State of Oregon Department of Environmental Quality

Oregon E-Cycles Collections Determination for 2023

April 29, 2022

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Introduction and summary

For each calendar year, Oregon's electronics recycling law[1] requires the Oregon Department of Environmental Quality to determine the total weight of electronics devices to be collected under the state's "E-Cycles" program. This number has conventionally been known as the "collections determination."

The law also requires DEQ to report the proportions of that total which represent two classes of devices: (i) televisions, and (ii) other devices – specifically, computers, monitors, peripherals, and printers, hereafter collectively called "computing devices."

This document contains DEQ's draft final collections determination for 2023.

DEQ sets a collection determination of 14.2 million pounds, of which 70% are projected to be TVs, and 30% computing devices. This is a moderate value given the range of results proposed by DEQ's analysis, where possible collections determination totals range from 12.5 to 15.8 million pounds. Note that DEQ identified a minor error in source data used for the April 12, 2022 *Draft Oregon E-Cycles Collections Determination for 2023*. This value reflects fully vetted source data.

The remainder of this document describes issues relevant to figuring the collections determination and provides a detailed account of DEQ's calculations.

[1] ORS 459A.300 and related sections

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Background

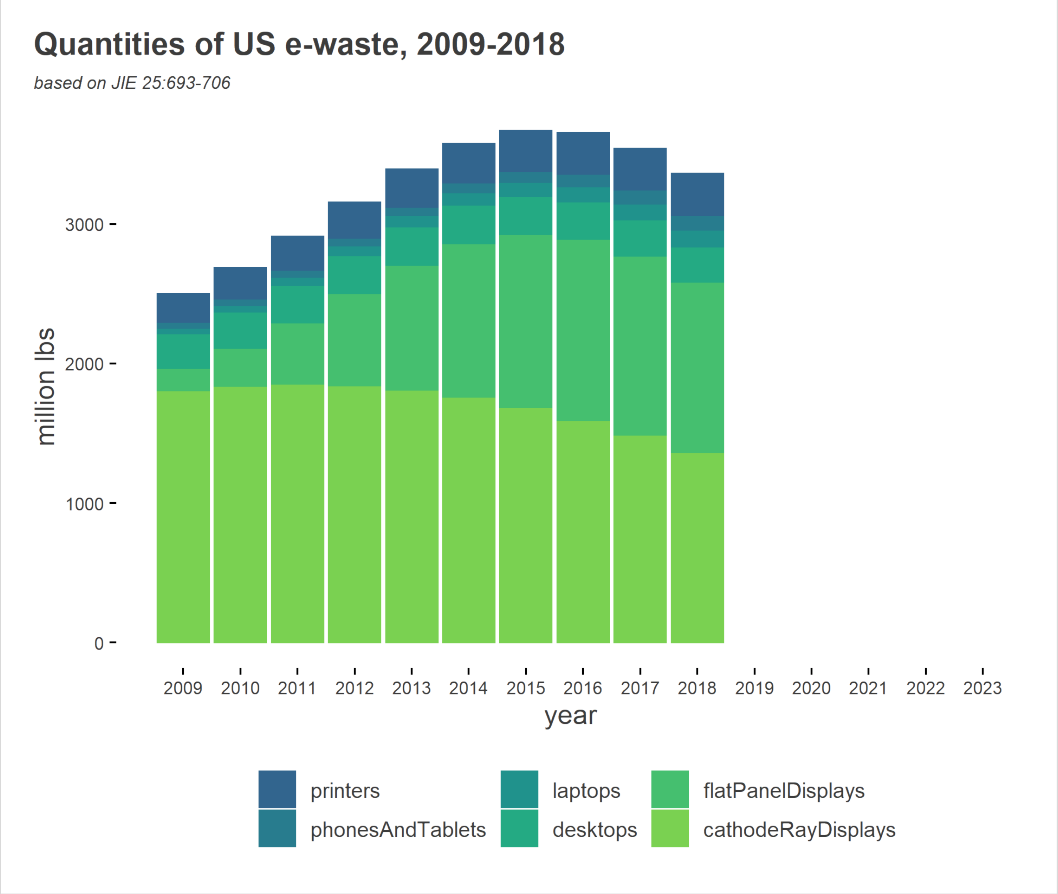
Setting a reasonable collections determination (hereafter, CD) for Oregon's E-Cycles program is not a simple task. The CD is both a goal and an expectation for participants in E-Cycles, but it must be set ahead of time with imperfect foresight. Here are some of the sources of variation that make predicting future collections difficult:

- Electronics are a fast-changing industry and part of daily life.
- Since 2020 the COVID pandemic has disrupted electronics production and use in ways that are still playing out.
- There could be a fundamental difference between the set of electronics *available* for recycling, and the ones that are *actually collected* – but this difference is difficult to quantify.
- Public awareness of the E-Cycles program itself may be changing.

The evolving electronics ecosystem

It is widely felt that electronics are playing larger and larger roles in our work and personal lives. Nonetheless, the total weight of electronic waste collected in the United States has been dropping since the mid-2010's, because in general devices have been getting lighter. Althaf and co-authors[2] document this authoritatively in a recent paper, at least up to the year 2018. Their results are re-charted below.

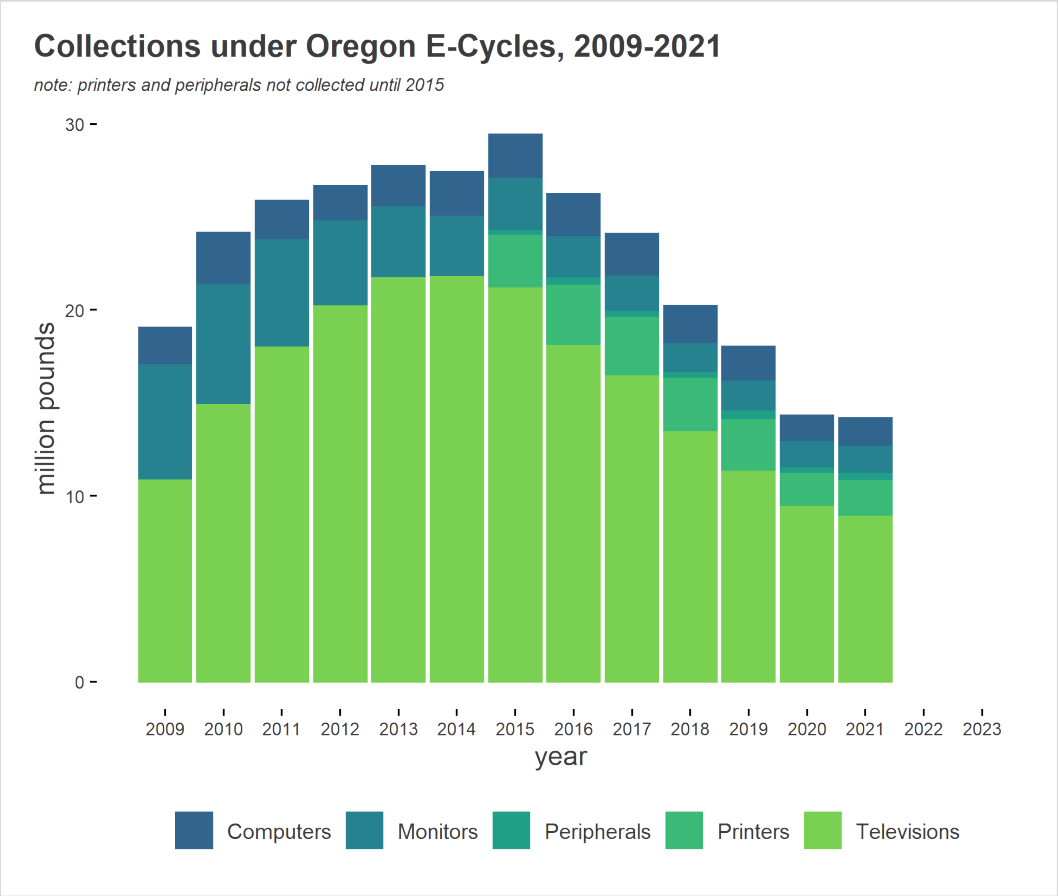
Figure 1



[2] Shahana Althaf, Callie W. Babbitt, and Roger Chen, "The Evolution of Consumer Electronic Waste in the United States," *Journal of Industrial Ecology* 25, no. 3 (2021): 693–706, https://doi.org/10.1111/jiec.13074.

