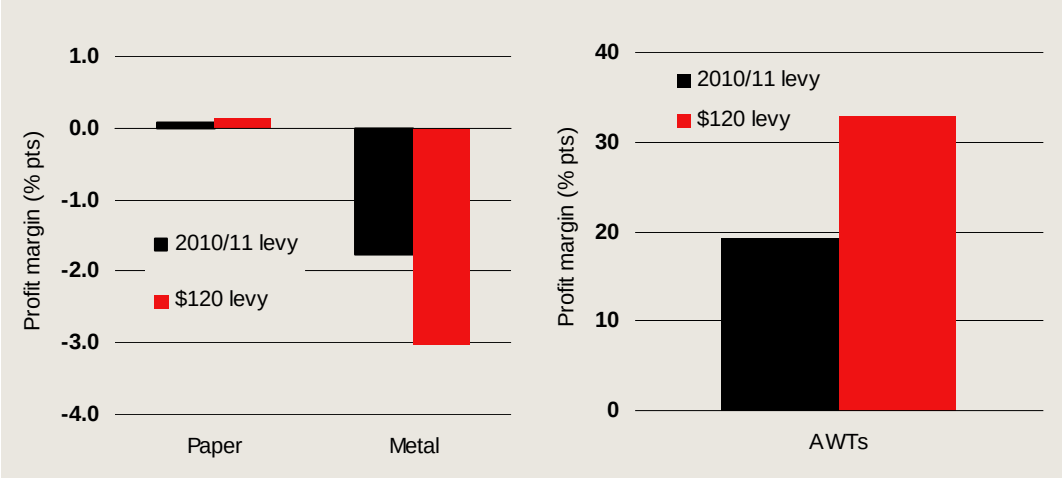
The impact of the levy on paper recyclers is ambiguous, reflecting the possibility for increased supply from landfill and increased exports. In any case, impacts are likely

to be small. This is reflected in investment decisions, with Amcor investing in a major new recycled paper mill in Sydney and closing its existing Sydney and Melbourne facilities.

The main viable alternative for mixed municipal waste inputs into AWTs is landfill. Higher landfill charges, reflecting a higher levy, allow AWTs to increase their gate charges. This increases the viability of AWTs. The only exception is where AWTs are operating under contracts that set landfill diversion targets that they are not meeting. In this case, AWTs directly bear the increased levy costs associated with their diversion underperformance.

In terms of the magnitude of impacts, our best estimates are presented in chart 2. A levy of $120 would be expected to reduce profit margins of metal recyclers by around 3 percentage points relative to no levy, for paper recyclers the impacts are negligible and for AWTs the levy increases profit margins by over 30 percentage points. (AWTs would have substantial negative profit margins in the absence of the levy.) These impacts should be considered in light of average margins for these businesses of 5 to 10 per cent.

2 **Estimates of impacts on profit margins**



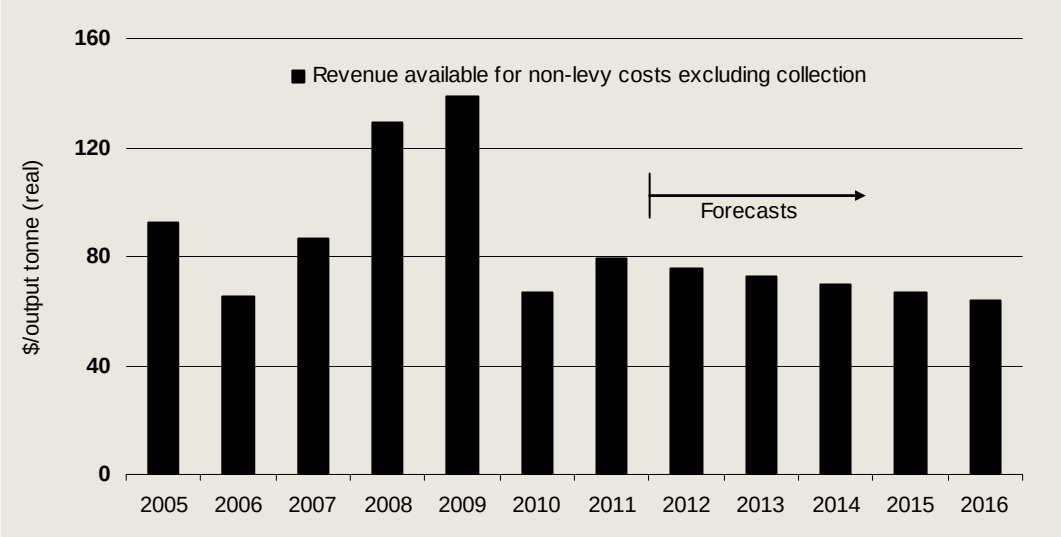
Note: Profit margin is an earnings before interest and tax equivalent.
Data source: CIE estimates.

The levy is unlikely to change the viability of the recycling businesses that we have examined for this project. Rather, these businesses will change and adapt their operations, most obviously in metal to become exporters of metal scrap. Businesses are well placed to make these adaptations and already export in other states, in NSW with non-ferrous metals and occasionally in NSW with ferrous metals.

For metals, the profitability of recycling businesses is volatile reflecting factors outside of the levy. These businesses are exposed to substantial commodity risk for their inventories and can find difficulties in selling when the market changes — as they did post global financial crisis. Chart 3 shows the historical and projected

revenue net of collection and levy costs for metal shredders on a per tonne basis. This net revenue would be required to cover processing costs, fixed costs and their margin. As can be seen, the levy acts as a continuous small negative impact on these businesses rather than being the major determinant of profitability.

3 **Revenue net of collection and levy costs for metals recyclers**



Data source: CIE estimates.

A major factor that would decrease the financial impact of the levy on recyclers is a waste to energy option, depending on how this was structured and the emissions standards around such a policy. Waste to energy was mentioned by every business we talked to.

The levy is only one of many policies that impose environmental and social standards that are potentially higher than in other jurisdictions, and that increase the cost for businesses operating in NSW. Such policies should be judged on their merits rather than through exclusive focus on the impacts on businesses. Hence, while the impacts on and incentives facing the NSW recycling industry should form *one part* of consideration of the structure and level of the waste levy, it is of greater importance to ensure that the waste levy is aligned to the environmental and social costs of landfill.

1 Introduction

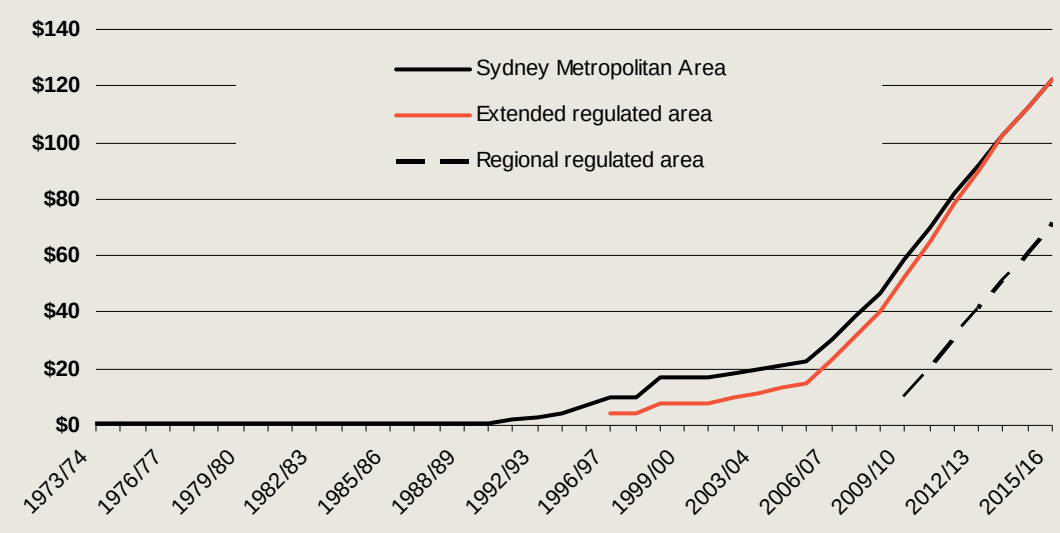
The Waste and Environment Levy (the levy) is the NSW Government's key economic instrument driving waste avoidance and resource recovery. By making waste received at landfills more expensive, the levy provides an economic incentive to reduce waste sent to landfill in NSW, and hence encourage more recovery and recycling.

The levy applies to all waste received at landfills, including the residual waste sent to landfill by recyclers. It is passed on in full by landfill operators to those disposing of waste and materials.

The waste levy

The Waste and Environment Levy was introduced in the Sydney Metropolitan Area (SMA), at $0.51 per tonne in 1971. Since then the levy has grown substantially and is expected to reach around $120 per tonne in 2015-16 (chart 1.1).

1.1 **The amount of the levy**

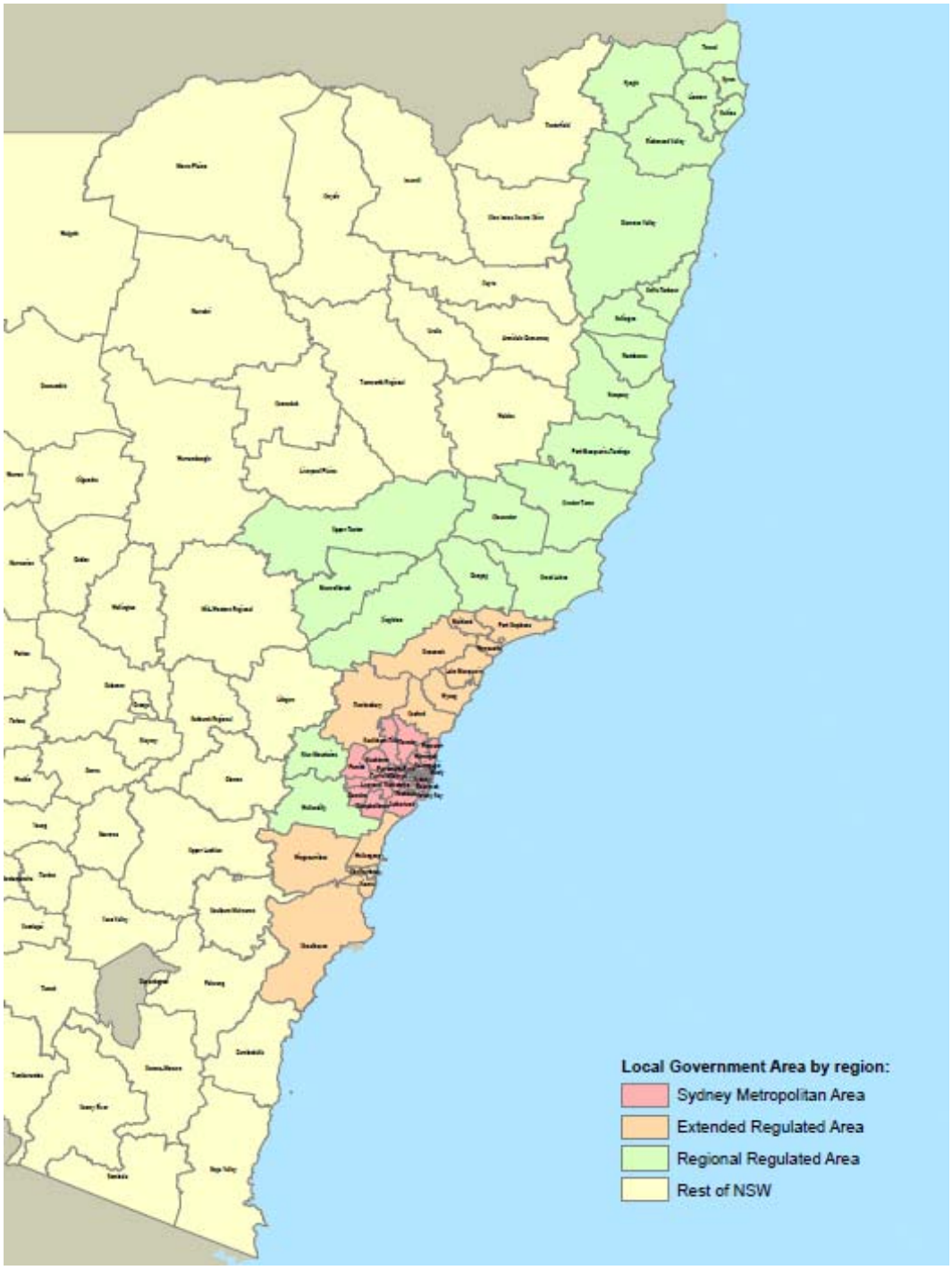


Data source: Office of Environment and Heritage (2011), *Background Paper: Waste and Environment Levy*, May.

The area to which the levy applies has also been widened. In 1996, the Extended Regulated Area (ERA) was introduced and is expected to achieve parity with the SMA rate in 2013/14. In 2008, the Regional Regulated Area (RRA) extended the levy to a further 21 council areas. The RRA is expected to reach $71 per tonne in 2015/16.

Around 4.1 million people or 56 per cent of the population of NSW reside in the Sydney Metropolitan Area, while the ERA and RRA cover 19 per cent and 11 per cent of the state's population respectively.[1] This leaves 14 per cent of the NSW population in unregulated areas.

1.2 Leviable areas



Source: NSW Office of Environment and Heritage.

1 ABS 2011, *Regional Population Growth, Australia*, 3218.0, March and the CIE calculations.

The NSW Waste and Environment Levy is currently higher, and likely to remain higher, than similar levies imposed by interstate neighbours. For instance:

- the Victorian landfill levy is currently just $30 per tonne for urban waste, and $15 to $25 per tonne for rural waste;
- the Queensland waste disposal levy will commence in December 2011 but will exclude municipal solid waste. The levy will commence at $35 per tonne for commercial and industrial and construction and demolition waste.

Landfill gate fees are higher in NSW relative to other states by more than the difference in levies. Average gate fees over the landfill sites surveyed in the Sydney region were $195 for a tonne of mixed waste, although recyclers may get much cheaper contracted rates than this.[2] The Brisbane City Council operates rubbish transfer stations which charge $93 per tonne for mixed waste, while in Melbourne disposing of a tonne of mixed waste would cost around $108. Further, disposing of domestic unsorted waste currently costs $66.35 per tonne in the ACT. The gap in costs is hence higher than the 2010/11 NSW levy of $70.30 per tonne.

Regulating waste in NSW

The NSW waste regulatory framework was established under the principal legislation of the *Protection of the Environment Act 1997*. The key objective of the Act is to

> Ensure a healthy and clean environment by regulating pollution and other adverse environmental impacts that may result from waste activities.[3]

The waste regulation programs are designed to mitigate pollution from waste disposal, minimise resource use, ensure appropriate disposal of harmful waste in NSW, and improve resource recovery.

Some features of the current regulatory framework include licensing of landfills (eg the types of materials allowed at particular landfills and capacity constraints imposed on these landfills) and penalties for illegal dumping of waste. Education and compliance programs undertaken by the NSW Office of Environment and Heritage (OEH) are also aimed at improving waste recovery.[4]

The Waste and Environment Levy is a key tool that forms part of the waste management framework. The levy is primarily intended to drive waste avoidance

---

2 Average charge across Kimbriki, Eastern Creek and Lucas Heights landfills for one tonne of mixed waste.

3 http://www.environment.nsw.gov.au/waste/RegulateWaste.htm

4 Targets for the amount of waste diverted from landfills are in place. However, these targets do not do not form part of any formal regulatory requirements on operators in the waste industry.

and resource recovery. It is levied on landfill operators and passed on as a fixed dollar increase (per tonne) to the gate price charged to customers at the landfill for solid waste disposal.

The rationale for the levy

Historically landfill has been the cheapest waste management option available. Landfill gate prices have generally (prior to the levy) reflected the private costs of operating the landfills and excluded the broader environmental and social costs associated with the landfills. Social costs include, for example, localised odour impacts and the ongoing maintenance costs associated with closed landfills, or the future reclamation costs of site use.[5] The environmental costs include impacts such as greenhouse gas emissions and leaching of hazardous materials from the site.

Without government intervention the gate price for disposal at landfills would only reflect the private costs of managing the landfill facility. Government intervention, via the introduction of the levy, is a way of incorporating these indirect costs such that the gate price at the landfill reflects the *full* cost of landfill disposal. That is, if the levy can be set at a level that reflects the social and environmental costs then the landfill gate price would reflect the private costs of managing the landfill as well as these other indirect costs associated with it.

The inclusion of the levy in the landfill gate price has the effect of increasing the *relative* price of disposing at the landfill compared to alternative waste management options (such as recycling). By increasing the relative price of landfill disposal it will create an incentive for recyclers to reduce the residual waste stream that is diverted to landfill and, therefore, to face a reduced total disposal to landfill cost. This is true not just for recyclers but for all waste generators, across the economy.

As a consequence the levy is expected to increase the level of waste that is recycled/reused and reduce the volume of waste being disposed in landfills. Where the levy is set at a level that accurately reflects the environmental and social costs, and other gate fees reflect the efficient costs of managing a landfill, the amount of waste disposed of at the landfill should reflect the level that is considered to be socially optimal.

The expected outcomes of the levy include the following.

- Behavioural change by waste generators (eg industries and households) to decrease their waste costs, which can be achieved by reducing the quantity of waste disposed at landfill.

---

5 For further discussion of relevant social and environmental costs see BDA Group 2009, *The full cost of landfill disposed in Australia,* prepared for the Department of Environment, Water, Heritage and the Arts; and Nolan ITU 2004, *National benefits of implementation of UR-3R process: a triple bottom line assessment,* prepared for Global Renewables Limited.

- Increasing recycling and resource recovery prior to waste reaching the landfill. As the levy increases, it is expected that more recycling technologies will come on line as these options become commercially viable compared to landfills.[6]
- Increasing resource recovery at the landfill. Under current arrangements owners of a landfill can receive rebates on the levy for materials recycled from the landfill.

While in theory the levy would have these expected outcomes, in practice, there are limitations to fully achieving these objectives. For example, the household that generates the waste is charged the levy through an *average* rate per household across the council area collected through council-funded services. That is, the levy paid by a particular household may have little connection to the amount of waste or recycling generated by that household.[7] Councils and other waste aggregators hence use a variety of non-price mechanisms to seek to maximise resource recovery rates, such as bin sizes and collection frequencies.

There are also likely to be a range of other factors that may limit the achievement of these outcomes. These include, for example, location of recycling facilities throughout the region and the costs of transporting waste to these recycling facilities compared to landfills.

Further, the response of waste generators and the waste industry to any increases in the levy is not likely to be immediate. That is, it may take some time to adjust behaviours and to increase investments in facilities to recycle the materials.

This project

With the levy scheduled to increase over the coming years, the costs to recycling businesses for managing non-recyclable residual waste will also increase. Some recyclers have suggested that the levy is affecting their financial viability, and threatening the recycling industry in NSW overall.

This project assesses the impacts that the levy and changes to the levy have on metal recyclers, paper recyclers and alternative waste treatment facilities that operate in NSW. It uses publicly available information to characterise the markets for input and output materials and information supplied by recyclers about their cost structures and material flows where this is available.

This project does not review alternative options for overcoming impacts on recyclers or the appropriate level of the levy.

---

6 The scheduled increase in the levy is expected to provide investors with greater certainty over a longer period.

7 At the higher level, councils should be incentivised to reduce the levy through promoting recycling education or investing in recycling infrastructure to keep the levy low.

Stakeholder consultation

As part of this project we have consulted across the recycling industry and sought data inputs. Consultations have included:

- metal recycling — Sims Metal Management, OneSteel and Sell & Parker. These businesses cover all metal shredding operations in NSW;
- paper recycling — Visy and Amcor. These businesses cover all major paper processing facilities from recycled paper in NSW; and
- alternate waste treatment facilities — Veolia, SITA, and Global Renewables. These businesses cover all but one of the AWT facilities in NSW.

We have also consulted with the Waste Contractors and Recyclers Association of NSW.

