SEQ Waste Management Plan

FINAL REPORT 2021

Council of Mayors
South East Queensland

Council of Mayors
South East Queensland

The Council of Mayors (SEQ) is Australia's largest regional local government advocacy organisation, representing one in seven Australians who call South East Queensland home. Council of Mayors (SEQ) aims to consistently deliver better regional funding, policy and collaborative outcomes for the communities of South East Queensland.

The SEQ Waste Management Plan was finalised on 2 June 2021. The plan has been prepared with and endorsed by Council of Mayor's (SEQ) member Councils: Brisbane City, Ipswich City, Lockyer Valley, Logan City, Moreton Bay, Redland City, Scenic Rim, Somerset, Sunshine Coast and Toowoomba. It also considers the City of Gold Coast, who were members of Council of Mayors (SEQ) during preparation of the plan.

CONTENTS

1. Executive Summary

This document sets out a directional path forward for action and collaboration across the Councils of South East Queensland as they address the challenges and opportunities associated with municipal solid waste management across the region, in the context of a rapidly shifting set of sector dynamics.

In recent years, five significant shifts have substantially reshaped the waste management landscape for CoMSEQ Councils: i) export markets have imposed significant limitations on accepting low grade or contaminated recyclable materials; ii) the Queensland government introduced its Waste Management and Resource Recovery Strategy, outlining ambitious targets for landfill diversion and adherence to the globally recognised waste hierarchy; iii) landfill levies were reintroduced in Queensland, with a glide path to $95/t; iv) a container refund scheme was launched for certain glass and plastic containers; and, v) the Commonwealth passed legislation banning specific waste exports.

In addition to these shifts, the choices facing Councils in relation to waste management are inherently complex, due to the high cost and long-term nature of infrastructure investments and service contracts; the plethora and continual evolution of waste processing technologies and collections options, and the broad range of preferences and expectations of citizens.

To respond to these challenges the eleven CoMSEQ Councils have worked together to develop this SEQ Waste Management Plan (the Plan), which articulates a 'target state' for 2030, with an outlook to 2050. In moving towards the 2030 target state it is anticipated that Councils will benefit from collaborating closely on some priorities, and progressing independently on others. The Plan recognises that individual Councils will choose to progress actions in the context of their individual circumstances and priorities, and seeks to identify the 'sweet-spot' between joint action to capture the benefits of scale, and independent action to reflect the unique requirements and expectations of different communities. Where these independent actions or unique requirements are already known, they are identified in this Plan as specific carve-outs for the relevant Councils from the overall target end-state, with the goal of enabling both maximum alignment, and maximum flexibility.

The scope of this Plan focuses primarily on the waste flows managed through kerbside collections, as these waste streams represent some of the most complex decisions facing Councils, as well the most significant opportunities for capturing the benefits of collaboration. Specifically, the Plan focuses on three areas of actions towards the 2030 'target state':

- Optimising comingled recycling: Improving the collection rate of comingled recycling from the general waste stream to remove a proportion of the ~208ktpa of recyclable materials currently disposed to landfill; reducing contamination in the comingled waste stream to increase the value of the recyclable materials, supporting the development of an additional 185 – 330 ktpa of MRF capacity in a way that stimulates competition, resilience and operating efficiencies; and pulling every lever available to support the development of secondary markets for recycled products, both to stimulate economic development and growth, and increase the market value of waste management processes.
- Removing organic waste from landfill and recovering it: Introducing organics recovery (mulching, composting) to remove a proportion of the ~440ktpa of organics from the general waste stream; working with the State and with industry to support households to make the behaviour changes required; and supporting secondary markets to absorb the new product generated.
- Optimising the treatment of residual MSW: Acting decisively on areas (i) and (ii) to ensure the general waste streams is as close to true 'residual' as reasonably practicable, while exploring the best options for residual management across environmentally optimised landfill, Thermal EfW, and emerging alternative waste treatment technologies.

If Councils are able to move on the actions defined in the Plan, the benefits will be significant, across the three areas of environmental outcomes, job creation, and cost efficiency:

- Environmental outcomes: In aggregate, up to 813 ktpa of waste could be diverted from landfill by 2030, achieving increasing the MSW landfill diversion rate from 28% to 45%. This represents significant progress towards the State's targets, although does not fully meet them. Meeting the targets in full would require immediate commencement of work towards Thermal EfW processing capacity, and rapid action upstream to drive down non-recyclable waste generation per capita (e.g. through movement in packaging regulation).
- Job creation: In addition to the landfill diversion benefits achieved, action outlined in the Plan would deliver direct net new job creation of up to 310 permanent jobs, as well as up to ~2,900 – 3,800 temporary construction jobs per year of construction (MRFs: 100-160, organics processing 300-400, Thermal EfW 2,500 - 3,200), and a multiple of indirect jobs.
- Cost efficiency: Efficiency savings of up to $17 – $25m per annum could be achieved, mostly driven by improvements in the comingled recycling scheme (e.g. reduced contamination and increase capture of recyclable materials).

Offset against these benefits would be a set of one-off costs for managing the transition, estimated at $210 – 280m by 2030, ~$2.7-3.6bn by 2050 (including $2.4-$3.1b for EfW facilities), and an ongoing increase in waste management operating costs of between $33- $83m per annum by 2030, largely driven by the increased collection costs associated with the broad-based introduction of a kerbside organics collection service.

As Councils seek to sustainably manage the increased costs of providing improved waste management services over time, a number of levers will be considered:

- Working collaboratively with the State to explore opportunities for revenues from the Waste Levy to be applied to support Councils in making an effective transition;
- Exploring opportunities for vertical integration/opportunities and potential ownership of new processing capacity, to achieve the best possible cost outcomes for rate payers
- If required, passing on unavoidable additional costs to rate payers, with a clear and consistent narrative on the benefits associated.

In moving forward immediate next steps are for each Council to develop a ten year roadmap for implementation over the course of 2021, while moving forward with 'early wins' this calendar year.

Alongside this work, CoMSEQ members will form negotiating positions and engage with both State and Commonwealth Governments to align funding support for implementation of the Plan.

2. Introduction

This report represents a significant effort of collaboration across the Councils of South East Queensland as they tackle one of their collective top 3 priorities – proactively and strategically shaping the future of waste management in South East Queensland to deliver the best outcomes for citizens.

This chapter provides a summary of the context underpinning the collaborative effort; the specific objectives and scope of work; the process undertaken to develop the report, and the data sources relied upon.

A) CONTEXT

The last decade has seen five significant changes in how waste is managed, recycled and treated in Queensland.

- International markets have mandated lower levels of contamination on imported paper and packaging material. China was an early mover, with the China Sword policy banning imports of contaminated recyclable material from 1 January 2018. This was followed by import bans across the region, including: Malaysia's ban on import of non-recyclable plastic waste in July 2018, Thailand's 2018 changes to plastics import allowances, India's ban on scrap plastics imports in August 2019, and Indonesia's May 2020 limits on contamination of bales of recyclable materials imported.
- Queensland's Waste Management and Resource Recovery Strategy was published in 2018. The strategy sets the ambition for Queensland to become a zero-waste society, where waste is avoided, reused and recycled to the greatest possible extent. It focuses on transitioning to the principles of a circular economy to help retain the value of material in the economy for as long as possible. It provides the framework to help deliver coordinated, long-term and sustained growth for the recycling and resource recovery sector while reducing the amount of waste produced and ultimately disposed of, by promoting more sustainable waste management practices for business, industry and households. Queensland's targets are to reduce household waste by 25%, while improving recovery to 90%, and recycling to 75%, by 2050. The targets represent a significant shift from Queensland's current state and trajectory of resource recovery.
- The Container Refund Scheme (CRS) was rolled out in Queensland in 2018, along with a Statewide ban on plastic shopping bags, as part of the State's Waste Management and Resource Recovery Strategy. The CRS has materially reshaped the volume and composition of the comingled recycling stream, to the benefit of some Councils, and potential disbenefit of others. Illustrative of the scale of the scheme, by November 2019 more than $100 million had been paid out with more than one billion containers directly returned.
- Domestic landfill waste levies were re-introduced in Queensland from 1 July 2019. Queensland's levy zone includes 39 out of 77 local government areas, covering around 90% of Queensland's population where the majority of waste is generated and disposed. Waste disposed of in the levy zone, or waste that originates in the levy zone or interstate and is disposed of in the non-levy zone, is liable for the levy. In the introductory period (until 30 June 2022), Government committed to ensure that the waste levy has no direct impact on households. During this period the Queensland Government provides Councils that dispose of household waste in the levy zone with an annual advance payment (calculated as 105% of forecast levy costs). In the short to medium term the levy rebate is intended to be removed, and a proportion of the funds raised will be used to support development of the recycling and reprocessing industries that will support a more circular economy.
- In August 2020 the Australian Government confirmed commitment to this pathway, introducing legislation that bans exports of waste of various classes including waste plastics, paper, glass and tyres.

While the pace of progress may be uncertain, the direction of these policy reforms are clear – to reduce material sent to landfill and maximise the recycling and reuse of waste materials in Australia. Collectively, these important changes in the waste management landscape represent both a significant challenge for South East Queensland Councils, but also a significant set of opportunities. Some of these challenges and opportunities can be addressed within the boundaries of individual Councils, but many of them can be more effectively addressed by acting collaboratively and leveraging the full scale represented by the CoMSEQ Councils. This is the context in which CoMSEQ members have worked together to develop a regional, long-term and coordinated SEQ Waste Management Plan (the Plan).

B) OBJECTIVES AND SCOPE

The objective for this Plan is to identify the set of levers, and the most appropriate sequencing of those levers, that would best enable all 11 SEQ Councils to:

- Optimise the economics of waste management operations
- Encourage local economic development and job creation
- Meet or move towards State targets relating to household waste generation, recycling, and landfill diversion by 2050
- Maintain or achieve high levels of citizen satisfaction with waste management services.

The intention for the Plan is to take a long-term view of critical system dynamics out to 2050 (particularly waste stream quantity and infrastructure capacity), for the purposes of informing shorter- and medium-term decision making over the 2020-2030 timeframe. As with all long term infrastructure planning, decision making is underpinned by considerable uncertainty – in this case specifically around the regulatory context, the evolution of waste processing technologies, and the always-evolving expectations of citizens. In addressing this natural level of uncertainty, the objective of this Plan is to provide Councils with the ability to take a portfolio approach to their Waste Management planning – moving quickly and boldly on levers for which there is high confidence, moving more moderately on levers for which there are higher levels of uncertainty, and creating a capability to dynamically adjust the Plan over time as the context evolves.

The scope of the Plan is quite focused, narrowing in on kerbside waste collection, across three major waste streams (comingled recycling, organics, and residual waste). These were identified as streams that represented the highest volume of waste and for which there exists the greatest opportunities for collaboration across Council borders. It is acknowledged that there are many more granular waste streams across which collaboration could be beneficial (e-waste, mattresses etc.) and while these are not specifically addressed in the Plan it is anticipated that some of the ongoing collaboration structures that are implemented as part of this Plan will enable these streams to be the subject of future collaborative efforts.

Finally, the Plan seeks to strike the appropriate balance between defining a pathway that provides the best 'system level' outcome for South East Queensland, and reflecting the need for each Council to act in the best interest of their own rate payers. The Plan attempts to achieve this in three ways:

- By focusing on defining an optimal long-term end state (i.e. 2030 target state), but providing flexibility in the speed and transition path adopted by individual Councils
- By clearly defining where acting in unison is 'critical' versus 'nice to have'
- By identifying options and alternatives to the primary recommendations, that are still consistent with the end-state goals, wherever possible.

C) THE PROCESS FOLLOWED

The Plan has been developed through intensive engagement with CoMSEQ Councils and extensive analysis of the current state and future options, informed by an assessment of current and emerging best practices locally and globally.

Three core beliefs framed the approach in developing the Plan:

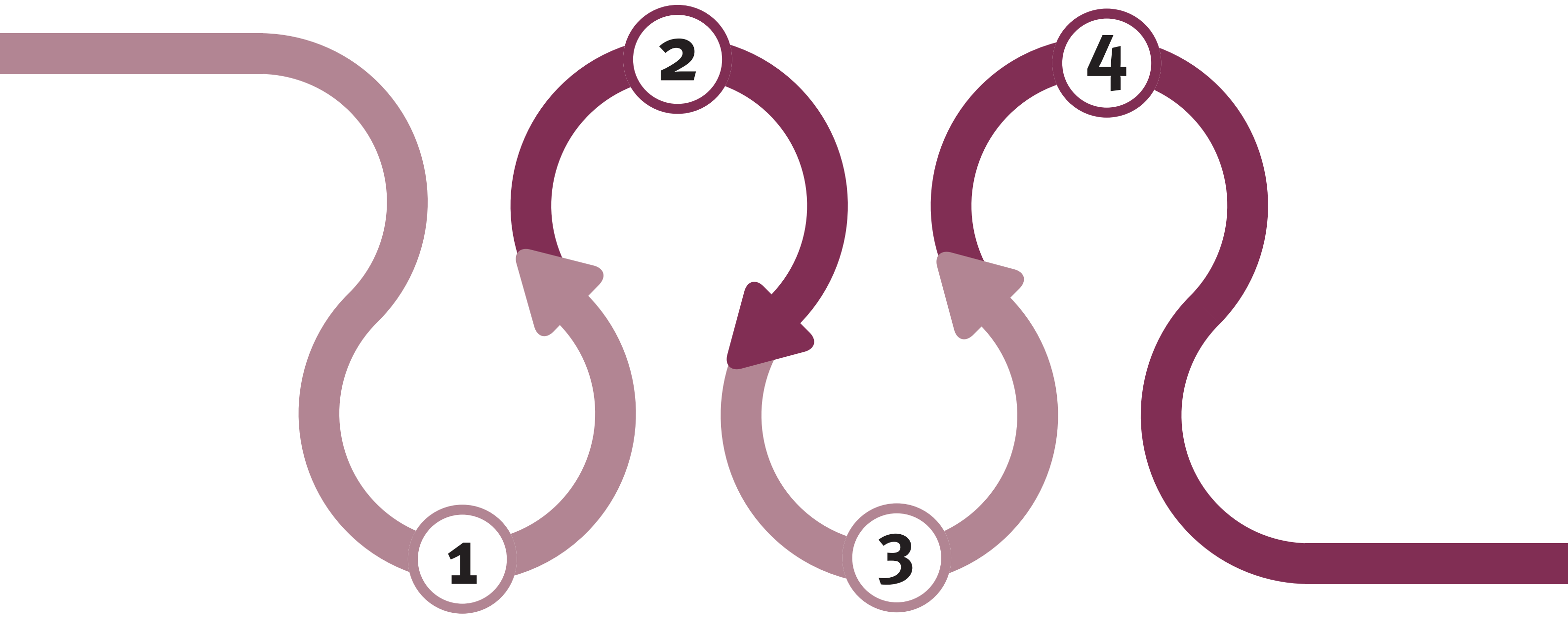
- An integrated, system-based solution will lead to better outcomes than could be achieved by each Council acting independently
- A first step to enable Councils to act in concert is to define and agree on long-term infrastructure and system intervention goals
- Alignment around such goals enables individual Councils to make decisions that align with the integrated Plan.

Engagement informing this draft of the Plan included:

- Four intensive workshops with the CoMSEQ Waste Working Group
- Two briefing sessions with the CoMSEQ Board
- One briefing session with the CoMSEQ Economic Working Group
- Four rounds of 1:1 engagement between each Council's chosen representatives and the working team
- Additional 1:1 working sessions with multiple Councils on request for deep dive into particular issues tabled (e.g. resolving conflicting data sources; exploring Council-specific waste concerns)
- Interviews with State agencies, including the Department of Environment and Science, and the Department of State Development Infrastructure Local Government and Planning.

After the Plan is agreed, ongoing coordination and collaboration between Councils will be required to:

- Scope and develop actions to support implementation (for example, additional analysis, modelling, specific business case development, market research, coordinating pilots and reflecting lessons learned etc.)
- Focus energy and attention where it most benefits Councils collectively
- Stay abreast of emerging technologies and shifts in the market landscape, and ensure the CoMSEQ approach is dynamically adjusted to reflect changing circumstances
- Ensure an implementation cadence and to track progress and celebrate achievements.



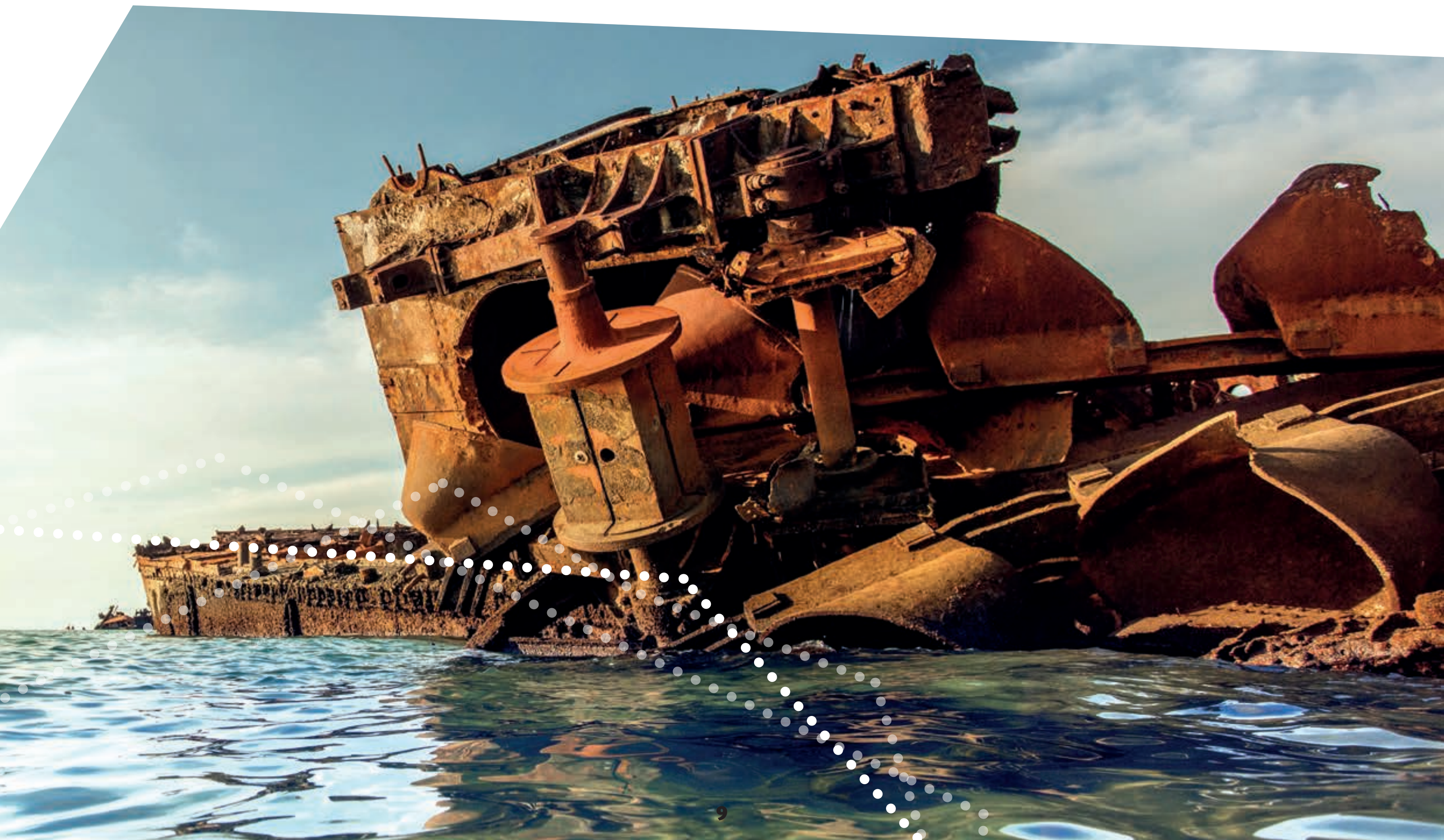
D) DATA SOURCES

In developing the Plan a range of data sources were used:

- Council responses to the Department of Environment and Science Annual Waste Data Survey (2015-2020)
- Council data provided for the Queensland Waste and Resource Recovery Infrastructure Report (2019)
- Council waste management strategy and reporting documents
- Council landfill airspace data
- Council waste site and facility statistics
- Australian Bureau of Statistics and Queensland government population and household forecasts
- Council information on waste management contracts and expiry dates
- A range of studies into various aspects of waste management in Queensland
- Interviews and discussions with Council Mayors, CEOs, Waste Managers and other technical specialists
- More than 15 global expert consultations, covering the fields of waste system modelling, waste contracting, circular economy, organics processing technology, energy-from-waste technology and economics, FOGO collection systems, recycling system operations and management of contaminants.
- Interviews with local industry operators and industry groups
- Targeted reviews of relevant academic and government published literature.

When data is presented as the aggregate SEQ view, averages will be different to the results achieved in any individual Council. Data limitations may include sample sizes for bin composition surveys, and some Councils will have different bin composition.

Limitations in waste management data are widely acknowledged and improving in this area is a priority.



3. Overview of the current SEQ waste management environment

The starting point for developing this Plan was to understand existing municipal waste management system dynamics in South East Queensland. In this chapter we provide an overview of six key features of the current waste management system:

a) Current waste flows and trajectory

b) Current and projected infrastructure capacity

c) Current waste system costs and the costs of alternative waste system elements

d) Operation of the landfill levy and rebate

e) Citizen satisfaction and expectations

f) Pilots and planning already in progress

A) CURRENT WASTE FLOWS AND TRAJECTORY

This section describes South East Queensland's current waste flows, and the current trajectory towards State targets based on historial performance.

South East Queensland generated ~1,804kt of municipal solid waste in 2018-19. Approximately 1,181kt of this waste was collected by Councils in kerbside collections with ~887kt collected in general waste bins, ~238kt of material collected in comingled bins, and ~56kt of materials collected in organic waste bins[1].

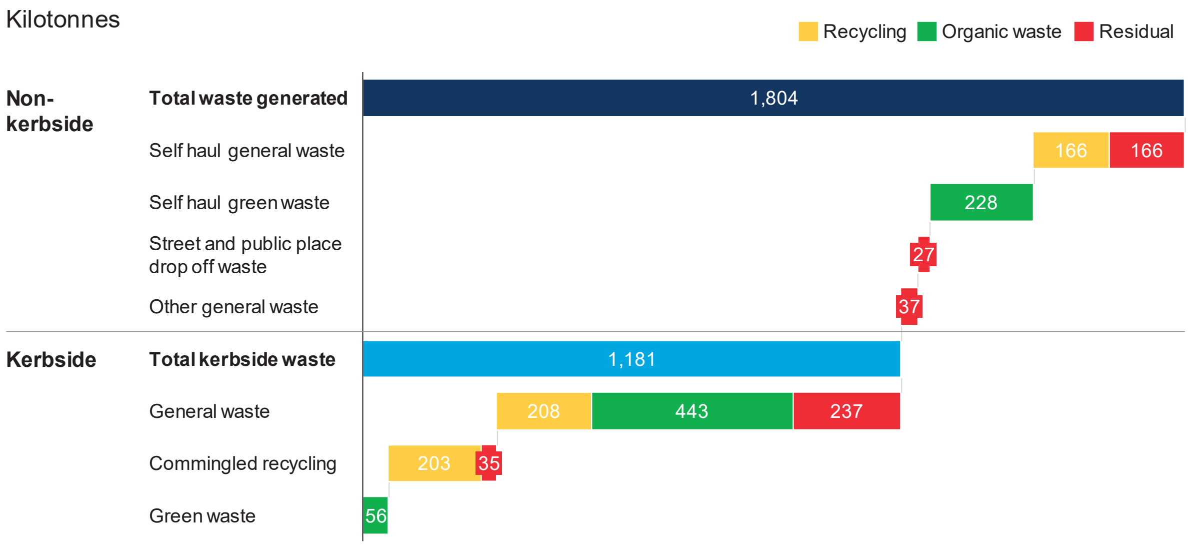
Extrapolating from available bin audits to understand the magnitude of opportunity in the kerbside system, it's estimated that ~208kt of comingled recyclables and ~443kt of organics were disposed of in kerbside general waste, with ~35kt of non-recyclable waste disposed of in comingled kerbside.

Exhibit 1 shows the mix of municipal solid waste generated in South East Queensland in 2018-2019 and by which means it is collected.