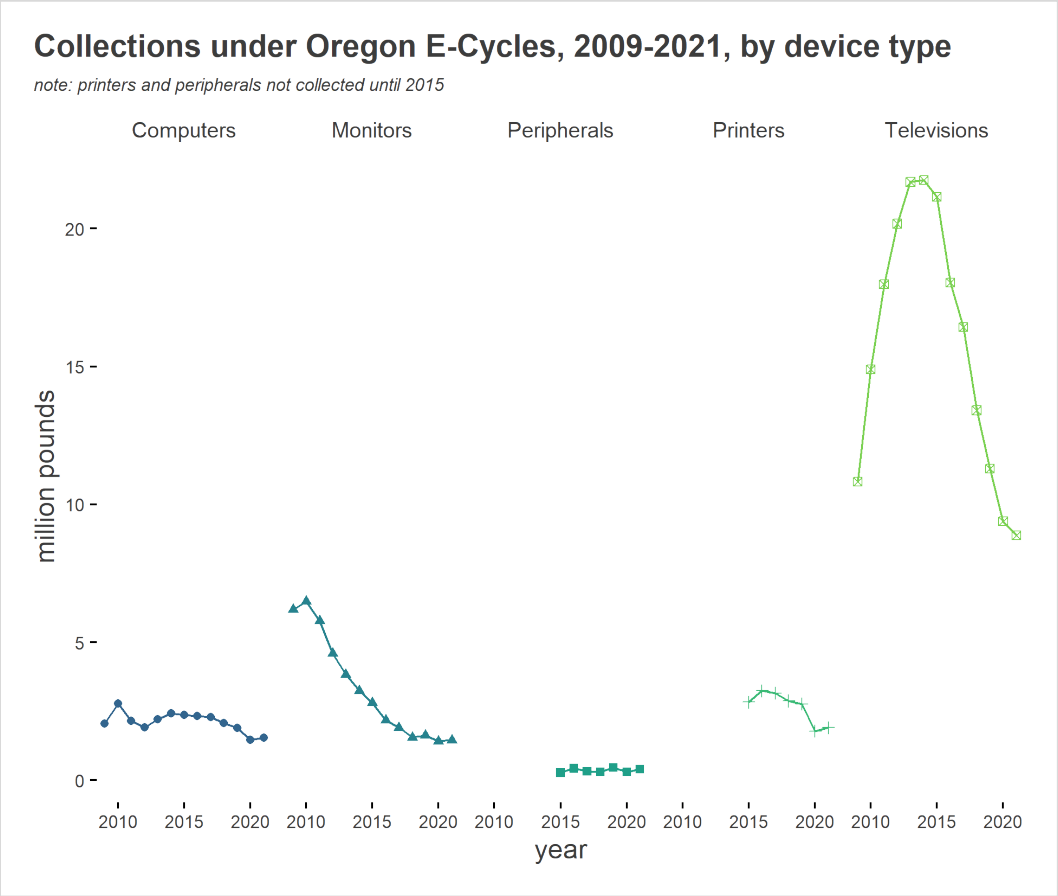
Oregon's actual collections under the E-Cycles program have largely imitated the national trend, as illustrated below. (Note that Oregon does not use the same device categories as the national figures.)

Figure 2



It may also be helpful to view the Oregon results by device type, as below:

Figure 3



Together the U.S. and Oregon datasets suggest that e-waste streams have been dominated by displays (TVs and monitors). While the weight of both types of displays seems to be declining, they are still the biggest elements in collected e-waste, by weight.

Though a decrease in waste should be good news for the environment, Althaf and colleagues[3] note that the new, lighter products present environmental and conservation issues of their own, due to the concentration of rare and hazardous materials in those products. They suggest that weight-based goals for electronics recycling – such as the ones that Oregon's E-Cycles program uses – may no longer have the same environmental value they once did, and that government recycling programs need to look for new ways of measuring performance of those programs.

COVID disruptions to e-waste flows and demand for electronics

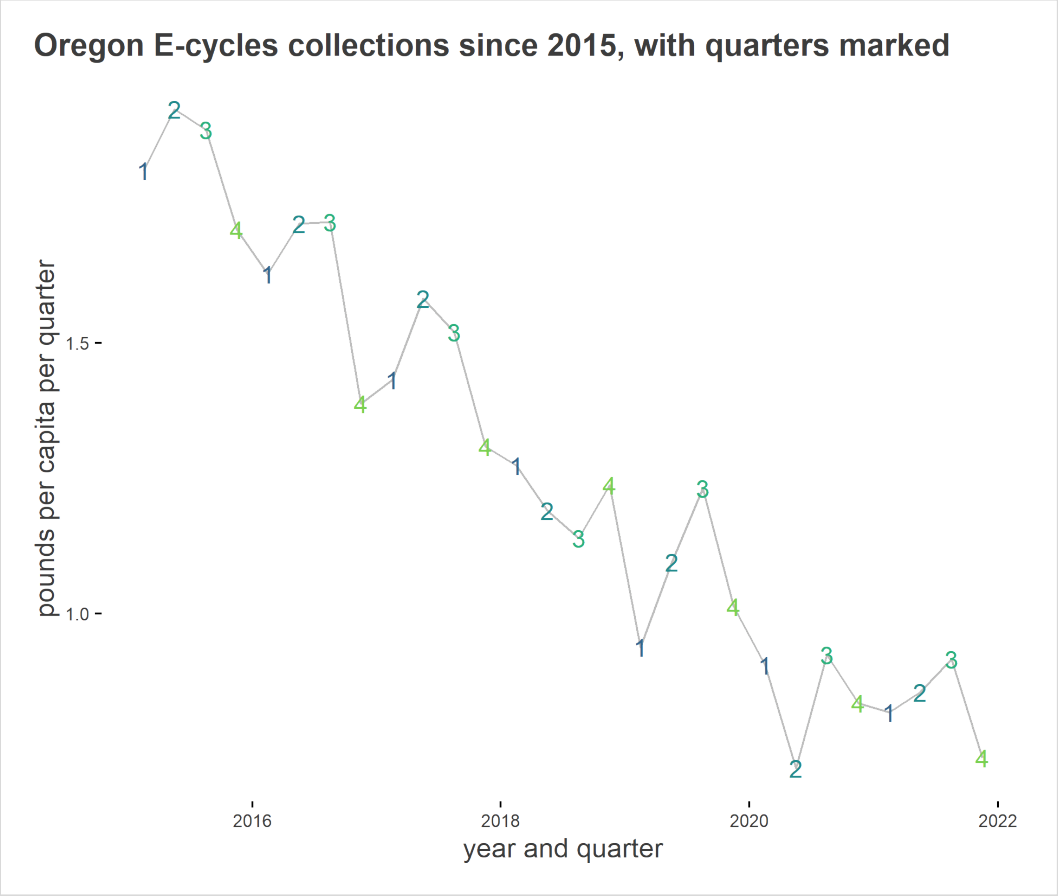
The electronics "ecosystem" was already undergoing a significant evolution before the COVID pandemic began in early 2020. When the pandemic hit, e-waste flows were clearly disrupted, at least for a short time. Demand for new electronics, which might anticipate future collections of retired equipment, also seems likely to have been affected.

[3] Althaf, Babbitt, and Chen.

E-waste collections in the United Kingdom took a sharp dip, near 50%, in the second quarter of 2020, according to Baldé & Kuehr,[4] reflecting a larger worldwide trend. These authors also describe a dip in "consumption" of new electronics across the first three quarters of 2020 (about 6% in North America, compared to business as usual), which they conclude will eventually be expressed in lower e-waste collections.