2 Overview of the recycling industry

Recyclers covered by this report

This report is focused on those businesses undertaking some form of processing to take collected materials to a form useable in production facilities. It covers:

- metal shredders — these facilities take scrap iron and steel and process it to a grade that is useable in production of steel billets (or bars);
- scrap paper mills — these facilities take scrap paper and cardboard and produce paper rolls that can then be used in producing paper products for final use; and
- alternate waste treatment facilities — these facilities take mixed waste, produce low-grade organic outputs and extract (small) amounts of plastic and metal.

It is worth recognising that the recycling sector is broader than the activities cited above, covering those involved in materials recovery and later processing for example.

Given the scope of the project, the key markets are:

- the market for inputs into paper mills, metal shredders and AWTs. In this context the input markets refer to markets for those waste materials that act as feedstock for recycling businesses.
- the market for outputs from paper mills, metal shredders and AWTs. These are the markets for the product from the recycling businesses.

Throughout this report we use the following terminology.

- For paper and metal recycling, those who provide input material are suppliers and those who receive output materials are customers.
- For AWTs and MRFs, those who pay to deliver input materials are customers and those who receive output materials are final customers.

The differing terminology reflects that 'customers' pay for disposing of materials while 'suppliers' are paid for materials delivered.

Stages in material recycling

Material recycling involves a number of steps undertaken sometimes by separate businesses and sometimes by a single vertically integrated business, as follows.

- Collection — materials are collected from households (municipal), businesses (commercial and industrial) and construction and demolition sites or are deposited directly to transfer stations by these groups.
- Transfer stations and scrap yards — materials may be taken to local transfer stations or scrap yards for minor sorting.
- Materials Recovery Facilities (MRFs) — materials may be taken to facilities to sort materials into relevant categories. This is the case for co-mingled recycling from households for example.
- Additional sorting/recovery — materials may go through higher intensity sorting processes such as metal shredding.
- Processing stages — materials may go through a number of processing stages to eventually produce products for final consumers.
  - In metals, processing can include smelting to produce steel billets and other long products (rods and bars) and shaping to produce goods for final consumers.
  - In paper, processing includes making paper rolls which are then inputs into further cardboard manufacture or other paper products for final consumers.
  - In AWTs, processing can include composting to produce organic outputs used for agriculture or mine rehabilitation.
- Distribution of product to end users.

A number of these stages can be considered as 'recycling'. The recycling part can be differentiated as the activities that are different to taking the materials to landfill or other disposal methods and that are different to the processing required from virgin materials. This definition still allows considerable ambiguity about what might be considered as recycling.

- In metals, recycling comprises collection and scrap yard operations, which remove some higher value metals, balers which compress scrap for longer distance transport (where necessary) and shredders/shearers which turn larger items into shredded metal or smaller pieces suitable for a furnace.
- In paper, recycling comprises MRFs which sort paper from other materials, balers which package paper for transport and recycling mills which use scrap paper to produce rolls used in further stages of production.
- In AWTs, recycling consists (generally) of single facilities that take in mixed waste and output organic outputs and other reusable materials.

The pathways that various materials (even within a single sector) take to go through the supply chain can differ depending on the quality of the material and where it is coming from. For example, paper collected through dedicated office paper bins can go direct to paper mills rather than needing to go through a MRF. Similarly, some

'clean' metal scrap can be cut up using shears to go into processing rather than needing to go to a shredder.

The supply chain and materials flows

Metals

A summary of the scrap metal supply chain is shown in chart 2.3.

The main players in metals recycling in NSW are OneSteel, Sims Metal Management and Sell and Parker. OneSteel is a large vertically integrated steel manufacturer, covering mining, scrap collection, processing and distribution of steel products mainly in Australia. Sims Metal Management is a large public corporation operating across the world. Sell and Parker is a relatively large private company operating in NSW.

In addition to these major players there are hundreds of small scrap collectors that supply the operations of the larger companies.

Metals can be divided into ferrous metals (iron and steel) and other metals. Non-ferrous metals are typically sent overseas for further processing while a large share of ferrous metals are processed in NSW at the processing facilities of OneSteel and BlueScope Steel.

Metals recyclers have explicitly priced the waste levy into the price their scrap providers are given. For example, a typical invoice will show:

- price of scrap — $190/tonne, less
- levy applied to scrap — $15/tonne, giving
- final price — $175/tonne.

The amount taken off the pre-levy purchase price of scrap for the levy reflects the amount of the levy multiplied by the proportion of residual waste typically extracted from a tonne of scrap input.

The amount of residual waste from shredders is in the order of 20-25 per cent of tonnes of feedstock materials entering the facilities. This may also partly reflect the additional moisture content added during processing. Shredders do price differentiate for different suppliers on the basis of the quality and quantity of the input scrap provided (and willingness to negotiate).

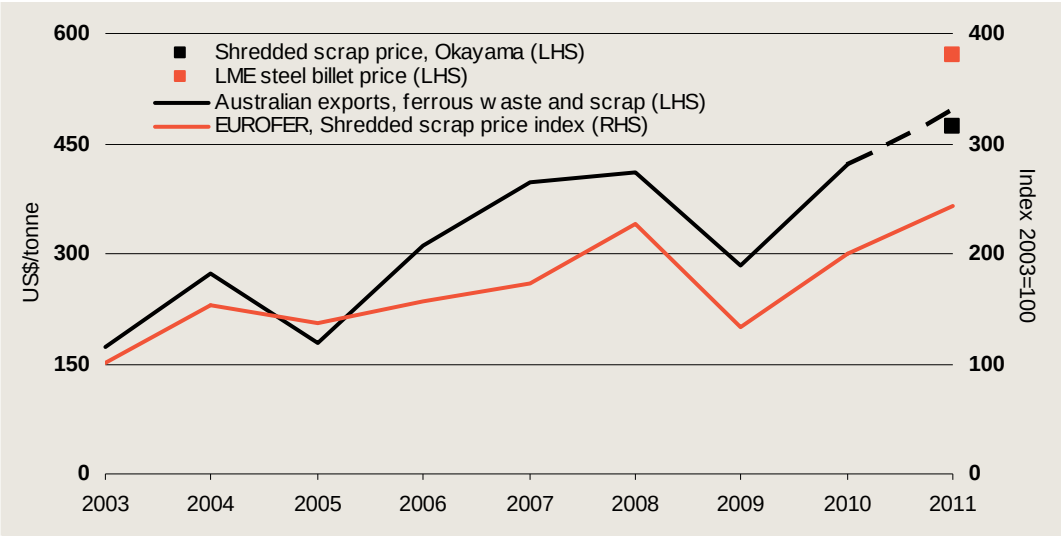
It was indicated by the metal recyclers consulted that some suppliers refuse to accept the reduction in price from the levy, although it was not clear whether shredders would simply then offer these suppliers a lower base price of scrap.

Scrap provision for metal recyclers is a combination of vertically integrated operations and separate suppliers. The three major companies all have scrap yards around NSW and a vehicle fleet to collect scrap directly from waste generators (eg farm equipment), although there has been a rationalisation of these facilities following the global financial crisis and ensuing rapid reduction in metal prices. One major company, CMA Corporation, has had to seek a number of refinancing deals and halt trading on its shares. Separate suppliers tend not to operate under contracts with shredders but to provide to whichever shredder is close to where the scrap was sourced and that is offering the best price.

The recycling businesses (and other waste collection businesses) can have contracts with councils or other major sources of scrap although prices would still be redetermined on a monthly basis so that shredders are not left with too much residual risk from their output prices.

Australian exports of ferrous waste and scrap were priced at US$421 per tonne in 2010. More recent data from the EUROFER shredded scrap price index indicates that these Australian export prices would have been around US$493 per tonne in early 2011. This compares with US$570 per tonne for steel billets as quoted by the London Metal Exchange and US$472 for shredded scrap steel from Okayama (chart 2.1). Relatively high Australian export prices for scrap and discussions with industry suggest that a large proportion of these exports are likely to be high quality scrap that would not need to go through a shredder.

2.1 Price indicators of scrap metal

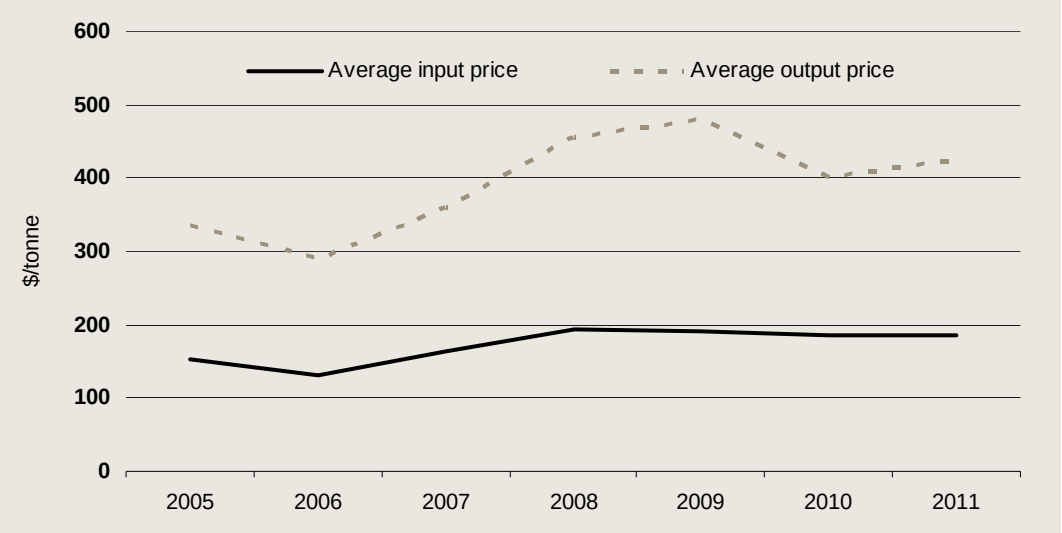


Data source: GTIS Global Trade Atlas database, London Metal Exchange steel billet price, European Confederation of Iron and Steel Industries scrap price index, Metalprice.com, Okayama shredded scrap, and CIE calculations.

Industry data confirms the considerable volatility in buying and selling prices for scrap ferrous materials (chart 2.2). Average prices for material inputs into shredders

have moved between $100 and $200 from 2005 to 2011. Within the year there have been much larger variations in price changes.

2.2 **Scrap ferrous input and output prices provided by industry**



Note: Output prices are in dollars per output tonne while input prices are in dollars per input tonne.
Data source: Industry data.

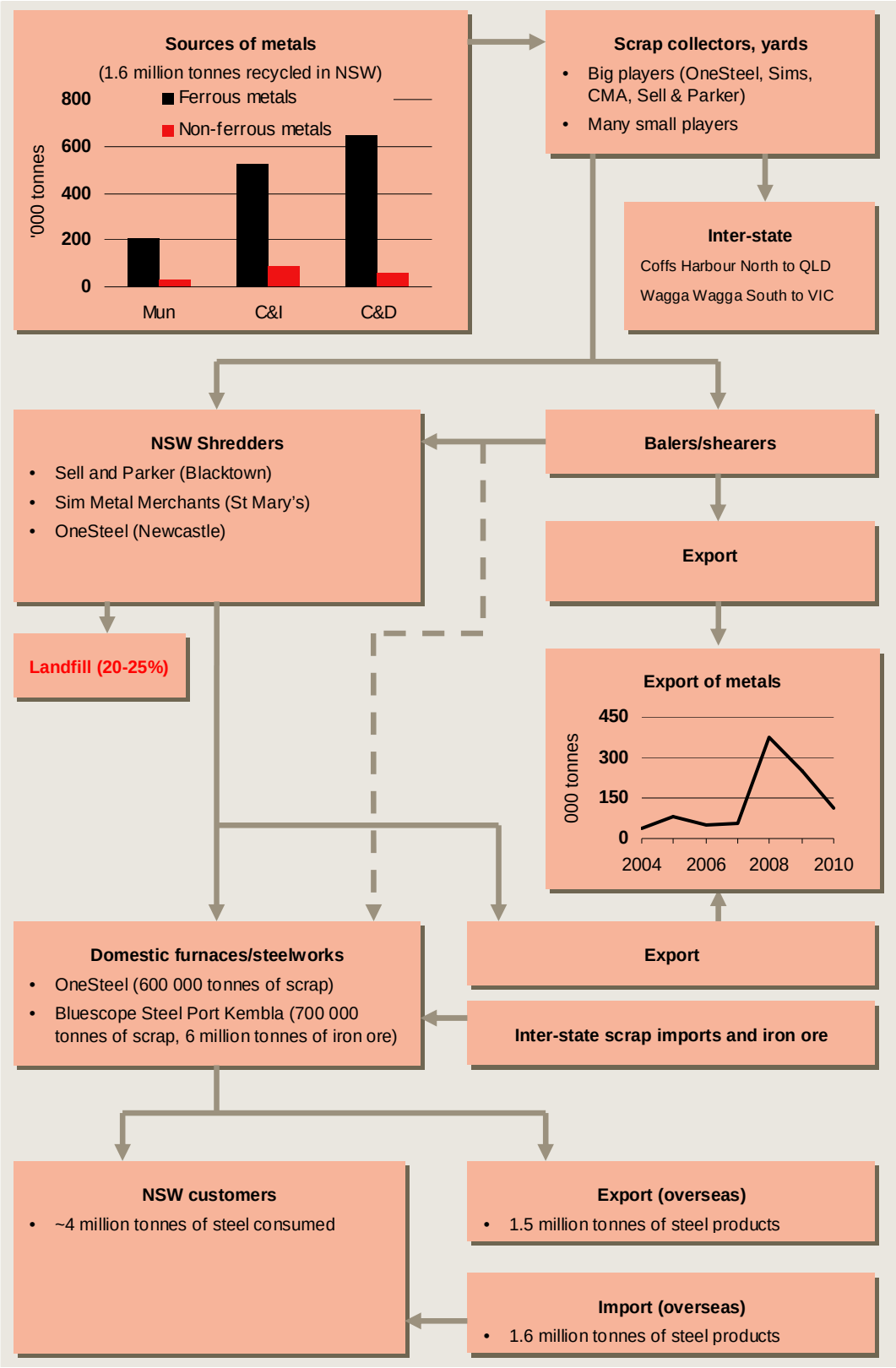
Post-shredded metal in NSW mainly goes to the OneSteel and BlueScope steel mills. Some scrap can also go directly to steel mills without requiring shredding. NSW also imports some scrap metal from other states for these mills — NSW is described by industry as having a scrap deficit.

Export data (overseas) indicates that somewhere around 10 per cent of recycled metal in NSW is exported.[8] This figure includes exports of unshredded scrap (of which much may not need to be shredded) and exports of shredded scrap. There may be some under-reporting in this figure given ambiguity amongst industry participants surrounding the legality of exporting waste and scrap under the Basel Convention. Major Australian export markets are concentrated in Asia, with 74 per cent of ferrous scrap exports being sent to Malaysia, Vietnam, Taiwan, Indonesia and China in 2010. Most of the available evidence points to exports primarily being post shredding.

- As noted previously, prices of export scrap align closely with prices of post shredded material. This suggests that exports are either metal that has very little waste — i.e is clean — or metal that has already been shredded.

8 GTIS database and Office of Environment and Heritage estimates of total metal recycled.

2.3 The metal supply chain



Data sources: GTIS, Global Trade Atlas database and the CIE.

- Sources inside China indicate that Australia is an important source of shredded cars and scrap is typically shredded pre-export.[9] Much of these exports are more likely to come from other states that have less steel processing capacity.[10]

Scrap metal is also competing with iron ore as an input into some steel mills. In NSW the steel mill capacity of OneSteel is highly reliant on scrap and could not substitute this for ore. BlueScope steel largely uses iron ore. The differences reflect the different furnace technology and output focus of the two plants.

The market for steel products can be considered to be global in most product categories, with NSW exporting and importing substantial amounts of steel products.[11]

Paper

A summary of the scrap paper supply chain is shown in chart 2.6.

The main paper recycling mills are owned by Visy and Amcor. Visy is a private company that also operates a MRF to assist in obtaining paper feedstock for its mills. Amcor is a public company. Amcor sources material directly from organisations with large quantities of scrap paper and cardboard, collectors and from MRFs owned by others such as SITA.

Both these businesses are vertically integrated with paper and recycling activities around Australia and further processing facilities (such as box making).

Official data indicates that 10 to 20 per cent of scrap paper collected in NSW is exported — 93 per cent of which was sent to China in 2010. Most of these scrap exports are likely to originate from Visy and Amcor, as these businesses export scrap when the amount collected exceeds their processing capacity.

For each tonne of scrap paper input into recycling paper processing about 15 to 20 per cent will end up in landfills. This includes the materials removed pre-milling and material waste from the milling process. Like metal, this is partly a result of a much higher moisture content of residual waste. Industry players indicated about half of the residual (by weight) was from a higher moisture content.

The market for paper and cardboard products can be considered to be global in most product categories with NSW exporting and importing substantial amounts of paper and cardboard products overseas and interstate.

---

9 Personal correspondence Adam Minter, www.shanghaiscrap.com .

10 GHD 2005, *Recyclable materials transport and logistics study,* prepared for Queensland Environmental Protection Agency, June, p. 31 notes that all of Sims Metal recycling in Queensland is exported to China based on the price of the London Metal Exchange.

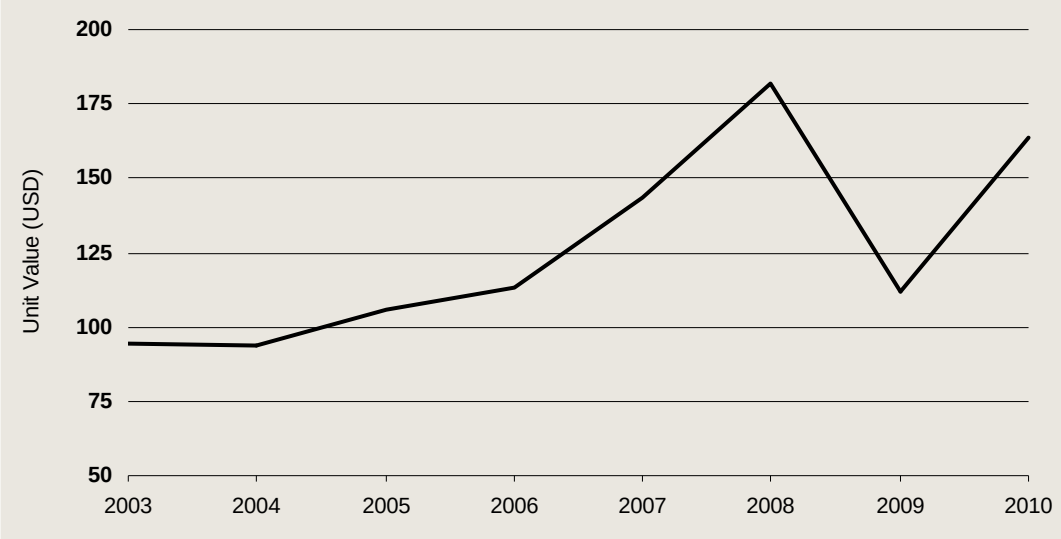
11 CIE analysis of Global Trade Information Services database.

There are substantial investments being made in paper recycling facilities in NSW by Amcor. It is investing in a facility at Botany to replace its two existing plants there and its plant in Melbourne.

Current prices of recycled paper inputs from scrap suppliers (businesses, collectors etc) are around $90 to $100 per input tonne and once sorted and baled around $130 per tonne. For paper reels (of packaging grade), the output from paper mills using recycled paper, prices are in the order of $600 per tonne.[12]

Australian exports of paper waste and scrap were priced at US$164 per tonne in 2010 (chart 2.4). While export prices have increased 46 per cent compared to lows reached in 2009, they have not yet recovered to the peak of US$182 recorded in 2008. Benchmark pulp indexes indicate that prices for final pulp products ranged between US$850 and US$950 in late 2010 (chart 2.5). These prices are far above prices of scrap as these materials allow for much higher quality paper production.