1 DES local government waste survey, 18-19, 13 sets of SEQ compositional waste audits (~25k bins). The data used is subject to limitations including: sub-optimal equipment (no weighbridges) in some locations, self reporting by Councils, and variable methods and definitions in measuring waste

Exhibit 1[2]

Municipal waste generated in SEQ by type 2018-19

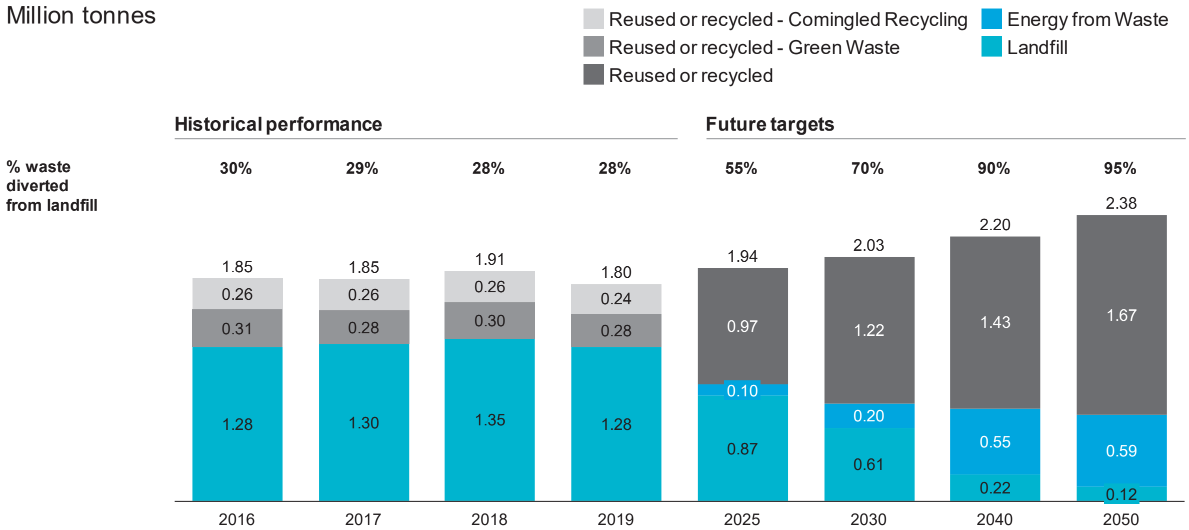


As part of the Queensland Government's Waste Management and Resource RecoveryStrategy, the Government has established specific targets for landfill diversion that would require a significant shift in the material flows described above.

Exhibit 2 shows SEQ's current performance and the trajectory required to meet future targets out to 2050.

Exhibit 2[3]

Current SEQ MSW generation and diversion and trajectory needed to meet State resource recovery targets



The current trajectory indicates that the State's targets are ambitious and meeting them would require rapid changes in South East Queensland's waste management system.

2 DES Local Government Waste Survey 18-19, 13 sets of SEQ compositional waste audits (⇢25k bins). The data used in this chart is subject to several data limitations including survey methodology (self-reported by councils), sub-optimal equipment (no weighbridges) in some locations, and variable methods and definitions in measuring waste. Composition of self-haul waste (recycling and residual materials) is not clear in DES data, shown here notionally as 50/50 split.

3 DES Local Government Survey, Queensland's Waste Management and Resource Recovery Strategy, Arup target modelling using ABS medium population growth scenario. Excludes flows from MRFs to landfill from contamination in yellow bin. Includes municipal self-haul and collections from public places.

B) CURRENT AND PROJECTED INFRASTRUCTURE CAPACITY

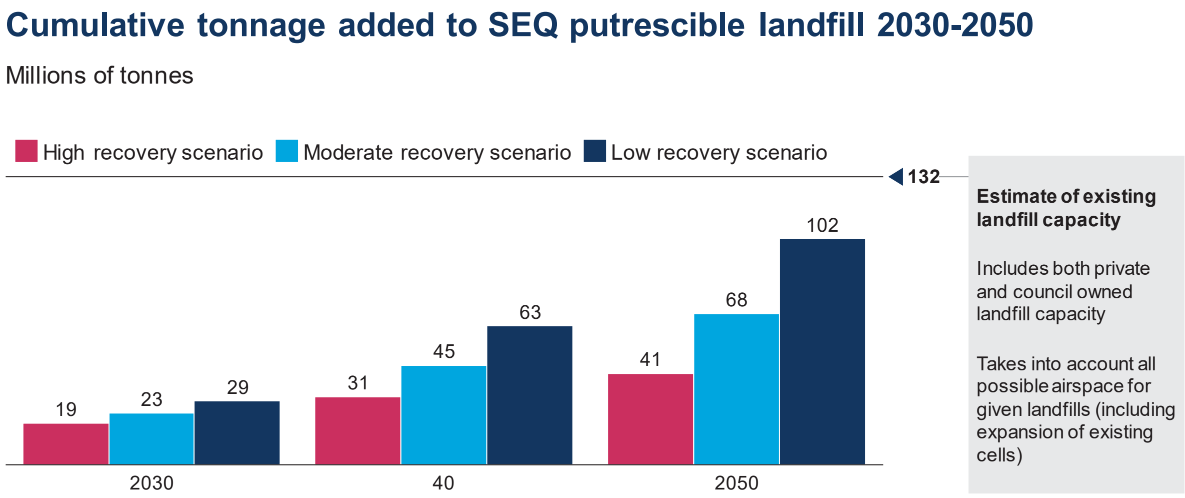
The current and projected capacity of both landfill and material recovery facilities are discussed in turn.

LANDFILL IN SOUTH EAST QUEENSLAND

The estimated capacity of existing public and private landfills in South East Queensland, including potential expansion of existing cells, is 132 million tonnes. This includes currently developed capacity, capacity that is approved but not yet constructed, and capacity that is available adjacent to existing cells but not yet approved.

When this capacity is compared with forecast aggregated SEQ waste flows across C&I and MSW waste streams, analysis suggests there is technically sufficient capacity to accommodate waste flows beyond 2050, provided there is a degree of capacity sharing across Councils. This is true under a range of different waste flow quantity scenarios. Exhibit 3 below shows projected quantity of waste flows through to 2050 under three scenarios. While all of these scenarios include population growth at rates currently forecast by the Australian Bureau of Statistics, they represent different potential outcomes in terms of waste generation per capita, and in terms of rates of recycling and recovery. In a high recovery scenario, as envisioned by the State's Waste Management and Resource Recovery Strategy, landfill capacity in 2050 is >3 times more than required. Even in a low recovery scenario – if waste generation and recycling behaviours stayed relatively stagnant – the analysis suggests that sufficient capacity exists.

Exhibit 3[4]



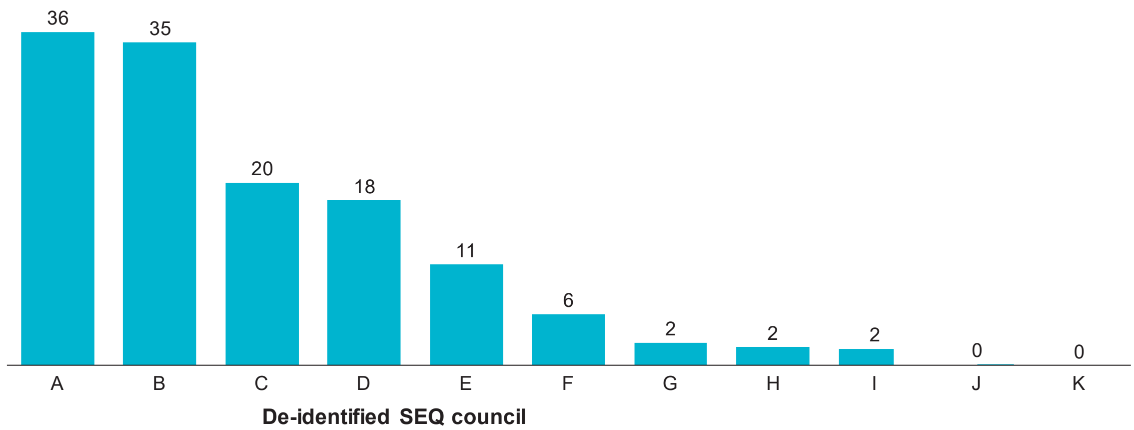
Existing SEQ landfills have the technical capacity to last until beyond 2050 based on available putrescible airspace. Several constraints may limit utilisation of this capacity in outer years, e.g. distances between councils and landfill sites, sufficiency of connecting road networks, dwindling capacity of inert landfills

While capacity is sufficient in aggregate across South East Queensland, it is not sufficient for each individual Council, with a number of Councils likely to reach landfill capacity within the next 10 years. Accordingly, one path to resolve this could be collaboration between Councils to match available capacity with demand across Councils. Such collaboration would entail detailed consideration of least cost approaches to transport and logistics, alongside consideration of the economics for the individual Councils involved. Alternatively, Councils seeking landfill solutions may choose to go to market to seek private sector responses to collect and find disposal locations for the waste stream. Exhibit 4 below demonstrates the available capacity by Council, including private landfills, highlighting that much of the available capacity is shared across five Councils.

4 DES local government waste survey 18-19, infrastructure report consolidated data, individual data from councils. High recovery assumes: MSW generation per capita declines in line with state targets; C&I constant at 2019 levels, C&I recovery rate increases in line with state targets, the proportion of total recyclable material placed in recycling bin is uplifted to SA levels (72%) by 2030 and Victoria's level by 2050 (80%), Proportion of organic waste removed from the red bin is 40% of food, 80% of garden organics by 2030 with a FOGO bin penetration of 80%, ABS medium population growth. Medium recovery assumes MSW generation per capita declines 50% of the way to state targets; C&I constant at 2019 levels, C&I recovery rate Increases 50% of the way to state targets, the proportion of total recyclable material placed in recycling bin is uplifted to SA levels (72%) by 2035, constant thereafter, proportion of organic waste removed from the red bin is 40% of food, 80% of garden organics by 2030 with a FOGO bin penetration of 40%, ABS medium population growth. Low recovery assumes: MSW and C&I generation per capita remain constant at 2019 levels, C&I recovery rate remains at 2019 levels, the proportion of total recyclable material placed in recycling bin remains constant at current levels (~49%), no change versus today on organics recovery, ABS medium population growth

Exhibit 4[5]

Available putrescible landfill airspace by de-identified council, millions of tonnes



MATERIAL RECOVERY FACILITIES IN SOUTH EAST QUEENSLAND

Based on outside-in analysis, it estimated that South East Queensland has a maximum material recovery facility capacity for MSW of ~315ktpa6, of which ~237ktpa (75%) is utilised in 2020. These outside in estimates are based on a number of assumptions that have been calibrated with relevant industry experts: that all MRF facilities can operate on a double shift; that facilities have maximum feasible utilisation of 90% of total capacity; that belt speed is reduced by 10% over time to reduce contamination of outputs; and that MSW accounts for 96% of waste being sorted in these facilities.

Exhibit 5 shows projected MRF requirements of South East Queensland in 2030 and 2050 under four comingled recycling waste flow scenarios[7]. There are multiple different options for the footprint of this additional capacity, and these are explored later in this document.

5 Council provided airspace data, local government ARCADIS survey
6 Including reduction in capacity based on 10% belt slowing to reduce contamination. If this is excluded, total capacity for MSW is ~350 ktpa
7 Scenarios based upon: Council interviews; ABS/QLD state government population forecasts; Queensland Waste Management and Resource Recovery Strategy targets; Annual waste survey data, Queensland 2018-19; Victoria Government Waste Profile, 2016-2017, p. 43 (Victoria waste composition); East Waste South Australian bin audits (https://www.eastwaste.com.au/bin-materials-audit-results-for-east-waste/); South Australia's Recycling Activity in 2017-18; and Victorian Local Government Annual Waste Services Report 2017–18.

Exhibit 5[8]

Annual SEQ MRFs comingled recycling throughput versus MRF capacity

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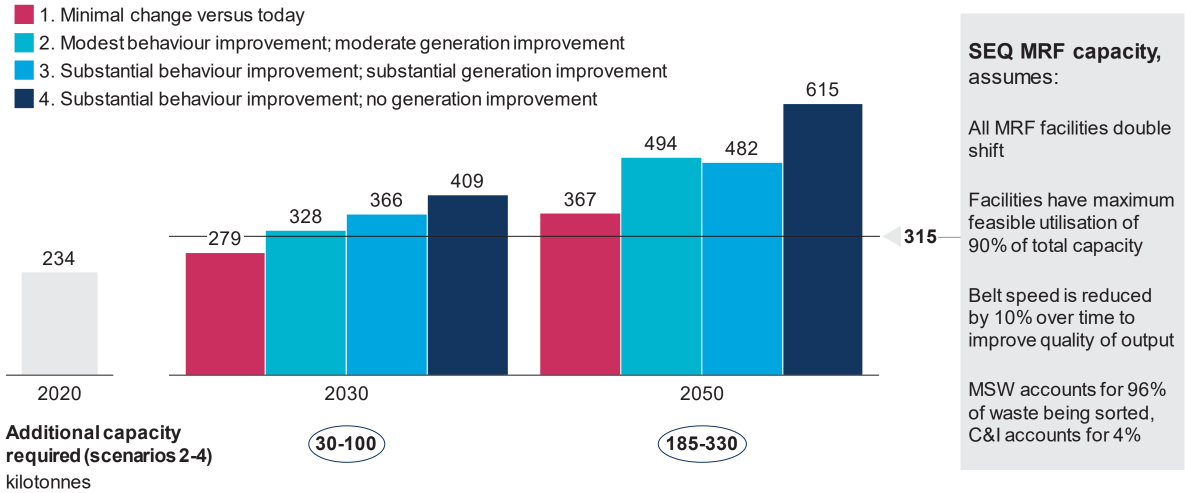


C) CURRENT WASTE SYSTEM COSTS AND THE COSTS OF ALTERNATIVE WASTE SYSTEM ELEMENTS

Council waste charges across CoMSEQ range from ~$240-$370 pa, with an average of ~$305 pa in 2018-19[9].

This range is likely to reflect significant variations in costs across Councils, driven by a number of factors including: the size, scale and location of the Council, and its negotiating power; whether landfills are owned or not; population density; collections services offered to rate payers and service levels.

Regardless of their absolute cost base, Councils have worked hard to keep cost increases to a minimum: over the last five years, the average annual increase is waste charges to ratepayers has been just 2%[10].

There are three important considerations of current state system costs to note:

- Key cost drivers: While variations exist, the most significant element of system cost is collections, which typically comprises 60-80% of total costs to provide the service. Processing costs, and to a lesser extent haulage costs, make up the bulk of remaining costs. This cost structure is an important consideration when considering future design levers, as shifts in processing costs can easily be dwarfed by design choices that require additional collections activities.
- Recent and emerging cost pressures: Recent pressures such as the China Sword have increased system costs significantly. It is estimated that reduction in value of recycled materials equates to roughly a $16/household/annum cost increase (~5% increase). This has in many cases been partially offset by the impact of Container Refund Scheme revenues, although not all Councils report having accessed this benefit. Exhibit 6 shows the average impact of these forces for South East Queensland.

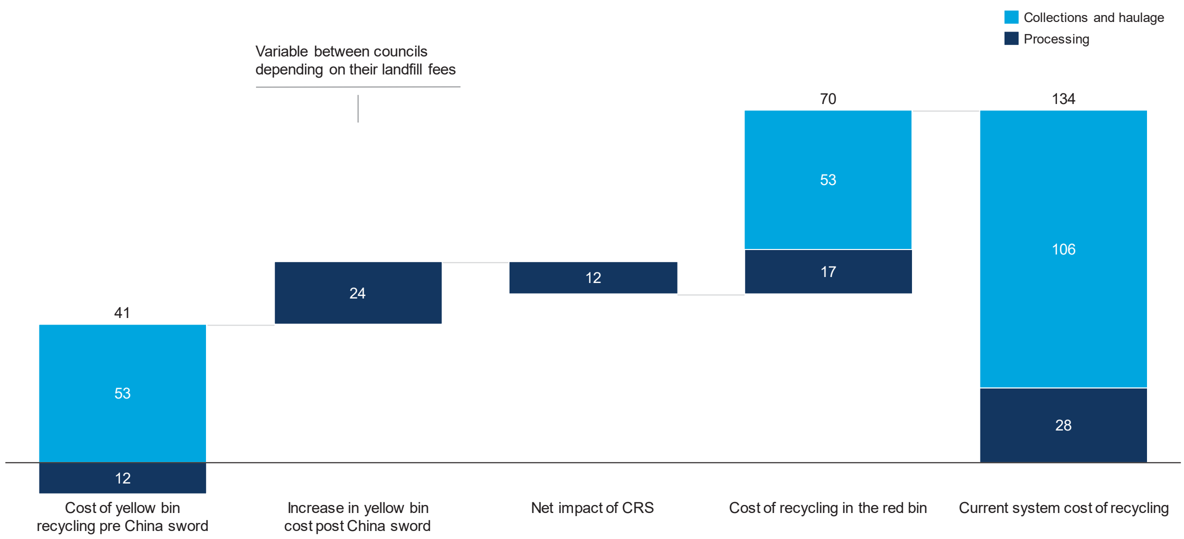
8 Council interviews, ABS/QLD state government population forecasts, Queensland Waste Management and Resource Recovery Strategy targets, Annual waste survey data, Queensland 2018-19, Victoria Government Waste Profile, 2016-2017, p. 43 (Victoria waste composition), East Waste South Australian bin audits (https://www.eastwaste.com.au/bin-materials-audit-results-for-east-waste/), South Australia's Recycling Activity in 2017-18, Victorian Local Government Annual Waste Services Report 2017–18. Major assumptions: Proportion of total recyclable material placed in recycling bin (46% today) remain Constant at current levels (~46%) for scenario 1, uplifts to SA levels (72%) by 2035, constant thereafter for scenario 2, uplifts to SA levels (72%) by 2030 and Victoria's level by 2050 (80%) for scenario 3, uplifts to SA levels (72%) by 2030 and Victoria's level by 2050 (80%) for scenario 4; ABS medium population growth case for all scenarios; waste generated per person constant at 2019 levels for scenario 1 and 4, declines 50% of the way to state targets for scenario 2, declines in line with state targets for scenario 3; growth in the recovery rate of the container deposit scheme (60% today) reaches 70% by 2025, constant thereafter for scenario 1, reaches SA levels (77%) by 2025, constant thereafter for scenarios 2-4

9 Queensland Local Government Comparative Information 2018-19, Department of Local Government, Racing and Multicultural Affairs

10 Queensland Local Government Comparative Information 2016-17 to 2019-20, Department of Local Government, Racing and Multicultural Affairs

Exhibit 6[11]

Current system cost of recycling and the impact of China Sword and the CRS $m

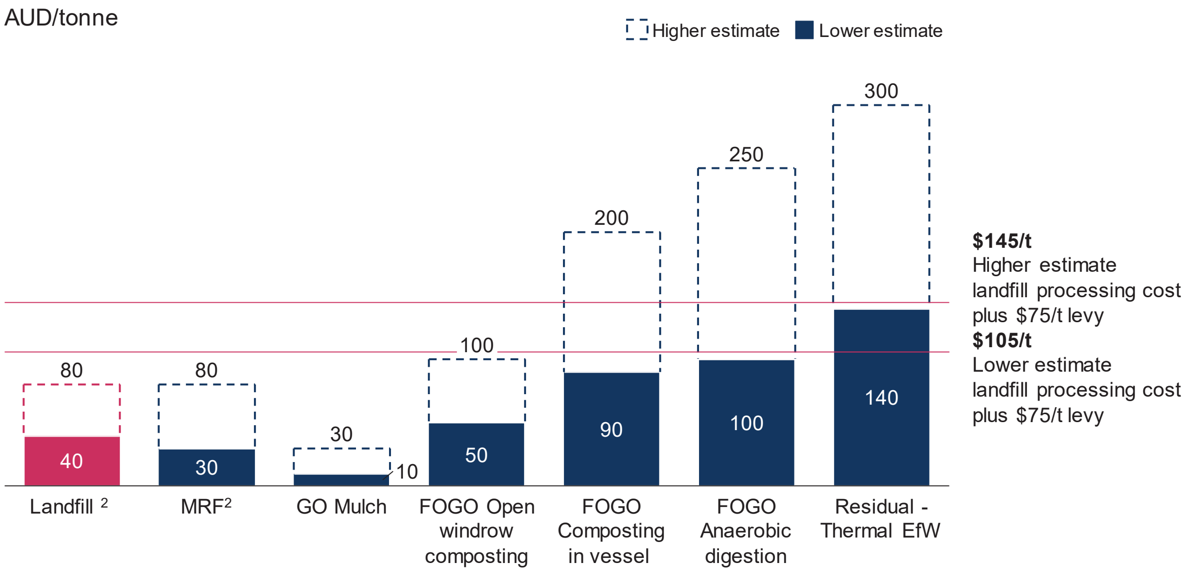


- Cost of alternate processing types: Different processing techniques have different associated costs and these have been benchmarked – with landfill and MRF having similar costs, organics option costs varying widely, and thermal energy-from-waste the most expensive. Exhibit 7 shows the indicative gate fees for several waste processing technologies. Range of these benchmarks is likely driven by differences in operational efficiency, relative negotiating power of suppliers and providers, timing of potential investment decisions and assumptions about labour required and its cost. It should be noted that the figures provided in Exhibit 7 represent a benchmarked range of costs to Councils (gate fees) based on current Australian/Queensland market dynamics. Accordingly these figures would include a return on capital deployed for the infrastructure asset owner. If Councils chose to become the asset owner, processing costs could be reduced from what is represented below if Councils are able to achieve: i) a significantly lower cost of capital than available to commercial providers; and ii) an offset of any profits achieved above the cost of capital.

11 Sustainability Victoria Recovered resources market bulletin July 2020, March 2019, Australian Packaging Covenant Organisation (Market Impact Assessment Report: Chinese Import Restrictions for Packaging in Australia), Container Exchange Annual Report 19-20, council provided compositional audits, DES local government waste survey 18-19

Exhibit 7[12]

Indicative gate fees for waste processing options (ex. collections and transport costs) with levy overlaid



Note that there is a significant range in cost estimates based a number of factors in play. True costs will be revealed through market testing and procurement processes, however, the relativity between the technologies is expected to hold.

D) OPERATION OF THE LANDFILL LEVY AND REBATE

The landfill levy was introduced into South East Queensland to drive a system-wide shift towards higher levels of waste recycling and recovery.

In the introductory period (until 30 June 2022), Government committed to ensure that the waste levy would have no direct impact on households. During this period the Queensland Government provides Councils that dispose of household waste in the levy zone with an annual advance payment (rebated 105%).

In the short- to medium-term the levy rebate is intended to be removed, with funds used to promote development of the recycling and reprocessing industries that will support a more circular economy. The Queensland government has committed that 70% of revenue raised from the landfill levy will go back to Councils, the waste industry, scheme start-up, and environmental programs.

Removing the levy rebate will alter the economics of recycling for local Councils, making some alternatives to landfill more economically attractive. Exhibit 7 (above) overlays the total cost of landfill to Councils without the levy rebate as a horizontal line, compared to the cost of other processing technologies; some of these alternatives now become less expensive than landfill, on the basis of processing cost only.

12 SEQ Local Government QWRRIP survey responses, SEQ industry and local government benchmarks, ‘The full cost of landfill in Australia’, Department of Agriculture, Waste and the Environment, Sustainability Victoria benchmarks

E) CITIZEN SATISFACTION AND EXPECTATIONS

Council interviews indicate that overall citizens are satisfied or very satisfied with the waste collection and management systems of Councils in South East Queensland. Waste services are in the highest groupings of citizen satisfaction, although some Councils identified concerns about cost increases.

Several Councils noted that their residents received extremely high levels of service and reported that changing or reducing waste services, or increasing charges, could be challenging.

In moving forward with new models of waste management, care must be taken to engage citizens fully in the reasons for change, and to take them on the journey about how to change, so that high levels of citizen satisfaction are maintained.

F) PILOTS AND PLANNING ALREADY IN PROGRESS

Councils have not stood still in the face of the many changes in this sector. At the time of developing this report, most Councils already had multiple strategic processes underway to explore options for strategically optimising waste management for their rate payers.

Several Councils have tested the market for options for additional material recovery facilities, co-digestion of organic materials with waste water waste streams through anaerobic digestion, and alternative food organics and garden organics treatment facilities.

Some Councils are progressing already with changes to food organics and garden organics collections and processing, including planning for the introduction of kerbside garden organics collections services, and trials of food organics and garden organics collection services.

The scope of this report is intended to be complementary to these processes, by providing CoMSEQ an opportunity to align at a high level on a longer-term strategic direction, the '2030 target state', enabling shorter-term choices to be made in a way that is consistent with this direction.

The following three chapters describe each of the waste streams, options considered, recommendations, future work required and impacts of the proposed 2030 target state. The combined recommendations are then presented, followed by funding options for the transition and the immediate next steps.

4. Comingled Recycling

This chapter provides an overview of the recommended pathway for CoMSEQ Councils for the comingled recycling waste stream. It includes:

a) Overview of comingled recycling waste stream dynamics

b) Implications of these dynamics for CoMSEQ Councils

c) Options considered

d) Recommendations to move towards the 2030 target state

e) Impacts of these recommendations on progress compared to State targets, economic development outcomes and operating economics

A) OVERVIEW OF COMINGLED RECYCLING WASTE STREAM DYNAMICS

The comingled recycling stream for MSW in South East Queensland is shaped by four factors, which are explored in more detail in the sections that follow:

- Available data indicates that SEQ has relatively low rates of recycling and high levels of contamination
- MRF economies of scale will drive future facility operating costs
- Secondary market prices declined significantly in response to the China Sword decision
- The Container Recycling Scheme (CRS) has increased the value of plastic and glass containers, with some Councils capturing a financial benefit, although this benefit may not be sustained in the long term.

