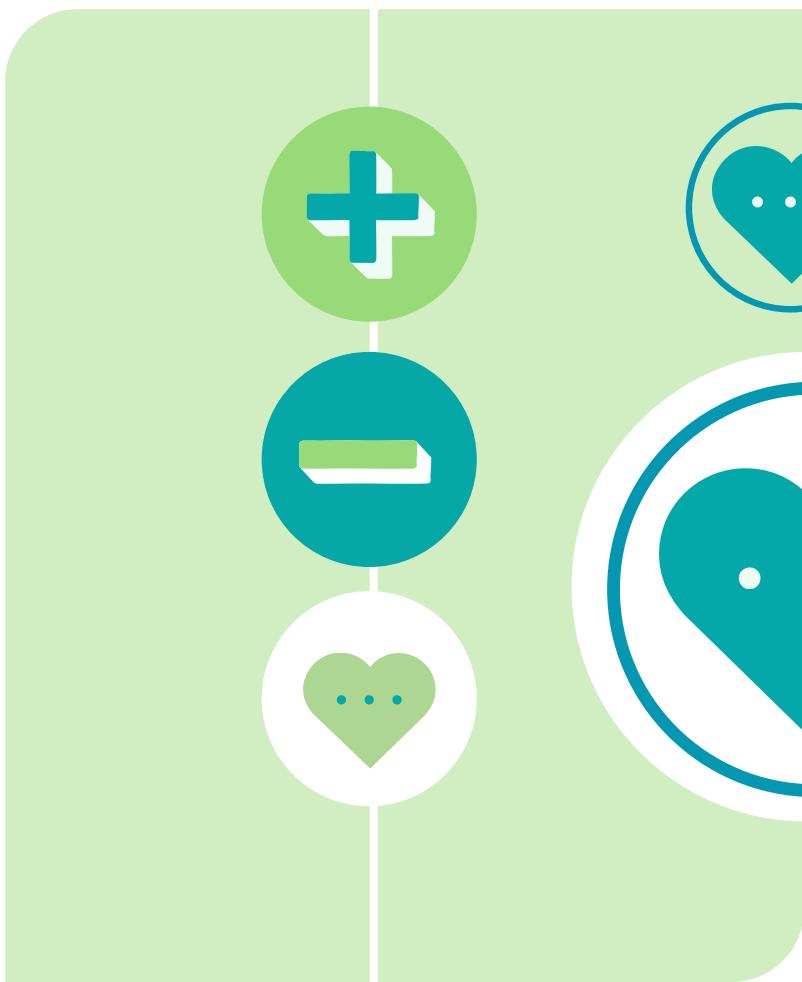




BATTERY RECYCLING INITIATIVE

Minnesota State Fair Survey Data Report

June 2025





The CollectED Project aims to educate the public about how battery recycling supports environmental protection and builds a circular economy of metals.

This data was compiled and analyzed by Catherine Kane and Chi Chi Okezie as part of Macalester College Prof. Roopali Phadke's research lab. This report was supported by a grant from the U.S. Department of Energy (DE-EE0011356). Any questions can be directed to phadke@macalester.edu.

Many thanks to Brianna Heggeseth, Maria Jensen, Jeremy Meckler, and Christie Manning for their assistance with data analysis. The data processing team included: Liv Dalby, Catherine Kane, Minoru Kishi and Chi Chi Okezie. Our thanks to the many Macalester students and CollectED team members who helped us with survey administration at the Minnesota State Fair in 2024.

Report design by Cristina Rutter at Sunny Day Design.

Collected Battery Survey

QUICK FACTS

About the survey



1,000
people surveyed at the
Minnesota State Fair



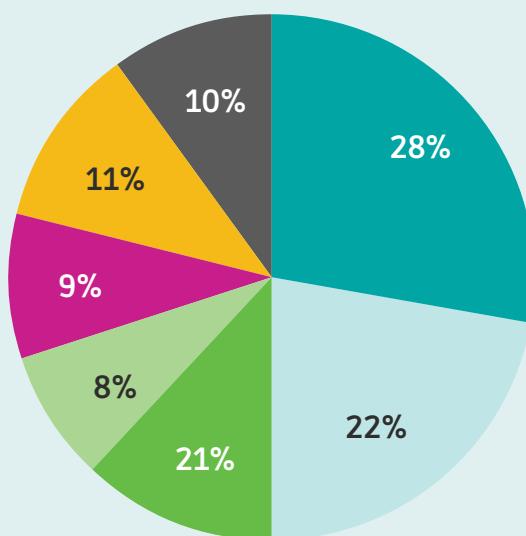
Conducted to understand
current battery recycling
habits, knowledge,
and barriers in Minnesota