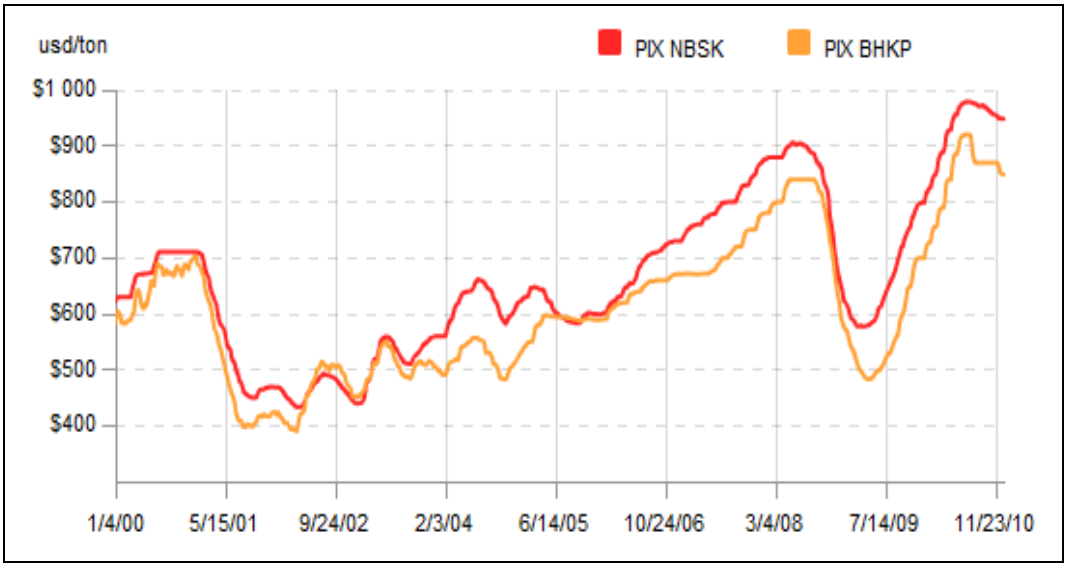
2.4 **Australian export prices of scrap paper**



Data source: GTIS, Global Trade Atlas database and the CIE.

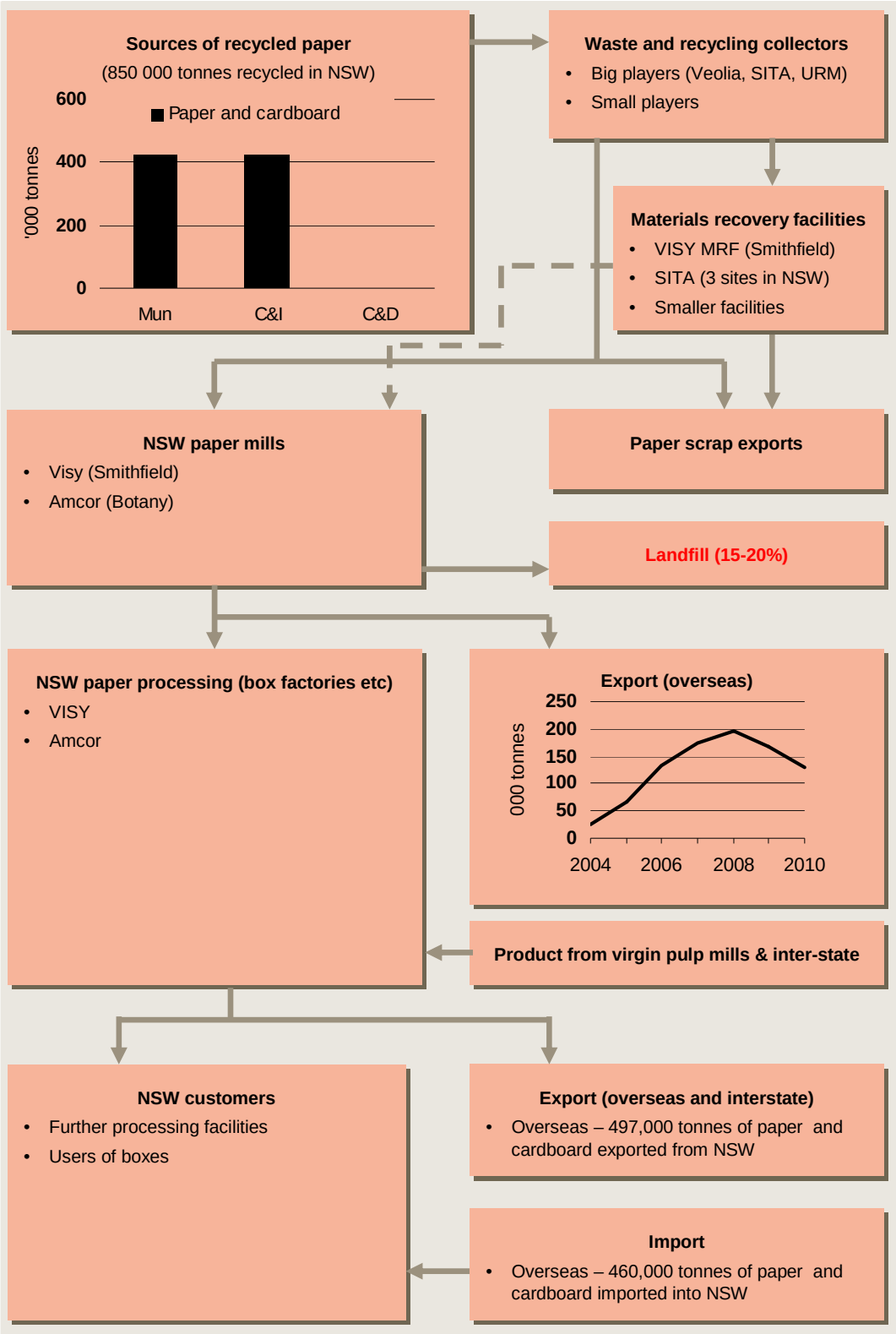
12 Information provided by recycling businesses.

2.5 Benchmark pulp prices, NBSK and BHKP PIX



Note: NBSK is long-fiber northern bleached softwood kraft pulp and BHKP is Bleached Hardwood Kraft Pulp.
Data source: FOEX.

2.6 The paper supply chain



Data sources: GTIS, Global Trade Atlas database and the CIE.

AWTs

A summary of the AWT supply chain is shown in chart 2.7.

The major players in the AWT market are Global Renewables, operating a facility at Eastern Creek and SITA operating a facility at Jacks Gully. Facilities are also operated in Port Stephens, Port Macquarie and Coffs Harbour.

Veolia has development approval for a facility at Woodlawn. It has an existing bio-reactor at Woodlawn that under some definitions would also be classified as an AWT.

Veolia and SITA are large vertically integrated businesses. Global Renewables is a private business operating in Australia and the UK (one site in each country).

The supply chain for AWTs is much simpler than for paper and metals because materials are not exportable at either the input stage or the output stage due to its low value to weight ratio.

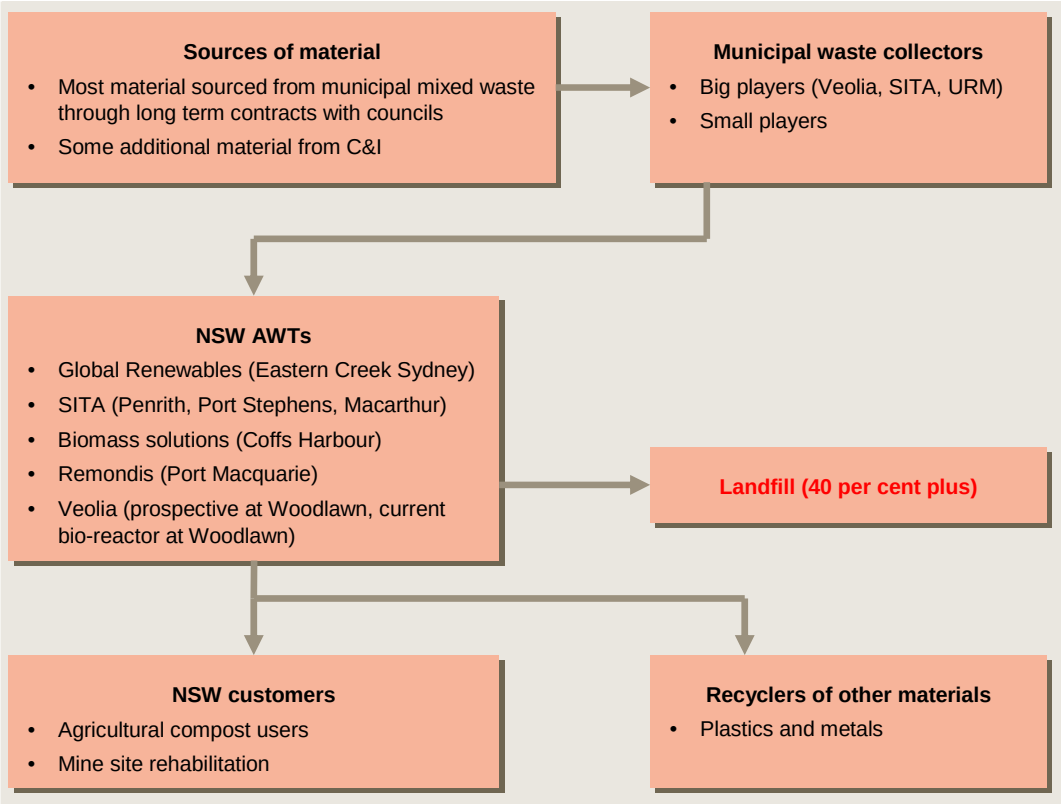
The main revenue stream for AWTs is gate fees for the acceptance of waste that operate in a similar way to landfill gate fees.

The output materials produced by AWTs are useable for certain agricultural uses and mine rehabilitation. It is not competitive against source segregated organic outputs derived from, say, green bins or fruit market waste, however, and is in any case restricted from such uses due to quality concerns. Prices for outputs from AWTs can vary from -$15 to +$10. Prices for these outputs are sometimes negative because it is beneficial for AWTs to pay people to remove material from the AWT rather than sending it to landfill.

For a tonne of inputs into an AWT over 40 per cent will typically end up in landfill depending on the efficiency of the facility. Much lower diversion rates were assumed for some facilities initially (and were locked into contracts). There is also a small amount of extraction of plastics and metals. Much of the diversion from landfill is from evaporation of moisture and the rest is from the creation of low-grade organic outputs.

AWTs operate under long term contracts with councils, typically of 15 to 25 years. Investment is modularised and (currently) facilities are only constructed once a contract is signed. Contracts will specify required input quality and expected diversion rates. The levy can be passed back to councils for the expected amount of material going to landfill. If expected diversion rates are not being met (and this is not because of poorer quality inputs than specified in the contract) then the AWT bears the cost of a higher levy on the difference between their target and achievement. Conversely, AWTs that can beat their diversion target can pass back more than their costs to councils and hence be substantially more profitable.

2.7 The AWT supply chain



Data sources: The CIE.

3 Potential impacts of the waste levy for recyclers

The waste levy would intuitively be expected to have a positive impact on recycling businesses. That recycling businesses are worried about the impacts of the levy suggests that the levy is not working as expected. In this chapter, we set out the main issues surrounding the extent to which the levy will have positive or negative impacts on recycling businesses.

How the levy is intended to work

A levy on NSW landfill increases the price of disposing of materials into NSW landfills where the levy applies. This makes alternative possibilities for disposing of materials or reusing materials more attractive in relative terms. When the only other option for materials is to recycle them in NSW rather than landfill them in NSW then the levy will tend to have positive impacts on recycling in NSW.

In practice, there are many more possibilities open for the use or disposal of materials than simply NSW landfills or NSW recyclers. For instance:

- materials may be disposed of in landfills outside of NSW;
- materials may be sent inter-state for recycling;
- materials may be exported for recycling;
- materials may not be disposed of or reused at all— i.e. industrial or farm equipment may be left on-site.

In addition to these possibilities, for unregulated areas in NSW there is no waste levy, which can again change the optimal decision for disposing or reusing of materials when a processing centre is in a regulated area while the materials are from an unregulated area.

These possibilities change the likely impact of a landfill levy. The possibilities have different levels of importance for different types of materials.

The discussions above are about the economic gains from recycling versus landfill. Additional constraints on recycling businesses relate to the contracts that govern activity in recycling businesses. These contracts may mean that economic gains are not translated into profitability for the businesses. In particular, overly optimistic

contracts for material recovery leave recyclers exposed to impact of a changing waste levy.

The discussions above also presume that recyclers are able to monitor the quality of feedstock materials that are inputs into their production processors. If there is a high cost of monitoring quality (or enforcing quality standards from contracts) then this may restrict the ability of recyclers to engender positive behavioural change further up in the supply chain.

These particular issues in relation to the levy are expanded on in turn below.

Recycling when landfill is the only alternative

In some cases materials can either go into landfill or be recycled in NSW, with no other legal or economically feasible alternative. This represents the situation facing generators of materials that provide feedstock for alternative waste treatment plants, as it is too expensive to move materials very far given the value of materials.

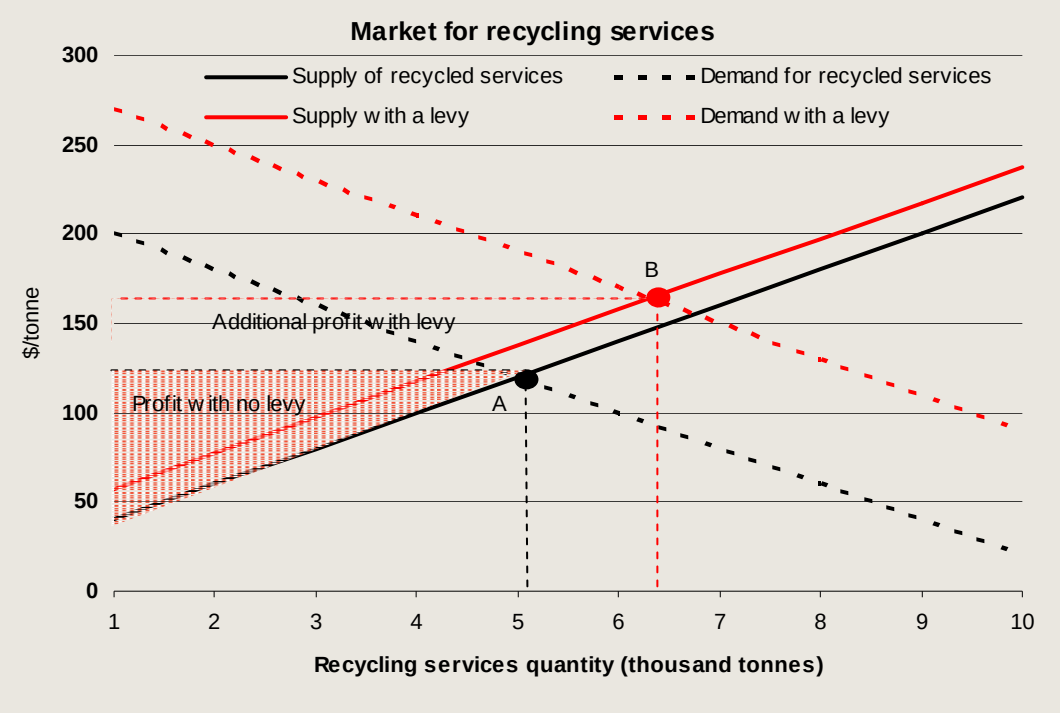
In this case a levy:

- increases the demand price for recycling services by the amount of the levy; and
- increases costs for recycling services by the amount of the levy multiplied by the share of input materials that will be unable to be recycled and will be sent to landfill.

Chart 3.1 shows the impacts of the imposition of a levy on landfill when landfill is the only alternative available. A levy increases the quantity of recycling and increases the profitability of recyclers. The additional demand for recycling services generated from a higher landfill charge generates the additional profits by allowing recyclers to access input materials for a lower price (or receiving a higher fee for taking the materials). For example, a higher landfill levy would allow AWTs to charge a higher gate fee.

Note that the more responsive is the supply of recycled services and more competitive the recycling market, the smaller the amount of additional profit to recyclers.

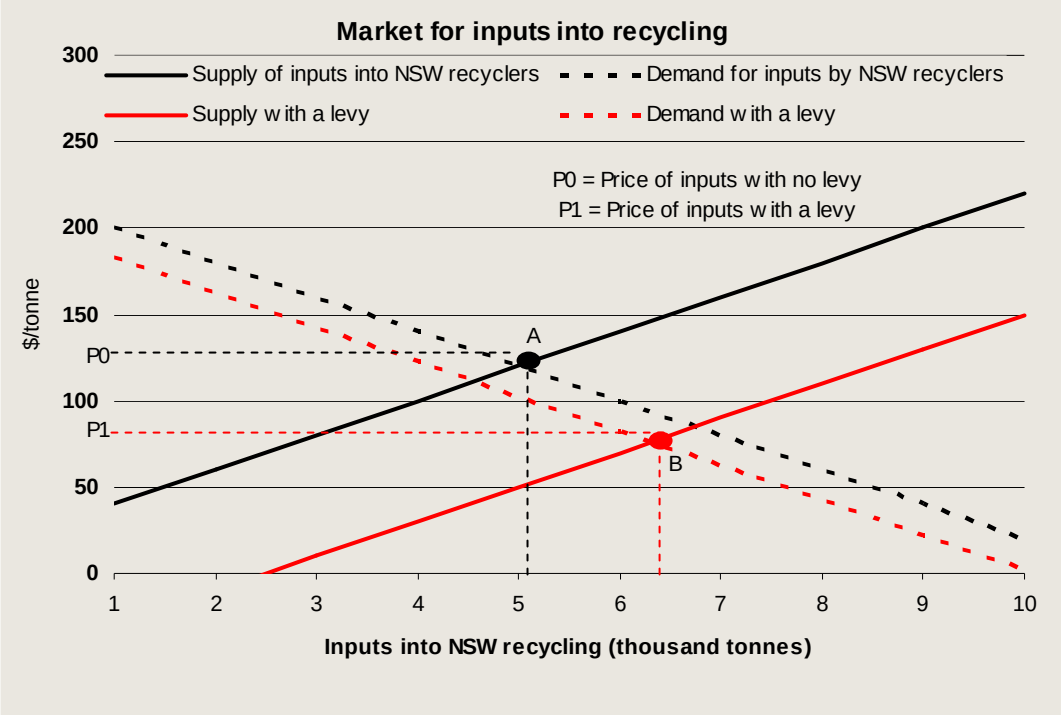
3.1 Impacts of a levy when landfill is the only alternative



Note: The market for recycled services captures the value added for recycling not the input costs. A supply-demand chart could also be formulated considering total costs. Numbers are indicative only.
Source: The CIE.

The market above depicts only one aspect of recycling activity — the segment of the value chain for recycling services. An alternative way of viewing the impacts is through considering the market for *inputs* into recycling. A levy increases the supply of inputs into recycling when landfill is the only alternative as shown in chart 3.2, while demand decreases for inputs by recyclers because of the levy costs incurred on residual waste. The dual effects in this circumstance are a reduction in the price of inputs into recycling and increased throughput of feedstock material for NSW recyclers.

3.2 Impacts of a levy when landfill is the only alternative disposal



Note: Numbers are indicative only.
Source: The CIE.