Oregon's own E-Cycles collections show a dip in collections in quarter 2 of 2020, though its magnitude was not as dramatic as the one in the UK. The following chart shows collections by quarter, with quarter numbers (1,2,3,4) serving as data markers.

Figure 4



This chart suggests that there is some seasonal element to E-Cycles collections, with quarters 2 and 3 often but not always showing higher values. Given this pattern, quarter 2 of 2020 looks especially low.

Tech Dump, an electronics recycling business, explained some of the decrease in recycling during early 2020 as a consequence of demand.[5] With so many workers being directed to work from home, they argued, corporate IT staff kept devices in service longer, and refurbished hardware had greater value, keeping machines out of the recycling stream.

[4] C P Baldé and R Kuehr, "Impact of the COVID19 Pandemic on E-Waste in the First Three Quarters of 2020" (United Nations University, 2021).
[5] Tech Dump, "The COVID-19 Impact on IT Recycling and What This Means for the Future," Tech Dump, May 11, 2021, https://www.techdump.org/it-recycling-mn/.

Some experienced figures in the American electronics recycling business expect that any decline in volume from the pandemic will be made up in future years.[6] One geographer expects that the pandemic will be a "blip" compared to the overall trend of rising use of technology.

Meanwhile, there are clues that demand for electronics may have been influenced by the pandemic as well.

- Canalys reports that global PC shipments (in units) showed >11% year-over-year growth in 2020, and 15% in 2021, and anticipates that 2022 will show growth as well.[7]
- Stewart and Crossan report that from 2018 to 2021, global sales of PCs (in $) grew about 11% per year, while sales of TVs grew about 4% per year.[8]

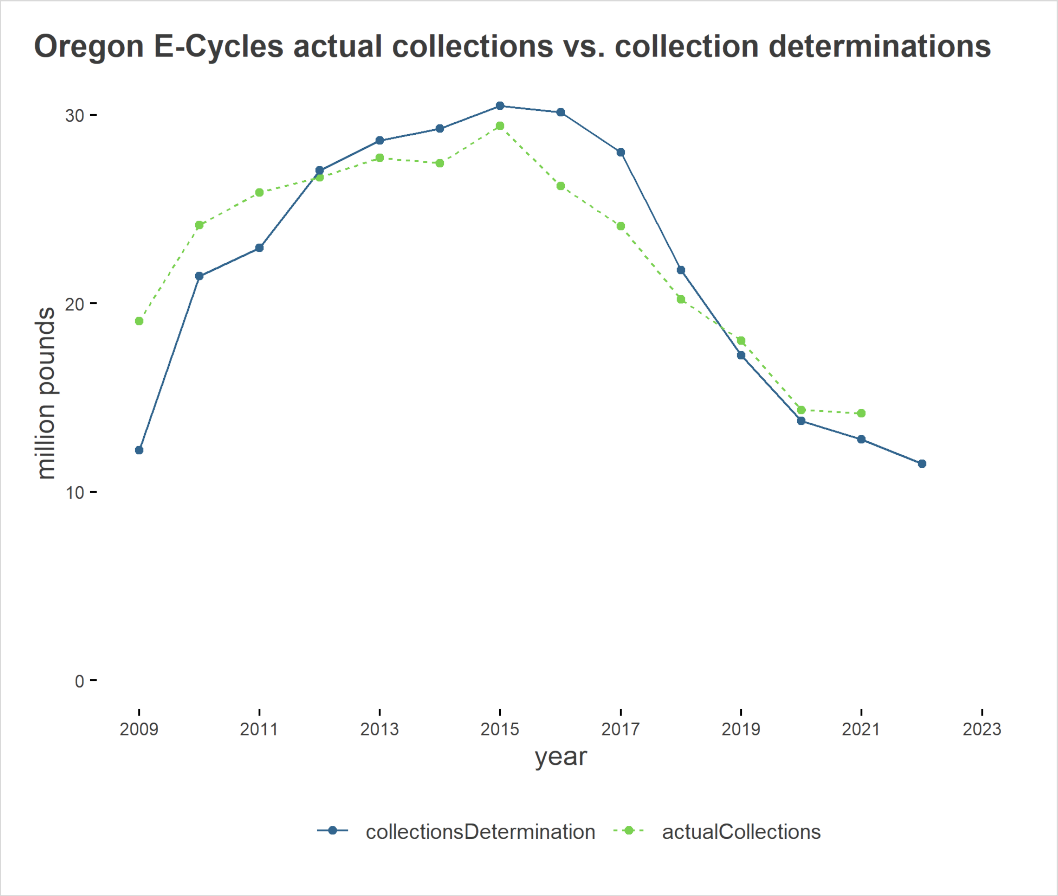
Altogether, these reports suggest that currently many new electronics, especially PCs, are coming into service. Some of these will be replacing older units which will end up in the recycling stream. It is reasonable to expect some increase in collections in 2023 due to these effects.

Available devices vs. collections

Over the history of the Oregon E-Cycles program, the relationship of the CD to the quantity of actual collections has evolved. The chart below illustrates:

[6] Maddie Stone, "E-Waste Will Go down Because of COVID, but for All the Wrong Reasons," Grist, June 15, 2021, https://grist.org/technology/electronic-waste-will-go-down-because-of-covid-but-for-all-the-wrong-reasons/.
[7] "Canalys Newsroom - Global PC Shipments Pass 340 Million in 2021 and 2022 Is Set to Be Even Stronger," accessed March 5, 2022, https://www.canalys.com/newsroom/global-pc-market-Q4-2021.
[8] Duncan Stewart and Gillian Crossan, "Consumer Electronics Sales: During the Pandemic, Computer and TV Sets Outgrew Smartphones," Deloitte Insights, accessed March 5, 2022, https://www2.deloitte.com/xe/en/insights/industry/technology/consumer-electronics-sales-growth-covid-19.html.

Figure 5



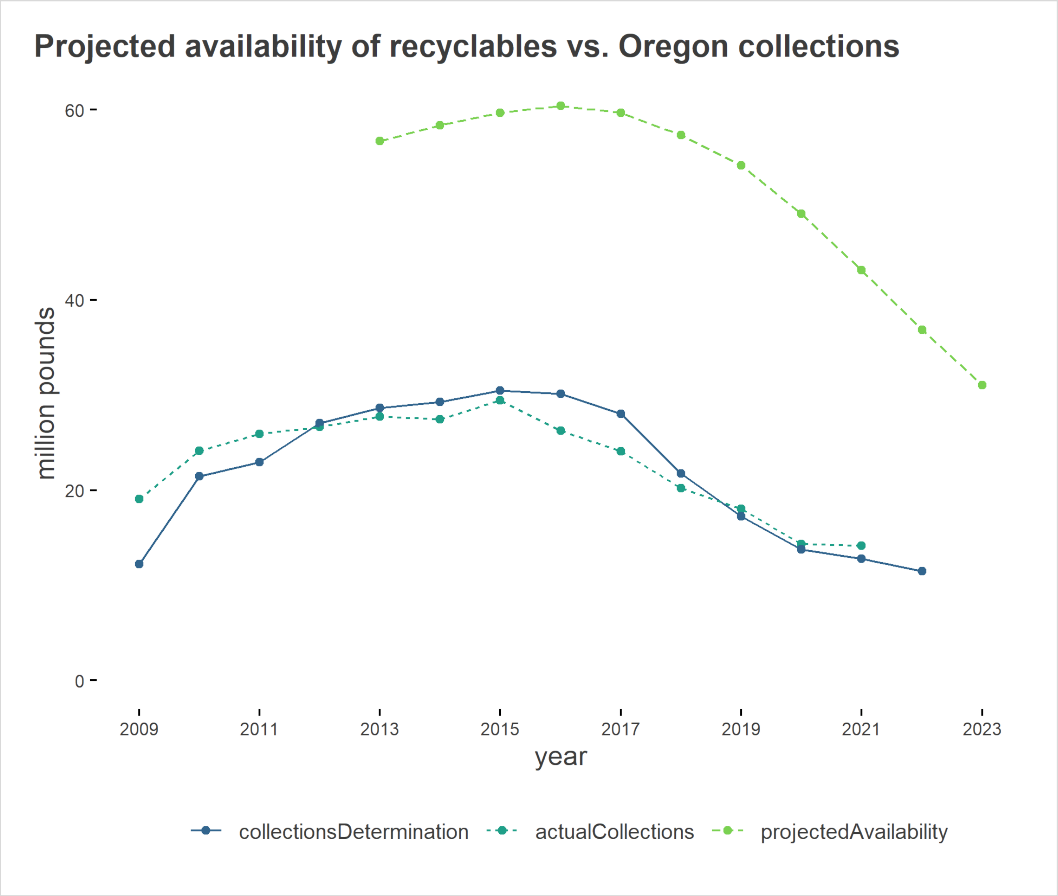
In early years actual collections were higher than the CD, from roughly 2012 to 2018 actual collections were lower than the CD, and in the three most recent years for which there are data (2019-2021) actual collections have been higher than the CD – though for 2019 and 2020 the numbers were very close.