70% of respondents recycle at least one type of battery (alkaline, coin, lithium-ion)

90% of respondents report barriers to recycling batteries

41% of respondents say they get information about recycling from a municipal mailer or website

Reported Barriers to Recycling Batteries



- I am confused about what kind of batteries can be recycled (28%)
- I am confused about where to recycle (22%)
- Hazardous waste sites are too far from my house (21%)
- I don't have time (8%)
- I am skeptical batteries actually get recycled (9%)
- I do not want to pay to dispose of old batteries (11%)
- Not applicable, I already recycle batteries (10%)

Low-income and non-college-educated individuals reported the lowest participation in battery recycling programs, yet they expressed a similar level of enthusiasm for battery recycling as their higher-income, college-educated peers.

A desire to keep toxins out of the air, water, and soil, and reduce the need for new mining of critical materials were the two most common motivators for battery recycling.



Batteries have revolutionized society. They increasingly power the small and large devices integral to our everyday lives, from cell phones to EVs. However, the correct process for disposal is not well known by general society, and improper disposal both harms our human and natural environments and robs our ability to create a curricular metals economy.

Battery recycling rates across the world are low. The EPA has estimated that North Americans throw away three billion batteries each year instead of recycling them. The lack of consumer battery recycling is in part driven by a lack of awareness. One 2024 study by the battery recycling firm, Cirba Solutions, surveyed 600 people from across the U.S. They found that half of respondents (53%) were unaware of how to properly recycle lithium batteries, while 55 % didn't know where to recycle lithium batteries.¹ A 2019 survey of 1,600 residents in California, Oregon, and Washington conducted for The Recycling Partnership found that 45% of those surveyed said they put batteries in their recycling or trash carts.²

Other studies have shown that awareness is not enough given the extensive barriers to behavioral change. A 2022 report by the Commonwealth Scientific and Industrial Research Organisation argued that low battery recycling rates can be overcome through better understanding of the importance of recycling, improved collection processes, and by implementing ways to efficiently recycle materials.³ The barriers to proper battery recycling also include the costs charged to consumers at collection sites.⁴ These findings are echoed by the U.S. Department of Energy. They cite that the barriers to consumer participation in battery recycling programs include: a lack of awareness of drop off locations, a lack of understanding of the value in spent batteries, concerns about privacy and security, and a lack of incentives to recycle.⁵

To add to the above empirical data, in 2024 we surveyed 1,000 people on their consumer battery recycling knowledge and behaviors. We were keen to examine whether battery recycling rates are higher in a state that is considered a leader on climate and e-waste

1 <https://www.cirbasolutions.com/new-research-uncovers-gaps-in-consumer-battery-recycling-knowledge-for-america-recycles-day/>

2 https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2020/04/West-Coast-Contamination-Initiative-Report-6.22.20.pdf

3 <https://www.csiro.au/en/research/technology-space/energy/Decarbonising-Industry-Transport/Energy-in-the-circular-economy/Battery-recycling>

4 Islam MT, Huda N, Baumber A, Hossain R, Sahajwalla V. Waste battery disposal and recycling behavior: a study on the Australian perspective. Environ Sci Pollut Res Int. 2022 Aug; 29(39): 58980-59001.

5 DOE Funding Opportunity Announcement (FOA) Number: DE-FOA-0002897



policy, with an active critical minerals mining industry. Minnesota's statewide recycling rate is consistently above the national average, demonstrating a commitment to waste reduction. Minnesota is also home to Fortune 500 companies Best Buy and Target, who are trend setters in recycling, product design and extended producer responsibility. Given all of this, we expected battery knowledge and recycling rates to be higher than national averages.