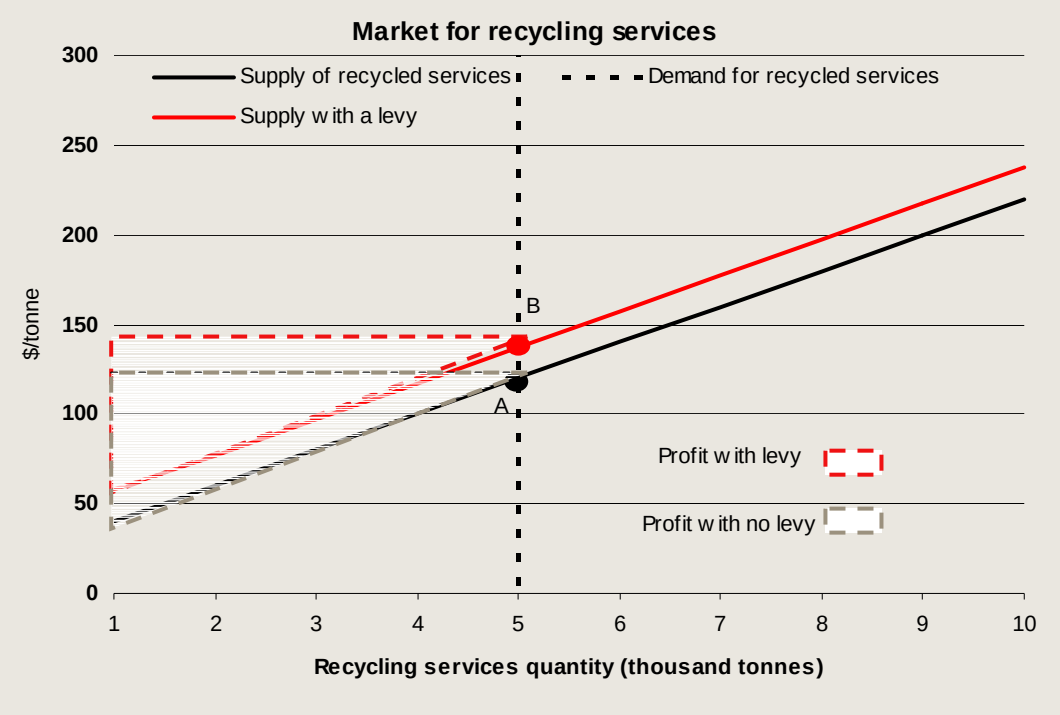
Recycling when there are alternatives other than landfill

When there are other alternatives to landfill the impacts of imposing a levy are more complicated. For example, take the extreme case where no material of a particular type is being sent to landfill. In this case, imposing a levy will have no impact on the demand for recycling as landfill was not a relevant option for the material in any case.

Metals are the closest analogue for this case, with the OEH estimating that 93 per cent of ferrous metals and 87 per cent of non-ferrous metals are currently recycled at the current costs of recycling including the cost of the levy and metal prices.

Under this extreme case NSW recyclers would still be able to pass costs back to material sellers **if** the only choice for those sellers is to recycle material in NSW and, as a result demand for recycling is inelastic (see chart 3.3). Hence recyclers would not be worse off as all costs would be passed back to material sellers.

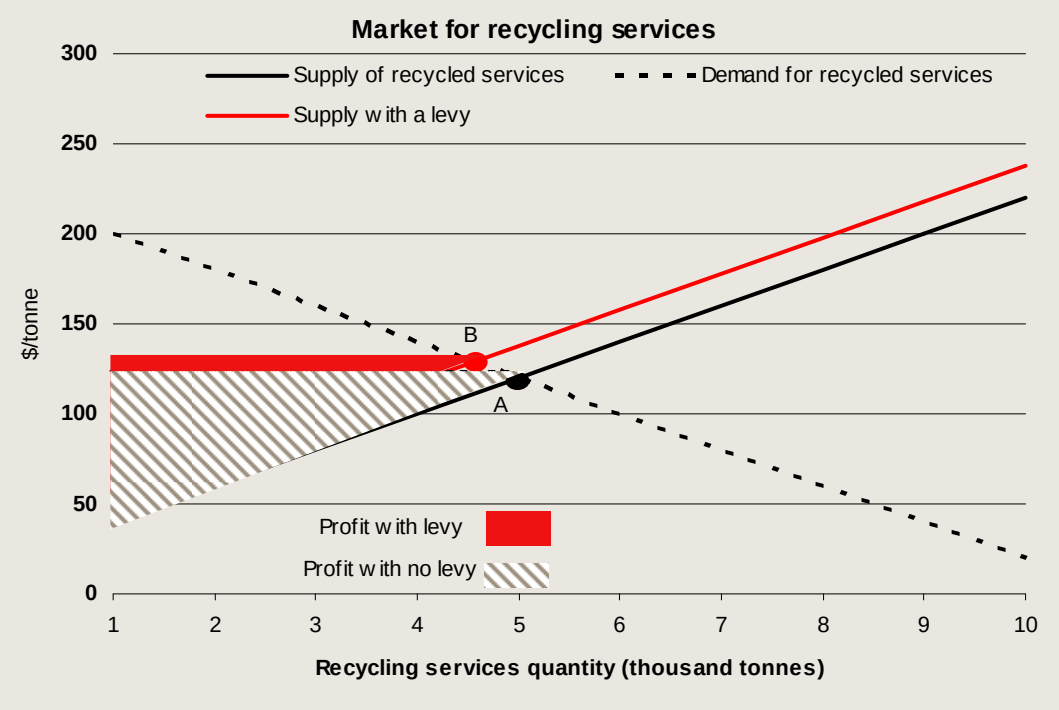
3.3 Impacts of a levy when recycling in NSW is only option



Note: Numbers are indicative only.
Source: The CIE.

If there are other options for disposal or re-use of materials then once landfill is not a relevant option recyclers will be worse off from the imposition of a levy and less recycling will be undertaken in NSW (chart 3.4). That is, where demand for recycling

3.4 Impacts of a levy — multiple disposal options not including landfill



Source: The CIE.

is responsive to the relevant change in price — i.e the demand curve for recycling is less than perfectly inelastic — then less recycling would be undertaken in NSW under this scenario.

The demand curve for recycling services in NSW may be responsive because:

- materials can be sent inter-state or overseas for processing, with some component of waste. For example, if paper for recycling is baled up and then sent overseas then demand would be less than fully inelastic; or
- materials can remain on-site being neither recycled nor landfilled. For example if old farm machinery was left on farms.

The more options material sellers have the more elastic the demand curve for recycling in NSW and the smaller the share of levy costs that recyclers would be able to pass up the supply chain.

The above examples illustrate the main determinants of whether a levy will be beneficial or not for recyclers. While recyclers are not at the extremes indicated by these examples, they may be characterised as being closer to particular examples than others.

Regional differentiation of the levy

The waste levy is not the same across NSW and has not increased by the same amount. In unregulated areas, the waste levy is zero.

This differentiation means that there can be negative impacts on recycling from regional areas because processing is often undertaken at locations that are subject to the levy while materials are sourced from locations that are not subject to the levy.

For example, for an unregulated area where landfill is an alternative option for disposal, the levy increases the cost of providing recycling services. This is because processing is undertaken in regulated areas and residual waste from processing will incur a levy. But the levy does not change the cost of landfill in unregulated areas and hence does not increase demand for recycling in those areas. In such a case the levy would be expected to reduce the amount recycled, if any recycling currently occurs.

The extent to which the levy actually reduces recycling in regional areas where processing is required in regulated areas will very much depend on the value of the commodity being considered. For example, under current high scrap metal prices, it is worthwhile bringing scrap in from most parts of NSW and the issue of regional landfills attracting a lower or zero levy is irrelevant. The relevant issue is whether regional scrap is processed in NSW or elsewhere.

Contracts and levy risk

Some types of recycling are governed by long term contracts that can act either to mitigate or to exacerbate impacts arising from the levy. This is particularly the case for AWTs, which required such contracts in order to attract initial investment.

AWT contracts specify a diversion rate from landfill (i.e. how much of the input materials will not end up as landfill). Contracts then allow for changes in the levy to be passed back to customers on the share expected to go to landfill. This effectively inoculates the AWT from levy increases provided diversion requirements are met. Diversion rates will be subject to some quality specifications on the input materials.

To take an example: an AWT contract may specify that 70 per cent of inputs will be diverted from landfill leaving 30 per cent that is expected to go to landfill. If the levy increases by $10 per tonne then this increase can be applied to the 30 per cent expected landfill residual.

If an AWT is not achieving its expected diversion rate of 70 per cent then this leaves the AWT exposed to the costs of a higher levy. If an AWT was achieving a 60 per cent diversion rate and hence 40 per cent of inputs were diverted to landfill then the $10 increase in the levy would cost it 40 per cent of inputs times $10 and it could recover only 30 per cent of inputs times $10 from customers.

The diversion rates for AWTs are affected by other government regulations around the required quality of outputs for particular purposes.

In the short term, contractual issues may undermine the viability of AWTs when these facilities are not achieving their expected diversion rates. However, there is an incentive for contracts to be renegotiated with customers rather than to close the AWT. This may involve changes in ownership of AWTs and hence lower viability for current owners. However, the underlying economic viability of AWTs is increased by a higher levy.

Note that the contract structures also provide strong incentives for AWTs to increase diversion rates as levies increase. This is because AWTs could still pass levy costs on to customers even if they are not paying the levy on above target diversions. (Contracts will require some sharing of these benefits with customers after a point.)

Contracts do not operate in a similar way in other sectors as contract prices are for much shorter periods (monthly for metals, 1-3 years for paper).

Transaction costs from monitoring input quality

The waste levy can change behaviour at many stages of the resource supply chain. Ideally:

- it provides an incentive to maximise recovery rates/ diversion rates for recyclers;

- it provides an incentive for collectors to maximise amounts of material delivered to recycling facilities instead of landfills; and
- it provides an incentive for waste generators to maximise materials available for recycling collection.

The extent to which it can have these impacts depends on the ability of each part of the supply chain to push the levy back up from the landfill gate to the recycler to the materials recovery facility to the collector to the waste/resource generator. The pathways for doing this are complex and vary across sectors, sometimes involving pricing solutions and sometimes involving other solutions. An example of a pricing solution is a dual collection service being able to price more competitively to businesses against a single collection service because it can divert resources to a MRF with a lower gate fee than a landfill. An example of a non-price solution is council education programs about what can and can't go into recycling bins and determination of bin sizes and collection frequencies.

In some instances, pushing a signal back up the supply chain in response to the levy does not occur because input quality is not monitored by processing facilities or is insufficiently monitored because of the high costs or difficulties in monitoring. For example:

- MRFs do not monitor the quality of inputs from each vehicle and charge accordingly; and
- metal recyclers do not monitor the amount of metal scrap versus non-metal scrap in each vehicle and price accordingly (although they do differentiate broadly amongst suppliers of their feedstock materials).

Presumably this is because monitoring costs and differential pricing systems are perceived as more costly than paying the levy on the extra waste generated because of the lack of monitoring. If monitoring costs are higher than the associated levy costs, a higher levy can lead to unintended consequences . In the case of MRFs, there is the possibility that quality of inputs will decline as the levy rises as customers seek to take advantage of lower MRF gate prices and the inadequacy of quality monitoring. In the case of recyclers, metal in particular, smaller recyclers appear to be setting up to take only zero or low waste metal scrap. This reflects the pricing advantage that such recyclers can offer relative to a levy-inclusive average price charged by others.

These issues are largely for the businesses to deal with through reconsidering their pricing structures and quality enforcement. Understanding the costs of the latter activity would be useful as this issue will become more prominent the higher the level of the levy. Clearly, as the levy rises the incentives for MRFs and others to improve their monitoring also increases. These issues are outside the scope of the present project.

Landfill and levy price structures

Landfill prices and the waste levy are set on a per tonne basis. This is because this is the simplest method of pricing. The incentive embodied in the levy is hence to reduce the tonnes going to landfill.

Metals and paper processing techniques involve some addition of water during processing. Waste from these processes is more moist than when it entered the process. This means that landfill charges are higher than for drier waste as the extra moisture adds to the weight of the waste.

For AWTs the opposite is the case. AWTs remove moisture, with almost half of the diversion of AWTs representing a loss of moisture from evaporation.

The pricing structure of the levy is encouraging recyclers to find ways to minimise the weight of their waste. Paper and metals recyclers are considering solutions to reduce the added weight of their waste by drying it. It is unclear that there are any environmental benefits from providing dry waste to landfill rather than wet (provided there is no difference in leaching), while such a move could impose economy-wide costs, such as from GHG emissions, depending on how the water is reduced.

It may not be administratively feasible to charge the levy on a basis other than weight. Issues related to weight-based charging will become more prominent the higher the level of the levy.

Definitional issues around the levy

A number of industry participants raised issues around the definition of landfill to which the levy applies and the link between what is levyable and what are environmental costs. For example, an argument put forward was if a process treated a material to a standard that substantially reduced environmental costs (and extracted energy and mass from landfill) of it being landfilled then the resulting material should be considered separately to untreated material sent to landfill.

We consider such definitional issues to be largely beyond the scope of this project although we note that definitions will be an important driver of investment decisions that are often made to avoid the levy.

4 How substitution possibilities effect recycling decisions

Potential alternatives to feedstock input materials in NSW

As discussed in the previous chapter there are a variety of options available for the use or disposal of material inputs into recyclers other than through NSW recyclers. These include:

- disposing of potential input materials in landfill (either in a regulated or unregulated NSW region or interstate);
- exporting potential input materials overseas for recycling;
- transporting potential input materials interstate for recycling;
- dumping potential input materials illegally; or
- amassing potential input materials on private property.

Factors affecting decisions between material disposal alternatives

The viability and importance of each of these alternative options differs across potential input material types and is governed by a number of broad factors. For instance:

- the price which may be obtained for the recycled material;
- the processing costs of taking input materials into useable output materials;
- the ability to cost-effectively move the input materials interstate or offshore; and
- the relative cost of disposal (including the levy) of potential input materials (reflecting residual waste).

These factors can be explicitly linked to the relevant decisions between the above alternatives.

When is recycling financially viable relative to landfill?

Recycling of scrap materials will be preferred to landfill where the net cost of recycling is less than the cost of landfill. The net cost of recycling is the cost of processing less the value that can be obtained from selling recycled materials. For

example, if scrap metal can be sold to a shredder for $160 pertonne, and it costs $50/tonne to transport it to the shredder then a scrap collector could offer up to $110/tonne to the generator of the scrap. Or they could pay $100 per tonne to dispose of the scap metal to landfill. In this case, the choice for the scrap generator is obvious.

Putting this more specifically, recycling of materials will occur when:

- the net cost of recycling is less than the net cost of landfill, i.e. when
- the costs of processing and transport for recycling less the revenue that can be obtained from selling materials is less than the landfill gate fee and costs to transport to landfill.

Viewing it this way it is clear that there are a number of key factors that will drive increased recycling.

- A higher value of materials will make recycling a better option than landfill.
- A higher cost of landfill, which partly comes from the levy will make recycling a better option than landfill.
- Lower costs of processing and transport of materials for recycling will make recycling a better option than landfill.

Note that a higher levy increases both the costs of landfill and the costs of processing — it increases the cost of landfill by more per tonne because only some part of the input material for recycling will end up as residual waste.

When is recycling in NSW preferred to recycling elsewhere?

Recycling can occur in NSW and elsewhere. Recycling will tend to occur in NSW when processing costs in NSW are lower than interstate or foreign processing costs, when there is a higher price for materials in NSW or where transport costs are prohibitively high.

The levy increases processing costs in NSW and hence makes it more likely that recycling will be done elsewhere.

Prices of material are likely to go up and down around the world at the same time as markets are increasingly closely linked. This means that higher commodities prices do not push material towards one country or another.

When is recycling preferred to storing material?

In some instances material can be stored on-site rather than landfilled. For example, there are old items of machinery lying on farms throughout NSW (or at least there were prior to the increase in commodity prices).

Recycling of scrap materials will be preferred to storing where the value that can be obtained from these materials less the cost of recycling is higher than the storage

costs of material. Generally, if scrap collectors can offer a positive price for material then most people and businesses would prefer this to storing on-site.

There is also the option of illegal dumping rather than stockpiling. This would be expected to become more attractive as the levy increased.

Summary of key factors

The key factors driving decisions can be summarised as in table 4.1. These factors have undergone substantial change over the past decade and have shifted the incentives on whether and where to recycle. These are discussed further below.

4.1 **Summary of drivers of choices**

Driver	*Impact on recycling (whether in NSW or elsewhere)*	*Recycling in NSW versus recycling elsewhere*
Higher material prices	+	
Higher NSW processing costs	-	-
Lower international processing costs		-
Higher land transport costs	-	
Higher sea transport costs		+
Higher landfill costs (including for residual waste)	+	-
Appreciation of Australian dollar		-

Source: The CIE.

The levy has ambiguous impacts on recycling in NSW. On the one hand it increases the incentives for recycling, while on the other it shifts the incentives to recycle outside of NSW. Which of these effects predominates will depend on which of the cost constraints are binding for each industry, as discussed below.

Summary of current viable alternatives

Which of the constraints discussed above are binding will be dependant on the particular scrap material and may change over time. A summary of the viability of alternatives to recycling different waste types is provided in table 4.2.

For metals, landfilling is largely not an alternative for most scrap because the value of material far outweighs the processing costs.[13] Hence even holders of scrap in regional NSW are generally receiving payment for taking their scrap, which is clearly better than putting it into landfill. Export and inter-state recycling are options for metals.

[13] This is true for most scrap but is not the case for material dispersed in mixed waste or very small amounts of metal for example.

For paper, landfill is still an option for a lot of paper when it is more costly to extract from other materials or is far from processing areas. Export and inter-state movements are also possible.

For AWTs, landfill is the only real alternative for that material.

These conclusions are discussed in detail below.

4.2 Viability of alternatives to recycling for different waste types

	NSW regulated landfill	*Export for recycling*	*Interstate recycling*
Metal		X	X
Paper	X	X	X
AWT	X		

Source: The CIE.

Metal

Current high scrap metal prices have meant that landfill costs are not a constraint to recycling — nor are they a significant stimulus of recycling. (The volatility of metals prices means that this may not be the case in the future.) OEH statistics indicate high rates of recycling within NSW of both ferrous metals (93 per cent) and non-ferrous metals (87 per cent).[14] Similar high recycling rates are observed around Australia for metals indicating that the levy is not currently a major driver of recycling activity for metals.[15]

- The market for recyclable materials is closely integrated with primary commodity markets with prices exhibiting similar trends. As such, following the global recession with drove scrap prices 75 per cent lower than their peak in 2008, recent high prices for recyclable commodities are the product of strong international demand and supply shortages. At the beginning of May 2010, the most representative scrap metal prices were above US$400 per tonne. This is twice as much as in March 2009 but only half as much as in June 2008.
- High prices for scrap metal materials limit the effectiveness of the levy in increasing volumes of materials recycled within NSW as scrap would be recycled anyway. The levy could make it feasible to extract more material from the input scrap processed by shredders, although the cost of doing so appears to be high in the absence of a waste to energy option. There is further discussion of this at the end of this chapter.

---

14 OEH advises that these percentages are estimates as metal recyclers do not provide data to the confidential surveys carried out by OEH that are used to determine resource recovery performance.

15 Data provided by Australian Department of Sustainability, Environment, Water, Population and Communities for 2008-09.

Most of the metal collected in NSW is currently shredded in NSW and directed to NSW steel processing facilities. In 2010, NSW exported 113 000 tonnes of scrap ferrous metal (around 8 per cent of ferrous scrap recycled) worth $55.4 million.[16] However, as noted earlier, these figures may be subject to underreporting given ambiguity surrounding the legality of exporting scrap and waste. These figures comprise both post-shredded scrap and pre-shredded scrap. Exports of scrap metal from NSW ports doubled in both value and quantity from 2004 to 2010.

Major market changes have pushed the incentives towards recycling outside NSW. International sea freight transport costs are relatively low, shredding capacity has been added in China and South East Asia and landfill costs have been increasing for residual waste.

Anecdotal evidence also suggests that a number of businesses have started up to bale metal scrap and transport it to China.[17] These businesses are relatively small. Industry consultations suggested that major players were engaged in export markets both post-shredding and unshredded sometimes in NSW and often in other states without downstream processing. Exporting is also the major option for non-ferrous metal.

A random survey of scrap metal collectors within NSW revealed that the majority of pre-shredded ferrous material remained within the state for recycling (table 4.3). While some companies onsold their materials to larger firms such as OneSteel and Sims Metal (who potentially exported a percentage), metal collectors reported that only around 11 per cent of their material was exported directly offshore. We note that relatively small operators are more likely to export their materials given that they do not possess their own shredding facilities. Distributing scrap materials interstate was rare, with the exception of one scrap metal collector located close to the Victorian border. This operator reported that all materials were shipped to Melbourne given lower transport costs and lower levies.