This "shortfall" in recent years raises the possibility that the CD might not be ambitious enough. Recent versions of the CD have relied heavily on projecting trends from past collections, but past collections may not fully represent the way the electronics ecosystem is evolving.

A *prospective* rather than *retrospective* view of the electronics ecosystem might provide a different perspective on trends relevant to the CD. Callie Babbitt of the Rochester Institute of Technology has provided DEQ with such a view. In the late 2010s, Babbitt and colleagues developed a predictive model of the electronics ecosystem[9] that, among other things, estimated the weight of electronic devices "outflowing" to recycling or disposal. In 2019, at DEQ's request, Babbitt and colleagues customized the model to project electronics available for recycling in Oregon. The chart below summarizes those results, and compares them to CDs and actual E-Cycles collections.

[9] Callie W. Babbitt et al., "Sustainable Materials Management for the Evolving Consumer Technology Ecosystem: Summary Report of Phase 2 Research: Predictive Modeling of Emerging Technology Products," January 2018, http://www.rit.edu/gis/ssil/docs/CTA-SSIL%20Final%20Report%20SMM%20Phase%202%202018.pdf.

Figure 6



The quantity of electronics available for recycling is considerably larger than the quantity collected. On some level, this is to be expected. Retired electronics may be sold, altered, donated, or simply sit unused – and the proportion of retired electronics that go to these fates is unknown. Nonetheless, the large surplus of "available" electronics suggests there might be more that E-Cycles could legitimately collect.

Beyond that large gap, the curves show some similarities but an intriguing difference. Both projected availability and actual collections peak around the same time: 2015 and 2016. The shape of the downward trend after the peak is more linear for the actual collections, and convex for projected availability.

The difference in shape (though not the magnitude) of these curves might be used to create a modest adjustment to expectations for the 2023 CD. However, it should be acknowledged that the projected availability curve was produced before COVID; it may be less relevant now.

Public awareness

A final variable that makes it difficult to set a precise CD is DEQ's work to promote the E-Cycles program to the public.

A 2019 DEQ survey found that 79% of those surveyed knew that Oregon has an electronics recycling program, and that 67% of Oregon residents have at least one device eligible for recycling through the

Oregon E-Cycles program. [10] DEQ intends to replicate its survey in 2022 to determine whether public awareness about the program or the percentage of people with devices eligible for recycling has changed over time. An increase in either one of these factors may result in increased recycling.

Also, DEQ created a subsequent 2021 public awareness campaign designed to move to action the 67% of residents who have items at home that could be recycled. The campaign is currently on pause, but has the potential to increase recycling if and when it is launched.

Another driver of public awareness is the ongoing outreach local governments conduct throughout the year to encourage residents in their localities to take advance of drop-off events. DEQ cannot predict how much or how little outreach will be conducted at the local levels.

Analysis

Approach

Given the dynamic nature of electronics consumption and disposal, especially in the context of the COVID pandemic, DEQ cannot expect to precisely predict recycled electronics collections under E-Cycles a year or more ahead of time.

Instead, this analysis attempts to set credible ***high and low boundaries*** for the quantity of electronics that might reasonably be collected under E-cycles in 2023. DEQ will then apply multiple considerations, including comments from stakeholders, in choosing an exact collections determination value within those boundaries.

With this process in mind, DEQ's formulae for calculating high and low boundaries intentionally represent strong choices. The low number is intentionally conservative, being based only on historical trends, and in all likelihood is too low a target. The high number is intentionally ambitious, reflecting an aggressive application of adjustment factors to 2023.

Formulae

The low boundary for the 2023 collections determination is defined as CD = HT. The high boundary is defined as CD = HT + C1 + C2 + E + A. In these formulae:

- CD is the collections determination;
- HT is a projection for 2023 based on a curve fitting analysis of actual collections in previous years;
- C1 is an adjustment reflecting a COVID-related drop in electronics collections in early 2020;
- C2 is an adjustment based on a COVID-related increase in consumption of computers in 2021 and 2022;
- E is an adjustment addressing the difference in shape between the trend of Oregon's actual collections and devices modeled to be available for collection; and
- A is an adjustment reflecting a possible change in Oregonians' awareness of the e-cycles program.

It is important to note that HT can express a lot about the evolving electronics and electronic waste ecosystem. To the extent that phenomena like "lightweighting" and a shift from desktops to tablets are mid-to-long term trends, occurring over years or a decade, they should be expressed by HT – with the understanding all such expressions are based on data from the past instead of the present. Accordingly,

[10] rockitscience, Larkspur, and Benenson Strategy Group, "Oregon E-Cycles Branding and Messaging Implementation Guide" (Oregon Dept. of Environmental Quality, May 2021), https://www.oregon.gov/deq/FilterDocs/EcyclesImplementation.pdf.

DEQ's formulae in the current analysis do not make any adjustments expressly for "lightweighting." Rather, the adjustments C1, C2, E, A, etc. are meant to reflect plausible influences on electronics and electronics waste that HT is incapable of fully expressing.

DEQ's analysis calculates HT, C1, C2, E, and A separately for TVs and computing devices in pounds per capita per calendar quarter. (The calculation of HT is slightly different for the low and high boundaries, as will be detailed later). When predicted values for all calendar quarters of 2023 have been created, those values are multiplied by the expected Oregon population for 2023 and summed appropriately to produce totals for 2023.

Differences in method compared to the 2022 collections determination; autocorrelation

The previous collections determination analysis, for calendar year 2022,[11] spent a great deal of effort quantifying the historical trend (HT in the formulae above). It documented the projections of dozens of variants of diverse curve fitting models. The results showed that many of the variants produced similar results.

That analysis also investigated a statistical concern, autocorrelation in the historical collection data, because the historical data is a time series expressed in quarterly intervals, and it is plausible to expect seasonal changes in recycling collections. The results showed that autocorrelation was evident for some classes of devices in some curve-fitting models. Models incorporating autocorrelation may have done a better job predicting quarterly variations, but it is not clear they had any substantial effect on yearly totals, which are the key output of interest.

Meanwhile that analysis spent relatively little analytical effort quantifying the magnitude of adjustments (e.g. C1, C2, etc., in the formulae above) which might be used to modify the baseline expressed by HT.

The present analysis distributes its effort differently. It uses a single and relatively conventional curve fitting model (locally weighted least square regression, or LOESS) on quarterly data, with no explicit consideration of autocorrelation. At the same time, the "high boundary" calculation explicitly quantifies the effects of specific adjustments to HT, while acknowledging that these adjustments involve elements of speculation.

The goal is not to foretell conditions in 2023 exactly, but to create some well-reasoned boundaries for the quantity of collections that might realistically be expected.

Historical trend (HT) for the low boundary

An earlier section of this report showed that there was a notable drop in Oregon E-cycles collections during the second quarter of 2020. This matches global trends and comes as no surprise, since early to mid-2020 was the initial lockdown phase of the COVID pandemic.

This outlier presents a choice when modeling HT.