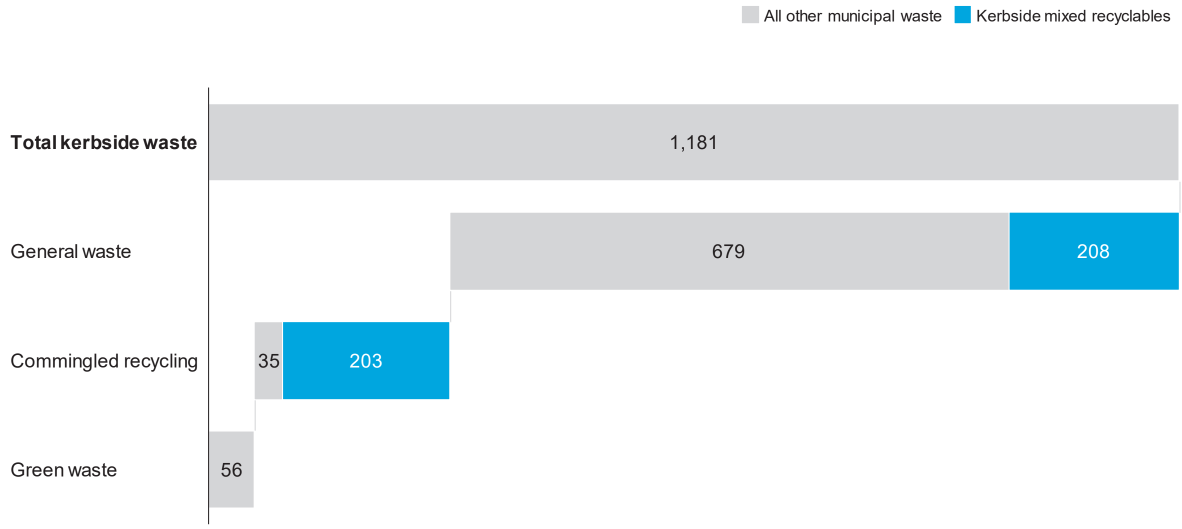
AVAILABLE DATA INDICATES THAT SEQ HAS RELATIVELY LOW RATES OF RECYCLING AND HIGH LEVELS OF CONTAMINATION

Peer state comparison suggests there is an opportunity to improve recycling behaviour in South East Queensland[13]. Based on available bin composition data, 49% of comingled recyclable material produced by households in South East Queensland is placed in the comingled recycling bin; the other 51% is placed in the general waste bin (see Exhibit 9). In South Australia, 72% of comingled recyclable material is placed in the recycling bin, while Victoria achieves 80%. Although compositional audits are imperfect and not representative for all Councils, this difference suggests a significant opportunity for SEQ in enhancing comingled recycling recovery.

Exhibit 8[14]

Kerbside waste collected in SEQ by type 2018-19

Kilotonnes



MRF ECONOMIES OF SCALE WILL DRIVE FUTURE FACILITY OPERATING COSTS

Material Recovery Facilities (MRF) exhibit economies of scale whereby larger facilities operate at significantly lower capital and operating costs per tonne. Available evidence suggests that MRFs cease accruing substantial economies of scale per tonne of waste processed after they reach ~60-100ktpa throughput per year [15]. Exhibit 9 shows operating and annual capital costs per tonne for 12 US MRF facilities, overlaid with existing SEQ facilities. While this analysis is based on international data, it is anticipated that the shape of the cost curve would be similar in Australia, although the absolute costs would be different.

13 Annual waste survey data, Queensland 2018-19, Victoria Government Waste Profile, 2016-2017, p. 43 (Victoria waste composition), East Waste South Australian bin audits (https://www.eastwaste.com.au/bin-materials-audit-results-for-east-waste/), South Australia's Recycling Activity in 2017-18, Victorian Local Government Annual Waste Services Report 2017–18, team analysis

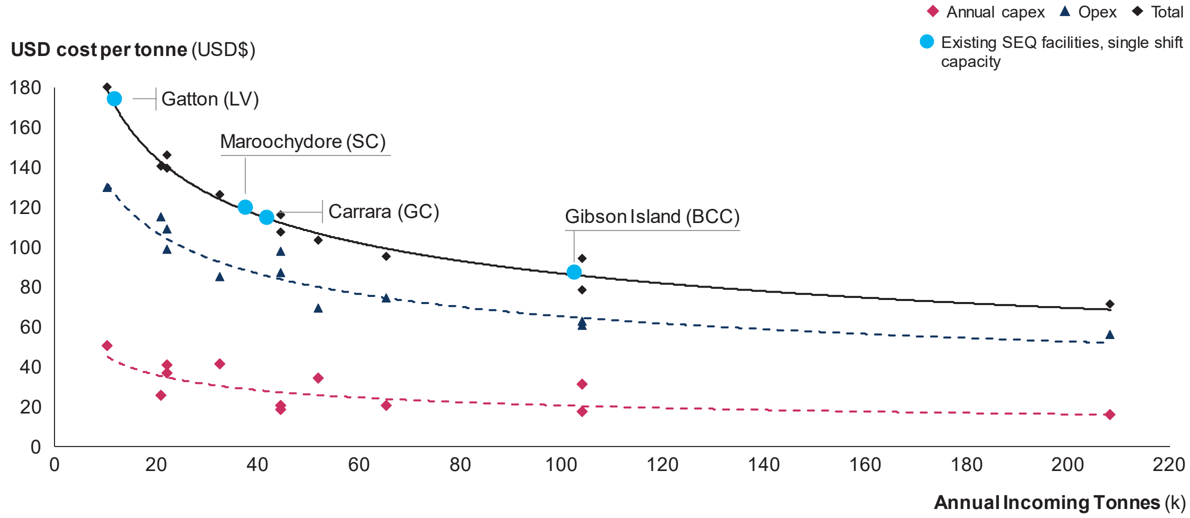
14 DES local government waste survey, 18-19, 13 sets of SEQ compositional waste audits (>25k bins

15 Resource Recycling Systems, A Study of the Optimization of the Blue Box Material Processing System in Ontario (Volume 3: Cost Modelling). Sample of 12 MRF facilities, 2012

Exhibit 9[16]

Operating and annual capital cost per tonne for 12 MRF US facilities by annual incoming tonnes

$USD/tonne



South East Queensland's Gibson Island facility processes an annual volume of over 100,000 tonnes per year, operating at a structurally efficient point on the cost curve. The Gibson Island MRF occupies the most central geographic position, and many Councils currently contract with this MRF. While other facilities in South East Queensland are operating at a higher point on the cost curve, dis-benefits of additional processing costs may be offset by benefits of local employment, reduced transport costs, and the price benefits of different ownership models.

Many Councils noted issues with current MRF arrangements in SEQ due to a lack of operator competition, limited control, lack of transparency of environmental outcomes achieved, and uncertainty on whether cost changes and efficiencies (e.g. from scale) are passed on to Councils in their contracts.

The scale of future facilities and their proximity will drive the cost efficiency of new MRF facilities in SEQ. Building additional MRF facilities is likely to reduce transport costs overall, since on average waste needs to be transported less distance to reach a facility. However, if smaller scale facilities are built this is likely to increase processing costs. Whilst difficult to estimate, it's likely that a less concentrated market structure with new entrants would increase prices for commodities produced.

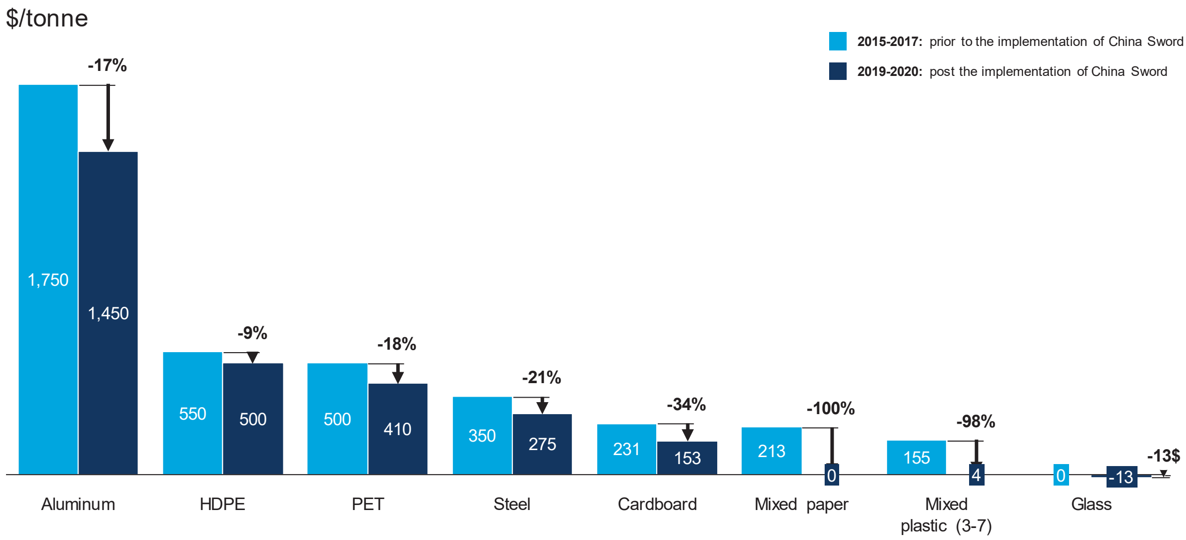
SECONDARY MARKET PRICES DECLINED SIGNIFICANTLY IN RESPONSE TO THE CHINA SWORD DECISION

Secondary markets for recycled materials substantially drive the economics of resource recovery. Post China Sword, recyclable commodity prices in Australia went to near zero or negative for mixed paper, mixed plastic and glass. These price drops have reduced the value of a tonne of recycling by ~$100/t, translating to a ~$24 million annual cost to SEQ and ~$16 per household per year. Exhibit 10 shows the difference in value of key recyclable commodities between 2015-2017 and 2019-2020.

16 Resource Recycling Systems, A Study of the Optimization of the Blue Box Material Processing System in Ontario (Volume 3: Cost Modelling). Sample of 12 MRF facilities, 2012

Exhibit 10[17]

Australian Recyclable commodity prices 2015-2017 and 2019-2020



Looking forward, international markets appear unlikely to return to accepting highly contaminated waste material. China was an early mover, with the China Sword policy banning imports of contaminated recyclable material (>0.5% contamination) from 1 January 2018. This was followed by a series of similar shifts across Australia's waste export destinations, including Malaysia announcing a ban of imported non-recyclable plastic by 2021, Thailand's ban on plastic waste and scrap import by 2021, India's enforcement of a 1% contamination limit for paper imports, and Indonesia's 2% contamination limit on paper and plastic.[18]

In August 2020 the Australian Government confirmed its commitment to reducing waste exports, introducing legislation that bans exports of waste of various classes including waste plastics, paper, glass and tyres. At the time of drafting this report the legislation had not passed the Commonwealth parliament to become law[19].

Domestic adjustments to the China Sword shock are still evolving, with a significant shift required to create a healthy local end market. Governments have taken some steps, including announcements by national, State and local agencies.

To contribute to industry development the Australian Government has announced a $250 million recycling modernisation fund, and the Queensland Government has committed $100 million investment in line with their 10-year Roadmap and Action Plan.

17 Sustainability Victoria Recovered resources market bulletin July 2020, March 2019, Australian Packaging Covenant Organisation (Market Impact Assessment Report: Chinese Import Restrictions for Packaging in Australia), Parliament of Australia (Key challenges and opportunities for Australia's recycling effort, VISY submission to APH paper

18 https://www.environment.gov.au/system/files/resources/99f2dfad-bcc3-40e0-9193-f343f76280d2/files/waste-export-summary-may-2020.pdf

19 https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r6573

THE CONTAINER RECYCLING SCHEME (CRS) HAS INCREASED THE VALUE OF PLASTIC AND GLASS CONTAINERS, WITH SOME COUNCILS CAPTURING A FINANCIAL BENEFIT

The Queensland CRS has increased the value of eligible containers and improved the recycling of eligible plastic and glass containers.

The CRS has had two major impacts on MRFs and Councils: it has decreased MRF volumes by ~10-15%, and increased value for CRS materials compared to market commodity prices. Specifically, the CRS currently equates to providing a secondary market price for glass of $915/t which is significantly higher than the market price of glass at approximately $0/t.

Perhaps somewhat counterintuitively, outside in analysis suggests that the combination of these two impacts has in general been favourable for Council economics. The value uplift for Councils occurs when the containers that could have been returned to container refund points are placed in bins for comingled recycling. In this case, the CRS refund is divided between the MRF operator and the Council. Currently, the default arrangement is a 50/50 split between councils and MRF operators as stipulated under state protocols, but this split can change depending on the specific contractual agreements between councils and MRF operators.

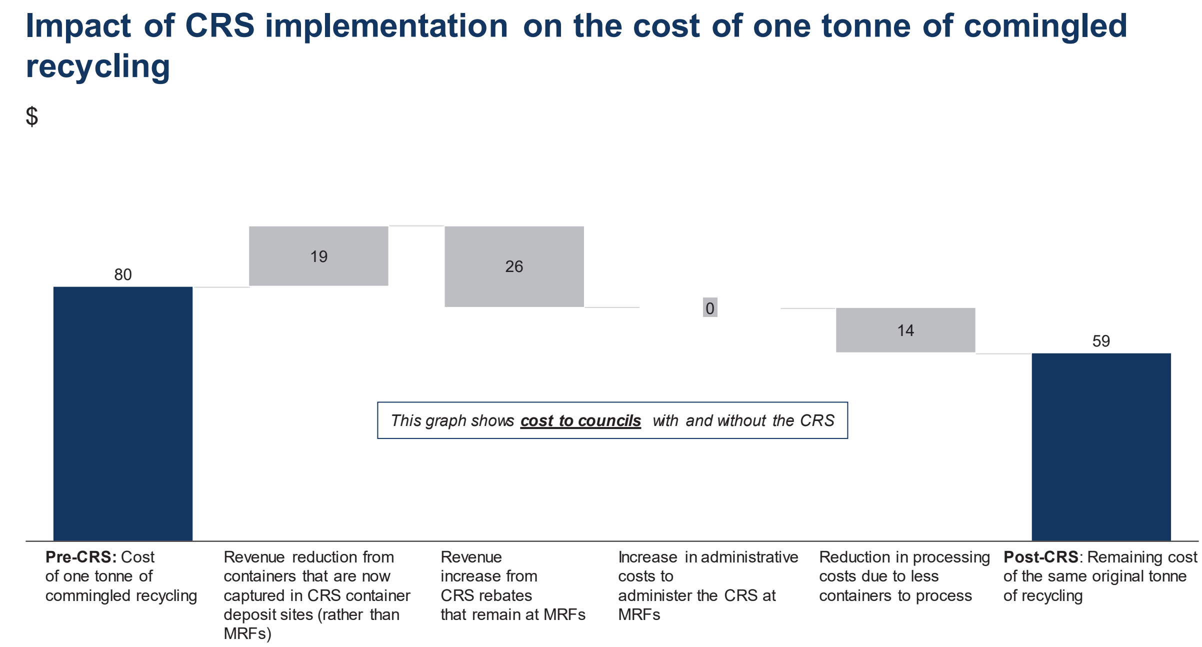
Exhibit 11 shows the estimated cost to Councils with and without the CRS, comparing the cost of one tonne of comingled recycling pre and post CRS[20].

This value capture for Councils shown in Exhibit 11 will persist if:

- Current CRS rebate levels do not decrease substantially
- The division of CRS revenue between MRF operators and Councils do not become significantly less favourable for Councils
- Prevailing commodity prices for glass do not increase significantly
- Substantial CRS volume (~20% of total CRS containers) continues to be collected through MRFs.

20 Major assumptions: 70% of waste captured in the CRS would go in the comingled bin if CRS not in place (conservative compared to 46% total recyclables in comingled bins in QLD), 20% of total CRS flows are through MRFs, 50% of revenue from MRF CRS rebates is accrued by councils, administrative costs per tonne of CRS are ~$2.6/t/t (CIE), processing costs assumed to reduce proportionally to volume

Exhibit 11[21]



B) IMPLICATIONS

There are three critical implications of the current state of comingled recycling in South East Queensland:

1. Developing strong secondary markets is critical to sustainability of the recycling sector, requiring a concerted effort to nurture healthy local end markets for recycled streams. As Councils ultimately carry the risk of ownership of waste, a healthy end market for recycled commodity streams is the best insurance enabling value capture from the waste on a sustainable ongoing basis
2. Improving recycling rates provides a win for Councils, both increasing landfill diversion and reducing costs.
3. Building a cost-effective and resilient recycling system relies on collectively making infrastructure and commercial decisions towards more desirable recycling processing and secondary uses, seeking to:
   - Minimise net system costs
   - Reduce market concentration
   - Increase system resilience
   - Align private sector incentives with state objectives of transparency and environmental outcomes.

21 Sustainability Victoria Recovered resources market bulletin July 2020, Container Exchange annual report and data dashboard, Revenue sharing arrangements between MRFs and councils from the NSW Container Deposit Scheme (CIE). Major assumptions: 70% of waste captured in the CRS would go in the yellow bin if it weren't in place (conservative compared to 46% total recyclables in yellow bin in QLD), 20% of total CRS flows are through MRFs, 50% of revenue from MRF CRS rebates is accrued by councils, administrative costs per tonne of CRS are ~$2.6/tonne (CIE), processing costs assumed to reduce proportionally to volume

C) OPTIONS CONSIDERED

This section sets out the key decision areas relevant to the comingled recycling waste stream, and the options considered in each decision area. A summary of this is provided in Exhibit 12.

Exhibit 12

OPTIONS CONSIDERED; COMINGLED WASTE STREAM, TARGET 2030 END STATE

Majority Target End State (highlighted options marked in **bold**)

Decision area	Options			Rationale
Achieving optimisedrates of recycling	No significant focus	Significant focus –individual Council level	**Significant focus – leveraging COMSEQ scale**	Bin audits suggest capture of recyclables in SEQ is lower than Victoria and SA. All tonnes diverted from landfill to recycling have significant cost and landfill benefits.
Supporting development of secondary markets	No significant focus	Significant focus –individual Council level	**Significant focus – leveraging COMSEQ scale**	Value of recyclables in secondary markets directly impacts cost to councils, and local job creation. Significant upside from supporting development post China Sword
Footprint for required new MRF capacity	Single 'mega' MRF	**1-2 additional 'at scale' MRFs**	Local, smaller scale MRFs	Provides a balance of efficient operating cost (processing at scale, and optimised haulage), with the benefit of introducing additional competition into the market at commercial scale. Choosing this as the 'majority position' would not prevent individual councils proceeding with local-scale solutions if that better meets local needs.
Ownership model for required new MRF capacity	Private (market) Ownership	Council owned, privately operated	Council owned and operated	Not considered in this piece of work, for future consideration
Scope of Container Refund Scheme	No Change	**Expand scope to include additional glass bottles**	Expand scope beyond glass bottles	Glass bottles have almost no value in secondary markets, and contaminate higher value recyclables (paper) when in yellow bin. The CRS transforms the value of glass, increasing its value — a net benefit to councils if MRF contracts provide for value-sharing. CRS for non-glass items devalues yellow-bins
Bin system	**No change (co-mingled yellow bin)**	Introduce extra bin - glass only	Introduce extra bin - cardboard/ paper only	Not yet a clear economic case for additional bin- could be considered in the future if actively supported by MRF/clear positive business case. Victoria is introducing a glass bin and this precedent could be observed to understand impact.

ACHIEVING OPTIMISED RATES OF RECYCLING

As described above, available bin composition data suggests that there is a significant opportunity across South East Queensland to improve the diversion of recyclable materials from landfill. Specifically, bin composition data suggests that only around 49% of commingled recycling is placed in the correct bin.

It is noted that bin composition data in South East Queensland is imperfect, so the available data may over or under-state or over-state the opportunity, particularly at the individual Council level. However, most Councils agree that there is an untapped opportunity in improving recycling rates, even if the exact scale of the opportunity cannot be fully quantified.

Capturing recycling rate improvements relies on behaviour improvement at the household level, which can be difficult to implement effectively and variable between Councils. Councils agreed that campaigns to improve recycling behaviour would need to be world class to be effective – steeped in most advanced understanding of behavioural science, and leveraging what has worked best globally while tailoring it to be appropriate for the local context. It is unlikely to be economic for any one Council to act alone in designing and implementing such an effort – hence this is an area where CoMSEQ-wide collaboration makes sense.

SUPPORTING THE DEVELOPMENT OF SECONDARY MARKETS

Healthy secondary markets are critical to achieving both the environmental and economic benefits of recycling, and have become more acutely important since China Sword. Councils do not have particularly high levels of control over the development of secondary markets, but do have a strong interest in these markets being healthy. As such, fostering secondary markets relies on both direct Council actions including taking a direct procurement role where it makes sense and setting an enabling posture towards new market entrants (e.g. rapid adoption of appropriate new products and standards, active facilitation of local markets); and using the combined scale of CoMSEQ to advocate for the State government to do the same. The Sustainability Victoria model is noted as a compelling example of momentum in this space.

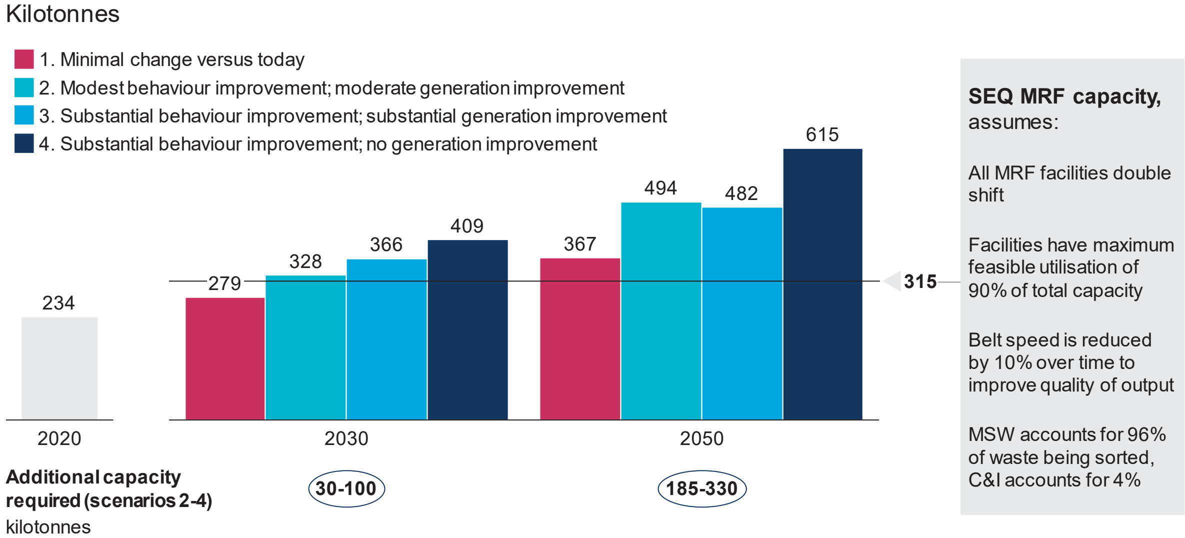
FOOTPRINT FOR REQUIRED NEW MRF CAPACITY

Scenario modelling of recycling stream waste flows out to 2050 suggests that an additional 185- 330ktpa of annual recycling capacity will be required over this time period, with the range determined by the level of improvement achieved in the rate of recycling, and the level of change in overall waste generation per capita, illustrated in Exhibit 13[22].

22 Council interviews, ABS/QLD state government population forecasts, Queensland Waste Management and Resource Recovery Strategy targets, Annual waste survey data, Queensland 2018-19, Victoria Government Waste Profile, 2016-2017, p. 43 (Victoria waste composition), East Waste South Australian bin audits (https://www.eastwaste.com.au/bin-materials-audit-results-for-east-waste/), South Australia's Recycling Activity in 2017-18, Victorian Local Government Annual Waste Services Report 2017–18. Major assumptions: Proportion of total recyclable material placed in recycling bin (46% today) remain constant at current levels (~46%) for scenario 1, uplifts to SA levels (72%) by 2035, constant thereafter for scenario 2, uplifts to SA levels (72%) by 2030 and Victoria's level by 2050 (80%) for scenario 3, uplifts to SA levels (72%) by 2030 and Victoria's level by 2050 (80%) for scenario 4; ABS medium population growth case for all scenarios; waste generated per person constant at 2019 levels for scenario 1 and 4, declines 50% of the way to state targets for scenario 2, declines in line with state targets for scenario 3; growth in the recovery rate of the container deposit scheme (60% today) reaches 70% by 2025, constant thereafter for scenario 1, reaches SA levels (77%) by 2025, constant thereafter for scenarios 2-4

Exhibit 13

Annual SEQ MRFs comingled recycling throughput versus MRF capacity



In determining the optimal footprint for this capacity, four key factors were considered: the efficient scale of an MRF facility (evidence suggests facilities are at efficient scale at a threshold of ~60ktpa); location of facility to minimise haulage costs; the negotiating power for Councils to secure competitive pricing (either through ensuring a competitive MRF market with multiple players, or through Councils taking an ownership stake); and the creation and location of jobs associated with MRFs.

From a pure economic perspective, analysis suggests that the lowest cost, highest resilience option for Councils would be to plan towards introducing one to two new, at scale facilities into the market between now and 2030. However, at the margin a similar outcome for the region could still be achieved if a number of Councils choose instead to work towards local, smaller scale recycling options.

OWNERSHIP MODEL FOR NEW PROCESSING INFRASTRUCTURE

Given that Councils will be a dominant customer of MRF processing facilities, the potential exists to explore an ownership or insourcing model for processing facilities, leveraging the potentially lower cost of capital available to Councils, and eliminating third-party margin, to reduce the total system cost to ratepayers. This model already exists for some of the smaller MRF facilities in the region. The attractiveness of this option versus market alternatives has not been considered in depth but would require consideration as part of the detailed business case development.

An additional factor to consider from an ownership perspective, and linked to the footprint question discussed above, is the benefit of introducing a higher level of competition into the MRF market, given the issues raised by some Councils about current service levels offered by the single current at-scale operator. This increased level of competition could be achieved either through introduction of a Council-owned, at scale MRF, or through the introduction of a new private operator.