---

16 CIE analysis of Global Trade Information Services databases.

17 Similar issues have been experienced in other countries with large amounts of UK materials transported to China for processing. See for example, 'The UK's new rubbish dump', *The Guardian,* 20 September 2004 http://www.guardian.co.uk/society/2004/sep/20/environment.china; World Watch Institute, 'Imported pollution adds to China's Environmental Woes', http://www.worldwatch.org/node/4986; The Independent, 'Made in Britain — dumped in China', 26 January 2007, http://www.worldwatch.org/node/4986.

4.3 Survey of scrap metal collectors, distribution of pre-shredded materials

Company location	*Interstate*	*Export*	*Processed in NSW (or sold to larger firms)*
	%	%	%
Albury	100		
Coffs Harbour			100
Sydney			100
Sydney			100
Sydney		20	80
Sydney			100
Sydney	2	18	80
Sydney		50	50
Total (average)	**13**	**11**	**76**

Source: The CIE.

4.4 Major drivers of metal recycling activity

Driver	*Impact on recycling in NSW*
Increasing scrap processing capacity in China and South East Asia	Negative. There has been substantial investment in scrap processing facilities in China and in other South East Asian countries. Feng Li in China has installed 4 large shredders each capable of processing 1 million tonnes of scrap a year. This has reduced marginal processing costs in China.
Deficit of container trade between Australia and China	Negative. The nature of Australia-China trade means that there is a surplus of containers that need to return to China and nothing to put in them. This has driven sea freight rates very low, with transport available for under $50/tonne (including port fees etc).
Higher landfill costs in NSW	Negative. Landfill costs applying to residual waste have roughly doubled from 2001 to 2010 (in nominal terms) reflecting both the higher levy and higher other charges.
Higher scrap prices	Positive. Very little metal is not being recycled. Stores of scrap metal can now be accessed economically in regional NSW.

Sources: CIE analysis; Industry data and consultations; The Shredder Company archives, http://www.theshredderco.com/articles.html##feng; Scott Newell 2007, "Trends in the production and use of shredded steel scrap", AMM Conference, November.

International shipping rates to China have remained relatively low in recent years. The cost of shipping a 20-foot (6.1 m) dry cargo container from Australia to China is approximately $1026, or around $47 per tonne when assuming the maximum gross mass. This is based on an independent quote obtained from China Shipping Container Lines Co. and is consistent with figures provided by one NSW metal recycler, although another reported a figure as low as $17 per tonne.

If scrap was going to be exported, the relevant decision would be whether to shred it pre-export or simply bale (compress) the scrap and then export. If a metal recycler sends scrap pre-shredding that has a similar amount of waste as average scrap (i.e around 25 per cent) then they will incur a 'disposal cost' from international

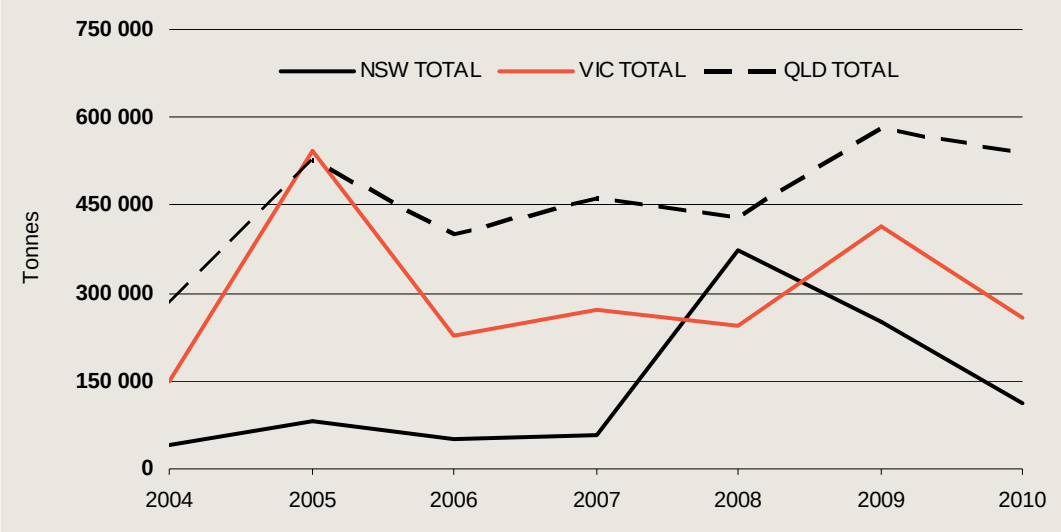
freight of this residual of $47/tonne plus the costs of baling the material (and any additional domestic transport costs). If they shred in Australia and then send then they would be charged around $105/tonne in landfill disposal costs for the residual waste from processing (based on landfill fees indicated by industry).[18] Hence, 'disposing' of residual waste through exporting scrap metal pre-shredding is not at unattractive option. This discussion presumes that differences in prices of shredded scrap and scrap for input into a shredding facility will reflect the costs of processing.

The amount of exports to China suggests that retaining scrap in NSW is still currently preferable to both these options. But if demand for shredded steel in NSW falls then NSW shredders would come under significant pressure because of the waste levy.

The levy can also have impacts on inter-state movement. Industry discussions indicated that scrap from Grafton or Coffs Harbour northwards typically went north to Brisbane, while scrap from Wagga Wagga and south went to Melbourne. This reflects both transport costs and the levy as much of the logistics of other goods moves in similar patterns to that indicated for metals.

Interestingly, ferrous scrap exports have increased from ports in NSW, Queensland and Victoria over the past 6 years (chart 4.5). This suggests that competition for scrap is becoming more intense regardless of the levy, as Queensland has not had a levy and Victoria's is lower than that for Sydney. Note that this is most likely to be already shredded scrap. NSW metal recyclers exported their scrap post GFC when they could not sell it to NSW steel mills.

4.5 Ferrous scrap exports by state



Data source: CIE analysis of GTIS databases.

18 Note that metal recyclers pay well below the standard gate fees which average $195/tonne, which is the average charge across Kimbriki, Eastern Creek and Lucas Heights landfills for one tonne of mixed waste

Paper

Recovery rates for paper and cardboard (around 59 per cent[19]) suggest that landfill is a viable alternative for paper and cardboard, at least for lower quality materials. Industry consultations suggest that waste paper and cardboard generated close to recycling facilities (such as in Sydney) is typically recycled (again depending on quality) but only very clean paper and cardboard in regional areas is recycled. Of the paper and cardboard going into landfill, Office of Environment and Heritage data indicates that most is from the commercial and industrial sector.

Where recovery rates are lower there will be greater scope for the levy to encourage recycling of waste materials currently diverted to alternative options. By increasing the costs of disposing waste materials in NSW landfills, the levy makes the other viable options (including recycling within the state) more attractive. The extent to which recycling within NSW will increase will depend on a number of factors discussed below affecting decisions on waste disposal alternatives.

While a levy is likely to increase recovery of paper and cardboard and potentially allow recyclers to access these materials at lower cost there is some ability to export paper scrap instead of recycling in NSW. The value of paper waste and scrap exports from NSW grew from US$2.2 million in 2004 to US$22.0 million in 2010. The volume of scrap paper exported from NSW in 2010 was 131 000 tonnes, or around 15 per cent of the total amount of paper material recycled in NSW. Anecdotal evidence suggests that paper scrap materials are also exported across state borders, but we have no reliable data on the size of these flows. The availability of export markets may constrain the ability of paper recyclers to pass back the costs of the levy, although it is often Visy and Amcor that are exporting scrap paper surplus to their requirements.[20]

The major drivers of paper recycling are set out in chart 4.6. Recent changes are both positive and negative for paper recyclers. Additional capacity installed in NSW, higher scrap paper prices and likely higher recycling from a higher levy are positive factors for paper recyclers. However, higher domestic transport costs and the levy cost on residual are negative.

19 Data provided by NSW Office of Environment and Heritage for 2008/09.

20 For instance Amcor exported around 5 per cent of its paper scrap in 2009/10.

4.6 Major drivers of paper recycling activity in NSW

Driver	*Impact on recycling in NSW*
Deficit of container trade between Australia and China	Negative. The nature of Australia-China trade means that there is a surplus of containers that need to return to China and nothing to put in them. This has driven sea freight rates very low, with transport available for under $50/tonne (including port fees etc).
Higher landfill costs in NSW	Positive and negative. Landfill costs for residual waste have roughly doubled from 2001 to 2010 (in nominal terms) reflecting both the higher levy and higher other charges. This will increase recycling of paper and cardboard where the levy applies but may also increase the incentive to ship scrap overseas or inter-state.
Higher paper scrap prices	Positive. Higher material prices will increase recovery rates for paper and make it more economical to access more distant paper and higher processing cost paper.
Higher domestic transport costs	Negative. Higher domestic transport costs make it more costly to access material from regional locations.
Higher domestic processing capacity	Positive. Higher processing capacity in Sydney is currently on the way through Amcor's investment. This will substantially lift the amount of recycled paper and cardboard that it can process.

Source: The CIE.

The aggregate impacts of a levy on paper recyclers within NSW are ambiguous and will depend on the response of suppliers in terms of volume able to be supplied and the ability of scrap paper exports to constrain the price.

In regional NSW the recovery rate of paper and cardboard is much lower per capita than in Sydney. Sydney Metro has 1.39 times the paper and cardboard recycled per capita compared to NSW as a whole (table 4.7). In areas where the levy is progressively lower the per capita recycling is smaller. This pattern will reflect more than just the levy, with transport costs being higher in regional areas, gate fees (excluding the levy) often lower and industry composition also differing.

4.7 Recycling and population by region

Region	*Share of population*	*Share of paper and cardboard recycled*	*Recycled share to population share ratio*
	Per cent	Per cent	No.
Sydney Metropolitan Area	56.3	78.0	1.39
Extended Regulated Area	18.9	12.0	0.63
Regional Regulated Area	10.8	5.5	0.51
Unregulated Area	14.0	4.5	0.32

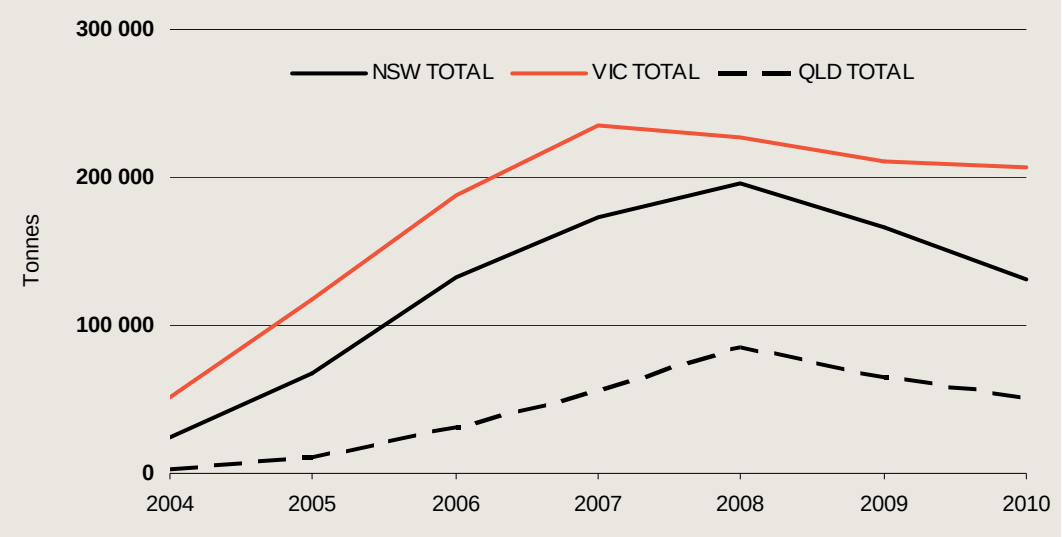
Source: ABS (2011), *Regional Population Growth, Australia*, 3218.0, and data provided by recyclers.

Increasing domestic transport costs are likely to reduce the ability to recycle paper and cardboard from regional NSW. The Bureau of Infrastructure, Transport and

Regional Economics report real increases in interstate freight costs. Reflecting a surge in world oil prices, interstate road freight rates have increased by 10 per cent over the 5 years to 2007-08 in real terms. Meanwhile, interstate rail transport costs increased by 5.6 per cent over the same period, but have fallen by 43 per cent over last decade.[21]

Exports of paper and cardboard scrap have increased from ports in NSW, Queensland and Victoria over the past 6 years (chart 4.8). This suggests increased competition for scrap paper and cardboard materials regardless of the levy, given that Queensland has not introduced a levy while Victoria's is significantly lower than that for Sydney.

4.8 **Paper and cardboard scrap exports by state**



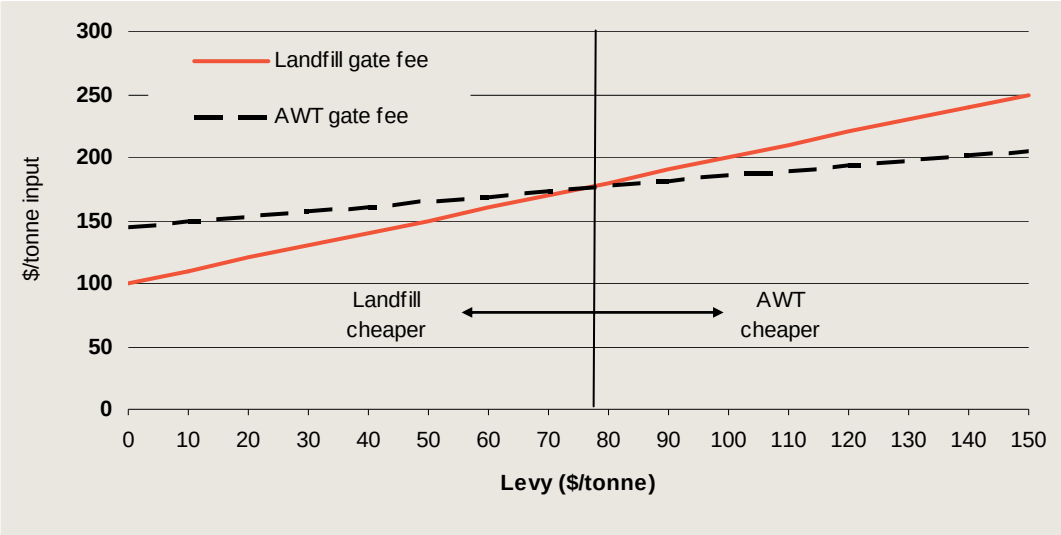
Data source: CIE analysis of GTIS databases.

AWTs

AWTs are an alternative to landfill. Costs of transport will be very similar to landfill as they are often co-located. Whether or not AWTs are preferred to landfill will then reflect whether the AWT gate fee is lower than the landfill gate fee. Both AWT and landfill fees increase with the levy, but landfill costs increase more quickly. This means that there is a cross-over at which the levy is high enough to make the AWT cheaper than landfill (chart 4.9). This cross-over is very close to the current levy point on the assumption of a 60 per cent diversion rate away from landfill.

21 BITRE (2008), Freight rates in Australia 1964-65 to 2007-08: Information sheet 28, November.

4.9 **Viability of AWTs related to the levy**



Source: The CIE.

The above is highly simplified. In practice, AWTs can invest more to extract more, although industry stakeholders indicated that diversion rates of 60 per cent were fairly typical.[22]

AWT material is typically not transported far given that transport costs are high and the only reason to transport would be to access lower landfill fees. Regulations mean that AWT material disposed of in NSW would be subject to a levy from the location it originated from. Distances and transport costs are too large to move material from high levy areas such as NSW to low levy neighbouring states.

As discussed in the previous chapter, where the only viable options to dispose of scrap materials are landfill or recycling within NSW, the levy is likely to increase demand for recycling services and the profitability of recyclers.

Potential for recycling industry to pass levy costs up the supply chain

The options above influence the extent to which each industry might be able to pass the levy up the supply chain (in the absence of contractual constraints) or to benefit from greater throughput.

Metal recyclers advise that they are be unable to pass the levy up in full through a lower price for scrap. This reflects the option that scrap suppliers (and indeed current shredders) have to export unprocessed contaminated scrap (at lower prices than clean or shredded scrap). Recyclers would likely be able to pass back a share of the levy costs, as they currently do in their pricing. One industry player indicated that 20 per cent of a higher levy might be passed back to suppliers. This is much lower than

22 Possible diversion rates will also depend on the input quality.

suggested by the current pricing structures and pass-through of the levy by metal shredders. Such a figure may be more realistic for additional price changes once the levy is higher and could be considered a lower bound to possible pass-back.

Paper recyclers would also face a constraint from exports. However, they would also be the beneficiaries of an increased supply of paper through higher diversion from landfill. The overall impact of these two effects is ambiguous. We would expect that exports would be relatively more responsive to price changes than domestic supply. However, exports are currently small, so any changes are from a small initial base.

We are aware of no direct evidence of the responsiveness of paper recycling to landfill prices in NSW. Overseas studies of the responsiveness of landfill quantities and recycling to price provide an indirect guide as to how the amount of recycled materials may respond to higher landfill prices. These studies report elasticities in various ways that are not always amenable to transfer. For example, the elasticity of recycling with respect to the recycling price is not directly transferable to the elasticity of landfill with respect to the landfill price. Estimates from previous studies for paper include:

- a one per cent increase in the price of recycled paper leads to a 0.06 per cent increase in the amount of paper recycled; [23]
- a one per cent increase in the price of recycled paper leads to a 1.7 per cent increase in the amount of paper recycled;[24]
- a one per cent increase in the price of mixed waste collection services reduced the quantity of non-recyclable waste by 0.069 per cent;[25]
- a one per cent increase in the price of mixed waste collection services reduced the quantity of non-recyclable waste by 0.12 to 0.39 per cent;[26]

The latter two figures are for all recyclable materials rather than being specific to paper.

There is clearly considerable uncertainty about what how a higher waste levy might impact on paper recycling in NSW. Using the above estimates as a guide, we assume that a one per cent increase in the price of landfill leads to a 0.2 per cent reduction in the amount of material going to landfill. At current recycling rates, this implies a one

---

23 See the literature summary reported in Appendix A in Resources for the Future (1995), *The cost of reducing municipal solid waste,* Discussion paper 96-35, September.

24 See the literature summary reported in Appendix A in Resources for the Future (1995), *The cost of reducing municipal solid waste,* Discussion paper 96-35, September.

25 Kuo, L. Y. and C. Perrings (2010), 'Wasting time: recycling incentives in urban Taiwan and Japan', *Environmental Resource Economics,* June.

26 Reported in Kuo, L. Y. and C. Perrings (2010), 'Wasting time: recycling incentives in urban Taiwan and Japan', *Environmental Resource Economics,* June.

per cent increase in the price of landfill leads to about a 0.13 per cent increase in the amount of paper recycled.

There are a few possible ways to consider the ability of paper and metal recyclers to pass-through prices in lower input prices. These include:

- using a particular assumed elasticity of demand for export scrap and domestic demand for scrap and then deriving what this means for the ability to pass-back prices and quantities processed; and
- using a model of a small number of buyers (oligopsony) and allowing exports to constitute one buyer of scrap.

These methods are discussed in greater detail in Appendix A. The second method is quantified in Appendix A but these findings are not used for the analysis below.

For metals, we consider analysis in the case where there is no response from landfill from the levy. The small current share of exports in the metals market means that even under highly elastic export demand, a significant amount of cost increase from the levy rise would be able to be passed up the supply chain (table 4.10). For example, exports of pre-shredded scrap metal may make up to 5 per cent of the current market. Even assuming a highly elastic demand for exports of 20 (i.e a 1 per cent reduction in the price offered for input materials by NSW shredders would lead to a 20 per cent increase in exports), NSW shredders would be able to pass back just 47.3 per cent of the cost increase through lower input prices. It is more likely that export demand is not so responsive, particularly in the short term, and they would be able to pass back as much as 80 per cent of costs.