- Collections data from the second quarter of 2020 might simply be ignored as an anomaly – which is compatible with a view that the pandemic did not alter the fundamental course of change in the electronics ecosystem, and so should not be allowed to influence the shape of the trend line.

[11] Oregon Department of Environmental Quality, "Oregon E-Cycles Collections Determination for 2022," June 1, 2021, https://www.oregon.gov/deq/FilterDocs/e-cycles-coldet.pdf.

- Collections data from the second quarter of 2020 might be included intentionally – which is compatible with the view that the pandemic did alter the fundamental course of change in the electronics ecosystem, and should be allowed to influence the shape of the trend line.

The low boundary estimate of HT ignores the anomalous data from the second quarter of 2020. It produces the following trend lines, expressed separately for televisions and computing devices:

Figure 7

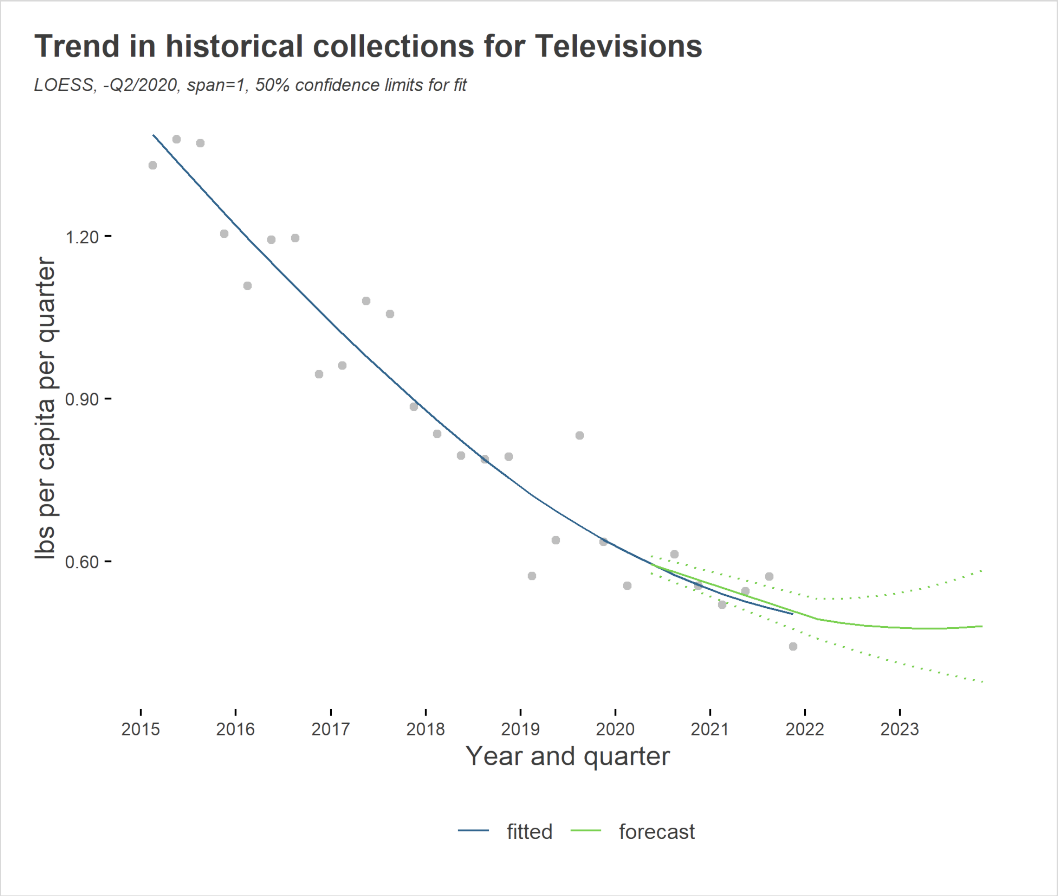
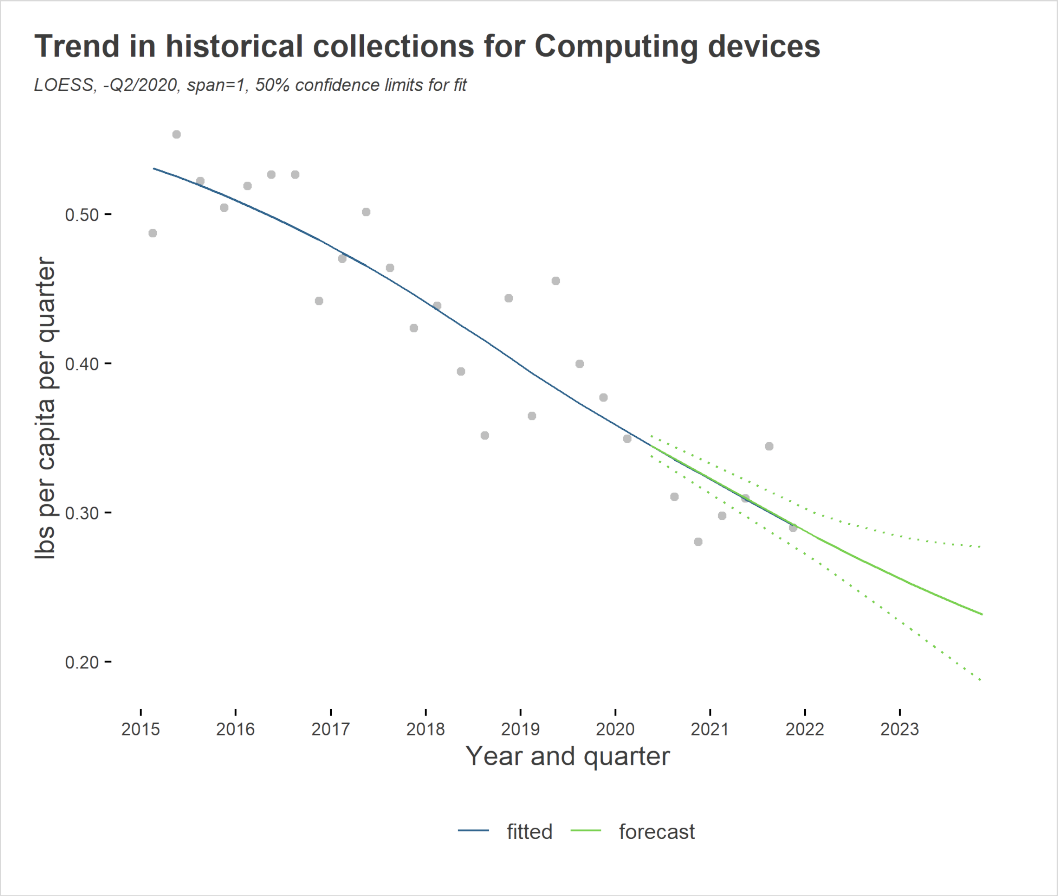


Figure 8



When adjusted for changes in Oregon's population, these trend lines calculate HT for 2023 as 8.3 million pounds for televisions, and 4.2 million pounds for computing devices.

Several things might be noted about these two charts. First, there are certainly variations from quarter to quarter and perhaps season to season, but it is not immediately obvious that these influence the overall trend over years, expressed by the "fitted" and "forecast" lines.

Second, the forecast line is not very precise. In each chart, the dotted lines represent 50% confidence intervals for the predicted curve (that is, of all the possible forecast lines that could be drawn by the regression, 50% of them are within those boundaries). In the case of televisions, this range encompasses trends of both negative and positive slope.

This demonstrates that forecasting complex curves from historical data inherently involves uncertainty. The solid forecast line is not a guarantee – rather, it is the most reasonable prediction that can be made, given the data and technique available.