SCOPE OF THE CONTAINER REFUND SCHEME

As described above, the economics of the container refund scheme, particularly as it relates to glass, has injected value into the kerbside comingled recycling waste stream. The CRS rebate for recycled glass ($915/t) is significantly higher than the value of glass in the secondary recycling market ($0/t). It is understood that not all Councils have benefited from this, as the ability to benefit from the value stream is dependent on the contract structure of individual Councils with the MRF facility (some Councils share the value of CRS items processed through the MRF, whereas with other Councils, it is reported that the MRF retains the full benefit). It is important to note that this benefit applies most clearly to glass containers in the CRS scheme; PET and aluminium containers have higher value in secondary markets and although the CRS rebate also exceeds their secondary market price, the net value created or detracted from the CRS is less clear.

BIN SYSTEM

Across Australia and globally, experimentation has occurred with further upstream delineation of recyclable materials, to optimise recovery from this stream. The main objective of increased upstream (household) sorting is to reduce contamination of relatively high value paper and cardboard waste from crushed glass, which renders paper/cardboard less valuable (e.g. presence of glass shards means the product couldn't be used in food packaging like egg cartons). The importance of minimising contamination is increasing as the markets for contaminated recyclables decline.

The most common models in practice include a separate bin for paper/cardboard (more common in NSW), or a separate bin for glass. This latter model – a fourth bin solely for glass – is being introduced mandatorily across Victoria by 2030. The challenges involved include increase household storage requirements for the introduction of a third or fourth bin, and increased collections costs.

Given these complexities, and the relatively low value of recyclable materials in secondary markets currently, introducing further upstream sorting was not viewed as a high priority relative to other components of this Plan, although there was acknowledgement that this position may shift in future. It is agreed that it would be important to keep a watching brief on this space, learning from the Victorian experience, and being prepared if/when the business case became compelling, particularly in higher density areas.

D) RECOMMENDATIONS

With the above taken into account, there are six recommendations on comingled recycling:

1. Launch a joint, evidence based behaviour change campaign to reduce comingled bin contamination rates to <5% and increase recyclables to 80% over the next 10 years
2. Advocate for State and peak body support for recycled product end markets, (e.g. procurement, standard setting, R&D etc)
3. Coordinate local government led efforts to support end markets for recycled streams (e.g. procurement, changes to LG specifications)
4. Advocate for the broader rollout of CRS to additional glass containers
5. Examine benefits and pathways for removal of glass from the kerbside comingled system in SEQ, if proven by Victorian experience
6. Plan for installation of 1-2 new MRF facilities by 2030, planning for;
   - Medium-large scale (> 60k single shift capacity)
   - Located to reduce transport costs
   - Jointly agreed optimised ownership model for new capacity (insourced or outsourced)

Caveat

One Council may look to partner with adjoining Western Councils to achieve economies and reduce transport costs

E) 2030 PROJECTED OUTCOMES FROM COMINGLED RECYCLING RECOMMENDATIONS

Projected outcomes from comingled recycling recommendations are summarised in Table 1, below;

Table 1: 2030 Projected outcomes from comingled recommendations

Outcome area	Estimated 2030 impact	Notes on method and inclusions
Landfill diversion rate impact	6% improvement versus 2018-19 baseline	Global expert input and national scan of States' achievement
Economic development outcomes	85 permanent jobs created 100-160 jobs per year of construction	Estimate of capital jobs created using Queensland Treasury standard multipliers
System operating cost	$17 – $25 m pa reduction in system operating cost	Based on global analysis of system operating cost
Up front, one off transition costs	$46 – $77 m	Based on capex for additional MRF facilities

5. Organics

This chapter provides an overview of the recommended pathway for CoMSEQ Councils for the organics waste stream. It includes:

a) An overview of the waste stream dynamics

b) Assessment of implications of foundational information for CoMSEQ Councils

c) Options considered

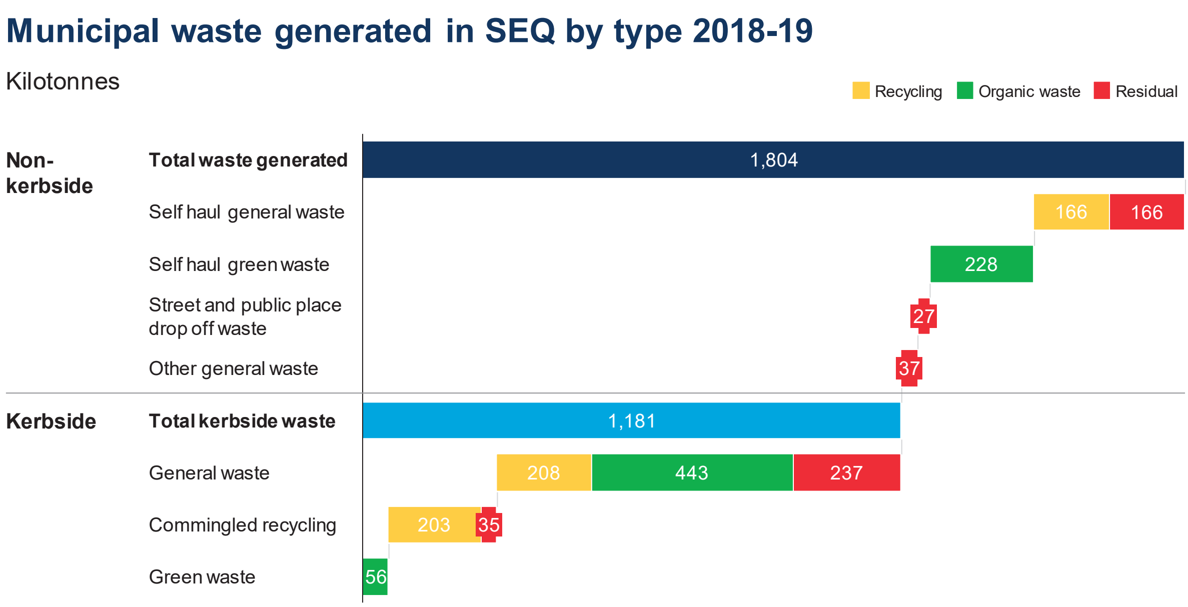
d) Recommendations to move towards 2030 target state

e) Outcomes from recommendations on progress compared to State Targets, economic development outcomes and operating economics.

Each of these is discussed in turn.

Exhibit 14 shows where organic material is currently collected in the MSW system today, coloured green. A total of 228ktpa is collected as self-haul garden waste, 56ktpa in kerbside garden waste services and 443ktpa disposed in the General waste kerbside collection service.

Exhibit 14[23]



23 DES Local Government Waste Survey 18-19, 13 sets of SEQ compositional waste audits (>25k bins). The data used in this chart is subject to several data limitations including survey methodology (self-reported by councils), sub-optimal equipment (no weighbridges) in some locations, and variable methods and definitions in measuring waste. Composition of self-haul waste (recycling and residual materials) is not clear in DES data, shown here notionally as 50/50 split.

A) OVERVIEW OF ORGANIC WASTE STREAM DYNAMICS

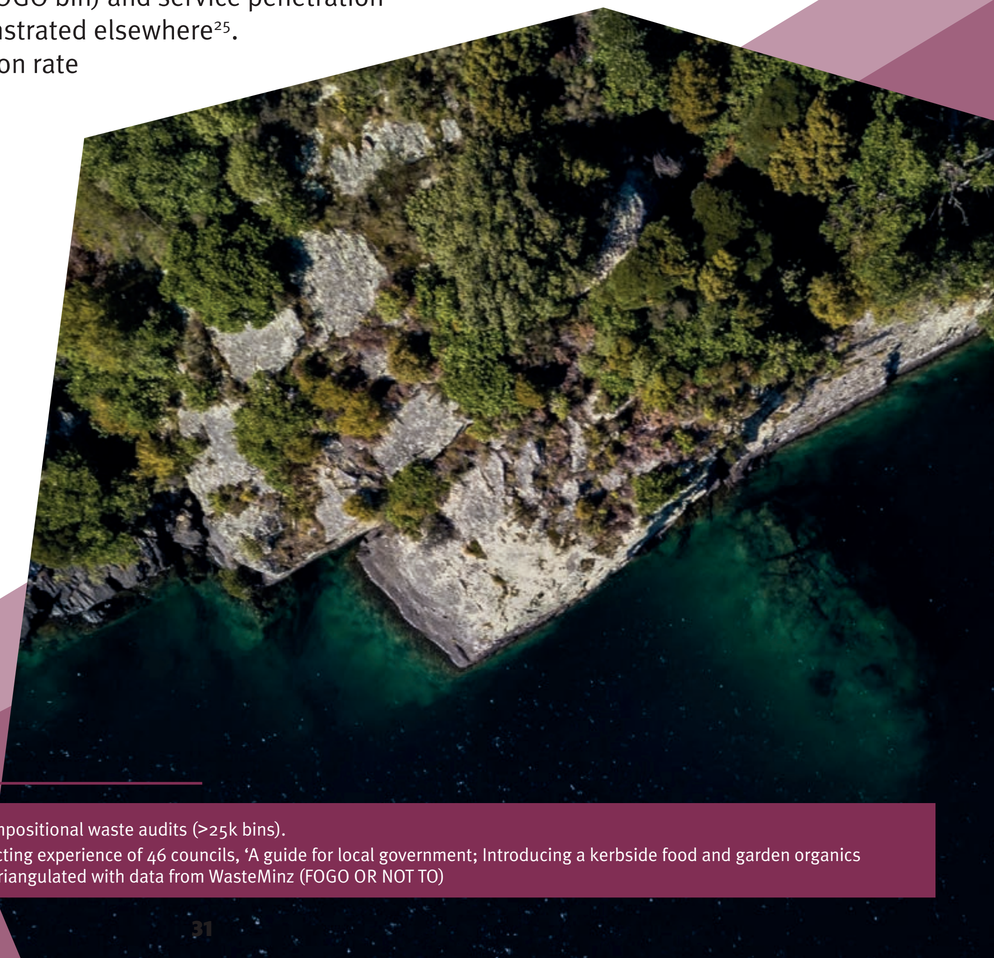
The organics waste stream for MSW in South East Queensland is shaped by six factors, which are explored in more detail in the sections that follow:

- Recovery of organics from the kerbside general waste stream represents the single biggest opportunity to move the needle on State landfill targets
- Source-separation of organics materials provides the strongest alignment with the waste hierarchy
- There is significant scope to learn from other Councils outside SEQ who are ahead on the organics collection journey
- All options for organics recovery will cost Councils more than sending the same waste to landfill, even assuming rebate removed
- In-vessel composting is the most likely processing technology to be suitable, and has the benefit of efficient scale achieved at low throughput
- Secondary markets for compost in SEQ are likely large enough to absorb new supply over time, and would benefit from market development support as FOGO schemes are rolled out.

RECOVERY OF ORGANICS FROM THE KERBSIDE GENERAL WASTE STREAM REPRESENTS THE SINGLE BIGGEST OPPORTUNITY TO MOVE THE NEEDLE ON STATE LANDFILL TARGETS

Organic material makes up ~50% of material collected in kerbside general waste bins in SEQ; this is split between food organics (29%) and garden organics (21%). As set out in Exhibit 15 (above), this is equivalent to 443ktpa, ~1.5 times more than the amount of organic material recovered through self-haul garden waste and existing kerbside garden organics services today[24].

With close reference to the experiences of other local Councils who have rolled out kerbside organics collection services, it's estimated that 178ktpa of the 406ktpa organic material collected in the general waste collection today could be captured through an organics collection service. This assumes SEQ is able to achieve benchmark capture rates (80% of garden organics, 40% of food organics based on a combined FOGO bin) and service penetration (80% of households) which have been demonstrated elsewhere[25]. This would translate to a MSW landfill diversion rate improvement of 11 percentage points versus what is achieved today.



24 DES local government waste survey, 18-19, 13 sets of SEQ compositional waste audits (>25k bins).

25 Based on suggested targets from Sustainability Victoria reflecting experience of 46 councils, 'A guide for local government; Introducing a kerbside food and garden organics service, Metropolitan Waste and Resource Recovery Group', triangulated with data from WasteMinz (FOGO OR NOT TO)

SOURCE-SEPARATION OF ORGANICS MATERIALS IS REQUIRED TO MOVE IN LINE WITH THE WASTE HIERARCHY

Organics recovery can be achieved in one of two ways:

- Source separation in the household, together with a kerbside organics collection service; this results in a 'clean' material stream which can be used to produce higher-order recycled products, for example composts and soil additives, or used to recover energy
- Sorting organic materials from the general waste stream, post collections; via technology such as a 'dirty MRF' or mechanical biological treatment (MBT). While technology in this space continues to improve, post-collection sorting results in a contaminated organics stream which is broadly considered only suitable for energy recovery or, in some locations, for use in landfill/land reclamation.[26]

It is worth noting that the benefits of post-collections separation are not insignificant – it involves a much lower collections cost, by avoiding the need for collection of a separate waste stream, and it also imposes less behaviour change demands on households, who can continue to mix their organic and inorganic waste. These benefits are offset by the lower amount of material that can be diverted from landfill due to contamination, and the inability to generate a higher-use end product for organic waste, again caused by contamination.

Queensland's Waste Management and Resource Recovery Strategy articulates a vision for a more circular economy, guided by the core principle of the waste and resource management hierarchy. It states: 'the options of fuel production, energy production or disposal should be reserved for residual waste that is unsuitable for higher order options'. Here, composting of organic materials is considered a higher order option, on par with recycling.

Adherence to this underpinning philosophy is evident in the policy direction taken by other Australian jurisdictions, for example;

- Western Australia has an explicit target to move to FOGO, as articulated in their headline strategy 'Deliver a harmonised kerbside collection system, which includes FOGO, in the Perth and Peel regions by 2025'[27]
- Victoria has an explicit organics recovery target for '100% of households have access to a separate food and organics recovery service or local composting by 2030'[28]

This also aligns with the position adopted by the EU, as outlined in its guidance notes to the Waste Framework Directive[29], with downstream sorting of organic waste encouraged only where it is not technically, environmentally or economically feasible to implement upstream sorting (the 'TEEP' provision).

WITH THESE CONSIDERATIONS IN MIND, FURTHER DEVELOPMENT OF THE PLAN FOR SEQ FOCUSES ON SOURCE SEPARATION OF ORGANIC MATERIALS.

There is significant scope to learn from other Councils outside SEQ who are ahead on the organics collection journey

With a more progressed rollout of organics collections services in many jurisdictions in Australia, there is a wealth of available knowledge on how to design and implement effective and successful organics collection services. The most in-depth of these is a guide developed by the Metropolitan Waste and Resource Recovery Group[30], which draws recommendations based on contributions from 46 participating Councils who have rolled out FOGO schemes, Swinburne University, and independent social research on community attitudes.

In this section, the recommendations set out in this guide and several others[31] are summarised for core service design choices, along with actions to mitigate risks to performance and uptake.

Organics collection service design choices

Table 2, below summarises core design choices for organics collection services and the recommended option, based on the experience of other Councils in Australia.

Table 2

Design Choice	Options; (with recommended option in bold)	Rationale
Types of food waste allowed in the bin	**All food waste including meat, bones, dairy, plate scrapings and fruit and vegetable scraps** All food (as above) and pet wastes Fruit and vegetable scraps only (no bones, meat or dairy)	Higher diversion rates achieved Research has shown there is no difference in odour levels between garden organics bins containing food scraps and residual waste bins containing food scraps. Proteins are also one of the bigger cause of issues in landfill, in terms of biological hazards in leachate and vermin
Rollout	**Compulsory/Universal, limited opt-out Universal with opt-out** Universal with opt-out or limited exclusions Voluntary	Higher diversion rates, lower cost per household, and more straight forward for Councils to administer
Collection frequency	**Weekly, with general waste fortnightly** Weekly, with no change to general waste Fortnightly, with no change to general waste	Responds to concerns about restricted garbage bin capacity and unsorted waste rotting in a FOGO bin for two weeks Fortnightly general waste collection keeps costs down
Provision of kitchen caddies and compostable bags/liners	**Supplied on opt-in basis and delivered** Supplied and delivered to every resident Supplied and can be collected at Council Not provided	Most Councils with a FOGO service have found that the highest levels of on-going participation and food diversion are achieved by providing a kitchen 'caddy' (a small tub with a handle that can be kept in food preparation areas for food scraps collection) and/or compostable bags/bin liners

30 A guide for local government; Introducing a kerbside food and garden organics service, Metropolitan Waste and Resource Recovery Group
31 Valuing our Food Waste, Green Industries SA; Inquiry into Recycling and Waste Management, Parliament of Victoria;

ACTIONS TO MITIGATE RISKS TO PERFORMANCE AND UPTAKE

There are three core challenges identified in rolling out a kerbside organics collection service, and actions to overcome each are described in this section:

- The change in behaviour needed
- Additional volumes of garden materials that can be placed in organic waste bins and
- Contamination issues.

To address the change in behaviour needed, three actions are identified:

- Messages about 'how to FOGO' need to be simple and consistent
- People need sustained (multi-year) education and communication, tailored for target groups (e.g. students, non-residents, tourists, people from culturally and linguistically diverse backgrounds)
- Bin lid colours that meet the Australian Standard, AS 4123.7 (dark green bins with light green lid for FOGO/GO) make it easier for people to know what to put in which bin and enable cross-Council communication efforts.

Municipalities deploying FOGO find that the convenience of a new green bin increases the amount of garden waste householders dispose of, increasing volumes that need to be collected. This impact can be mitigated through actions such as encouraging residents to home-compost, rolling out food waste reduction programs (e.g. Love Food, Hate Waste) or promoting low waste gardening practices.

Contamination of FOGO with metal, plastics or glass creates treatment difficulties. Three actions successfully combat FOGO contamination. Using a collections contractor that has systems in place for detecting contamination and linking contaminant to source locations (e.g. on-vehicle cameras and GPS systems can be used to pinpoint sources of contamination) allows contaminating households to be actively managed. Identifying sources of contamination enables compliance programs that remind residents found with contaminated bins to keep materials clean. These measures are supported by engaging a FOGO processing contractor with systems and equipment in place to manage contamination.

ALL OPTIONS FOR ORGANICS RECOVERY WILL COST COUNCILS MORE THAN SENDING THE SAME WASTE TO LANDFILL, EVEN ASSUMING REBATE REMOVED

In order to develop a recommendation on the 2030 target state organics collection service in SEQ, a model was developed to calculate costs and benefits from different options. This model considers the incremental cost, relative to current costs, of different organics collection service options at a non-rebated $95 levy price point.

The outputs from this model are presented in Exhibit 15, below. Major assumptions to develop the model are summarised in Appendix 1; these inform

- Tonnage of material diverted, considering service penetration, sorting behaviour, impacts on self-haul behaviour and additional garden organics tonnes 'created' by supplying bins
- System cost, considering additional collections costs driven by collections frequency, cost per bin lift, mix of processing technologies used and the gate rate to use them, and cost savings in general waste collections from landfill costs and levy saved, reduced general waste collection frequency and reduced general waste bin yield.

Exhibit 15[32]

Costs and benefits of options for SEQ organics collection, based on 18'-19' baseline

Option	Diversion rate impact (pp)	Incremental cost versus today with $95 non-rebated levy ($m pa)	Incremental cost per household ($/hh pa)	Incremental cost per incremental tonne of landfill avoided ($/t)
(1) Expand GO only; general waste frequency unchanged	5%	19-33	17 - 30	197 - 339
(2) Retire GO, introduce FO; general waste frequency unchanged	7%	64-109	59 - 100	525 - 894
(3A) Expand to FOGO; general waste frequency unchanged	10%	74-139	68 - 127	417 - 780
(3B) Expand to FOGO; general waste frequency reduced to fortnightly	10%	38-85	35 - 78	215 - 477
(4) Expand GO and introduce FO; general waste frequency unchanged	12%	86-141	78 - 130	392 - 647

Modelling suggested that the optimal organics collection option for SEQ is option **3B: Expand to FOGO; general waste** reduce to fortnightly. This option delivers the second highest diversion rate at the second lowest incremental cost.

IN-VESSEL COMPOSTING IS THE MOST LIKELY PROCESSING TECHNOLOGY TO BE SUITABLE, WITH THE BENEFIT OF EFFICIENT SCALE ACHIEVE AT LOW THROUGHPUT

Four technologies are available for the processing of organic materials: mulch, open windrow composting, in vessel composting and anaerobic digestion. Each have application for different kinds of organic material, costs and trade-offs discussed further in this section.

Exhibit 16 illustrates the differences in materials that can be processed, capital cost per tonne of material processed per annum, and range of gate fees per tonne processed, between the technologies. Of the technologies available mulch is only suitable for garden organics, and open windrow composting introduces significant odour issues if used to process food waste.

Exhibit 16[33]

Comparison of processing costs of organics waste treatment

	Product	Suitable organic material	Capital cost $/tonne	Gate fee $/tonne
Mulch	Mulch	Garden organics	20-30	10-30
Open windrow composting	Compost	Garden organics FOGO[1]	100-140	50-100
In-vessel compost	Compost	Garden organics FOGO Food organics	250-320	90-200
Anaerobic digestion	Biogas (high methane content) and nutrient rich digestate	FOGO Food organics	225-500	100-250

32 DES local government waste survey. Queensland Waste Transport Economics report (ARCADIS), Economic opportunities for the Queensland waste industry: final report (QTC), data directly from Sustainability Victoria, FOGO OR NOT TO (wasteMINZ), expert interviews. See appendix 1 for detailed assumptions

33 Guide to Biological Recovery of Organic (Sustainability Victoria), data directly from Sustainability Victoria, FOGO OR NOT TO (wasteMINZ), Queensland Waste Transport Economics report (ARCADIS), Economic opportunities for the Queensland waste industry: final report (QTC)

Considerations in addition to cost and suitable organic material are also present. Mulch is a lower value use that requires a large land area. Open windrow composting also requires a large land area, and can create significant odour issues where there are surrounding residents. Where forced aeration is used in vessel composting can be energy intensive. Anaerobic digestion (AD) is sensitive to feedstock mix and there is limited experience in treating household waste with AD in Australia.

With these factors considered, in-vessel composting (IVC) is anticipated to be the most likely processing choice in SEQ, and hence economic considerations of this technology are explored further, below. It is noted that in practice, it is anticipated that the market will choose the lowest cost processing technology that can meet the standards and requirements set by Councils, rather than Councils dictating technology. Nevertheless, for long-term planning processes its helpful to begin to understand what the future infrastructure footprint could look like.

In terms of infrastructure footprint, IVC technology has a number of features which make local, smaller scale solutions preferable:

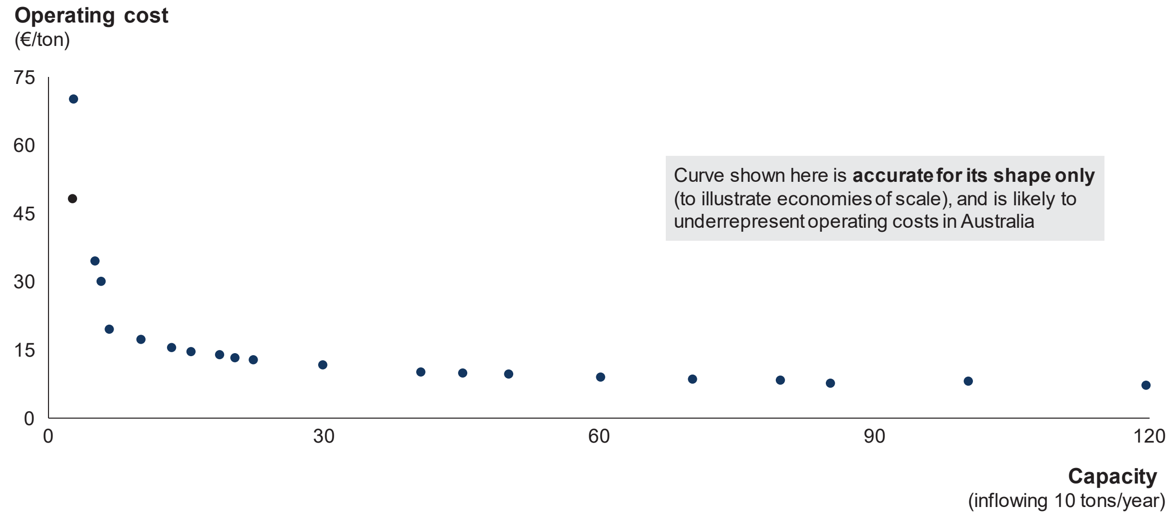
- Available evidence suggests that IVC facilities cease accruing substantial economies of scale per tonne of waste processed after they reach ~20-30ktpa throughput per year, as illustrated in Exhibit 17
- Capex costs are comparatively low, with one facility costing 20 – 40 m[34] to construct

These two features together allow for multiple small scale facilities which minimise transport and collections cost, which is by far the largest cost component for waste services. Based on forward estimates of FOGO volumes, at a size threshold of 20ktpa, all Councils would be able to partner with one other Council to achieve the minimum scale. In practice, this equates to eight to 13 IVC facilities by 2030, depending on organics collections recovery performance.