4.10 **Pass back of input price increases — metals**

Elasticity of demand for scrap exports	***Export share (per cent)***			
	5	***10***	***15***	***20***
	Per cent	Per cent	Per cent	Per cent
1	95.0	89.9	84.9	79.8
5	**78.7**	63.8	52.6	44.0
10	64.6	**46.6**	35.6	28.1
20	47.3	30.2	21.6	16.3

Note: Domestic demand elasticity set to 1. The elasticity of demand for scrap exports is the percentage change in the quantity of exports for a 1 per cent reduction in the price offered by NSW recyclers. Numbers in bold are used for estimates in subsequent analysis.

Source: CIE analysis.

For paper, a large part of the 15 per cent market share for scrap paper exports are from Visy and Amcor. Hence a large degree of pass-back would also be expected for paper recyclers. There is the added complication that more material would likely become available as councils and businesses acted to avoid the landfill levy, driving input prices lower. As discussed above, we allow for a one per cent increase in landfill costs to lead to a 0.2 per cent reduction in paper going to landfill.

Estimates of pass-back allowing for a response for material shifting out of landfill are shown in table 4.11. Under a range of plausible assumptions, paper recyclers would be able to pass back more than the full increase in the cost of the levy.

4.11 **Pass back of input price increases — paper**

Elasticity of demand for scrap exports	*Export share (per cent)*			
	5	***10***	***15***	***20***
1	136.8	131.7	126.7	121.6
3	**123.9**	109.2	96.8	86.2
6	108.1	**86.4**	71.2	59.8
10	92.0	67.4	52.5	42.4

Note: Domestic demand elasticity set to 1, material response from landfill is set at a 2 per cent reduction in landfill for every 10 per cent increase in price. Recycling rate set at 59 per cent. The elasticity of demand for scrap exports is the percentage change in the quantity of exports for a 1 per cent reduction in the price offered by NSW recyclers. Numbers in bold are used for estimates in subsequent analysis.

Source: CIE analysis.

Based on the market parameters for each industry, our expected levels of pass back are shown in table 4.12.

- The pass back for paper is based on:
  - a one per cent increase in landfill costs leading to a 0.2 per cent reduction in the amount of paper going to landfill;
  - a one per cent reduction in the price offered by NSW recycled paper mills leading to a 3 to 6 per cent increase in exports; and
  - a current export share of 5 to 10 per cent.
- The pass back for metal is based on a one per cent reduction in the price offered by NSW recycled paper mills leading to a 5 to 10 per cent increase in exports, and a current export share of 5 to 10 per cent.

We allow for a range of estimates for the export reaction, as there is considerable uncertainty about the true figures. These figures involve some subjective judgement in moving from our analysis of the export market to the magnitude of the response that might be expected from a price change.

Under the estimates above, metal recyclers would be able to pass back 47 to 79 per cent of the levy up the supply chain and paper would be able to pass back 86 per cent to 124 per cent. We take the mid-point of low and high estimates for our analysis.

AWTs would be able to pass back around twice their levy costs. AWTs may be limited by competition from other AWTs in the future, so they would not be expected to be able to continue to pass back levy increases twofold forever. Where AWTs are not meeting contractual diversion requirements they would incur negative impacts from the levy.

4.12 **Pass back estimates used in financial analysis**

Scenario	*Paper*	*Metal*	*AWTs*
	Per cent	Per cent	Per cent
Best estimate	105	63	208
Low	86	47	167
High	124	79	250

Source: CIE estimates.

Potential for recycling industry to pass levy costs down the supply chain

Even if recyclers could not pass the cost of the levy up the supply chain to materials suppliers and material/waste generators they could potentially pass it down to end customers. While this would not assist in the levy achieving higher recycling rates it would reduce the impact on recyclers.

The global nature of the markets for metals and paper suggests that recyclers of these products will have low ability to pass higher costs on to further processing centres and to final customers. In the case of metals, seeking to pass costs downstream would probably exacerbate competitive pressures on steel manufacturers already occurring as a result of the higher Australian dollar. For vertically integrated businesses such as OneSteel, decisions on what to do with their scrap and shredding facilities would be made in conjunction with decisions about their steel furnaces. This may mean that any losses in the metal recycling businesses would be borne by the rest of the business for some time, given the substantial capital invested along the entire supply chain. We consider the impact of the levy as a share of final steel prices in chapter 5 to better understand this potential.

The global nature of metal product markets is clear from the use of export parity pricing and the large international trade flows.

- In metals, imports of metal products likely constitute over a third of NSW consumption,[27] while a large share of production is exported inter-state and overseas.[28]

The data suggesting that imports provide contestability in the metals market is backed up by the decisions made by the Australian Competition and Consumer Commission (ACCC).

---

27 CIE analysis based on Global Trade Information Services databases showed imports of steel products at 1.6 million tonnes in 2009-10 and exports and 1.5 million tonnes.

28 BlueScope Steel 2009, *Port Kembla Steelworks and Springhill Analyst Sitye Visit*, September, presentation (for 2008/09) showed 1 million tonnes exported overseas and 1.7 million tonnes exported inter-state from a total production of 3.5 million tonnes.

- The ACCC approved the acquisition of Smorgon by OneSteel subject to anti-dumping undertakings. This reflected the view that imports provided a competitive constraint in markets for steel products.[29]
- The ACCC approved the acquisition of Metals Trading by OneSteel in 2010. This reflected the view that the ability of scrap processors to export scrap was likely to act as a constraint on the merged entity.[30]

For paper recyclers there are questions as to what extent imports provide competition amongst particular products. There are substantial imports and exports of paper products in total (496 000 tonnes were exported and 460 000 tonnes were imported,[31] compared to an amount of recycled scrap of just over 800 000 tonnes[32]). However, the evidence of prior cartel behaviour between Amcor and Visy from 2000 to 2004 in the corrugated packaging market[33] suggests that import competition was not effective across all market segments during this time period. If import competition was effective then a cartel, and 90 per cent combined domestic market share, would have been difficult to maintain. Exports and imports have increased since that time, but there are still likely to be areas where there is limited contestability from imports.

There may also be competition from other states that have lower levies. Despite this, it is possible that Amcor and Visy would be able to pass some of the costs of the levy down to their customers in the event that they could not pass impacts upwards in lower prices for their inputs.

Potential to reduce residual waste

If recyclers are able to find methods that reduce their amount of residual waste and that are cheaper than sending this waste to landfill, they will also be able to reduce the negative impacts of a higher levy. In this case, they will be either less negatively financially impacted or more positively financially impacted.

A higher levy will provide greater incentive for recyclers to find ways of recycling their residual waste. The magnitude of the change in financial implications will depend on the cost curve for residual waste reduction options and the time lags until

---

29 ACCC 2007, Public Competition Assessment, OneSteel Limited — proposed acquisition of Smorgon Steel Group Limited/ BlueScope Steel Limited — proposed acquisition of Smorgon's steel distribution assets, June 22.

30 ACCC 2010, http://www.accc.gov.au/content/index.phtml/itemId/924551/fromItemId/751043.

31 CIE analysis based on Global Trade Information Services databases.

32 NSW Office of Environment and Heritage.

33 ACCC media release, 2 November 2007.

these options can be undertaken. We have no quantitative evidence on this. Discussions with industry suggested that:

- for paper, options for reducing residual waste from were possible. These included removing wetness from residual waste and turning waste into fuel (although this is currently limited in NSW);
- for metals, options for reducing residual waste have occurred but additional options are not commercial:
  - businesses had invested in options that reduced residual waste through removing more of the metals — particularly non-ferrous metals. This has largely reflected the value of these metals. This has not reduced residual waste by a large amount because of the small share of the materials in the residual waste stream. Discussions indicated an extra 1-2 per cent of input materials were extracted from this process. Importantly, this process reduces the metal content in residual waste and increases the ability for such waste to be useful in the future;
  - OneSteel has investigated other options for using residual waste such as plastics and fuel for cement kilns.[34] These options are not currently commercial or are not possible within regulatory arrangements. Industry indicated that these are not likely to occur over the next 3 to 4 years; and
- for AWTs, there are options to use materials in plastics that are currently being investigated and trialled.

[34] This includes an option discussed at the Australian Industrial Ecology Conference.

5 *Quantifying financial impacts of the levy on recyclers*

The levy is likely having negative consequences for some NSW recyclers.

- For NSW metal recyclers, alternative options to disposal, are to export overseas prior to shredding or stockpiling (for scrap a long way from processing centres). These options are unaffected by the levy. The levy will likely have negative consequences for metal recyclers because they will incur costs of disposing of residual material but face limited ability to pass costs back to scrap suppliers through lower prices.
- For NSW paper recyclers, the levy will have mixed impacts and the overall financial implications are unclear. The levy will divert more recycled paper from landfills, putting downward pressure on paper prices. Recyclers will also seek to push levy increases back to paper suppliers. Price reductions for inputs will be somewhat limited by export competition for these inputs. Nevertheless, it is plausible that paper recyclers could have either lower or higher profitability from a higher levy. If necessary, paper recyclers may also be able to pass some costs down to customers.
- For AWTs the levy will have positive financial implications, although these may be clouded in the short term by contractual issues.

In terms of financial impacts there are two parts to an assessment. Firstly, what is the direction and likely magnitude of the financial impacts on recyclers? Secondly, is the levy moving any recyclers from a position of financial viability to a position of non-viability?

We focus on the first of these given the data constraints and the limited nature of the information industry was willing to provide. We make comment on the second, although it is not possible to be conclusive with respect to issues of financial viability of particular capital investments. With regard to the second issue, there are also many non-levy related factors that impact on the success of NSW recycling businesses. It is clear that while the levy could potentially make some types of operations unviable in NSW, recyclers would adjust their operations and their businesses would remain viable.

There are different possible definitions for a recycling business, particularly for vertically integrated businesses such as Visy and Amcor and depending on the extent to which a business pays at the factory gate or collects itself. This is reflected in the

information provided to us. We have sought to provide comparable indicators across the industries of the importance of the waste levy.

No detailed information is presented for AWTs as the financial impacts of the levy are positive aside from contractual concerns. Hence the relevant analysis is quite different to that necessary for paper and metals recyclers.

The cost structure of recycling businesses

The cost structure for metal and paper recyclers is shown in table 5.1. The levy costs as a share of total costs (including the cost of collection sourced input materials) for recyclers is 4.8 per cent for metals and 1.3 per cent for paper.[35] Hence, as a share of all costs for shredded metal and paper reels, the levy is not substantial. It is more important as a share of operating costs or value added.

5.1 Cost structure of recycling businesses

Cost item	*Paper*	*Metal*	*AWT*
	% of costs	% of costs	% of costs
Material input costs	19.0	60.0	na
Collection costs	5.9	13.6	na
Processing costs	61.2	11.5	57.1
Levy costs	1.3	4.8	14.1
Other landfill costs	1.6	2.7	21.5
Other costs	10.9	7.5	7.4
Total costs	100.0	100.0	100.0

Note: For paper, costs are backed out from prices and a margin of 5 per cent where not provided by recyclers. Material costs refer to the costs of scrap materials such as scrap metal, scrap paper and mixed waste.
Source: Information supplied by recyclers and CIE calculations.

For metal shredders, the levy is of comparable size to the sum of labour, electricity and fuel costs.[36]

The revenue structure of recycling businesses

Recycling businesses have very different revenue structures.

- For AWTs, revenue comes almost entirely from gate fees to take material (over 90 per cent of revenue). Revenue from sale of outputs is typically small.
- For metals, revenue comes entirely from sale of simply transformed materials — processing costs are small relative to materials prices so metals businesses incur a significant risk of price changes while they hold material.

[35] One industry source for paper indicated the levy was 3.5 per cent of total costs including input materials — it is unclear why these figures differ so significantly.

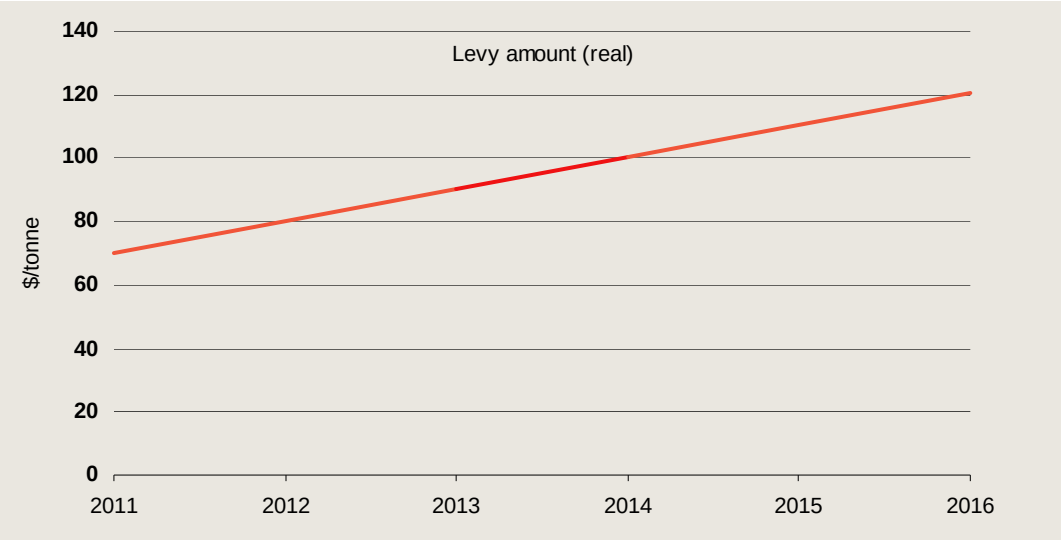
[36] Confidential data provided by industry.

- For paper, revenue comes mainly from sale of processed materials (or internal transfers of materials within a vertically integrated business).

The impact of a higher levy

The analysis presented below is based on the levy schedule put forward by OEH (chart 5.2).

5.2 **Projections of the levy**



Data source: NSW Office of Environment and Heritage.

The impact of the levy can be presented along many dimensions that have different sets of relevance for the businesses involved. We present impacts in terms of the following.

- The levy as a share of value added for the recycling and first stage processing of materials. For paper, we include value added from paper mills, for metals we consider value added for shredding.
- The levy as a share of input prices — input prices are the price most likely to change in response to the levy.
- The levy as a share of output prices. There are a variety of measures of output prices that could be used and that allow understanding of impacts across different business types. For a vertically integrated business, the size of the levy against final product prices is probably the most relevant. This is a good measure for OneSteel, Visy and Amcor.
- The levy as a share of margins.

We also show the levy as a share of operating costs.

All scenarios are based on the current amount of residual waste continuing to go to landfill. Recyclers in all three sectors are considering ways to minimise their residual

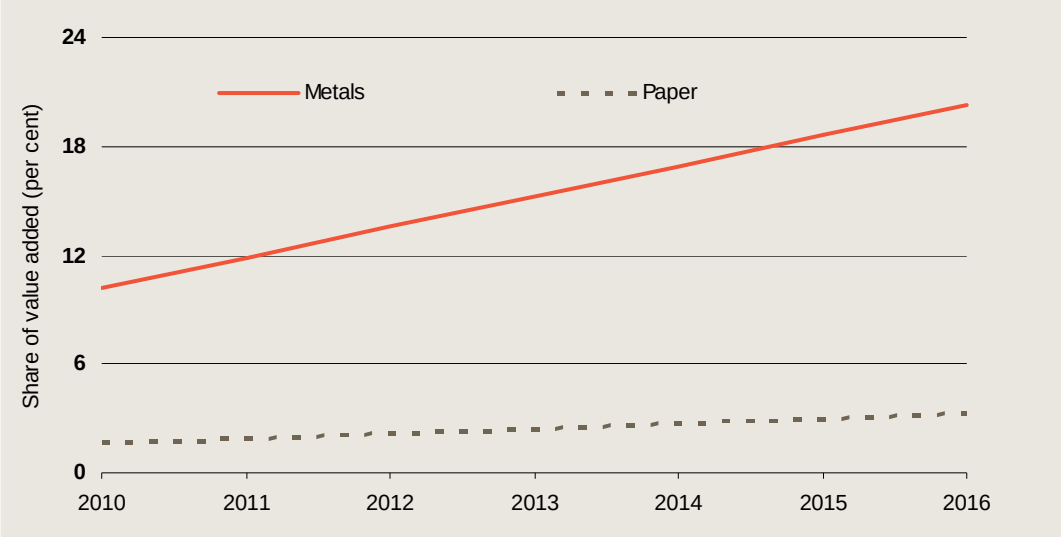
waste, largely to avoid the costs imposed by the levy. Consultations indicated that this would be most feasible if waste was able to be used in a waste to energy option. Any technology that is taken up to reduce the amount of residual waste will lead to either less negative or more positive impacts from the levy than are presented below.

The scenarios are also implicitly based on continuation of current relatively non-discriminatory pricing structures. We do not expect that adopting different pricing structures would make any significant difference to the analysis. This type of system might reduce costs directly arising from the levy but if successful at this would likely mean a higher average input price than is currently paid for other higher quality materials. Such pricing differentiation is likely to make more difference for MRFs than for the recyclers that are the focus of this report.

Levy as a share of current value added

The levy is currently quite a high share of value added for metal shredders, where value added is defined as the revenue they currently earn less the costs of metal scrap material inputs. It is expected to rise to over 20 per cent of value added by 2015/16. For paper, there is considerable value adding in the paper mill process, making the levy a small part of the value added for these businesses.

5.3 **The levy as a share of value added**



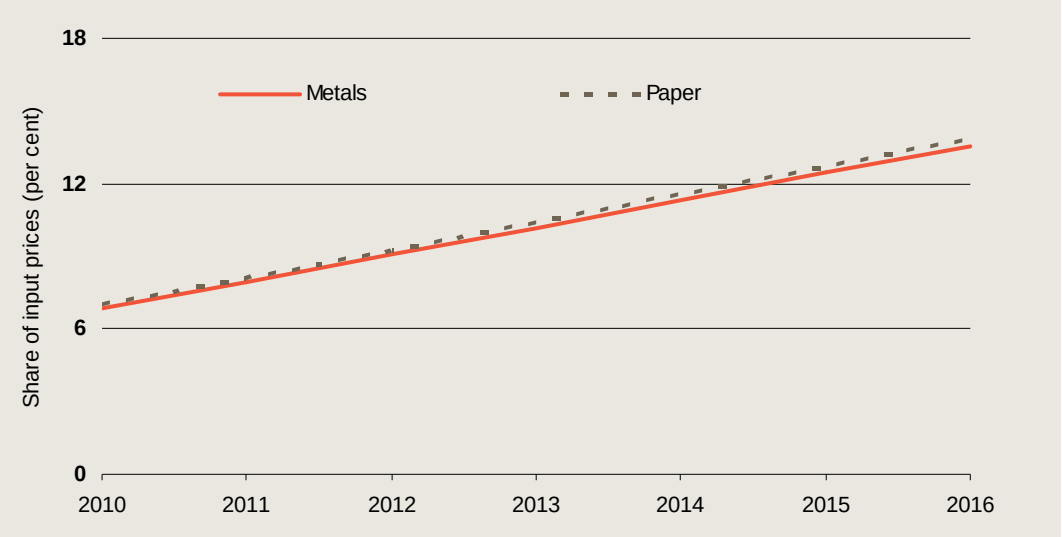
Data source: CIE calculations from industry data.

Levy costs as a share of current input prices

The levy was around 7 per cent of the material input price for both metals and paper in 2009/10. This is expected to rise to 15 per cent by 2015/16 (chart 5.4). Given that this price is what would most likely change in response to a higher levy, this suggests that there is still room to move on input prices at current market conditions. By 2015/16, the levy would comprise around 15 per cent of current input prices for

metals and paper. Hence at current prices a metal recycler would have to offer 15 per cent less in 2015/16 for their inputs than if there were no levy to make the same margin. The businesses selling to metal recyclers, which often make up more than half of the supply to metal recyclers, would be deciding whether baling and sending overseas, for example, would allow them to access this extra 15 per cent price.