Historical trend (HT) for the high boundary

The high boundary estimate of HT includes the anomalous data from the second quarter of 2020. This has the effect of bending the trend lines slightly higher for 2023, as shown in the charts below:

Figure 9

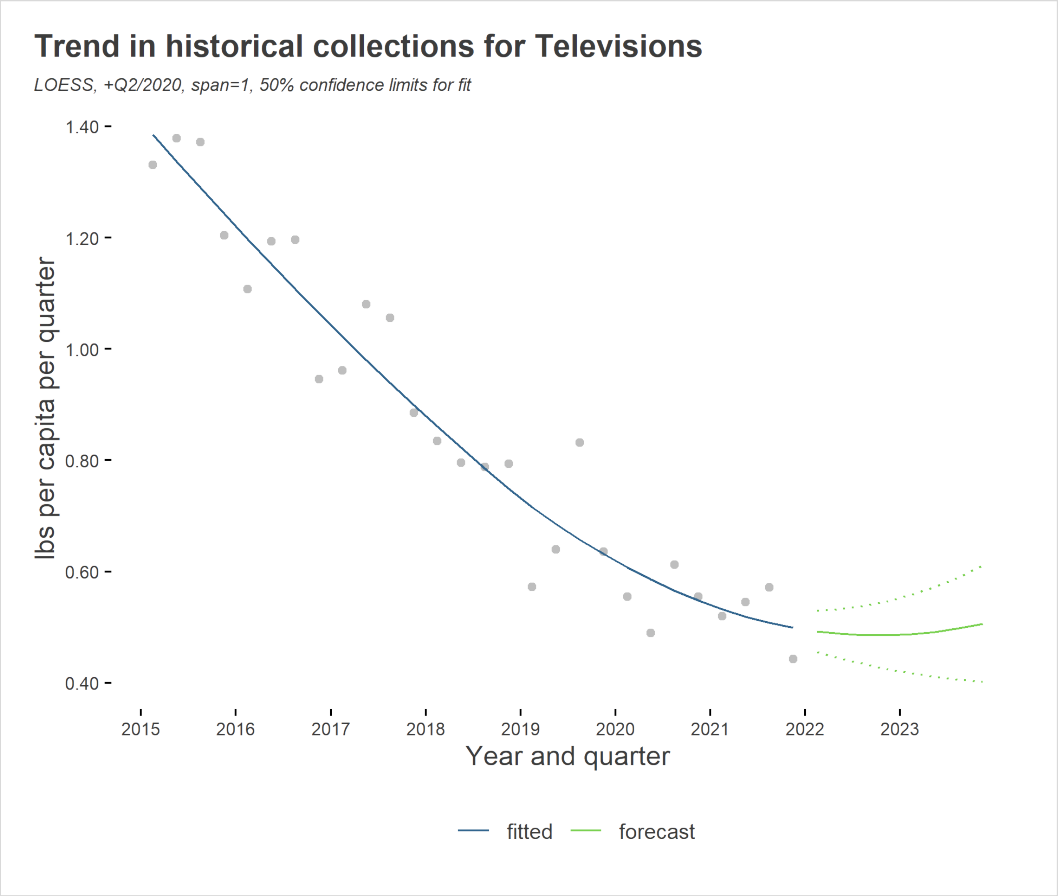
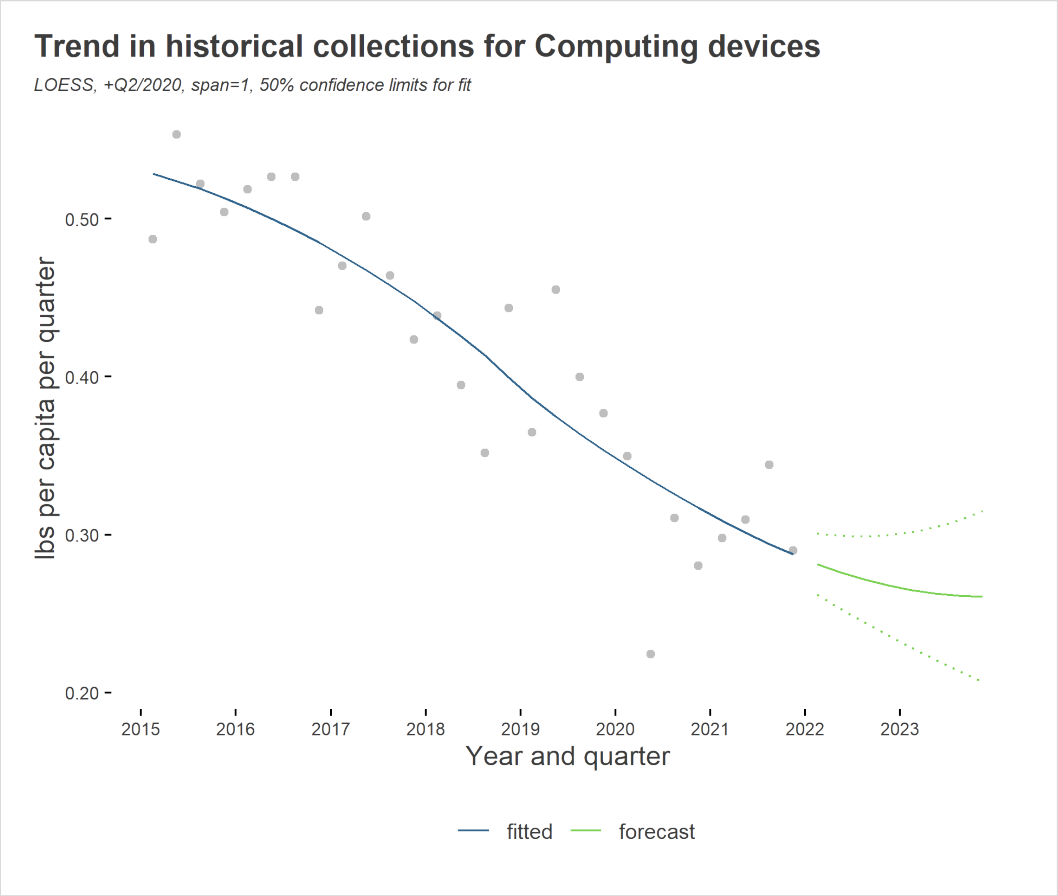

Trend in historical collections for Televisions
LOESS, +Q2/2020, span=1, 50% confidence limits for fit
lbs per capita per quarter
1.40
1.20
1.00
0.80
0.60
0.40
2015
2016
2017
2018
2019
2020
2021
2022
2023
Year and quarter
fitted
forecast

Figure 10



When adjusted for changes in Oregon's population, these trend lines calculate HT for 2023 as 8.6 million pounds for televisions, and 4.5 million pounds for computing devices.

For televisions the model shows a slight upward slope at the end of 2023, which is an actual change in direction of the trend compared to the years 2015-2021. As a practical matter this raises the calculated 2023 value of HT a small amount. It should not be concluded that collection of televisions, in pounds per person per quarter, is destined to rise substantially in 2024 and beyond. Data collections in 2022 may alter the predicted trend and provide more clarity.

COVID dip adjustment (C1)

Collections of electronics dipped drastically in the second quarter of 2020, both in Oregon and elsewhere. Some devices were simply not turned in due to the general lockdown; others were pressed into extended service as demand for teleworking and related services grew. As detailed earlier, there is an expectation within the electronics recovery industry that these un-collected devices will, within a few years, turn up in the waste stream.

The C1 adjustment, which is only utilized in the high boundary calculation, makes a strong assumption: that *all* of the missing collections from the second quarter of 2020 will be collected in 2023. While this is not necessarily realistic, it is certain that some of those missing collections will be collected in 2023 – and the point of the high boundary calculation is to provide a maximum.

C1 is calculated from the difference between actual collections in quarter 2 of 2020 and predicted collections for that quarter, according to the high boundary calculation of HT (see section above). This difference is then multiplied by Oregon's estimated population in 2023.

The magnitude of that difference was 0.100 pounds per person for televisions, and 0.115 pounds per person for computing devices. This translates into C1 values of 0.4 million pounds for televisions, and 0.5 million pounds for computing devices.