34 Based on single shift capacity of ~60ktpa

Exhibit 17[35]

Operating costs of European in vessel composting facilities



SECONDARY MARKETS FOR COMPOST IN SEQ ARE LIKELY LARGE ENOUGH TO ABSORB NEW SUPPLY OVER TIME, AND WOULD BENEFIT FROM MARKET DEVELOPMENT SUPPORT AS FOGO SCHEMES ARE ROLLED OUT

This section addresses two factors relevant for secondary markets for FOGO-derived compost in SEQ; how large the market is today, relative to new supply which would be introduced, and actions Councils can take to support stable and efficient market development.

Best estimates of the total size of the organic reprocessing market in SEQ today is ~990ktpa, of which manufactured soil (554ktpa) and soil conditioner (175ktpa) are feasible segments in which FOGO-generated compost products could be sold[36]. By way of comparison of scale, conversion of total SEQ forecast collected FOGO into compost would generate ~45ktpa of new supply into the market, assuming a 30% conversion rate[37]. Whilst significant, with these relative quantities in mind, it is reasonable to expect that local markets could absorb the new supply over time.

There are a number of actions Councils can take to support stable and efficient secondary markets for compost:

- Provide a purchase guarantee for part of the product stream for landscaping of public spaces such as parks and playing fields, and encourage other government actors to buy product (e.g. schools)
- Developing stronger quality specifications to support buyer confidence, for example by requiring outputs are compliant with AS4454 for composts, soil conditioners and mulches
- Proactively monitor developments in legislation and standards for PFAS/PFOS, microplastics or other contaminants, and work with processing operators to manage issues, where required.

Specifically, in relation to contamination, PFAS/PFOS and microplastics are known contaminants that may occur in materials produced from food and garden organic materials. These materials have been subject to detailed risk assessment in Europe and by the NSW EPA[38,39].

The risk assessments identify circumstances where contaminants may be of concern and where contaminants may concentrate within the environment. Materials sourced from biosolids (sewage) and waste streams with high levels of contaminants, such as contaminated land or abattoir waste, can be a source.

By contrast, compost produced solely from food organics and garden organics has not been found to have levels of PFAS of concern. In the absence of standards or regulation, PFAS appears not to be a concern in FOGO derived compost, provided it is not made on contaminated soil and is used for non-food producing purposes. Continuing to monitor this space will remain important, as knowledge and waste streams continue to evolve.

35 Konstantinia Tsilemou, Approximate cost functions for solid waste treatment facilities, 2006, expert interviews
36 DES annual survey data, NSW EPA, NSW Organics Market Analysis Feb 2020, Growing markets for quality organics products
37 Mass balance in different types of composting facility, Zhang and Matsuto, Oct 2010
38 Digestate and compost as fertilisers: Risk assessment and risk management options, Final Report, European Commission 2019
39 https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/recycling/mixed-waste-technical-committee-report.pdf

B) IMPLICATIONS

Organics recovery in SEQ is a 'must do' given it provides the single biggest lever on landfill diversion, has significant greenhouse gas benefits and creates jobs.

However, the establishment of a dedicated organics waste stream will create a true incremental cost burden, over and above levy price path – which means that it is critical to choose efficient/ lower cost solutions and to resolve 'who pays'. Councils will need to decide whether to pass on costs to rate payers, absorb additional costs, seek levy funding, or a combination of all three.

Councils will need to pull every lever they can to help rate payers make the big shift to FOGO, with a great deal of benefit from collaboration on behaviour change, for example through a single SEQ set of FOGO rules. Thoughtful Council interventions and planning can help with smoothing the path to an efficient and stable compost market.

C) OPTIONS CONSIDERED

This section sets out the key decision areas relevant to the organics waste stream, and the options considered in each decision area. A summary of this is provided in Exhibit 18 below, with further detail on each of the key decision areas provided in the text that follows.

Exhibit 18

OPTIONS CONSIDERED; COMINGLED WASTE STREAM, TARGET 2030 END STATE

Majority Target End State (shown in bold)

Decision area	Options					Rationale
Priority of focus on organics waste stream	Not a priority focus	**priority focus**				Biggest lever available for landfill diversion; biggest impact on greenhouse gas emissions; favourable secondary market conditions
Point of organics separation (source/ downstream)	Downstream separation (by MRF)	**Upstream separation (by household)**				Best alignment with Waste Hierarchy; dominant model emerging locally and globally
Waste stream composition	Garden organics only	Food organics only	All garden organics and some food organics	**All food and garden organics**		Enables greatest diversion impact; most efficient cost per diverted tonne; evidence from Victoria that this is the best model for household compliance.
Collections frequency	Weekly organics, weekly general waste	**Weekly organics, fortnightly general waste**				Most cost effective for rate payers; bin composition data suggests residual waste volumes should be too low for weekly collection once organics & recycling diversion optimised
Mandatory or optional	Opt in	Opt out	**Mandatory**			Biggest diversion impact; strong precedent in SA, WA, Vic; may transition to this over time
Processing technology	**Mulch**	**Open Windrow**	**In vessel composting**	Anaerobic Digestion	Emerging technologies	Allowing the market to decide will provide most cost effective solution, likely to be a mix of technologies: AD not well suited to GO stream; open windrow not appropriate in urban areas
Infrastructure ownership	Private (market) ownership	Council owned, privately operated	Council owned and operated			Not assessed –decision for future consideration
Regional coverage	Full coverage	**Very low population density areas excluded**				Extra pollution from collections transport could outweigh environmental benefits in low density areas; opportunity in these areas to focus on home composting/carbon capture
Posture on secondary markets	Limited intervention	**Moderate level of support and intervention**	High level of support & intervention			Existing secondary markets are large so should not require too much intervention; key is to ensure standards are clear & consistently met; State/ councils could also guarantee demand
Approach to behavior change	Limited focus	Priority focus –at individual council level	**Priority focus – leveraging COMSEQ scale (consistent)**			Transition is hard for households; evidence suggests sustained and targeted education programs required + provision of enabling infrastructure

PRIORITY OF FOCUS ON ORGANICS WASTE STREAM

Bin audit information suggests that currently, up to 50% of general kerbside waste collected is organic waste. Organic waste is one of the biggest drivers of greenhouse gas emissions from landfill, but can be converted into a re-usable product (e.g. mulch or compost) for which there is likely secondary market demand in SEQ.

For these reasons, at the aggregate CoMSEQ level this waste stream is considered a high priority for its potential to contribute both to landfill reduction, emissions reduction and job creation/ economic development. It is noted for very low population density areas this is not a priority, as the relative cost and emissions from additional collections can outweigh the benefits of diversion. In these areas, the focus may be better placed on optimised landfill methane capture instead.

POINT OF ORGANICS SEPARATION

A fundamental design choice is required as to whether separation of organic waste is undertaken upstream (at the household level), or downstream (through dedicated sorting infrastructure such a 'dirty MRF' or mechanical biological treatment (MBT)). Although technology for downstream processing is advanced, upstream sorting by households is more closely aligned with the principles of the Waste Hierarchy. Without upstream sorting, contamination of organics from other materials in general waste limits the type of application to energy recovery, as opposed to higher order recycling into mulch and compost products.

For these reasons the option of upstream sorting is selected.

WASTE STREAM COMPOSITION

As described in Exhibit 18, there are multiple options for the composition of a kerbside organic waste stream: from garden organics only, to food organics only, or to a combination of garden and some food organics (for example, excluding proteins), or incorporating all garden and food organics.

The choice of waste stream composition impacts on processing choices available. Mulching, which is a very cheap form of processing, is suitable only for garden organics. Anaerobic digestion is effective for food organics, but does not cope well with a high share of fibrous garden matter. Composting (open windrow, or in-vessel), is appropriate for combination of food and garden matter, but open windrow composting can have extreme odour management issues.

These choices have been explored at length in other jurisdictions, and evidence suggests that the optimal end-state composition is a waste stream comprised of all food and all garden organics. This achieves the best trade-offs across landfill diversion rates, costs to provide the service, and household acceptance/compliance.

For these reasons the option of 'all food and garden organics' is selected.

COLLECTIONS FREQUENCY

Many Councils currently have an opt-in organics bin that accepts garden waste only and is collected fortnightly. As this shifts to an organics bin that also accepts food waste, a decision is required as to whether fortnightly collection is still appropriate. Particularly in the South East Queensland climate, it is widely accepted that organic food waste needs to be collected weekly. Additionally, given that organic waste currently makes up to 50% of the matter in general waste bins, there is opportunity to consider whether general waste bins will still contain sufficient volume to justify weekly collection after the introduction of a food organics service.

Analysis of waste stream quantity and system costs suggests that shifting to a weekly organics collection and fortnightly general waste collection would provide the most cost effective outcome together with meaningful progress towards target diversion rates, and therefore be a desirable end state. However, it is acknowledged that this would represent a significant shift for households, and might be a transition that takes time. The specific South East Queensland climate conditions also need to be taken into account, acknowledging that some organic matter will likely always remain in the general waste bin, causing some odour issues in the case of fortnightly collections.

Across Australia, there is no single consistent approach emerging. Councils in NSW take a range of approaches to general waste bin collection, with some continuing to collect weekly and others moving to a fortnightly collection. South Australia has introduced legislative requirements ensuring weekly general waste bin collection. Western Australian Councils trialling FOGO are encouraged to collect general waste bin contents fortnightly instead of weekly.

Accordingly, across the options considered in Exhibit 18, the 2030 target end state option selected is FOGO collection weekly and general waste collection on a fortnightly, while acknowledging that trials/pilots will likely be critical to shape the transition path and ultimately inform the 2030 target state.

MANDATORY OR OPTIONAL?

To date, most Councils that operate an organics kerbside collection service do so on an ‘opt in’ basis. This has enabled a user-pays approach, and results in lower rates of contamination. With a view towards the landfill diversion objectives set by the State, it is clear that more widespread adoption will be required.

While there may be a significant period of transition, it is recommended that the 2030 target state for CoMSEQ is for mandatory roll-out of organic waste kerbside collection, rather than opt in or opt out systems.

PROCESSING TECHNOLOGY

As defined in Exhibit 18, there are currently four types of organic processing that are widely employed (mulch, open windrow or in-vessel composting, and anaerobic digestion). Both forms of composting are suitable for combined food/garden waste streams, while mulch is appropriate only for garden organics, and anaerobic digestion is best suited to food waste streams only, and performs better when MSW food waste is combined with a more consistent feedstock from C&I sources.

Importantly, the efficient operating scale for mulching and composting is relatively small, meaning that there is scope for each Council to pursue its own choice of solution either alone, or in conjunction with a single other Council. While the market can therefore be allowed to decide on the technology solution, it is anticipated that in-vessel composting is likely to be the dominant processing technology that emerges.

INFRASTRUCTURE OWNERSHIP

Given that Councils will be a dominant (potentially sole) supplier to organic waste processing facilities, the potential exists to explore an ownership or insourcing model for processing facilities, leveraging the potentially lower cost of capital available to Councils, and eliminating third-party margin, to reduce the total system cost to ratepayers. The attractiveness of this option versus market alternatives has not been considered in depth but would require consideration as part of the detailed business case development.

REGIONAL COVERAGE

As described above, in very low population density areas the additional costs and emissions involved in introducing an additional round of bin collections could offset the environmental benefits achieved. In such areas, a better approach may be to encourage higher adoption of home composting, and investment in optimised landfill methane gas capture technologies to achieve the best mix of environmental and economic outcomes.

POSTURE ON SECONDARY MARKETS

Given the size of the compost market in South East Queensland, relative to the scale of compost that would be produced from the CoMSEQ organics waste stream, it is anticipated that market demand for the product produced is unlikely to be a problem. Accordingly, creation of secondary markets for composted materials may not need to be a significant priority for CoMSEQ (in contrast to the comingled recycling stream, where secondary market stimulation is critical).

One area where collaboration and effort may be required is in setting and monitoring against standards of compost produced, ensuring that there are no issues relating to contamination (e.g. PFAS or microplastics). It is anticipated as a minimum that the compost produced would be recommended for use only for non-food producing purposes. Other standards may also need to be adopted, in close collaboration with the State.

APPROACH TO BEHAVIOUR CHANGE

Evidence suggests that the introduction of a combined food and organics kerbside collection service represents a significant shift for households, who need to starting sorting their waste 'in the kitchen'. This process takes time, sustained and culturally adapted/targeted education and nudges, and tactical support, such as the provision of kitchen caddies, and compostable bin bags. Work with industry is also important – for example, ideas have been raised around collaboration with major retailers like Woolworths and Coles to shift to compostable fruit and vegetable bags in store, which is believed will make a significant impact on contamination rates.

D) RECOMMENDATIONS

With the above taken into account, there are five recommendations on Organics:

1. Rollout evidence-based behaviour change campaigns to both reduce food waste and enable use of GO/FOGO bins, seeking to keep consistent message and branding but with scope to tailor for local context

2. Collaborate to support stable and efficient markets for compost

   - Ensure high quality outputs (i.e. set standards, but don't dictate technology) and require appropriate monitoring program for PFAS, microplastics and other potential contaminants in line with State regulations
   - Support local operators by buying recycled mulch/compost products, and encourage other government agencies to buy product (e.g. transport)

3. Collaborate with the State to work with private sector (e.g. NRA, Coles, Woolworths) to adopt product stewardship changes to improve organics recovery (i.e. compostable veggie bags default in supermarkets)

4. Move towards a consistent organics recovery bin system by 2030, in a way that is coordinated and provides flexibility in timing and transition pathway

   - Align on definition of FOGO 2030 target state in SEQ, ultimately with FOGO collection weekly, general waste weekly or fortnightly, and inclusion of all plant and food waste
   - Move towards 2030 target state either directly from current state or first by rolling out a GO service or GO+ service
   - Make the transition as fast as reasonably practicable; 1-2 frontrunner Councils will pilot and roll out within next 12 months, other Councils follow
   - Systematically share lessons learned from frontrunners and pilots to enable ongoing optimisation of approach

Caveats

Very low population density will reduce economic feasibility and environmental benefits. Councils, or select areas (rural or island) within Councils may choose not to offer a FOGO service

One Council has a preference to explore alternative/emerging technologies that may require organics remaining in the general waste bin

5. Collaborate to procure market-led solutions for organics processing services at an efficient scale, located to minimise transport costs

   - If the market nominates IVC technology as the lowest cost solution, Councils should collaborate with 1-2 neighbours for facilities > 20ktpa in scale; this implies ~8-13 facilities for SEQ by 2030
   - As part of business case development, consider ownership structure for infrastructure, including option for Council ownership

E) 2030 PROJECTED OUTCOMES FROM ORGANICS RECOMMENDATIONS

Projected outcomes from organics recommendations are summarised in Table 3, below;

Table 3: 2030 Projected outcomes from organics recommendations

Outcome area	Estimated 2030 impact	Notes on method and inclusions
Landfill diversion rate impact	11% improvement versus 2018-19 baseline	Expert interviews and Australian analysis
Economic development outcomes	220 permanent jobs created 300-400 jobs during construction	Estimate of capital jobs created using Queensland Treasury standard multipliers
System operating cost	$50 – $110 m pa increase in system operating cost	Expert interviews and Australian analysis
Up front, one off transition costs	$185 – $240 m	Hypothecation of global cost estimates to Australia

6. Residual

'General waste' refers to materials which are placed in the general waste kerbside bin. A proportion of this waste is termed 'residual'; this is the portion of waste for which recovery through the comingled recycling stream or organics stream is not possible.

This chapter steps through the facts, considerations and implications which shape the recommended actions for CoMSEQ to move towards the 2030 target state for residual waste. Each of these is discussed in turn:

a) An overview of the waste stream dynamics

b) Assessment of implications for CoMSEQ Councils

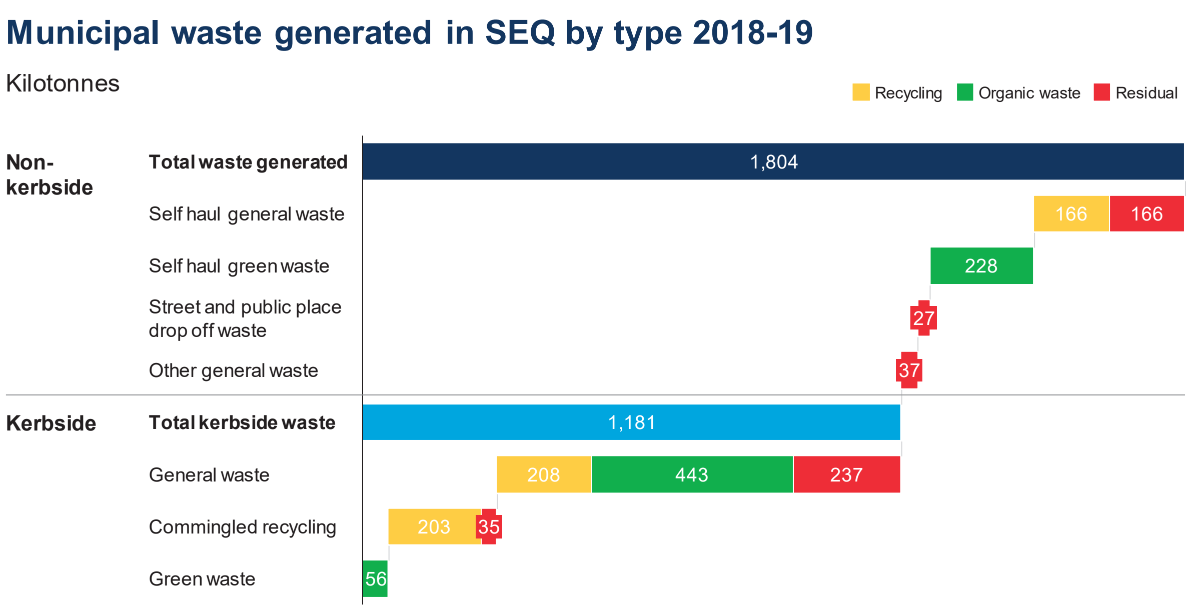
c) Options considered

d) Recommendations to move towards a 2030 target state

e) Impacts of recommendations on progress compared to State targets, economic development outcomes and operating economics.

Exhibit 19 shows the size of the general waste stream for SEQ Councils together, and its component parts based on compositional data. 'Residual' waste is shown in red.

Exhibit 19[40]



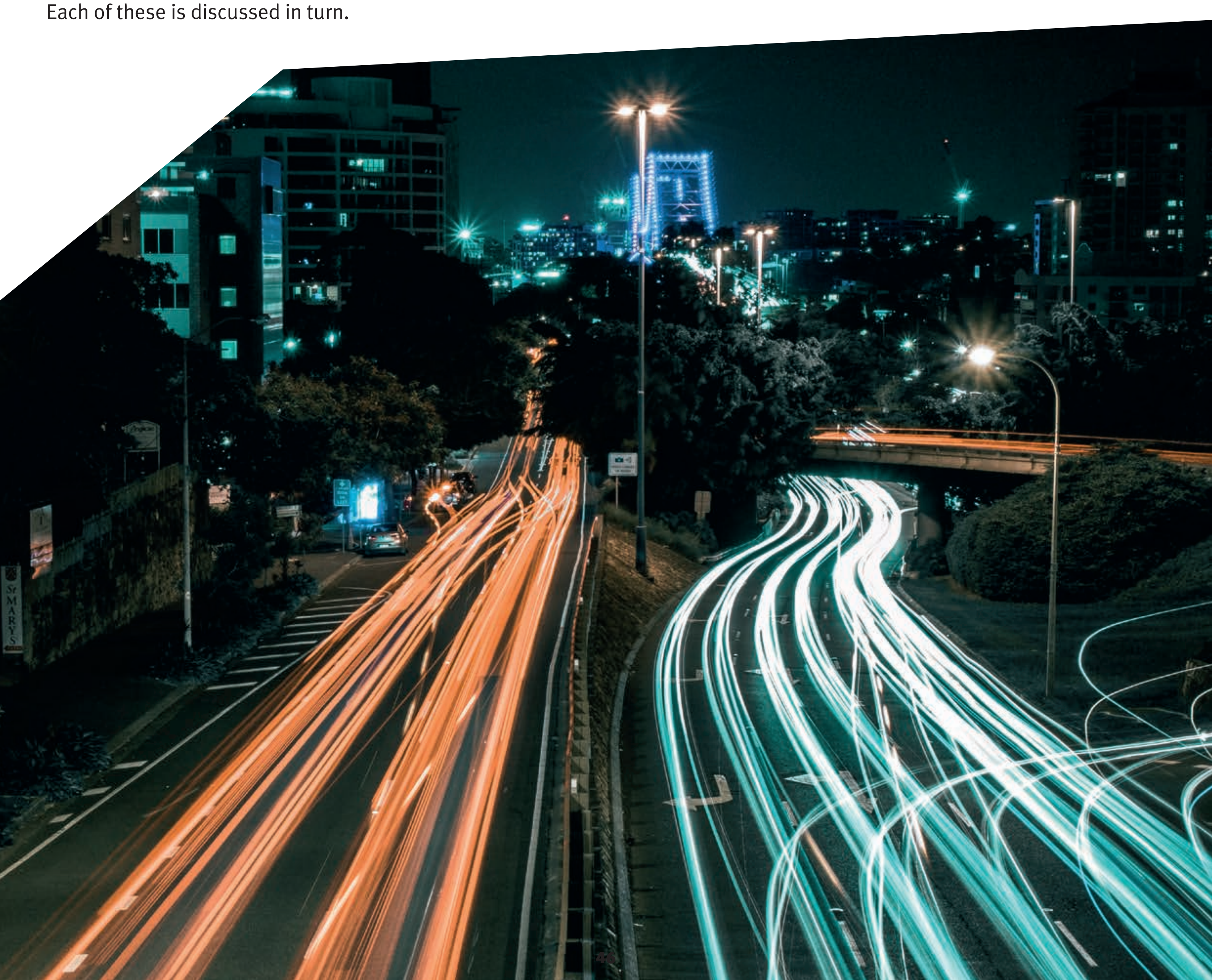
40 DES Local Government Waste Survey 18-19, 13 sets of SEQ compositional waste audits (>25k bins). The data used in this chart is subject to several data limitations including survey methodology (self-reported by councils), sub-optimal equipment (no weighbridges) in some locations, and variable methods and definitions in measuring waste. Composition of self-haul waste (recycling and residual materials) is not clear in DES data, shown here notionally as 50/50 split.

A) OVERVIEW OF RESIDUAL WASTE STREAM DYNAMICS

The residual waste stream for MSW in South East Queensland is shaped by seven factors, which are explored in more detail in the sections that follow:

- The Queensland Waste Management and Resource Recovery Strategy envisages a rapid ramp up in higher-order residual waste processing such as Thermal EfW, but also compliance with waste hierarchy principles that discourages thermal treatment of waste that is recyclable or compostable
- Landfill capacity in SEQ is not constrained, providing time and optionality for consideration of how residual waste is best handled
- If higher-order processing facilities are to be developed in the next 5-10 years, Thermal EfW is most likely candidate of the technology options available and in development
- There is strong policy support for EfW across Australia, although with some outliers, and some community concerns on social license
- The environmental, cost and economic development case for Thermal EfW is not clear cut
- Deal structures for EfW infrastructure are complex and have long lead times
- The scale of processing capacity required in South East Queensland to achieve the targets set by the Queensland Waste Management and Resource Recovery Strategy, for the combined MSW and C&I waste streams is 1 million tonnes by 2030 and 1.7 million tonnes by 2050, indicating a requirements for ~4 facilities by 2030, and an additional 1-2 by 2050

Each of these is discussed in turn.



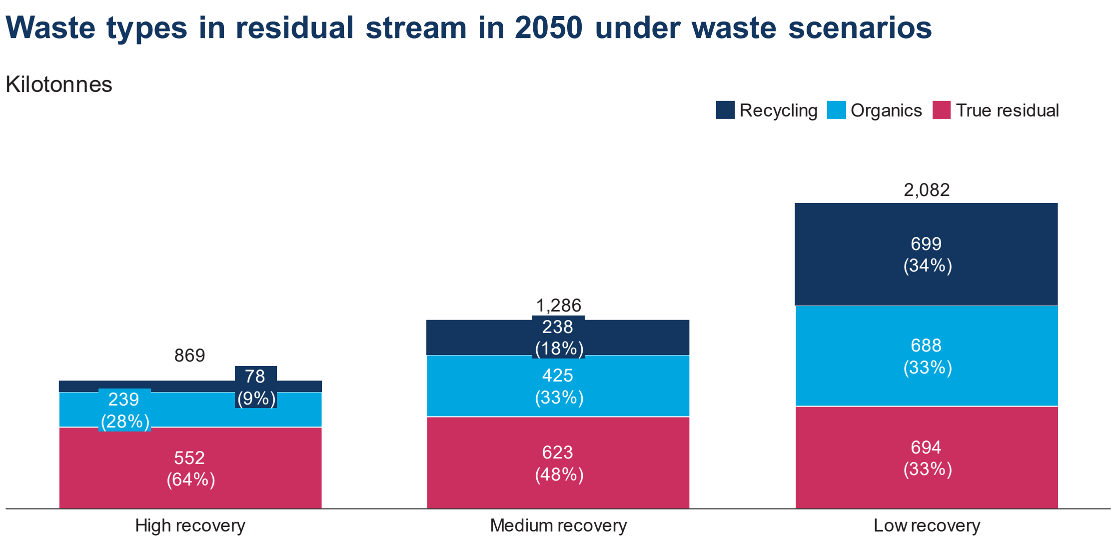
THE QUEENSLAND WASTE MANAGEMENT AND RESOURCE RECOVERY STRATEGY ENVISAGES A RAPID RAMP UP IN RESIDUAL WASTE TREATMENT, BUT ALSO COMPLIANCE WITH WASTE HIERARCHY PRINCIPLES

Higher-value treatment of residual is a key part of Queenland's Waste Management and Resource Recovery Strategy, with the target glide path suggesting that ~10% of residual should be processed by 2025, increasing to ~80% by 2050. Given this, it is clear that the State intends for residual processing to be a core part of Queensland's waste management system over the long term, in preference to landfill.