5.4 The levy as a share of input prices



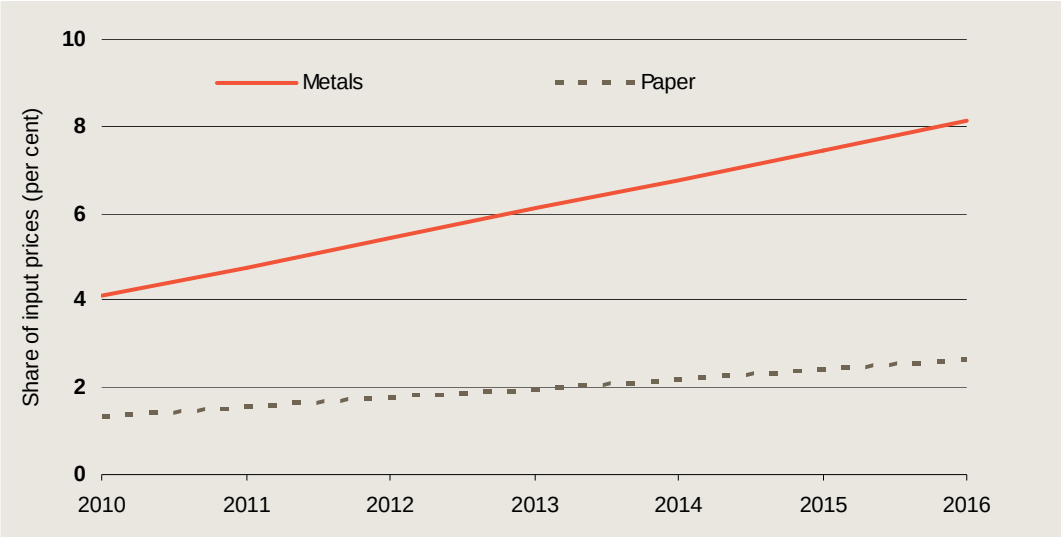
Data source: CIE calculations from industry data.

The levy as a share of output prices

Relative to the first stage output prices — i.e shredded metal and paper reels — the levy is currently 4 per cent for metal recyclers and 1 per cent for paper recyclers (chart 5.5). This would approximately double to 2015/16 under current expected levy increases.

The levy impact could also be measured against final product prices. This is a particularly relevant comparison for vertically integrated businesses such as OneSteel. A $10 increases in the waste levy would translate into about a $3 per output tonne figure that would have to be borne across the supply chain. Reference prices of long product (i.e steel beams etc) range from $800 per tonne to $850 per tonne. The extra $3 for every levy increase therefore represents about one third of one per cent. The cumulative levy increase from 2010/11 to 2015/16 of $50 would increase costs across the supply chain by about 2 per cent, although a substantial share of this would most likely be borne by scrap suppliers in lower prices.

5.5 The levy as a share of output prices



Data source: CIE calculations from industry data.

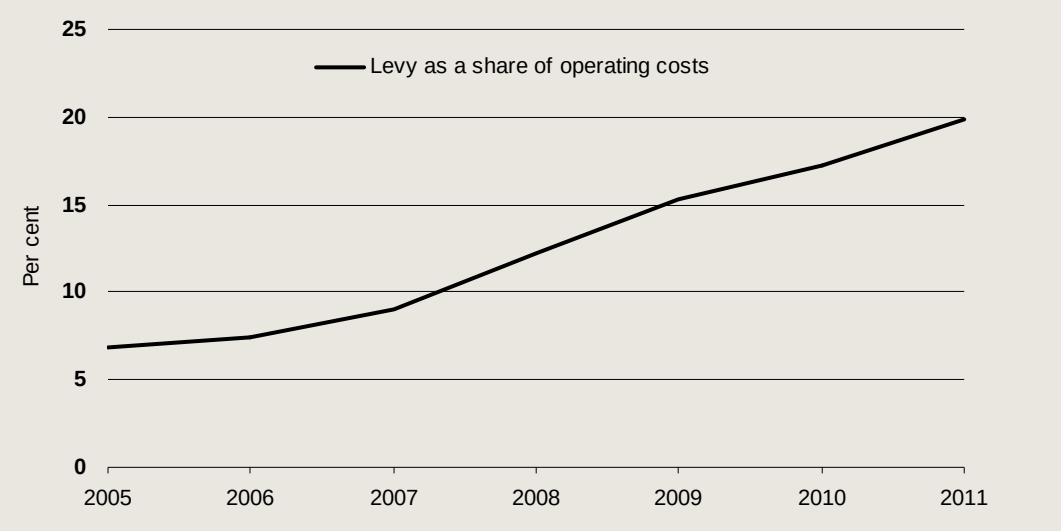
The levy as a share of operating costs

Industry often reports the levy as a share of operating costs. This is not a particularly good measure of impact as the narrower the business is (i.e. the less vertical integration) the higher the impact of the levy will appear to be. This measure also excludes non-operating costs such as depreciation and capital costs.

We do not have sufficient data to report the levy as a share of operating costs for paper recyclers. For metals, one industry player provided us with the historical information in chart 5.6. For this calculation, operating costs includes labour, electricity and fuel costs, waste disposal costs and maintenance costs. It does not include collection costs, overheads, working capital costs, depreciation or lease costs. Using this definition of costs, the levy has risen from 7 per cent of operating costs in 2004-05 to 20 per cent of operating costs in 2010-11.

The increase in the levy cost reflects both a higher levy and a lower amount of metal recovered from scrap inputs.

5.6 **The levy as a share of reported operating costs — metal**



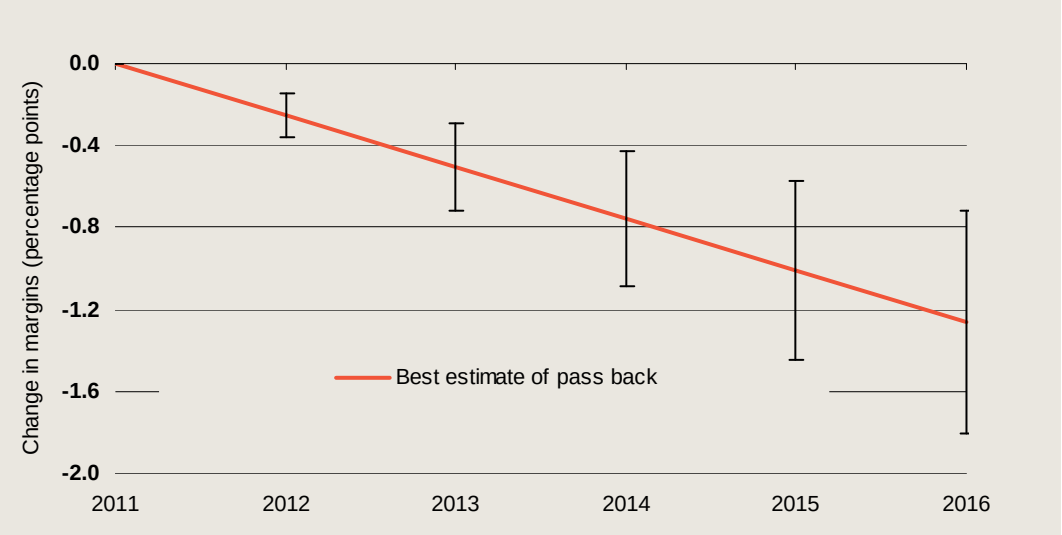
Data source: Industry data.

Impact on margins

Under the best estimate of pass-back of costs discussed above, the impact on margins of projected increases in the levy is shown in chart 5.7 and 5.8.

For metals, the levy increases from 2010-11 to 2015-16 would be equivalent to a reduction in margins in 2016 of between 0.7 percentage points to 1.8 percentage points at current market prices. This should be viewed in the context of target margins of 5 to 10 per cent.

5.7 **Impact of levy on margins — metals**

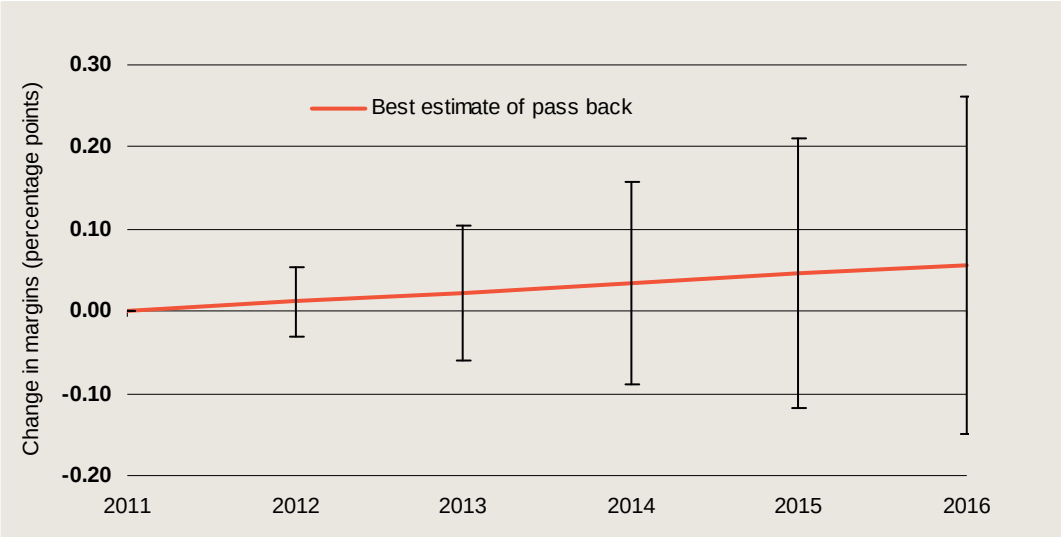


Data source: CIE calculations from industry sources.

For paper recyclers (including the paper mills), the levy increases from 2010-11 to 2015-16 would be equivalent to an increase in margins of up to 0.3 percentage points

or a reduction in margins of 0.15 percentage points. The impacts are hence expected to be small.

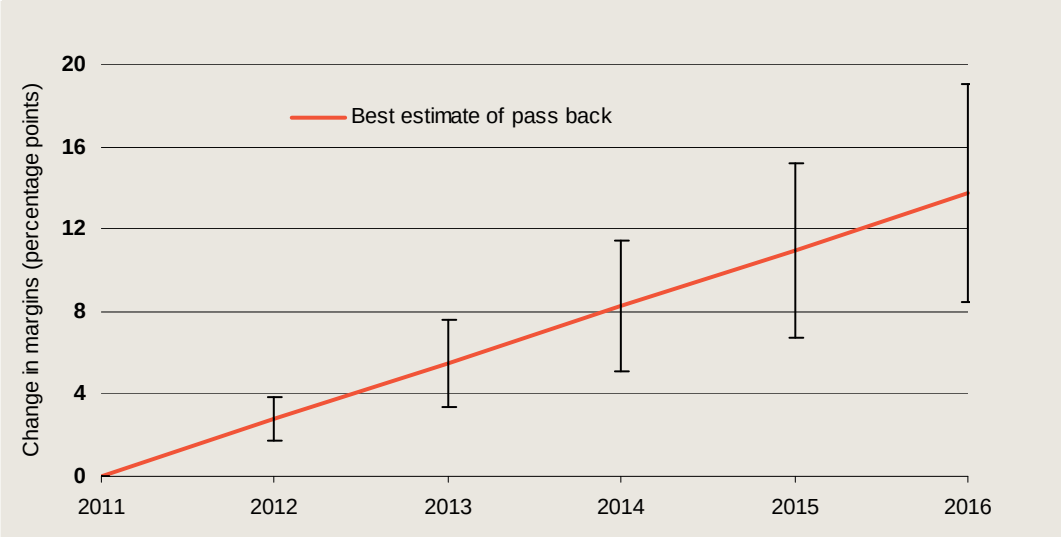
5.8 Impact of levy on margins — paper



Data source: CIE calculations from industry sources.

For AWTs, every $10 increase in the levy allows them to roughly charge an extra $10 for new customers if their only competition is against landfills, while costs increase by only $4. Hence an AWT gains an extra $6 per input tonne for each $10 increase in the levy. Their margins would be expected to rise quickly with increases in the levy (chart 5.9). If AWTs are competing against each other, the ability to actually match landfill gate prices will be constrained.

5.9 Impact of levy on margins — AWTs

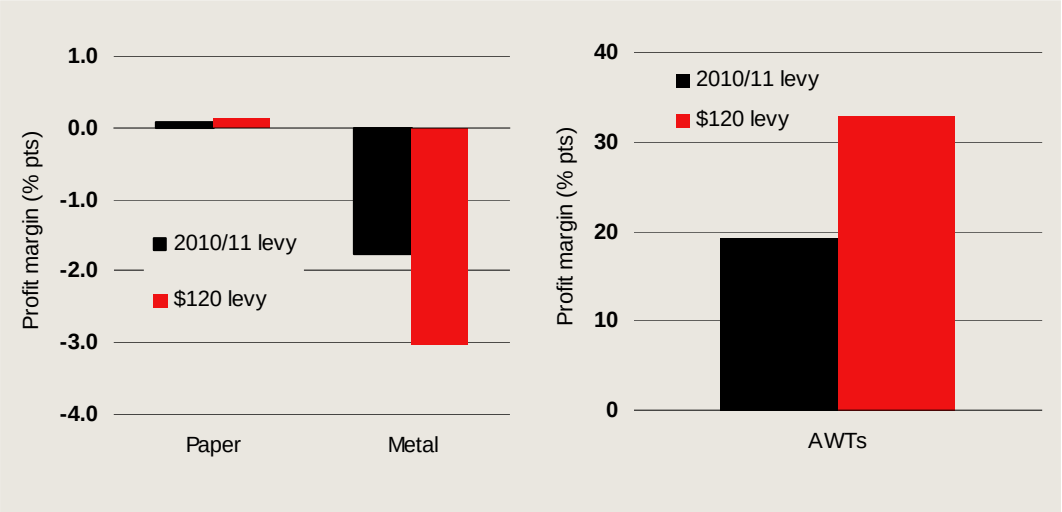


Data source: CIE calculations from industry sources.

Impact of the levy to date

The current impact of the levy on recyclers and the projected impact including scheduled increases up to $120 per tonne is shown in chart 5.10. By 2015-16, the levy would be expected to have had negligible impact on paper recyclers, have substantially increased profitability of AWTs and reduced profit margins of metals recyclers by around 3 percentage points.

5.10 **Impact of levy on margins — all industries**



Data source: CIE calculations from industry sources.

The charts above are based on the same amount of pass back for each increase in the levy. It is highly likely that the extent to which metals and paper can pass back levy changes will fall as the levy continues to increase. But they have probably been able to pass back more than our constant estimates of pass-back up to now.

Paper and metals businesses typically operate under margins of 5 to 10 per cent, according to industry consultations. This is similar to information across businesses from public financial accounts (see table 5.12). Hence, for metals, the increase in the levy from 2010/11 to 2015/16 would reduce profitability by about 20 per cent (at a current margin of 5 per cent). This is a significant impact. For paper recyclers, the impact will be smaller and as noted potentially positive. For AWTs, their viability rests very much on the existence and level of the levy.

Impact on particular market segments

The levy may have different impacts on particular product segments, differentiated by factors such as location and type of inputs.

In areas where the levy increases less quickly than in Sydney, where processing of recycled materials typically takes place, the increasing levy will discourage recycling. Of the sectors of interest for this report, this is most relevant for paper, where per

capita recycling is lower in areas where the levy is lower. Higher transport costs would also discourage recycling from regional areas, as this would increase the costs for regional material suppliers. For metals, the high current price appears to be driving recycling regardless of levy rates. However, if scrap prices fall, landfill may become an alternative destination for metals in areas where the levy is lower.

A recent study conducted on the Victorian landfill levy concluded that every $15 of levy reduced the internal rate of return of a typical steel recycling business by about 1.7 percentage points and the net margin on processed scrap by about $1.50.[37] This was considered relatively minor given the high IRR found within the steel recycling industry. However, the study concluded that increasing the levy could affect viability of recycling in some regions as well as for some scrap types.

The other interesting segmentation of the market is by material quality. Materials input into paper and metal recycling operations differs considerably. In Sydney, paper scrap material has much higher levels of material that will eventually go to landfills, reflecting that a lot of this material comes from MRFs sorting municipal collections. For material sourced from outside Sydney, there is typically less residual waste, as it is not commercial to transport low quality paper scrap to Sydney and then incur higher disposal costs of residual as against disposing in a region where landfill charges are lower.

In metals, quality differentiation is also evident. For shredding operations, cars will typically have about 25 per cent residual, post consumer goods (eg fridges) will have over 40 per cent and other scrap will have less than 15 per cent.

What are the likely impacts of a higher levy on these metal product segments?

- It is plausible that recycling of some high waste residual post consumer goods will be discouraged in unregulated areas as a result of the levy and if scrap prices fall. At current prices, most material will continue to be collected.
- A lack of pricing differentiation would see higher quality scrap being exported and this pressure increasing as the levy increases. For example, currently metal shredders reduce their standard contract price by the amount of the levy multiplied by an average share of residual waste (around 20 to 25 per cent). The cleaner the scrap, the greater the penalty relative to what might be obtained from a differentiated price. If overseas markets are offering such a differentiated price then cleaner scrap would be exported and the residual waste share for NSW metal shredders would increase.

---

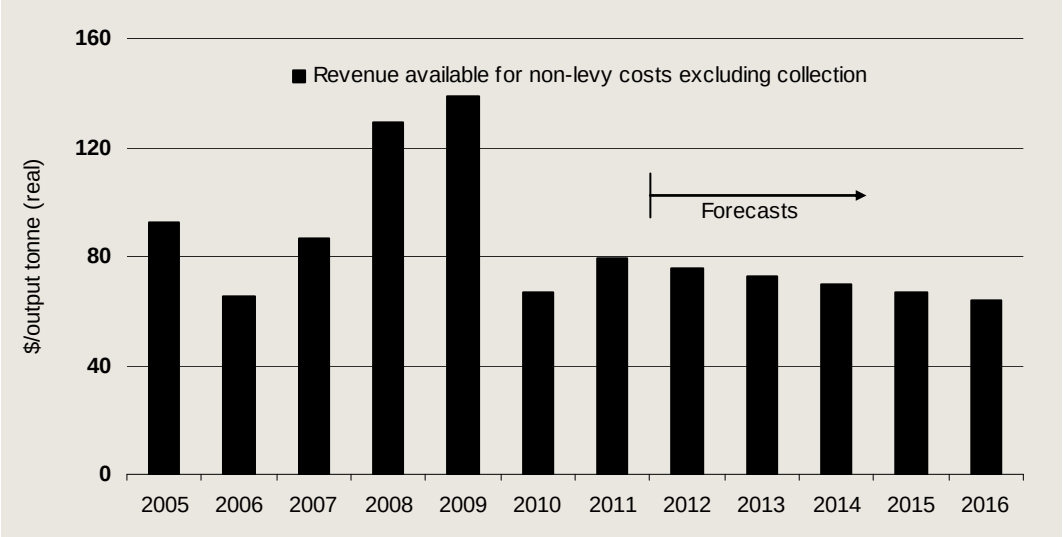
37 Marsden Jacob Associates and Warnken ISE 2007, *Impact of landfill levy on the steel recycling sector in Victoria*, prepared for EPA Victoria, August.

Other financial measures

One metal recycler provided information from 2004-05 to 2010-11 on input and output prices and residual recovery rates. We rearrange this to provide an amount of revenue available to cover the costs to produce a tonne of output and then subtract off collection costs, as these would be incurred regardless of whether processing was being squeezed offshore. We also subtract the costs incurred by metal recyclers from the levy. The resulting figure represents the amount of revenue available to cover non-levy costs (chart 5.11).

As can be seen, there has been substantial volatility in the amount of revenue available to metal recyclers to cover their costs, particularly around the global financial crisis. The levy may have been having an impact on the historical trend, although it is difficult to tell with the large movements in financial position as against the relatively small impacts of the levy. While the volatility swamps the impact of the levy over any one year, the levy likely does act as a continual small drag on revenues available to recover costs and hence on profitability.

5.11 **Revenue net of collection and levy costs for metal recycling**



Note: Output price is ferrous only — metal recyclers also receive revenue from non-ferrous sales.
Data source: CIE calculations from industry sources.