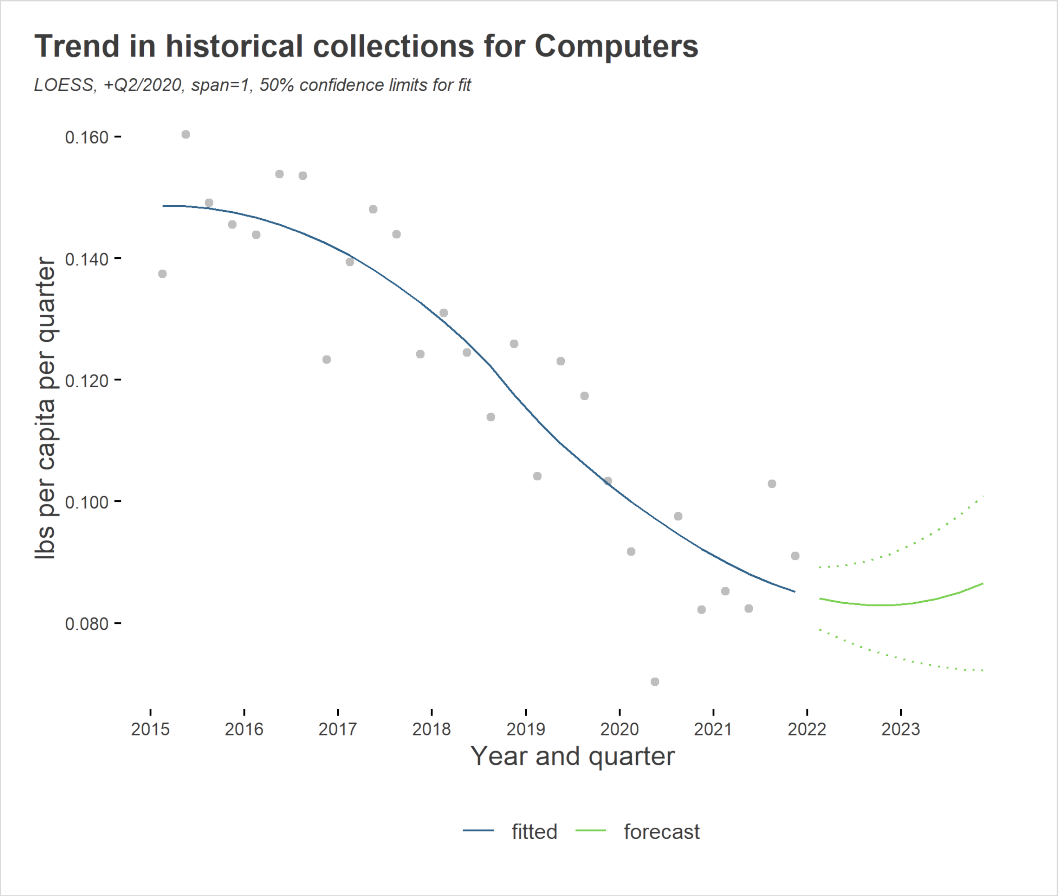
COVID computer demand adjustment (C2)

As detailed earlier, several computer industry sources have noted that demand for computers rebounded strongly as the COVID pandemic stretched into 2021. There was also some anticipation that this increased demand would continue in 2022. Some of this increased demand will be matched by related retirement of old computers and their entry into the electronics waste stream.

The C2 adjustment, which is utilized only in the high boundary calculation, makes a strong assumption: that in 2023, electronic waste in form of computers will be increased by an amount proportional to the computer demand increase associated with 2021 and 2022. While this is not necessarily realistic, it is certain that some of the demand increase in 2021 and 2022 will be reflected in recycling collections in 2023 – and the point of the high boundary calculation is to set a maximum.

C2 is calculated based on the results of a historical trend model, similar to the models for HT, but one that considers computers only (not other computing devices and not TVs). The chart below shows the computer trend model that includes the second quarter of 2020:

Figure 11



Predicted computer waste collections for 2023 are then scaled by 11%, which is a low approximation of the increase in demand linked to 2021 and 2022.[12]

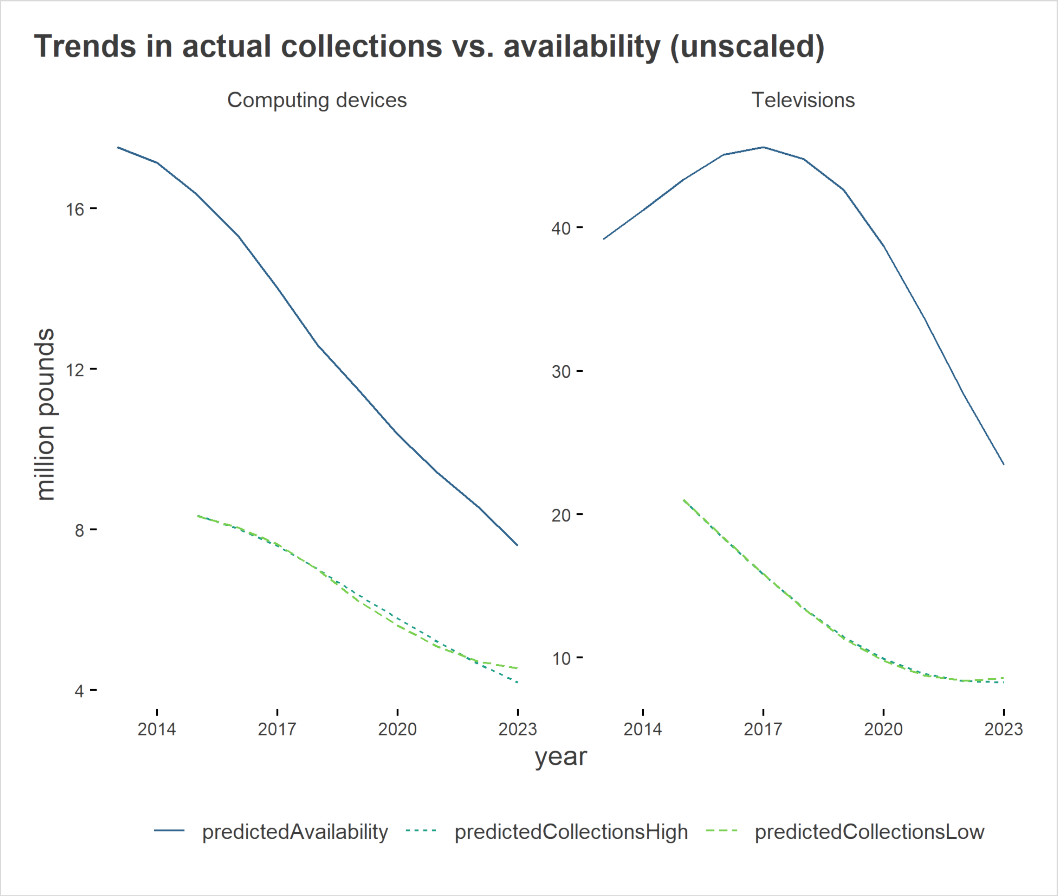
The C2 adjustment is quite small. Despite the noted increase in demand, computers should remain a relatively small portion of e-cycles collections. Adding 11% to the computer collection estimate for 2023 makes only a modest difference. The correction is 0.033 lbs/person/year. Adjusting for Oregon's 2023 population, C2 is about 0.2 million pounds.

Availability curve adjustment (E)

An earlier section of this document described the difference between the quantity of electronics actually collected and the quantity hypothetically available for collection, according to a custom projection created for Oregon DEQ by the Rochester Institute of Technology in 2019. The chart below illustrates those differences for two different classes of devices, comparing the trend lines developed for factor HT to the Rochester projection.

[12] "Canalys Newsroom - Global PC Shipments Pass 340 Million in 2021 and 2022 Is Set to Be Even Stronger."

Figure 12



Actual collections are anticipated to be lower than availability. This is entirely expected. Some "retired" devices inevitably will remain outside of the waste stream (and this may provide an environmental benefit if the absence represents repair or reuse).

However, when the magnitudes of the trends in actual collections and projected availability are ignored, the shapes of those curves differ, as in the chart below. This chart scales each trend line against its maximum value.

Figure 13

The difference in shapes is suggestive. It communicates that in 2023 there may be more televisions available for collection than the historical trend predicts, and fewer computing devices. In short, extrapolation based past collections may not adequately anticipate materials available for collection in the future.