However, the Queensland Government Waste Management and Resource Recovery Strategy also endorses the globally recognised waste hierarchy, and intends that waste management systems are developed in accordance with this hierarchy. The waste hierarchy requires first that waste is avoided and reduced. If that is not possible then waste materials should be reused. If materials cannot be reused they should be recycled or composted. Residual material should have energy recovered, and finally if no other option is available residual may be disposed of. What this means from a practical perspective is that before a waste stream can be processed as residual waste, it needs to be a true residual waste stream, with all reasonable efforts undertaken to remove from it recyclable and organic content.

Exhibit 20 shows estimated percentage and tonnes of the municipal general waste stream by 2050 under three scenarios: 'high recovery', 'medium recovery' and 'low recovery (where recovery refers to recovery of recyclable and organics materials from the general waste stream). As this analysis shows, in a low recovery scenario, the volume of residual MSW waste in 2050 could up to 2.4 times higher than in a high recover scenario, and up to two thirds of the stream would be recyclable in nature. This indicates the criticality of optimising the residual waste stream before moving into residual processing, and certainly before making choices about the 2030 target state processing capacity required.

Exhibit 20[41]

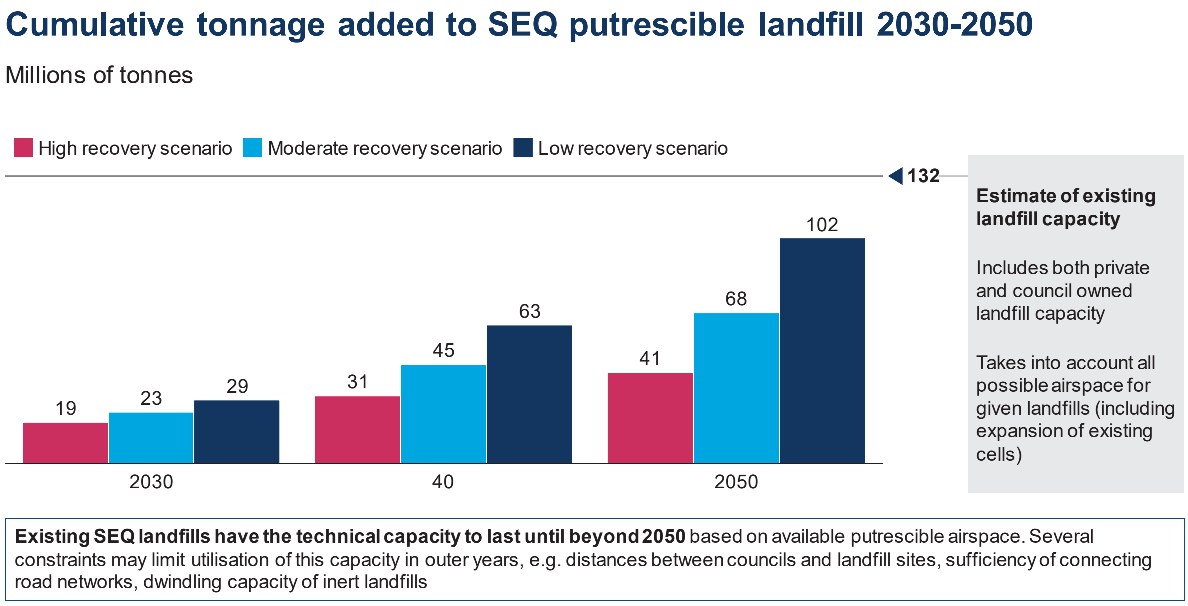


41 DES local government waste survey 18-19, infrastructure report consolidated data, individual data from councils. High recovery assumes: MSW generation per capita declines in line with state targets; C&I constant at 2019 levels, C&I recovery rate increases in line with state targets, the proportion of total recyclable material placed in recycling bin is uplifted to SA levels (72%) by 2030 and Victoria's level by 2050 (80%), Proportion of organic waste removed from the red bin is 40% of food, 80% of garden organics by 2030 with a FOGO bin penetration of 80%, ABS medium population growth. Medium recovery assumes MSW generation per capita declines 50% of the way to state targets; C&I constant at 2019 levels, C&I recovery rate Increases 50% of the way to state targets, the proportion of total recyclable material placed in recycling bin is uplifted to SA levels (72%) by 2035, constant thereafter, proportion of organic waste removed from the red bin is 40% of food, 80% of garden organics by 2030 with a FOGO bin penetration of 40%, ABS medium population growth. Low recovery assumes: MSW and C&I generation per capita remain constant at 2019 levels, C&I recovery rate remains at 2019 levels, the proportion of total recyclable material placed in recycling bin remains constant at current levels (~49%), no change versus today on organics recovery, ABS medium population growth

LANDFILL CAPACITY IN SEQ IS NOT CONSTRAINED, PROVIDING TIME AND OPTIONALITY

Unlike many cities globally, constrained landfill capacity is not a challenge SEQ currently faces at the aggregate level. This provides both time and optionality to explore other alternatives to landfill for managing residual. Exhibit 24 shows the estimated landfill capacity available in South East Queensland, indicating that even under a 'low recovery' scenario landfill is not a binding constraint for SEQ as a whole beyond 2050. While this is true at the aggregate level, it is not true for individual Councils – some Councils will reach capacity before 2050. These Councils will need to decide whether to move their waste to other private or government owned landfills across the SEQ region, or move the majority of the volume to higher order processing such as Thermal EfW.

Exhibit 21[42]



If residual processing facilities are developed in the next 5-10 years, Thermal EfW is most likely candidate of technology options available and in development

There are a range of energy generation technologies for the treatment of residual waste, at various states of commercialisation globally. The three technologies that are most developed are:

1. Incineration (non-constricted supply of oxygen, at least 850˚C)
2. Gasification (limited supply of oxygen, 650˚C)
3. Pyrolysis (absence of oxygen, heat treated at between 400 and 1000˚C).

Although anaerobic digestion (AD) is a classified as an 'energy-from-waste' technology, it is considered instead in the Organics section of this report, as it is a technology that applies to organic or biodegradable waste rather than residual waste[43].

The Table 4 below gives a comparison of key characteristics across each of the three energy-from-waste options, drawing on expert analysis conducted by Ranieri, L; Mossa, G.; Pellegrino, R; Digiesi, S. in 'Energy recovery from the organic fraction of municipal solid waste: A real options-based facility assessment. Sustainability 2018 and from Perrot, P; Subiantoro, A. in 'Municipal waste management strategy review and energy-from-waste potentials in New Zealand'. Sustainability 2018.

42 References as for exhibit 20
43 Ranieri, L; Mossa, G.; Pellegrino, R; Digiesi, S. Energy recovery from the organic fraction of municipal solid waste: A real options-based facility assessment. Sustainability 2018, 10, 368.

Table 4: Key metric comparison table[44]

	Incineration	Gasification	Pyrolysis
Air pollution	Most air pollution of options due to large oxygen supply in combustion process which produces largest amount of CO_2. This option also produces polluting metals, dioxins and toxic gases harmful for human and environment health. The levels of pollution have however decreased in the past few years due to stricter rules imposed by governments and technological advances.	Medium air pollution due to limited oxygen being used in process creating some CO_2	Best option for air pollution as no oxygen used in process therefore minimal CO_2 released
Cost	Least expensive to build of the three options as technology is proven and commercially viable	More expensive than incineration	Most expensive of the three options, in part because less proven at commercial scale
Side products	Metals, bottom ash (can be used in road bases)	Minimal side products (syngas along with minimal ash)	Largest amount of side products with potential commercial use (unconverted carbon, charcoal, ash, pyrolysis oil, syngas)
Capacity	1,500 ton/day	10-100 ton/day	10-100 ton/day
Maturity	Mature technology, many examples of commercial size plants throughout Europe.	Technology not proven in Australia for MSW, some commercial-scale examples internationally; less proven than incineration.	No at scale facilities in Australia; weakest track record globally for MSW at scale
Energy production efficiency	15-30%	30-40% (advanced gasification)	16-25%
Waste type	All types of residual waste effective as feedstock.	May be able to treat all types of residual waste but track record significantly limited. More susceptible to variations in composition than incineration. Biomass is an extremely suitable feedstock, but this cannibalises the waste hierarchy by not removing all organics for recycling	May be able to treat all types of residual waste but track record significantly limited. More susceptible to variations in composition than incineration. Biomass is an extremely suitable feedstock, but this cannibalises the waste hierarchy by not removing all organics for recycling

From the above assessment, and given momentum in Australia to date, thermal energy-from-waste technology (incineration) is the most likely candidate in SEQ given technology maturity, feedstock capacity constraints and current systems costs. However, future innovations in gasification, pyrolysis or other technologies should be monitored to ensure the solution aligns with relevant policies and objectives, and best available technology, at the time when investment decisions are made.

44 Perrot, P; Subiantoro, A. Municipal waste management strategy review and energy-from-waste potentials in New Zealand. Sustainability 2018.

THERE IS STRONG POLICY SUPPORT FOR THERMAL EFW ACROSS AUSTRALIA, ALTHOUGH WITH SOME CONCERNS ON SOCIAL LICENSE

Queensland, most other states, and the Commonwealth have policy positions that encourage Thermal EfW as an alternative to landfill of the residual waste fraction. However, there is notable opposition at local and federal level (IRATE, Greens), and recently ACT has legislated against use of incineration, gasification and pyrolysis on waste streams.

There are some areas of Queensland Government's position on Thermal EfW is still being developed, including consideration of:

- Will the waste hierarchy be enforced, and if so, how will waste composition standards be set?
- Will the bottom ash generated by incineration be subject to the landfill levy?
- Will government provide support for a robust bottom ash solution (e.g. through approved use in road base)?

THE ENVIRONMENTAL, COST AND ECONOMIC DEVELOPMENT CASE FOR HIGHER PROCESSING OF RESIDUAL WASTE IS NOT CLEAR CUT

The environmental case is generally considered favourable, with some uncertainty.

In general, the current mainstream view is that Thermal EfW is environmentally preferable to landfill. For example, a review[45] of 15 Thermal EfW Life Cycle Assessments (LCA) concluded that Thermal EfW is better than landfill from a greenhouse gas (GHG) perspective.

There is some uncertainty related to landfill sequestered carbon, with more recent LCAs suggesting that when taking into account carbon sequestration, landfill may be more GHG friendly. Available studies vary in the landfill gas capture methodology used as a baseline for comparison, which can substantially change estimated GHG emissions from landfill.

In recent Australian LCAs the point of comparison used for emissions from energy production has been black coal, rather than renewables such as wind or solar. Likewise the comparison level for gas capture from landfill has been 49.6%, which is the current Australian average, rather than the current or projected performance of sites where the waste would otherwise be sent. This is the basis on which recent LCAs have concluded that Thermal EfW delivers superior environmental outcomes.

In general, across the three dimensions in which Thermal EfW has historically outperformed landfill from an environmental perspective, there is significant potential that current underlying trends could shift this balance in the opposite direction, over the lifetime of the asset:

- Grid energy production is getting cleaner – as renewable energy becomes cheaper than coal, and Queensland works towards its 2050 zero emissions target
- Energy from residual waste stream will get less clean – with a higher fossil fuel composition and lower organic/biogenic composition, as papers and organics are pulled out of the residual stream in line with the Waste Hierarchy
- Landfill emissions will fall – as organics are pulled out of the residual stream, and landfill emissions capture improves.

45 Review of life-cycle environmental consequences of energy-from-waste solutions on the municipal solid waste management system, Journal of Resources, Conservation and Recycling 157 (2020); Estimation of global warming emissions in waste incineration and landfilling: An environmental forensic case study, Journal of Environmental Forensics (2019)

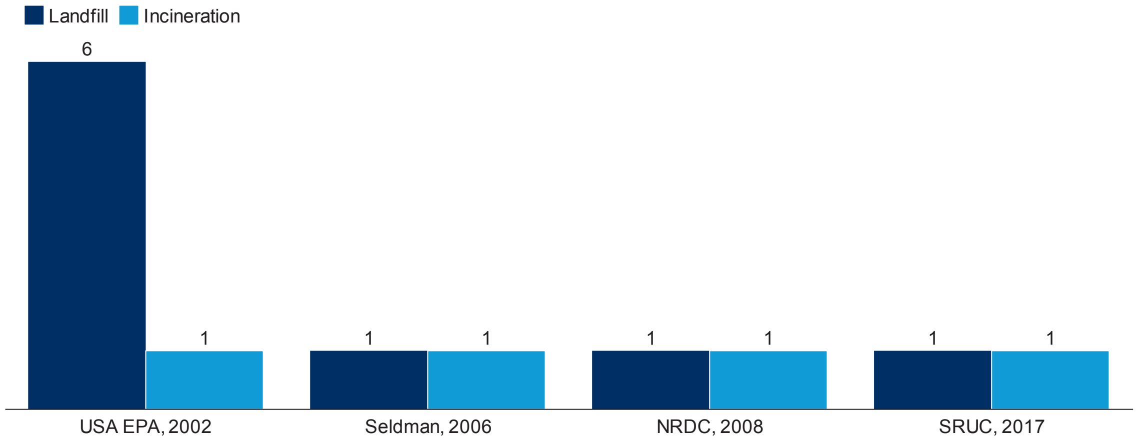
THE ECONOMIC DEVELOPMENT CASE IS LIKELY NEUTRAL

Direct permanent job creation from MSW incineration is likely similar to jobs lost from landfill. However, existing evidence is sparse, and dependent on the scale of facilities. Exhibit 22 compares permanent jobs generated from landfill with Thermal EfW facilities.

Exhibit 22[46]

Jobs per 10,000 tonnes of waste processed by available study

FTE



The job creation of the Kwinana energy-from-waste plant in Western Australia is in line with this evidence, and projected to be ~60 jobs (1.5-1.7 per 10,000 tonnes[1]) once fully operational

This analysis does not include temporary construction jobs, which will be substantial. The Queensland Government uses a 3.3x multiplier to estimate jobs created in capital construction, indicating an estimated 550 jobs created per year of construction of a $500 million energy-from-waste facility. For the Kwinana plant, construction jobs are estimated at least 800 over the three year construction period.

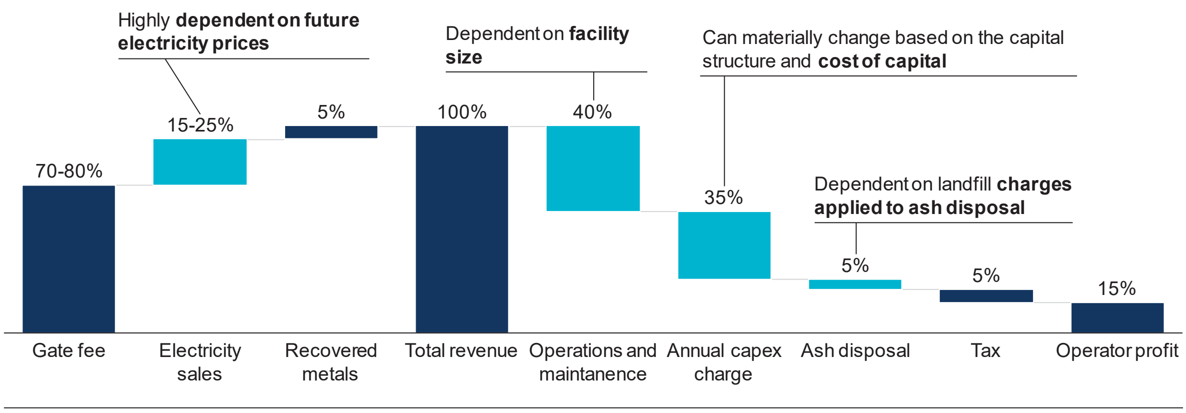
46 Campaigning Against Waste (USA EPA, 2002), Recycling Means Business, Institute for Local Reliance, Waste to Wealth Program (Seldman, 2006), More Jobs, Less Pollution: Growing the Recycling Economy in the U.S (NRDC, 2008), Evidence review of the potential wider impacts of climate change Mitigation options: Agriculture, forestry, land use and waste sectors (Scottish Government, SRUC, 2017); Construction of Kwinana energy-from-waste plant to create 800 jobs (press release, Government of Western Australia). 1. Based on 90-100% utilisation

GATE FEES ARE LIKELY COMPARABLE BETWEEN LANDFILL AND THERMAL EFW, ALTHOUGH THERE IS POTENTIAL FOR SIGNIFICANT SAVINGS IF COUNCILS BECOME ASSET OWNERS

Based on available data and a landfill levy of $95 (for 2025+), incineration gate fees are likely to be broadly similar to landfill, depending on key drivers of uncertainty in Queensland (ash disposal price, electricity prices, transport economics). Western Australia has incineration gate fees between $120-150/t with estimates for South East Queensland higher at $160-200/t – likely due in part to lower electricity prices in Queensland. This estimate is comparable to the $135-175/t estimate of gate fees for landfill post 2025 when landfill levies are $95/t. Exhibit 23 shows the elements of the gate fees for energy-from-waste facilities.

Exhibit 23[47]

Approximate Thermal EfW facility revenues and costs



Gate fees make up 70-80% of revenue for a thermal waste to energy plant and are the major revenue lever that operators can pull to impact profitability, especially if sources of uncertainty (electricity price, charges for ash disposal) adversely impact their economics

It is worth noting however that a significant portion of the cost of Thermal EfW is driven by the capital intensity of the process, and the need for the investor to generate a return that sufficiently covers the cost of capital. In addition, the potential return needs to sufficiently reflect the risk associated with the investment over its 30- year lifespan. If Councils were able to access a significantly lower cost of capital than commercial providers, and/or have a different risk profile (for example, by being substantially vertically integrated), Councils may be able to achieve a significantly lower effective gate rate, to an extent that may make Thermal EfW cheaper than the landfill alternative, and transforming it into a source of economic value creation for Councils and ratepayers. To bring this to life very simplistically, on a typical Thermal EfW facility capital investment of $650 million, every 1% differential in capital costs/profit margins that could be achieved by Councils would equate to a ~$16.25 reduction in operating cost per tonne.

Infrastructure deals are complex and have long lead times, but returns to asset owners can be significant

The large scale and capital cost of energy-from-waste facilities results from economies of scale that push plan sizes beyond 200ktpa. Exhibit 24 shows the cost curve and estimated capital expenditure required for energy-from-waste facilities in Australia.

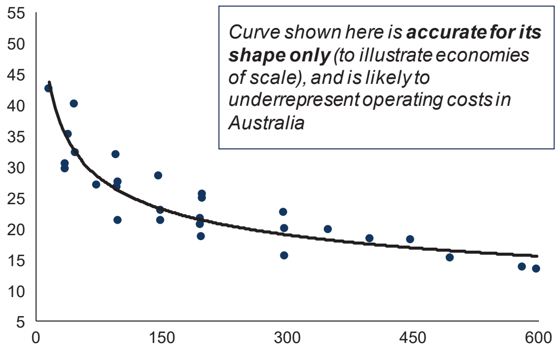
Exhibit 24 Annual operating costs for energy-from-waste alongside capex budgets for current Australian projects

47 Estimates of incinerator profit and loss statement for SEQ

Exhibit 24

Annual operating costs for Thermal EfW alongside capex budgets for current Australian projects

Economies of scale push plants to sizes >200kt…



…requiring high capex budgets and long lead times

Example proposed and planned Australian projects

	Capacity	Capex	Project timeline
Kwinana, Western Australia	400 ktpa	$696m	**7 years** from project initiation in 2015 to planned completion date in 2021
East Rockingham, Western Australia	300 ktpa	$511m	**7 years** from Council tender in 2016 to planned completion date in 2022
Maryvale Victoria	650 ktpa	$600m	**8 years** with initial feasibility study in 2017 and planned completion by 2024

The value drivers for Thermal EfW facilities include both construction and operational elements, described in the Table 5 below.

	Infrastructure feature	Investor requirements
Project build	High Project investment capex	Often multiple investors involved in transaction
	30-40 year asset life	Require long-term contracts to secure return on capital over life of asset
	Economies of scale curve implies bigger is better	Seek to secure volumes from multiple parties; rare where one organisation (public or private) can provide total volume
	Long project lead time	Seek Government support for coordinated approval and licensing processes
Operations	Three major sources of revenue (gate fee, power, metals)	Seek long-term contracts on volume and on power offtake
	Costs of residual dependent on government policy	Lobby for no levy applied for bottom ash disposal to landfill Seek for regulatory approval for re-use in road base
	Need for flexibility to blend/mix input waste streams to optimise energy value	Ensure secure access to both C&I and MSW waste streams Do not set capacity to absorb up to 100% residual volume available – need ability to choose 'best' waste streams from energy content perspective

The range of returns received from Thermal EfW facilities is driven by risk exposure, with returns of up to 16% for top of the range for projects with significant risk exposure (e.g. to power prices in liberalised markets) and up to 5 % for projects with government supported risk and no minimum equity return requirements[48].

Implementing a contract structure that appropriately manages risk should be a priority for Councils. In order to meet continuingly increasing waste diversion targets, Councils must be able to implement improvements to their waste management practices over time without fear of being locked into a put-or-pay contract. This is a critical issue in securing and maintaining a social licence to operate in the Thermal EfW sector in Australia.

There are five major risks to be managed through the contracts for Thermal EfW operation:

- Quantity of waste which is naturally owned by the operator, who can seek other sources from C&I sector to balance municipal solid waste residual
- Composition of waste which is naturally owned by the operator who can 'mix and match' waste to balance out calorific value
- Electricity price which is best owned by the operator, who can price impacts into gate fees, investor returns or electricity market hedges
- Government policy which is jointly owned with both investors and operators able to advocate for alternative
- Approvals and community acceptance are shared risks, with each participant owning different elements.

48 Expert interviews

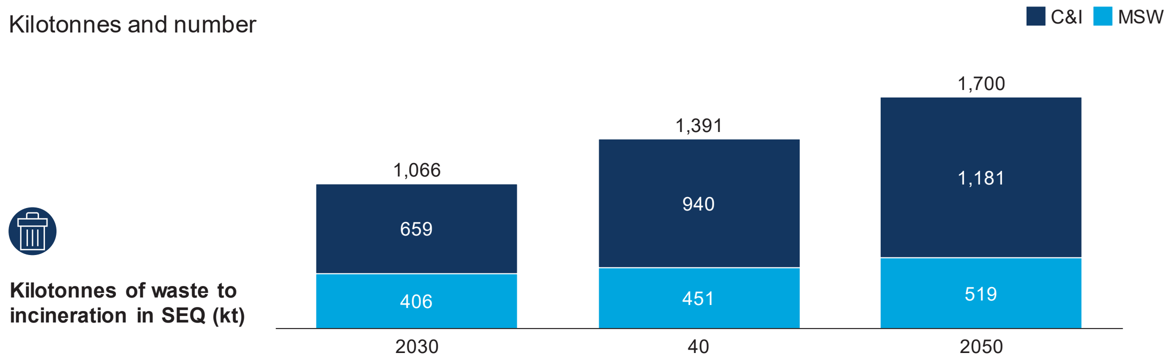
IF SEQ WERE TO TREAT ALL RESIDUAL WASTE TWO TO SIX 300ktpa THERMAL EFW FACILITIES WOULD BE REQUIRED BY 2050

Moving in line with Queensland waste policy targets for SEQ would require at scale (300ktpa) Thermal EfW facilities by 2050, with a total capex of between $2.4 billion and $3.1 billion. This assumes that sufficient capacity is constructed to absorb target residual waste from MSW and C&I combined, given that plants typically operate more efficiently with blended waste streams. Exhibit 25 shows the overview of waste and energy production facilities needed by 2030, 2040 and 2050 respectively.

Exhibit 25

Tonnage of Thermal EfW processing and number of facilities required by decade

Kilotonnes and number



Number of 300kt facilities required (n)		2030	40	2050
	MSW only	2	2	2
	Total waste	4	5	6

B) IMPLICATIONS

Considering the dynamics of the residual waste stream described in the previous section, three key implications emerge:

- Maximising recycling/recovery before moving to Thermal EfW or other alternative treatment technology is essential for aligning with the State's waste hierarchy, and achieving this would mean a multi-year lead time before the general waste stream is 'eligible' to be considered residual.
- Although it is a core part of the Queensland Waste Management and Resource Recovery Strategy, making the social, environmental and economic case for Thermal EfW or other Alternative Waste Treatment in SEQ is nontrivial, considering community perception, availability of high-quality landfill capacity, and the changing landscape of energy production (cheap renewables)
- If/when Councils choose to proceed with procurement of any Thermal EfW facility (or other AWT facility), negotiating the appropriate cost and risk sharing will require collaboration between Councils, deep expertise and a long lead time.
- Emerging technologies and smaller scale facilities may be appropriate in instances where transport costs for residual materials are very high

C) OPTIONS CONSIDERED

This section sets out the key decision areas relevant to the residual waste stream, and the options considered in each decision area. A summary of this is provided in Exhibit 26 below, with further detail on each of the key decision areas provided in the text that follows.