Independent financial and investment information

A number of the businesses that provided us with information are also required to produce public reports because they are public companies. These reports set out information that can be used as a cross-check against the information provided directly by businesses.

The latest annual reports available for the public companies that provided information (Amcor, Sims Metal and OneSteel) are for 2010. Business profitability

improved in 2010 across these businesses although businesses noted that they were still feeling the impacts of the global financial crisis. The recycling components of these businesses in NSW are a small part of the overall business undertaken by the three public companies —segments for reporting purposes are much larger than the activities that are the focus of this report. This makes it difficult to ascertain the publicly reported performance of recycling in NSW.

The only conclusions that can be made using annual reports concern the broad health of the businesses involved. The three public companies are large businesses with over $6 billion in annual revenue each (table 5.12). Profitability improved for all three businesses in 2010 relative to 2009. This is also true for the business segments that include recycling. (These segments are much larger than recycling in NSW.) Profitability as a share of revenue ranged from 0.7 per cent to 5.6 per cent for three businesses and most relevant business segments.

5.12 **Business performance from public reports**

	Sims Metal	*One Steel*	*Amcor*
Entire business			
– Revenue ($m)	7 459	6 205	9 850
– Profit in 2010 (EBT, $m)	208	423	504
– Profit as a share of revenue (%)	2.8	6.8	5.1
– Profit in 2009 (EBT, $m)	-103	395	441
Closest segment			
– Segment name	Australasia	Recycling	Australasia and packaging distribution
– Revenue ($m)	1 225	1 124	2 800
– Profit in 2010 (EBT, $m)	61	8	158
– Profit as a share of revenue (%)	5.0	0.7	5.6
– Profit in 2009 (EBT, $m)	19	-39	98

Note: EBT is earnings before tax.
Source: Amcor Annual Report (2010), Sims Metal Annual Report 2010, One Steel Annual Report (2010).

Annual reports and other sources also detail the investment decisions and environmental performance of the three public companies. Some relevant points are set out below.

- Amcor has invested in a new paper recycling plant in Botany and is closing its Melbourne (Fairfield) and existing Sydney (Botany) paper recycling plants. The investment required is around $400 million.[38] The new mill is expected to reduce water usage by 26 per cent, energy use by 34 per cent and waste to landfill by 75 per cent.[39] The impacts of levy increases may therefore be lower than suggested

[38] NSW Industry and Investment, media release, 2 September 2010, http://www.business.nsw.gov.au/news/$400-million-investment-in-amcor-recycled-paper-plant-upgrade-at-botany.

[39] Amcor medial release, 20 February 2008, http://www.amcor.com/about_us/media_centre/news/15860057.html.

by the analysis above and the scheduled levy increases may have influenced the decisions to invest in new technologies to reduce waste disposal.

- Amcor has reduced its waste to landfill from 167 000 tonnes in 2005-06 to 89 000 tonnes in 2009-10, which is mainly attributable to Australian recycled paper mills.[40] Part of this is attributable to processing waste into pellets and using it as a coal replacement.[41]
- Sims metal has invested $9 million in facilities to extract an additional 2 per cent of (mainly) non-ferrous metal from its recycling operations.[42]

Amcor's decision to put its new plant in Sydney despite the higher levy suggests that there are many more important factors for their business than the levy.

Annual reports also include qualitative information about the business environment. OneSteel notes:

> Over the longer term, the Recycling segment anticipates a positive return to sustainable growth. Continued economic growth in China and an escalating emphasis on emissions and sustainability bodes well for business.[43]

Businesses should also be noting major risks to their business in their annual reports. This could include the levy. Sims Metal notes the cost increases for its business of taxes on landfill, while the other businesses do not.[44]

Financial viability

Financial performance and viability can include assessment of:

- the short term viability of the particular NSW recycling operations
- the long term viability of recycling in NSW, and
- the viability of the businesses involved in recycling.

The businesses that we met are unlikely to be made unviable by the waste levy. These businesses often have diverse operations across many states (and overseas) that will continue regardless of the levy and regardless of whether or not they continue to recycle in NSW.

The viability of recycling in NSW in the short term is also not at stake from the levy. Capital investments have been made and businesses will continue to use these assets

---

40 Amcor 2010, Sustainability report 2010, p. 45.

41 Amcor environmental case studies, Fibre Shots project, reported in Amcor 2010, Sustainability report 2010, p. 46.

42 Discussions with Sims metal, 7 June 2011.

43 One Steel 2010, Annual Report 2010, p. 23.

44 Sims Metal 2010, Annual Report, p. 18.

in the future. In the case of paper, major new investments are being made that will continue to be operated for many years in NSW.

Key decision points will occur when new capital investments need to be made, such as replacing shredders. One metal recycler reports that it will be making a decision about a new shredder within the next 18 months, or whether to invest in balers for export. There is more than adequate capacity for other existing shredders to absorb material if a single shredder closes.

Regardless of these decisions, metal shredders such as Sims Metal and Sell and Parker would remain viable businesses albeit with a loss in the value of their capital as they switched to baling operations.

For OneSteel the options are different as it is a vertically integrated business. It will face decisions about whether to absorb levy costs in its upstream businesses. This currently does not occur with buying prices set at export parity. OneSteel is subject to larger negative and positive influences other than the levy that will largely govern its decisions, such as exchange rate movements and the pricing arrangements for carbon (and compensation arrangements).

Key points

Metal recyclers will be unambiguously worse off from an increase in the waste levy. An increase of $10 would be expected to reduce margins by around 0.25 percentage points.

Paper recyclers will probably be unaffected by an increased levy. They will benefit from the push of greater paper out of landfills as a result of the levy, while incurring negative impacts due to export competition for scrap paper, which would somewhat reduce their ability to pass back increased disposal costs for residual waste. Any impacts on paper recyclers are expected to be small.

AWTs will be better off with a higher levy, particularly potential new AWTs or expansion of existing facilities. An additional $10 increase in the levy would be expected to increase potential profits per input tonne for AWTs by around $6, although actual increases will be somewhat lower in a competitive AWT market.

There are also likely to be impacts outside of these specific industries that are not the focus of this report. In particular, MRFs will probably face higher costs of monitoring the quality of their inputs as collectors seek to avoid higher landfill charges. We would also expect that illegal dumping problems would be exacerbated by a higher levy.

6 Key sensitivities and risks

The levy alone could shift decisions by metal recyclers to undertake activity outside of NSW and could substantially increase demand for AWT facilities. It is unlikely in and of itself to influence the viability of the businesses in general.

This chapter traces out some of the key sensitivities in the analysis of the impacts on recyclers.

Key sensitivities considered

Chapter 5 quantitatively assess the different financial impacts on recyclers if the ability of recyclers to pass levy costs up the supply chain is altered. This is the most important sensitivity for the final impact on recyclers. We provide a further stress test of these assumptions through considering the impact if there was no pass back of prices.

In this chapter we also consider a number of more specific scenarios in as much detail as is possible given the information that has been provided to use by industry. Sensitivities analysed are:

- the impact of changes in the downstream steel processing market on metal recyclers;
- the impact of changes in commodity prices on metal and paper recyclers; and
- the impact of exchange rate movements on metal and paper recyclers.

The second and third of these scenarios are analysed quantitatively, while for the first only qualitative analysis is possible.

Impact based on no pass back for metal or paper

If there was no pass-back of the levy then recycling businesses would find their margins reduced relatively quickly.

- For metals recyclers, if there was no pass back in input prices each increase in the levy of $10 would reduce margins by 0.7 percentage points.
- For paper recyclers, if there was no pass back in input prices each increase in the levy of $10 would reduce margins by 0.2 percentage points.

This scenario is not realistic for levy increases at the current levy rate, given the small amount of activity in baling and exporting scrap metal and paper in NSW. It may be more realistic in future years as the levy increases and if scrap prices fall leading to greater effort by scrap collectors to find higher paying destinations for their scrap.

Downstream steel processing

NSW currently has a downstream processing capacity for scrap steel through BlueScope Steel and OneSteel. These businesses are under pressure from exchange rate movements and carbon taxation arrangements, although the latter will likely be reduced through assistance provisions.

- The exchange rate was 23 per cent above its average for the previous five years in 2010/11 in US dollar terms and 13 per cent higher on a trade weighted basis.[45]
- The recently announced carbon pricing arrangements have allowed for $300 million in compensation for these businesses during the first four years of a carbon price and a 10 per cent increase in permits for crude steel from 2016-17.[46]

Should downstream processing of scrap steel move offshore then there are two options for metal recyclers. Firstly, they could continue to shred scrap metal where required and then export post shredding. Secondly, they could compact metal and send it to facilities offshore for shredding.

Shredding then exporting offers advantages in transportation as bulk shipments can take probably three times as much material if it is shredded. If containerised, there is little difference in transportation of shredded or compacted scrap.

Exporting prior to shredding offers the advantage of avoiding landfills costs in NSW, including the levy, on residual materials.

There may also be differences in shredding costs in NSW relative to overseas that would show up in the differences between the pre-shredding and post shredding price offered for materials.

At current transport and levy rates, and assuming processing costs in NSW are similar to overseas, we expect that exporting prior to shredding would prove to be a better option financially. In this case, as shredders approached the end of their economic lives they would not be replaced.

Note that a similar model exists for plastic, with plastics baled together and sent overseas for further processing.

---

45 CIE analysis based on table F11 from the Reserve Bank of Australia statistical tables.

46 Australian Government 2011, *Support for the Australian Steel Industry*, Clean Energy Future Fact Sheet.

Commodity prices

High commodity prices generate favourable conditions for recyclers making it easier to obtain materials and allowing them to increase their margins. In fact, the scrap price is likely much more effective than the levy in encouraging recycling in NSW for materials such as metals.

Currently, commodity prices are high relative to a long term average. Should they reduce substantially as occurred post global financial crisis then throughput volumes would be expected to decrease and margins to reduce for recyclers. Recyclers would also be subject to risks associated with a changing value of their scrap stocks, to the extent that this is not hedged, which is probably more important than the previous impacts in terms of financial viability where recyclers have not hedged against commodity price movements.

Under these conditions, the levy would have a similar impact on the margins of recyclers but would be off a lower base margin.

In order to quantitatively assess the impact of a change in commodity prices it is necessary to know:

- the share of costs that are fixed and would hence be incurred regardless of the amount of throughput; and
- the change in throughput resulting from a change in commodity prices.

In the case that recyclers have not hedged their exposure, it would also be necessary to understand the time lags between buying and selling.

For metals we have sufficient information to undertake analysis on these issues. For paper we do not. We would expect that the following costs would be fixed at least in the short term:

- labour costs for processing — staffing would be slow to adapt and we would expect in the short term that labour costs would be fixed;
- depreciation;
- site lease costs;
- overheads;
- working capital costs; and
- some transfer yard costs.

This would amount to about a third of costs being fixed.

Using data on prices and throughputs from a single shredder for 2005 to 2010 suggests that a 10 per cent increase in the input price offered leads to a 5 per cent increase in throughput. Presumably this impact is somewhat limited by the stocks of metal accumulated over past years.

The lowest annual average output price for shredded scrap over the past 6 years was $290 per tonne, which is 30 per cent below the current market price. A similar fall now would be expected to lead to a reduction in input prices offered of between 30 per cent to 50 per cent — the fall would be larger if the gap between input prices and output prices remained constant. This in turn would reduce throughput by 15 per cent to 25 per cent. If 30 per cent of costs are fixed, this would reduce margins by 4.5-8 percentage points. This would be expected to lead to significant viability concerns.

In the longer term, reduced throughput would lead to consolidation of throughput into fewer shredding facilities.

The reduced throughput for metals would have to reflect reduced access to stocks of metal scrap, reduced generation of metal waste, storing of scrap metal or disposal to landfill. This would be particularly likely in regional NSW as the revenue available from recycling may not be sufficient to allow a positive price for scrap metals in these regions.

Exchange rate movements

Metals and paper businesses have argued that they are global businesses. This is supported by their pricing arrangements and export and import statistics. Exchange rate movements hence have important impacts for the business that can outweigh impacts of the levy. For example, using the same pass through assumptions as above to analyse an exchange rate impact, a 20 per cent appreciation of the exchange rate would:

- decrease margins of metal recyclers by 1 percentage point; and
- decrease margins of paper producers by 3 percentage points.

Paper recyclers are more exposed to exchange rate movements than metal recyclers as a greater share of their costs are trade exposed. For metals, input prices and collection costs make up a substantial part of the costs of metal recyclers and would flow through to NSW or export prices. If we considered steel processing then the exposure of metals would be much higher, bringing in issues related to the viability of downstream steel processing discussed above.

7 Conclusions

Impacts on recyclers (metals, paper and AWTs)

The waste levy is having different impacts across these recycling businesses in NSW.

- The waste levy is having negative impacts on metal recyclers, with the waste levy for 2010-11 plausibly reducing margins by up to 1.8 percentage points relative to what would have otherwise been the case. Additional increases in the levy to 2015-16 could reduce margins by an additional 1.3 percentage points.
- The waste levy has had and will continue to have mixed impacts on paper recyclers. On balance it is likely that the impacts from additional increases in the levy will be a very small positive as the higher levy increases the amount of scrap paper moving out of landfills but also increases the competitiveness of the option to export this scrap.
- The waste levy is having positive impacts on AWTs, subject to these facilities having specified contractual obligations that they are able to meet. Additional increases in the levy will drive higher profitability and higher volumes of material into AWTs.

The waste levy could also drive other responses outside of the above. The levy increases the cost of landfill and hence increases the incentives **for all types** of diversion away from landfill. This can include illegal dumping and, as noted by MRFs, shifting waste material into other disposal streams. This can lead to higher monitoring and enforcement costs for recyclers such as MRFs, AWTs and the NSW Government.

Viability of recyclers

While the waste levy is likely having negative impacts on some part of NSW's recycling industry, there are many larger impacts that are important in the financial performance and viability of recyclers. The businesses impacted by the waste levy will not be made unviable from a whole of business perspective by the waste levy but could shift the nature and location of their operations.

If activity shifted outside of NSW then it should be appreciated that this already happens for a range of materials. For example, recovered non-ferrous metals are all

exported, most of which does not come out of shredding process and plastics are exported.

Impact of waste levy on recycling in NSW

The waste levy does appear to be a driver for industry players with considerable thought and investment being directed to ways to reduce landfill. Hence, while recycling activity may shift outside of NSW the aggregate amount of material recycled is likely to rise as the levy increases. The exception to this is in unregulated areas where an increase in the waste levy makes recycling less preferred financially where materials are taken from a location with no waste levy to one where residual waste will incur a levy.

A higher waste levy would be expected to increase recycling through AWTs and increase paper recycling. It may lead to marginal increases in recycling for metals, although industry discussions suggested that the most likely commercial option for reducing residual waste would be through a waste to energy facility, which would currently be difficult under NSW regulations.

Context for the impacts on industry

The impacts on industry are one important part of the policy discussion surrounding the waste levy. But while there may be negative impacts for recyclers in NSW, the levy is not reducing recycling but potentially shifting some activity overseas. Arguments could be put that this is exporting our waste problem — similar arguments have been put forward for other environmental policies such as a carbon tax or emissions trading scheme. In the case of waste, these arguments are less relevant as the environmental and social costs of landfill are largely local. It would therefore be expected that each country should undertake its own policies to minimise these impacts. If a country such as China views that too much residual waste is being imported as part of its recycling of materials it has the ability to act to change this.

It is also important to recognise that the waste levy is considered by industry as leading to an unlevel playing field. Similar arguments could be put against the landfill standards for NSW landfills (and hence higher charges), general Australian and NSW Government taxation regimes, workplace safety requirements etc.

Hence, while the impacts on the NSW recycling industry should form one part of consideration of the structure and level of the waste levy, it is more important to ensure that the waste levy is aligned to the environmental and social costs of landfill.

Attachments

A Modelling of price pass though

Price elasticity pass through

The price for scrap materials is jointly determined by domestic demand and export demand. If we posit a constant elasticity demand function:

$$Q = a.P^{-\varepsilon}$$

Where Q is quantity, P is price, a is a constant and ε is the constant elasticity of demand.

There are two such demand equations, one for domestic (D) and one for exports (X).

$Q_D = a_D.P^{-\varepsilon D}$ and $Q_X = a_X.P^{-\varepsilon X}$

Suppose for now that scrap supply is fixed at $\overline{Q}$ – i.e all scrap is either exported or used domestically. Then the price P^0 is given by:

$$Q_D + Q_X = a_D.\left(P^0\right)^{-\varepsilon D} + a_X.\left(P^0\right)^{-\varepsilon X} = \overline{Q}$$

The current market equilibrium prices and quantities determine the constants a, under assumptions about the two elasticities of demand.

Now consider a cost shock to domestic scrap processors. This reduces the price that they are willing to pay for scrap by c. To demand the same quantity, they now require a lower price, hence a shift down in demand as below.

$$Q_D = a_D.\left(P + c\right)^{-\varepsilon D}$$

Again, if scrap supply is fixed then the new price P^1 is given by:

$$Q_D + Q_X = a_D.\left(P^1 + c\right)^{-\varepsilon D} + a_X.\left(P^1\right)^{-\varepsilon X} = \overline{Q}$$

This can be solved under alternative assumptions to show the change in price as a share of the change in cost under alternative assumptions about elasticities of demand and the original share of exports in the market, as reported in table 4.10.

Cournot model and pass through

The Cournot model considers how firms behave when there are a few sellers, or in this case a few buyers. The model introduces strategic behaviour by firms, which is

related to their decisions about capacity. It is a useful model typically when there are four or fewer firms.

In the case we are looking at there is the added complication that exports can represent multiple firms that do not act in concert.

The basic Cournot model specifies a linear demand curve and allows for n firms. The profit of firm i is:

$$\Pi_i = \overline{P}.q_i - P^I(Q).q_i - c_i.q_i - F_i$$

Where $\overline{P}$ is the price obtained from selling outputs (per unit of input), q_i is the quantity of inputs purchased by firm i, $P^I(Q)$ is the price of scrap inputs which is a function of Q the total quantity of inputs purchased, c_i is the marginal cost of firm i and F_i is the fixed costs of firm i. Note that $\overline{P}$ is assumed fixed on the basis that downstream markets are completely export constrained.

Each firm maximises its profits choosing q_i, giving the condition:

$$\overline{P} - P^I(Q) - q_i.\frac{dP^I(Q)}{dQ} - c_i = 0$$

The demand curve for inputs is linear, such as:

$$P^I(Q) = a + b.Q$$

Hence the profit maximising condition can be rewritten as:

$$\overline{P} - a - b.Q - q_i.b - c_i = 0$$

Aggregating across n firms gives the market solving condition for Q. That is:

$$n.\overline{P} - n.a - n.b.Q - Q.b - \sum_i c_i = 0$$

In turn, this gives the solution for the quantity produced by each firm and the price.

$$Q = \frac{n.(\overline{P} - a) - \sum_i c_i}{b.(1+n)} \text{ and } P^I(Q) = a + \frac{n.(\overline{P} - a) - \sum_i c_i}{(1+n)}$$

From here we can see that if the costs go up by 1 unit for each of the n-1 domestic firms then the price of inputs will go down by (1-n)/(1+n).

Estimating the impact using the Cournot model

Under the Cournot model analysis, industry players are able to act strategically in their choices of capacity. They no longer take the price of inputs as exogenous but recognise the impact that their decisions will have on this price and choose capacity and hence output accordingly, given assumptions that their rivals do not respond in

turn to their actions. Under this model, the current share of exports will not change the ability to pass back, as strategically exports are considered as one unit.

Under the typical Cournot assumptions, this means that if there are n NSW firms buying materials then they can pass back n/(n+2) of the change in costs through input prices. That is, if there are 3 NSW firms buying materials then they could pass back 60 per cent of costs. While providing some useful information in terms of strategic inter-reactions, this model is likely to be a poor predictor as exports (both domestic and overseas) are treated as a single unit and current export shares are unimportant. The basis of this model is capacity decisions made by firms — overseas capacity decisions reflect much more than Australian scrap supply, which is clear from the substantial Chinese investment in shredding facilities.