The E adjustment, which is only utilized in the high boundary calculation, attempts to compensate for this gap. It finds the proportional difference between the availability curve and the predicted collection curve for 2023, and then scales that difference to the quantities of actual collections for each device class. This results in a fairly substantial adjustment: 2.4 million pounds extra for televisions in 2023, but 0.8 million pounds fewer for computing devices.

This adjustment is perhaps the most speculative of all the adjustments contributing to the high boundary. It is based on a projection developed pre-COVID, from a material flow model that was designed for the US as a whole, then adapted to Oregon.

Nonetheless, the E adjustment has value because it is the most substantial *prospective* adjustment in the analysis. It anticipates future changes to the electronics ecosystem, rather than extrapolating from past waste collections.

Awareness adjustment (A)

DEQ is still collecting data reflecting public awareness of the E-cycles program and electronics recycling. Since that effort is incomplete, the awareness adjustment is set at zero.

Analysis summary

The results of the analysis are summarized in the table below, for both low and high boundary calculations. Note that DEQ identified a minor error in source data used for the April 12, 2022 *Draft Oregon E-Cycles Collections Determination for 2023*. Results below reflect fully vetted source data.

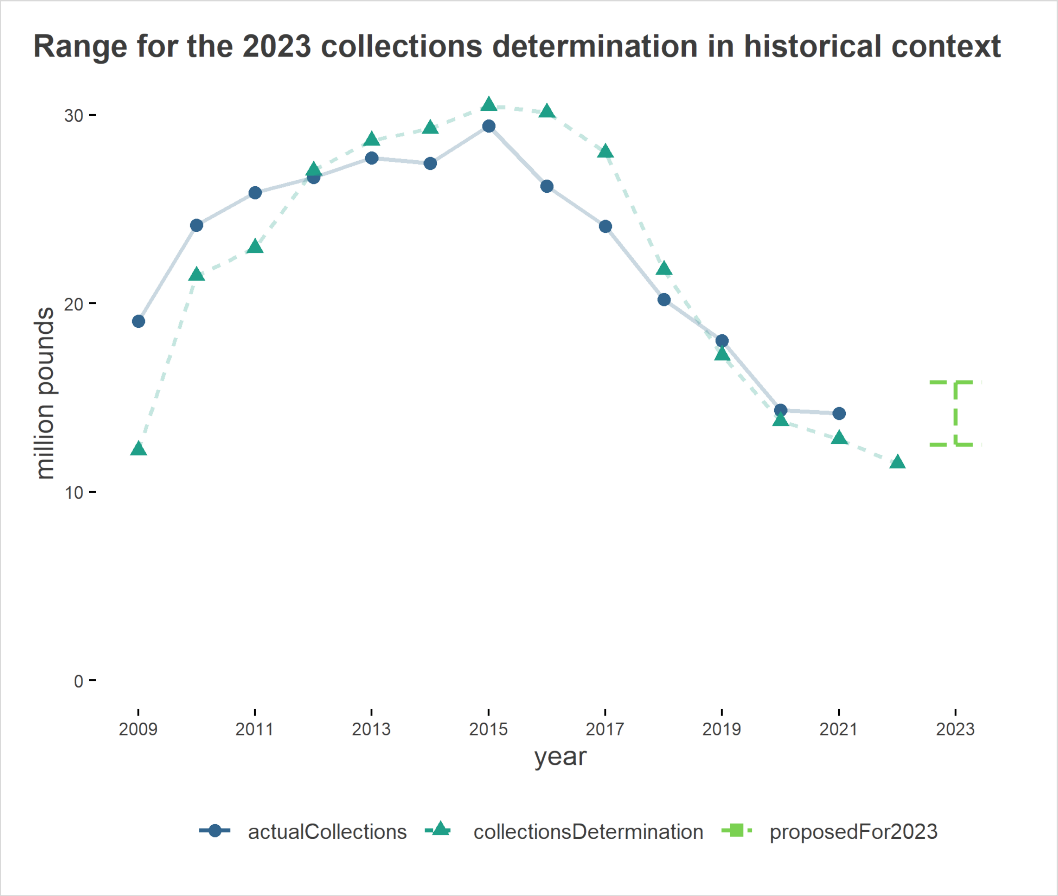
- The low boundary, based entirely on the observed historical trend without any explicit consideration of COVID or marketplace changes, suggests a 2023 collections determination of 12.5 million pounds, of which 8.3 million pounds are projected to be TV's and 4.2 million pounds computing devices.
- The high boundary, based on an observed historical trend with a small compensation for COVID effects on waste collection, plus the other corrections described earlier, suggests a 2023 collections determination of 15.8 million pounds, of which 11.4 million pounds are projected to be TV's and 4.4 million pounds computing devices.

Table 1. Summary of collections determination calculations for 2023

Element	Low boundary (millions of pounds)			High boundary (millions of pounds)		
	TVs	Computing devices	All	TVs	Computing devices	All
HT	8.3	4.2	12.5	8.6	4.5	13.1
C1	0	0	0	0.4	0.5	0.9
C2	0	0	0	0	0.2	0.2
E	0	0	0	2.4	-0.8	1.6
A	0	0	0	0	0	0
Sum using all adjustments	8.3	4.2	12.5	11.4	4.4	15.8

The figure below compares this range (12.5 to 15.8 million pounds) to both actual collections and collections determinations since the inception of the E-Cycles program.

Figure 14



The range suggested here represents an increase compared to the collections determination for 2022, but appears to be of a realistic magnitude when compared to actual historical collections.

The midpoint between the high and low boundaries is 14.2 million pounds, of which 70% are anticipated to be televisions and 30% computing devices.

Public input

DEQ posted the *Draft Oregon E-Cycles Collections Determination for 2023* for public input on April 12, 2022, and hosted a virtual public information meeting on April 13, 2022 to explain the document and answer questions. More than 60 people attended the meeting, representing state and local government, policy makers, electronics manufacturers, collection sites and waste haulers, the general public, and the media. Three commenters submitted written input on topics directly related to the collection determination and more broadly about longer-term improvements to the Oregon E-Cycles program.

Specific to the collection determination, commenters voiced support for a collection goal that would:

- Minimize disruption to the existing collection infrastructure
- Allow for flexibility in implementation
- Reflect the mid- to upper range of the draft determination proposed by DEQ

Commenters also sought program improvements that would:

- Provide transparency and early communication with collection sites and the public about any changes
- Ensure continued convenient and accessible access to the public

Finally, commenters expressed interest in working together to develop long-term solutions through legislation.

Final collections determination and next steps

DEQ evaluated all input received within the context of the current law and gave particular consideration to the risk of a potential disruption to the collection network if the goal were set too low.

Based on its analysis and evaluation of public comment received, DEQ sets a 2023 collection determination of 14.2 million pounds, of which 70% are projected to be TVs, and 30% computing devices. This is a moderate value given the range of results proposed by DEQ's analysis, where possible collections determination totals range from 12.5 to 15.8 million pounds. It is higher than the collection determination in 2020 and 2021, and is slightly higher than actual collections in 2021. Although one commenter noted that Q1 2022 collection was higher than in recent years, this was not a statewide trend. The 2023 goal will be attainable for program operators who can also rely on credits from overcollection in previous years to meet their obligations.

Looking forward, DEQ is committed to engaging stakeholders in a robust and collaborative discussion to update the Oregon electronics recycling law during the 2023 Legislative Session.

Alternative formats

DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email deqinfo@deq.oregon.gov.

El DEQ puede proporcionar los documentos en un formato alternativo o en un idioma distinto al inglés si así lo solicita. Llame al DEQ al 800-452-4011 o envíe un correo electrónico a deqinfo@deq.oregon.gov

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Tùy theo yêu cầu, cơ quan DEQ có thể cung cấp các tài liệu ở định dạng thay thế hoặc bằng ngôn ngữ khác ngoài tiếng Anh và tiếng Tây Ban Nha. Liên hệ với DEQ theo số 800-452-4011 hoặc gửi email đến deqinfo@deq.oregon.gov