Exhibit 26

OPTIONS CONSIDERED; RESIDUAL WASTE STREAM, TARGET 2030 END STATE

Majority Target End State (shown in **bold**)

Decision area	Options				Rationale
Priority of focus on residual waste stream diversion	Not a focus	**Secondary focus –need to optimiserecyclables and organics first**	Priority focus – pursue in parallel to recyclables and organics		Need to optimise recyclables and organics streams before having a true residual stream for processing. Cost, jobs and environmental benefits are modest/neutral relative to landfill
Time to commence planning	**Commence only if landfill diversion mandated**	**Commence if/when compelling new technologies emerge**	**Commence now to create real options**	Commence now with conviction to proceed	Range of situations across councils –some with no burning platform to move actively on this stream or facing active rate payer opposition, others facing more direct landfill constraints creating a benefit in understanding optionality
Waste stream composition	**No active posture on standards**	Actively seek state-led standards	Develop council-led standards		Provides greatest flexibility for councils. However if residual processing became mandated, preferable outcome would be for any standards required to be set by State given need for consistency across council areas
Processing technology type	**Thermal energy from waste**	Gasification	Pyrolisis	Emerging technology	Thermal W2E is the only residual processing technology appropriate for MSW waste stream that is proven at commercial scale; this may evolve over time and decision should be made at point of proceeding with residual processing
Infrastructure ownership	Private (market) ownership	Council holds ownership stake owned, privately operated	Council owns and operates		Not explored in this piece of work – for future consideration
Infrastructure coverage	No infrastructure unless mandated	**Work towards infrastructure for a portion of MSW & C&I waste (e.g. <4 plants by 2050)**	Work towards sufficient infrastructure for all MSW & C&I residual (~6 plants by 2050)		Accommodates range of preferences across councils (e.g. some pursuing W2E, some not), and enables flexibility in response to technologies that may emerge in future; reduces risk of excess capacity

PRIORITY OF FOCUS ON RESIDUAL WASTE STREAM DIVERSION

The aspirations defined in the Queensland Government Waste Management and Resource Recovery Strategy demonstrate an expectation that a significant share of residual waste will be processed and converted to energy rather than sent to landfill (10% of total waste by 2030, 25% by 2050). If Queensland were to move in step with WA and choose Thermal EfW technology, achieving this would require investment in the order of magnitude of $2 billion to $3 billion of capital over the coming decades, to establish two to six at-scale Thermal EfW facilities.

Given the scale and complexity of the infrastructure decisions in play, six material considerations emerge as CoMSEQ determines the priority placed on this element of waste management:

- Economic impact (on costs and job creation): As described in the previous section, it is anticipated that the impact on ongoing jobs and costs is likely to be relatively neutral compared to the 'do nothing' option of continuing to send residual waste to landfill, although significant construction jobs would be created if new infrastructure were built.
- Environmental impact: The current broad consensus across relevant institutions is that the environmental impact of thermal energy-from-waste is preferable to the impact of landfill. However, three underlying trends may reverse this position in future – the share of fully renewable energy in the Queensland grid is increasing; methane release at landfills will be reduced; and the biogenic content of residual waste is decreasing, making the resultant energy produced less renewable in nature and closer to a fossil fuel.
- Citizen expectations: Most CoMSEQ Councils believe there is a relatively low social licence for incineration of waste. This is reinforced by the stance of active lobby groups (e.g. IRATE, and the official Greens party policy), and the recent legislative shift in the ACT to prohibit thermal treatment of residual waste (via incineration, gasification, pyrolysis or any variations of these). By contrast, government policies in WA, SA, Victoria and NSW are all supportive of Thermal EfW. It is likely that the choice of location for such facilities would have a material impact on community acceptance.
- Feasibility: A precursor to processing residual waste is creating a waste stream that is truly 'residual' in nature, meaning that as much recyclable and organic material as reasonably possible has been removed from the waste stream before it is incinerated or otherwise converted to energy. At present, no specific standards have been set in Queensland to define what a true 'residual' waste stream composition would look like. However, there is broad consensus that CoMSEQ will not have achieved true residual waste streams until comingled recycling and organics recycling streams have been optimised.
- Availability of alternatives: Many regions that have embraced processing of residual waste globally have been motivated by the absence of alternatives (e.g. limited landfill space/capacity within reasonable distances). This constraint does not exist for CoMSEQ as a whole, with analysis suggesting there is sufficient capacity well beyond 2050 across all scenarios for waste volume generation. However, given that some individual Councils are nearing full landfill capacity, cooperation across the group, or acceptance of private sector led solutions would be required to for all Councils to have a genuine alternative to Thermal EfW.
- Value stream opportunity: Analysis suggests that Thermal EfW investments have the potential to generate attractive returns for the asset owners. Subject to the availability of capital and risk appetite of the group, there could be potential for Councils to participate in this value stream, creating a new revenue source, which could be used to offset cost increases to rate payers in the post-rebate environment.

Taking into account the six considerations above, the choice on priority for residual waste management is 'moderate' – it is an important stream to address, but optimisation of organic and comingles is both a pre-cursor to addressing residual waste and likely to generate more immediate benefits. Further, the passage of time may enable new technologies for residual management to emerge and/or provide more clarity on how the cost/benefit trajectory of thermal energy-from-waste will unfold.

TIME TO COMMENCE PLANNING

Thermal energy-from-waste infrastructure projects typically have a very long lead time (6-8 years from commencement of planning), due to the complexity of deal structure and financing arrangements, planning requirements, and construction. Accordingly, CoMSEQ would need to commence work on this well before it desired to have the capacity in place.

Across the options set out in Exhibit 26, the predominant view is that there is not yet sufficient impetus to commence proactive planning, particularly given other priorities. However, it is worth noting that it would only require one to six[49] Councils to move collaboratively on this to have sufficient volumes to proceed with a single facility, providing there is good flexibility for Council-specific solutions.

There are triggers that may change the decision around the time to commence planning, specifically, if the State Government set mandatory landfill avoidance targets, or if the State took the lead in stimulating development on state-owned land.

WASTE STREAM COMPOSITION

There are currently no defined standards in Queensland for what constitutes 'residual' waste, that is, the level of recyclable and organic matter that could acceptably be incinerated or processed through other alternative treatment technologies. Given that energy-from-waste facilities are likely to operate at a scale that cuts across Council boundaries, and in collaboration with the C&I waste sector, it is anticipated that any such standards would be more appropriately set by the State than by CoMSEQ or individual Councils.

PROCESSING TECHNOLOGY TYPE

At the moment, the only commercial scale technology for processing of non-organic residual waste that has been widely adopted globally is thermal energy-from-waste (incineration). This is also the technology that has the most momentum across Australia. Accordingly, it is anticipated that if Councils were to proceed with creating processing capacity in this space, this is the most likely technology to be adopted. However, as for all discussion on future infrastructure choices in the Plan, the opportunity exists to 'let the market decide' once the decision to proceed with residual processing has been made, and technology advancements could provide other options.

OWNERSHIP MODEL FOR PROCESSING INFRASTRUCTURE

As described in the previous chapter, assessment of Thermal EfW deals globally suggest that returns to investors can be significant, with an indicative IRR range of 5-16%. Given the key role that Councils play in shaping the demand for Thermal EfW capacity, it could be attractive to consider the option of taking an ownership stake in the required infrastructure. An outside-in simulation estimated that by fully leveraging the Government's low cost of debt capital, relative to typical investment hurdle rates for private market investment, Councils might be able to achieve the equivalent of up to 50% of the effective gate-fee per tonne for Thermal EfW. Once the landfill levy rebate is removed, this could result in Thermal EfW being significantly cheaper to Councils than landfill. If this were achieved over the entire South East Queensland EfW residual stream, it would amount to a saving of ~$24 million/pa on 2030 volumes relative to landfill, or $36 million/pa relative to commercially owned Thermal EfW.

Whether or not this is an attractive option depends on the availability and cost of capital, the risk appetite of Councils, the actual cost profile of asset in question (noting the uncertainties around costs for dealing with bottom ash, and energy prices), the returns available on alternative investment opportunities, and the ability to structure a deal that appropriately meets Council's target investment profile. These options have not been considered in detail as part of the scope of this work, but given the potential scale of benefits would be appropriate to consider if/when Councils determine that residual waste processing is a strategic part of their waste management strategies.

49 Reflects range of forecast 2030 waste flows depending on recovery performance, and includes C&I

INFRASTRUCTURE COVERAGE

As described above, given the availability of alternate options, the challenges associated with thermal energy-from-waste, and the potential for new technology to emerge in this space, it is helpful that the opportunity exists to proceed incrementally. It is estimated that up to two to six at-scale Thermal EfW facilities would be required to process all appropriate residual waste in South East Queensland by 2050. Accordingly, if Councils were to proceed with just one or two facilities over the next ten to 15 years, it would provide the opportunity down the track to incorporate newer processing technologies, and would minimise the risk of building excess capacity if new societal breakthroughs emerge that drive a step change in waste generation or reuse.

D) RECOMMENDATIONS

With the above taken into account, there are seven recommendations on Residual

1. **In the immediate term**, optimise waste flows by pulling all levers further up the waste hierarchy, to create a stream that is true residual

- Achieve goal levels for maximum organics/recyclable components in general waste
- Collaborate to manage residual using landfill capacity across SEQ, whilst focus is on resource recovery levers

2. Periodically review alternative waste treatment (AWT) technology developments, and emerging solutions preferable for residual MSW
3. Work with DSD on land use planning and State Development Areas for residual (Thermal EfW or other AWT technology facilities)
4. For Councils that wish to proceed or explore the complete and in-depth study to assess the environmental, economic development, health & safety and operating economics outcomes in SEQ, in order to develop & test the fact base that could support local social licence
5. **In the medium term**, for Councils that seek to proceed collaborate & seek expert support to ensure any deal that is pursued achieves four things:

- Environmental & jobs outcomes that are better than optimised landfill
- No disincentives to continued optimising of waste recovery
- Ongoing costs are acceptable to rate payers
- Limited exposure to electricity or other price risk borne by operator

If the above conditions cannot be met, continue to move residual waste to landfill, continue to work towards minimising emissions from landfill in SEQ and explore alternate emerging technologies for continually reducing residual volumes

6. **In the long term**, if social licence has been effectively established move to combine residual flows to allow development of 2-6 Thermal EfW facilities by 2050 with scale >200ktpa (assuming MSW residual streams are combined with C&I) or a suitable number of facilities using alternative technologies
7. As part of business case development, consider desired ownership structure for processing infrastructure, including option for Council ownership

Caveats

Several Councils believe that establishing social licence in SEQ for Thermal EfW will never be feasible

Two Councils have noted they would have additional specific objectives to be met before proceeding, in addition to those listed here; these are yet to be developed

E) 2030 PROJECTED OUTCOMES FROM RESIDUAL RECOMMENDATIONS

Projected outcomes from residual recommendations are summarised in Table 6, below;

Table 6: 2030 Projected outcomes from residual recommendations

Outcome area	Estimated 2030 impact	Notes on method and inclusions
Economic development outcomes	Nil	Facilities not operational until after 2030
System operating cost	Nil	Facilities not operational until after 2030
Up front, one off transition costs	Nil	Facilities not operational until after 2030

7. Overview of Recommendations and Outcomes

This chapter provides a summary of recommendations in the Plan, and notes specific caveats or limitations on alignment that emerged from Council input. It also sets out overall outcomes from recommendations, in terms of progress towards State landfill diversion targets, economic development outcomes, impacts on system operating economics and up front, one-off transition costs.

Recommendations are grouped by the type of waste material, with enabling actions first, followed by infrastructure and bin system changes.

A) RECOMMENDATIONS

COMINGLED RECYCLEABLES

1. Launch a joint, evidence based behaviour change campaign to reduce comingled bin contamination rates to <5% and increase recyclables to 80% over the next 10 years
2. Advocate for State and peak body support for recycled product end markets, (e.g. procurement, standard setting, R&D etc)
3. Coordinate local government led efforts to support end markets for recycled streams (e.g. procurement, changes to LG specifications)
4. Advocate for the broader rollout of CRS to additional glass containers
5. Examine benefits and pathways for removal of glass from the kerbside comingled system in SEQ, if proven by Victorian experience
6. Plan for installation of 1-2 new MRF facilities by 2030, planning for;

- Medium-large scale (> 60k single shift capacity)
- Located to reduce transport costs
- Jointly agreed optimised ownership model for new capacity (insourced or outsourced)

Caveat

One Council may look to partner with adjoining Western Councils to achieve economies and reduce transport costs

ORGANIC MATERIALS

7. Rollout evidence-based behaviour change campaigns to both reduce food waste and enable use of GO/FOGO bins, seeking to keep consistent message and branding but with scope to tailor for local context

8. Collaborate to support stable and efficient markets for compost

- Ensure high quality outputs (i.e. set standards, but don't dictate technology) and require appropriate monitoring program for PFAS, microplastics and other potential contaminants in line with State regulations
- Support local operators by buying recycled mulch/compost products, and encourage other government agencies to buy product (e.g. transport)

9. Collaborate with the State to work with private sector (e.g. NRA, Coles, Woolworths) to adopt product stewardship changes to improve organics recovery (i.e. compostable veggie bags default in supermarkets)

10. Move towards a consistent organics recovery bin system by 2030, in a way that is as coordinated and provides flexibility in timing and transition pathway

- Align on definition of FOGO 2030 target state in SEQ, ultimately with FOGO collection weekly, general waste weekly or fortnightly, and inclusion of all plant and food waste
- Move towards 2030 target state either directly from current state or first by rolling out a GO service or GO+ service
- Make the transition as fast as reasonably practicable; 1-2 frontrunner Councils will pilot and roll out within next 12 months, other Councils follow
- Systematically share lessons learned from frontrunners and pilots to enable ongoing optimisation of approach

Caveat

Very low population density will reduce economic feasibility and environmental benefits. Councils, or select areas (rural or island) within Councils may choose not to offer a FOGO service

One Council has a preference to explore alternative/emerging technologies that may require organics remaining in the general waste bin

11. Collaborate to procure market-led solutions for organics processing services at an efficient scale, located to minimise transport costs

- If the market nominates IVC technology as the lowest cost solution, Councils should collaborate with 1-2 neighbours for facilities >20ktpa in scale; this implies ~8-13 facilities for SEQ by 2030
- As part of business case development, consider ownership structure for infrastructure, including option for Council ownership

RESIDUAL

12. **In the immediate term**, optimise waste flows by pulling all levers further up the waste hierarchy, to create a stream that is true residual

- Achieve goal levels for maximum organics/recyclable components in general waste
- Collaborate to manage residual using landfill capacity across SEQ, whilst focus is on resource recovery levers

13. Periodically review alternative waste treatment (AWT) technology developments, and emerging solutions preferable for residual MSW

14. Work with DSD on land use planning and State Development Areas for residual (Thermal EfW or other AWT technology facilities)

15. For Councils that wish to proceed or explore the, complete and in-depth study to assess the environmental, economic development, health & safety and operating economics outcomes in SEQ, in order to develop & test the fact base that could support local social licence

16. **In the medium term**, for Councils that seek to proceed collaborate & seek expert support to ensure any deal that is pursued achieves 4 things:

- Environmental & jobs outcomes that are better than optimised landfill
- No disincentives to continued optimising of waste recovery
- Ongoing costs are acceptable to rate payers
- Limited exposure to electricity or other price risk borne by operator

If the above conditions cannot be met, continue to move residual waste to landfill, continue to work towards minimising emissions from landfill in SEQ and explore alternate emerging technologies for continually reducing residual volumes

17. **In the long term**, if social licence has been effectively established move to combine residual flows to allow development of 2-6 Thermal EfW facilities by 2050 with scale > 200ktpa (assuming MSW residual streams are combined with C&I) or a suitable number of facilities using alternative technologies

18. As part of business case development, consider desired ownership structure for processing infrastructure, including option for Council ownership

Caveats

- Several Councils believe that establishing social licence in SEQ for Thermal EfW will never be feasible
- Two Councils have noted they would have additional specific objectives to be met before proceeding, in addition to those listed here; these are yet to be developed

Enabling

19. Collaborate with the State Government to embed the principles into the agreed final funding model to support implementation of the SEQ Waste Management Plan

20. Develop high quality and consistent data practices to support ongoing optimisation og waste management across the region

B) OUTCOMES

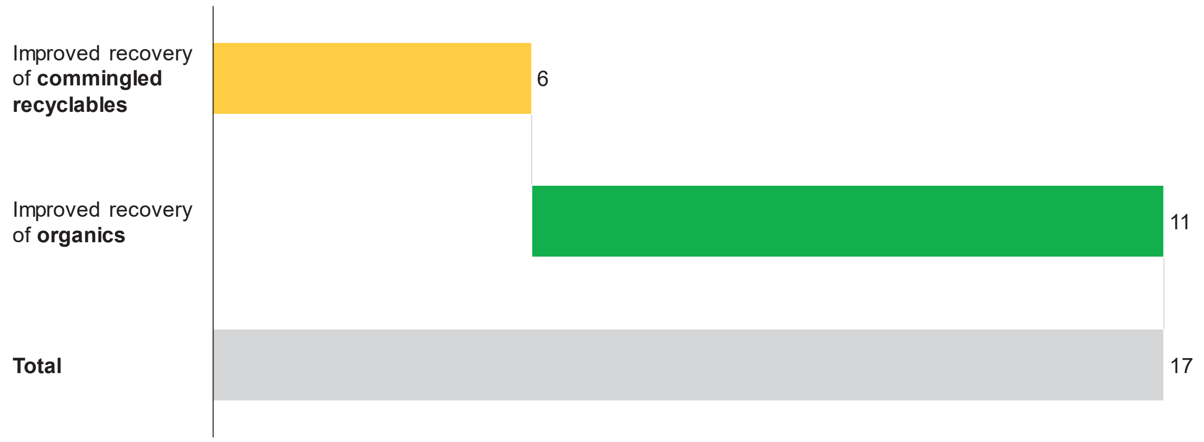
The Outcomes from the implementation of the Plan are both environmental and in jobs created for South East Queensland. Each of these is discussed in turn.

Recommendations will improve landfill diversion rates by ~17 percentage points by 2030 versus a low recovery scenario, driven mostly by improvements in organics recovery (see Exhibit 27).

Exhibit 27[50]

Diversion rate impact by 2030 from recommendations

Percentage point improvement versus a 'low recovery' scenario

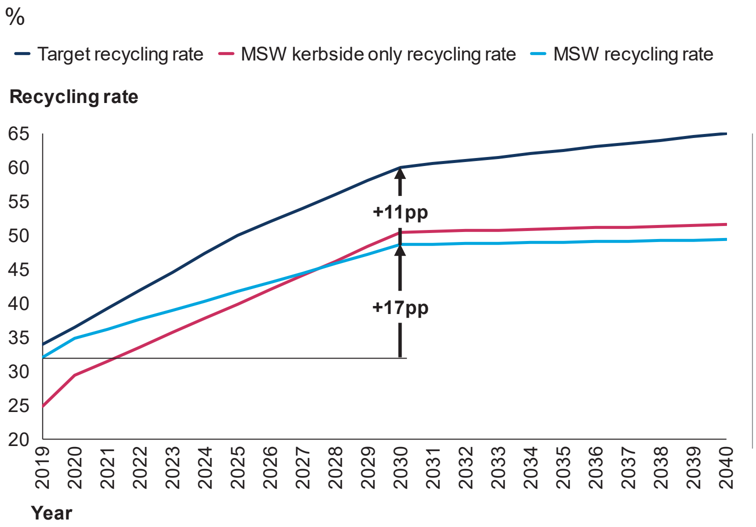


50 Recycling diversion rate based on increasing the proportion of total recyclable material placed in recycling bin to SA Uplift to SA levels (72%) (up from 49% today). Organics diversion assumes that bin penetration for organics bins reaches 80% by 2030, 80% of garden organics are removed from the red bin, and 60% of food organics. Diversion rate impact shown compared to a 'do nothing' case where recycling and organics behaviours stay constant versus today (with significant contamination the red bin)

Recommendations will move SEQ ~60% of the way to Queensland Waste Strategy recycling targets. A further 11 percentage point improvement is required by 2030 to reach targets, which could be achieved through a combination of interventions (e.g. statewide product stewardship and improvements in self-haul recovery) not considered in the Plan as they do not directly benefit from CoMSEQ collaboration (see Exhibit 28)

Exhibit 28[51]

Forecast recycling rate versus state targets and benchmarks



MSW diversion rate benchmarks[1]

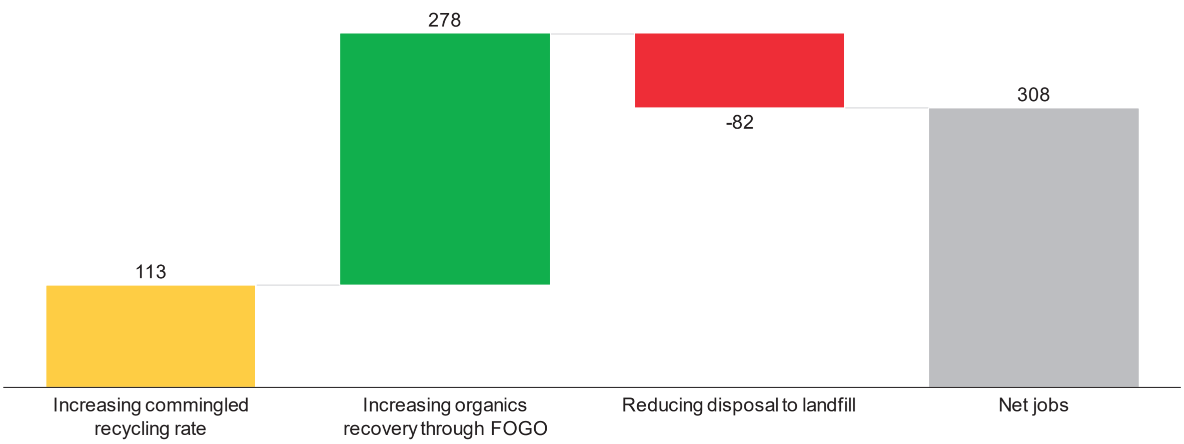
	Victoria	South Australia
Total MSW	44%	57%
Kerbside only	43%	47%

Recommendations will create ~310 permanent jobs in SEQ, driven mostly by FOGO roll out (see Exhibit 29). In addition, recommendations would create ~2,900 – 3,800 temporary jobs per year of new infrastructure construction (MRFs: 100-160, organics processing 300-400, Thermal EfW 2,500 - 3,200). Job creation from establishment of manufacturing precincts to support expansion of organics recycling in South East Queensland and beyond have not been modelled.

Exhibit 29[52]

Permanent jobs created by recommendations by 2030

Number of jobs



The costs associated with transition to and implementation of the Plan are discussed in the next section.

51 As per Exhibit 27 footnote, and Queensland state targets, DES local government waste survey, 18-19

52 Assumptions: Recycling diversion rate based on increasing the proportion of total recyclable material placed in recycling bin to SA Uplift to SA levels (72%) (up from 49% today). Organics diversion assumes that bin penetration for organics bins reaches 80% by 2030, 80% of garden organics are removed from the red bin, and 60% of food organics. Based on available evidence, jobs/10kt of waste assumed at 2.2 for landfill, 4.2 for organics, 9 for recycling. Collections net jobs assumed at ~1/10k households under a FOGO weekly, general waste fortnightly model based on experience from Sustainability Victoria.

8. Costs of the Transition

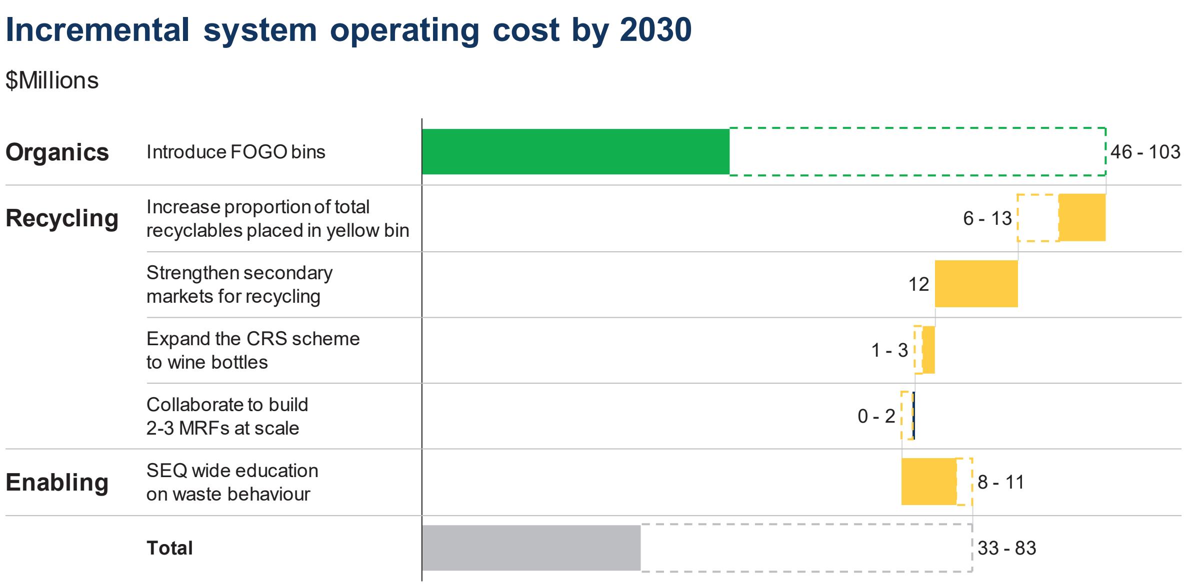
This Chapter has four parts, describing the funding challenge to achieve the transition, options to fund the transition, priority considerations for CoMSEQ Councils, and recommendations to progress funding of the Plan. Each is discussed in turn.

A) OVERVIEW OF THE FUNDING CHALLENGE

This part describes the funding required to implement the transition, taking into account both the one-off transition and infrastructure costs, as well as shifts in ongoing operating costs, with a focus on the 2020-2030 timeframe

It is estimated that implementing the recommendations will increase total system operating cost by $33-83m by 2030, driven by the additional cost of collecting and processing FOGO waste across SEQ ($46-103m), partially offset by savings from recycling. This increase translates to an average increase of ~$19 – 47 per household annual waste charge, after levy removal. Exhibit 32 shows the elements of system costs changes associated with implementation of the Plan.

Exhibit 32[53]

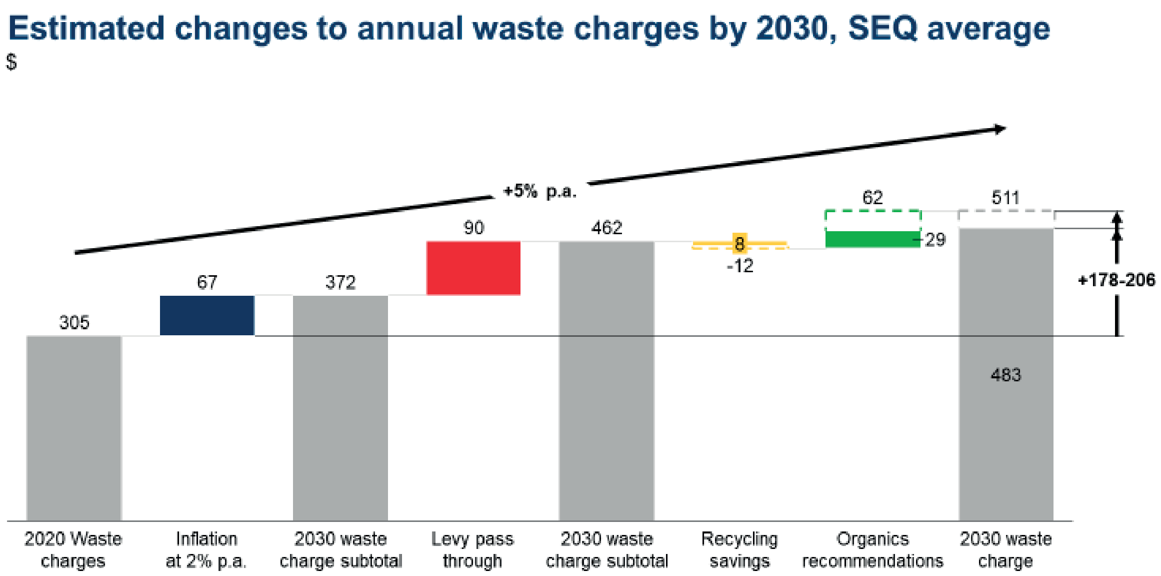


53 Assumptions: FOGO bins are introduced at 80% penetration across SEQ by 2030, and that 80% of garden organics and 40% of food organics are shifted from the red to FOGO bin for households that have the bin. Recycling assumes that the proportion of total recyclables in the yellow bin improves to benchmarks observed in SA by 2030 (72% from ~49% today), Secondary markets development assumed to raise the price of recyclable commodities 30% of the way back to pre-China Sword prices. CRS analysis based on savings for expanding scheme to glass wine bottles only

The largest contribution to ongoing system operations costs is the weekly collection of organics through the FOGO bins as this adds an additional weekly or fortnightly household collection across the system for all households that do not currently have a green bin service. It is also a common experience for Councils to have an increase in volumes or organic waste received when FOGO services are introduced. The costs of FOGO collection are partially offset by the benefits of increased recycling with increased proportion of recyclables in the yellow bins, higher value achieved from the secondary recycled materials, expanded CRS and increased number of MRFs. The investment in education enabling the community to change behaviour to support the outcomes of the Plan will need to be sustained to keep people on track.

Alongside these total system operating costs the system is subject to two forces driving costs upwards – inflation, at 2% per annum, and the pass through of the levy to householders that would accompany levy removal. Of these four forces increasing costs, those from implementation of the Plan account for between 10 – 25% of the total system operating cost increase estimated between now and 2030. Exhibit 33 illustrates the estimate changes to annual waste charges by 2030 (SEQ averages, per household), showing that if no levy rebate was paid to Councils, household rates paid for waste would need to increase at 5.3% per year to cover costs

Exhibit 33[54]



Significant transition costs (also called 'one off' or capital costs) are required to execute on the recommendations.

These are estimated to be ~$210-280m by 2030, and ~$2.7-3.6bn by 2050. These can be considered in two parts – those infrastructure costs that would be expected to make a commercial return, and other one-off costs that will not generate a return. Exhibits 34 and 35 show the split of one off transition costs and capital costs that would be expected to make a return.

54 Assumptions: FOGO bins are introduced at 80% penetration across SEQ by 2030, and that 80% of garden organics and 40% of food organics are shifted from the red to FOGO bin for households that have the bin. Recycling assumes that the proportion of total recyclables in the yellow bin improves to benchmarks observed in SA by 2030 (72% from ~49% today), Secondary markets development assumed to raise the price of recyclable commodities 30% of the way back to pre-China Sword prices. CRS analysis based on savings for expanding scheme to glass wine bottles only

Exhibit 34[55]

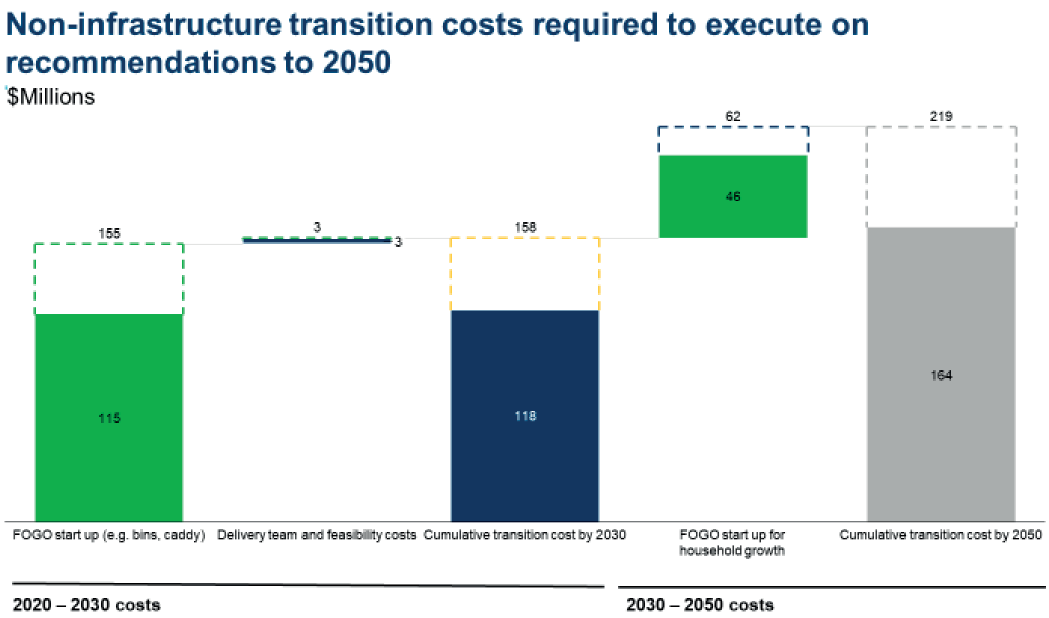
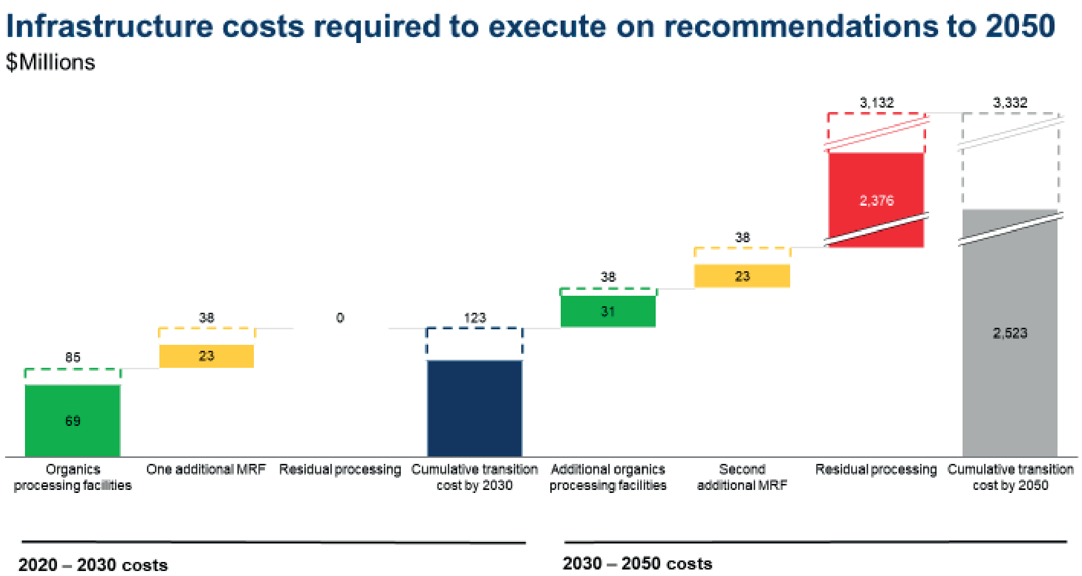


Exhibit 35[56]



As shown in Exhibit 35 more than 85% of the infrastructure costs are related to residual processing technology, and investment falls beyond 2030. For the infrastructure spend that has the potential to generate a significant return for the investor (with associated risk), ownership may be either public or private, depending on risk appetite, availability of capital, and timing. A large proportion of this funding will likely be available from the private sector under infrastructure development arrangements.

The essential considerations in moving to fund these transition costs are whether they are borne by Councils (and passed on to ratepayers), borne by the State or Commownealth Governments, or in the case of some classes of capital investment borne by the private sector.

55 Assumptions: FOGO bins are introduced at 80% penetration across SEQ by 2030, and that 80% of garden organics and 40% of food organics are shifted from the red to FOGO bin for households that have the bin. Recycling assumes that the proportion of total recyclables in the yellow bin improves to benchmarks observed in SA by 2030 (72% from ~49% today), Secondary markets development assumed to raise the price of recyclable commodities 30% of the way back to pre-China Sword prices. CRS analysis based on savings for expanding scheme to glass wine bottles only

56 Compilation of multiple analyses from previous workshops. Assumes that FOGO bins are introduced at 80% penetration across SEQ by 2030, remaining at 80% penetration therafter. FOGO capex from 2030-2050 due to household growth.

B) CONSIDERATIONS IN FUNDING THE TRANSITION

- At its simplest, funding to support transition of the waste system will come from two sources: Governments, either State or Commonwealth, sourced from either general revenue or specific levies or charges (ie a waste levy)
- Citizens, via increases in rates payments to Councils

There are three dimensions to consider in thinking about paying for the implementation of the Plan:

i. How much of the State Government waste levy collected from ratepayers is provided back to Councils

ii. How Government funding (both levy and any other funding) is allocated to Councils

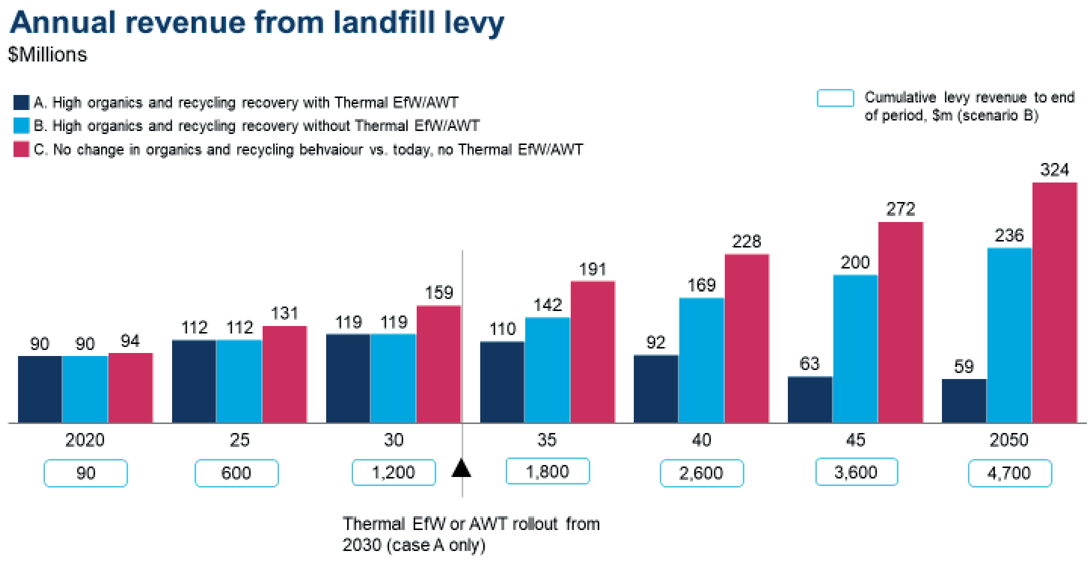
iii. Timing of funding available, including both of government funding and any rates increases funded by citizens

Together these three dimensions will support (or inhibit) rapid delivery of the Plan. The options for each is discussed in turn.

The State Government holds the levers for Queensland's waste management levy. The levy arrangements will be reviewed in 2021, with the rate or possible removal of the levy rebate to Councils and timeframe over which this should occur likely topics for the review.

The amount of funding potentially available through the levy depends on how much citizens change their waste production and sorting behavior and when alternate processing facilities come online. The dynamics of the future levy flow under several scenarios are illuminated in Exhibit 34.

Exhibit 34[57]



The State government could contribute to SEQ's waste system transition through:

- alignment of future levy arrangements with the ambition and direction of the Plan;
- investment of the levy in actions contained in the plan (either with 'one off' capital commitments, ongoing systems operations costs, or the community education required to support success of the Plan); or
- investment of non-levy funds into actions to support the plan.

Assumes one MRF built between 2020-2030, and another between 2030-2050 at approximately the same capacity (~125k double shift). Assumes organic processing is built as required to meet the required throughput of organics from FOGO. Organics processing capex growth from 2030-2050 due to household growth. Assumes all EfW infrastructure (regardless of technology) capex is incurred after 2030. EfW capex sized as incineration in this analysis. Delivery team costs assume 2-3 FTE at ~150k p.a. for 5 years and includes a $1m provision for environmental feasibility of WtE before 2030

57 DES local government waste survey 18-19, QLD state waste target modelling, state levy price path. Assumptions: A&B: bin penetration for organics bins reaches 80% by 2030, 80% of garden organics are removed from the red bin, and 60% of food organics. Proportion of recyclables in the yellow bin uplifted to SA levels (72%) by 2030 and Victoria's level by 2050 (80%), WtE ramping up linearly from 2030 to reach 64% of residual waste stream by 2045, increasing gradually in line with waste targets thereafter. No WtE in case B. C: No change in recovery rates. No change to waste generation per capita in any scenario.

In providing levy funding to Councils the State could allocate funding as a direct pass through to Councils, which may be tied to specific projects or infrastructure. Alternatively there may be specific grant programs that Councils can apply for, noting that administration of grant programs tends to increase system costs and often also introduces delay

The Commonwealth Government could contribute to SEQ's waste system transition. Options would be for funding to be provided through specific waste related funding programs, grants or the upcoming SEQ Cities Deal.

The timing and design of funding mechanisms to support and incentivise implementation of the Plan will drive how quickly progress can be made. For example, if specific action is incentivised by how levy funding is allocated action is likely to be more swift. Similarly, if levy funds are provided in advance actions can be brought forward, or 'front-loaded'. Alternatively, if Councils were required to fund the transition predominantly or entirely by increasing rates it would likely severely delay implementation, especially if community concern developed during the transition period.

C) PRIORITY CONSIDERATIONS FOR COMSEQ COUNCILS

The following principles, developed by CoMSEQ, outline the type of levy and funding environment that CoMSEQ believes would be most conducive to supporting timely implementation of the Plan:

i. The funding model should **incentivise the long term end state** described in the Plan;

ii. One hundred percent of MSW waste levy **funds raised from rate payers should be reinvested back into MSW waste management** to accelerate the transition, create transparency, and build citizen confidence and trust in how the transition is being managed;

iii. **Certainty is an important anchor** for the long run investments that are needed to deliver on the Plan. L**ong term certainty is the most important ingredient**, followed by achieving certainty **rapidly** so that action can begin;

iv. A **rules based approach is generally preferred to an applications/ grants model** because it provides long term certainty;

v. **Consultation (and 'no surprises) is vital to achieve buy-in for change** and so both funding model development and waste industry sector development (planning and approvals) should be anchored in mutual respect and high levels of consultation between Local and State Government;

vi. A **unified set of messages to rate payers** about the transition, rationale, importance, and value for money will be more effective than blame shifting for cost increases;

vii. **Government funding support should focus primarily on the one-off transition and start-up costs and on smoothing the cost increase to households**, while over time any ongoing increase in operating costs (in excess of the levy amount) should be passed on to households via Council rates, to incentivise efficient operations and ensure ongoing financial sustainability.

viii. **In the limited circumstances where Councils choose to opt certain areas out of Plan recommendations due to very low population density, the waste levy for those households should be removed or redesigned to reflect the differential desired behavior shift (e.g. higher levels of home composting).**

9. Implementation Approach & Roadmap

This chapter has 4 parts, describing the levels of collaboration associated with each of the recommendations in the Plan; phases to move towards delivery; and what a SEQ Waste Management Plan Ten Year Implementation Roadmap should contain; and the supportive program of work to be done at the regional level. Each is discussed in turn.

A) LEVELS OF COLLABORATION NEEDED FOR SUCCESSFUL DELIVERY

The premise of CoMSEQ's collective work to produce this South East Queensland Waste Management Plan was that there are areas where collaboration will be needed to drive the best possible outcomes for the Region. Preparing the Plan has illuminated where and how such collaboration is likely to yield the best results.

This section first describes four levels of collaboration, each of which is illustrated with an example, and then indicates which would be most applicable to each of the recommendations.

The first level of collaboration is simply to increase the transparency of an individual Council's planned local action, so that others are aware and may have the opportunity to learn from the approach. An example would be when a large Council commissions an in vessel composting system for its own FOGO waste stream.

The second level of collaboration is where sub-regional partnership is needed, generally to achieve the economies of scale in procurement or operations to warrant capital investment. A smaller group of Councils would then be acting regionally, with transparency of the planned local action, so that others are aware and may have the opportunity to learn from the approach. An example would be where 2-4 Councils work together to procure or otherwise incentivise a new at-scale MRF operator and facility.

The third level of collaboration is where action is regional and all councils act at the same time. This ensures that all Councils benefit from the joint action and outcomes. An example would be the negotiation of a preferred waste levy rebate funding model with the State, or a city deal outcome with the Commonwealth.

The fourth level of collaboration is where whole of SEQ regional action is necessary, but Councils do not need to take the action at the same time. This is generally the case in citizen facing communications and 'rules' where there are benefits in citizens across the region taking the same approach, and economies of scale in preparing for it once. An example would be the commissioning of a 'best in class' citizen education campaign, which is rolled out by different Councils according to their FOGO roll-out timeline.

In turning to the recommendations of the Plan different levels of collaboration are needed for success in delivering the different recommendations. Due to the transaction costs inherent in collaboration the lowest level of collaboration needed for successful implementation has been selected.

Exhibit 35 illustrates the level of desirable collaboration between Councils to successfully deliver on the recommendations of the Plan.

Exhibit 35

At what level should Councils collaborate

	**1 Comingled recycling**	a. Launch a joint behaviour change campaign to increase proportion of recylables placed in yellow bin;	Regional, local pace
		b. Advocate for the right scope for State-level interventions in supporting end markets	Regional Unison
		c. Advocate for the broader rollout of CRS to addition glass containers	Regional Unison
		d. Plan for installation of 1-2 new MRF facilities by 2030 at medium-large scale	Sub-regional
	**2 Organics**	a. Move towards one consistent organics recovery bin system, in a coordinated way by 2030	Regional, local pace
		b. Launce a joint behaviour change campaign to support FOGO adoption	Regional, local pace
		c. Collaborate with neighbouring councils and adjacent industry (where applicable) to procure market-led solutions for organics processing services	Local or Sub-regional
		d. Act to support stable and efficient end markets (procurement levers, quality standards)	Regional Unison
	**3 Residual**	In the immediate term	
		a. Optomise waste flows by pulling all levers further up the waste hierachy	As above
		b. Keep abreast of alternative waste treatment technology developments	Regional
		c. For councils that seek to proceed with Thermal EfW/AWT solutions, colaborate & seek expert support to ensure any deal structure delivers best possible environmental and economic outcomes, including considering a direct ownership option	Sub-regional
	**4 Enablers**	a. Develop high quality and consistent data practices to support ongoing optimisation of waste managment across the region	Regional, local pace
		b. Work with the State to agree funding arrangments that incentivise and enable delivery of this Plan	Regional Unison

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B) MOVING TOWARDS DELIVERY

Implementing the Plan will be a staged approach, with each Council embedding actions into the waste management plans in line with their own strategic priorities and waste management contracts and capability, and community acceptance.

Over the course of 2021 each Council will move to identify when they will make key shifts towards the 2030 target end state and the actions required over the next ten years to reach it, as well as early wins that can be actioned in the short term.

The ten year Roadmap for each Council will be consolidated into a ten year master plan for the region. Synergies and opportunities for learning across the group will be synthesised with key topics placed onto the forward agenda of the Waste Working group to progress.

In 2022 the full implementation cadence of the Plan will kick in, with each Council acting at the pace and on the priorities identified in the ten year roadmaps. The Waste Working group of CoMSEQ will have active oversight of progress across the network.

C) REGIONAL WORKPLAN TO SUPPORT IMPLEMENTATION

To support implementation of the Plan six enabling activities at a regional scale are required. Each of these is briefly described.

i. Coordination to support delivery of the joint behaviour change campaigns in the Plan. This could include commissioning of research, and development of framework approaches and materials to enable all Councils to lean in to the community behaviour change campaigns needed to support the Plan.

ii. Development of the CoMSEQ advocacy positions to advocate for action by the State and Commonwealth. This would include developing positions on procurement standards, secondary market development support, and changes that would be desirable for the future Container Recovery Scheme.

iii. Coordinate engagement on behalf of CoMSEQ members with the State and Commonwealth Government on key advocacy positions. Examples would include: on land use planning around State Development Areas for resource recovery infrastructure; advocacy for shared positions on funding for capital and program investments.

iv. Facilitate knowledge sharing of best practices data and knowledge, for example lessons learned in roll out of organics collection, or efforts to support end market development for recycled waste streams

v. Commission and manage delivery of work by external organisations on behalf of the Waste Working Group. These may include,

- Benefits and pathways to remove glass from kerbside comingled system
- Environmental and economic benefits of Thermal EfW/AWT in SEQ
- Feasibility and benefits of Council ownership of new infrastructure

vi. Coordinate the CoMSEQ ten year Roadmap for delivery and ensure that the Plan is reviewed every 3-5 years to consider progress, innovation opportunities and potential for updating.

10. Appendices

APPENDIX 1: MAJOR ASSUMPTIONS AND MODELLING APPROACH TO TOTAL SYSTEM ORGANICS COST

			Major assumptions
Material Diverted	Tonnage of material diverted	Organics bin penetration	In all scenarios, organics bin of choice assumed to be at 80% of households by maturation (note this assumption does not substantially impact the relative cost of each option)
		Household behaviour	Households will shift 80% of the garden organics tonnage in the red bin into a GO or FOGO bin[58]. Households will shift 60% of food organics in the red bin into a FO bin, and 40% of food organics into a FOGO bin
		Tonnage of self-haul	Where GO or FOGO bins are rolled out, 25% of self-haul green waste is assumed to now be captured in the kerbside bine (instead of self-haul)[59]
		Additional GO material 'created' by supplying bins	Where GO or FOGO bins are rolled out, the amount of garden organics produced by households is assumed to double
System cost	Additional collections cost	Collections frequency	Weekly for FOGO and FO, fortnightly for GO
		Cost per bin lift	$1.3-2/lift based on bottom up modelling of bin lift costs in SEQ and Victoria; range reflects population density
	Organics processing costs	Mix of processing technologies	Clean GO streams processed at 80% mulch, 20% open windrow composting. FOGO and clean FO streams processed at 80% IVC, 20% AD Self-haul green waste treated as a clean GO stream and processed 100% through mulching.
		Processing cost rates	Range of gate fees triangulated from industry benchmarks and operator interviews
	Landfill cost savings	Landfill costs and levy	Cost per tonne of $40-100, plus a non-rebated levy of $95 (2025 level) assumed in analysis, with sensitivities for lower levy amounts
	General waste collections savings	Reduced collection frequency	Reduced general waste collection to fortnightly considered appropriate in FOGO weekly scenario only given odour risk in all other scenarios
		Reduced yield	General waste bin collection costs per lift reduced by 0.25% for every 1% reduced in tonnes due to a lower bin yield requiring less travel time for collections trucks
Source: Sustainability Victoria Introducing a kerbside food and garden organics collection service (MWRRG)			

58 Based on Sustainability, Victoria targets which are informed by experience of 46 councils
59 Based on approximate bin yields achieved at ~25% above Victoria's levels of tonnage shift (based on climate)

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