Some of the highlights from our data analysis include:

-  **70% percent of respondents told us they recycled at least one kind of battery**
-  **90% of respondents also reported a range of continued barriers to recycling batteries**
-  **41% of respondents say they get information about recycling from a municipal mailer or website**

Research Methodology

We surveyed approximately 1,000 people at the Minnesota State Fair in August 2024, an annual event that attracts nearly two million attendees over a twelve-day period around Labor Day. We chose this venue because attendees represent a cross section of Minnesota residents. We sent a team of over 30 students to survey State Fair attendees over three days. We surveyed on a Saturday, a Thursday and a Sunday. During those days, we ran shifts during mornings, afternoons and evenings to get a diverse set of participants. We collected responses via a three page, double-sided paper survey that respondents self-administered with a canvasser supervising. Those who completed surveys received a \$5 food coupon to be used at Fair vendors. We used RStudio and Excel to analyze our data.

Our survey asked participants how they disposed of three different types of batteries: alkaline, coin (with mixed chemistries), and lithium-ion. To assess current battery knowledge, we asked participants whether or not different types of devices contain batteries in a multiple choice format. We also asked survey respondents about their current recycling habits for traditional recyclables (metal cans, plastic bottles, paper, etc.), non-traditional recyclables (paint, motor oil, electronics, etc.), and organics composting. Finally, to ensure that we sampled a representative group of people, and to understand how responses differ across socioeconomic groups, we asked participants about their ethnicity, age, level of education, income, place of residence, and other demographic information.



Sample Integrity

Of the survey respondents, 88% were Minnesota residents. Of the Minnesota residents surveyed, 74% percent lived in the seven-county Twin Cities metropolitan area. According to the Metropolitan Council, 2020 census data found that 55% of Minnesota's population, 3.16 million people, live in the Twin Cities seven-county region. The Twin Cities region accounted for 78% of Minnesota's population growth between 2010 and 2020.

The ethnic background of our survey respondents largely mirrored that of the state's population: 77.8% of our survey respondents were white, while the state of Minnesota is 76.9% white. Our sample had a slight overrepresentation of Asian participants and a notable underrepresentation of Black participants, compared to the state of Minnesota.

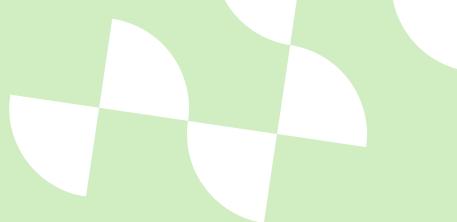
The annual household income of our survey respondents was mostly representative of the state at large, with our participants skewing slightly wealthier. Among our 1,000 respondents, 436 told us they earned more than \$100,000 a year. The median household income in Minnesota in 2023 was \$87,556.

Respondents aged 18-30 were overrepresented in our sample at 40% of participants, compared to 19% of the state's population. However, 32% of the metro population is under 25. Our sample also skewed more educated, with 70% of respondents having a bachelor's degree or higher, compared to 33% of the state's population.

In summary, our sample population skewed more white, urban, college educated and younger compared to the state's population. Some of this can be attributed to the location of our survey booth. We partnered with the Minnesota Pollution Agency's Eco Experience building, and were limited to surveying inside and along the perimeter of their building. In 2024, the roughly 250,000 attendees of the Eco Experience had a median household income of \$89,600 and 48% were college educated.

Knowledge and Behavior Scores

In order to get a sense of survey participants' self-reported recycling behavior, we developed a Sustainable Behavior Score. We created this scoring system to value difficult recycling tasks (e.g. composting versus paper recycling). Our first survey question asked respondents whether their households recycled "traditional" recycling materials. Respondents who selected any of the five options ("Other," "Metal Cans," "Plastic containers or bottles," "Glass Containers or Bottles" and "Paper/Cardboard") were awarded 1 point.



SUSTAINABLE BEHAVIOR SCORE

Metal cans = 1

Plastic containers/bottles = 1

Glass containers/bottles = 1

Paper/cardboard = 1

Other = 1

Clothing = 2

Paint = 2

Scrap Metal = 2

Electronics = 2

Plastic Film = 2

Plastic Bags = 2

Batteries = 3

Additional points for each type of battery:

Alkaline Battery = 1

Coin Battery = 1

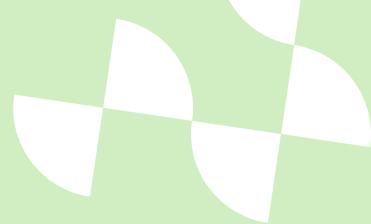
Lithium-Ion = 1

Highest possible score = 23

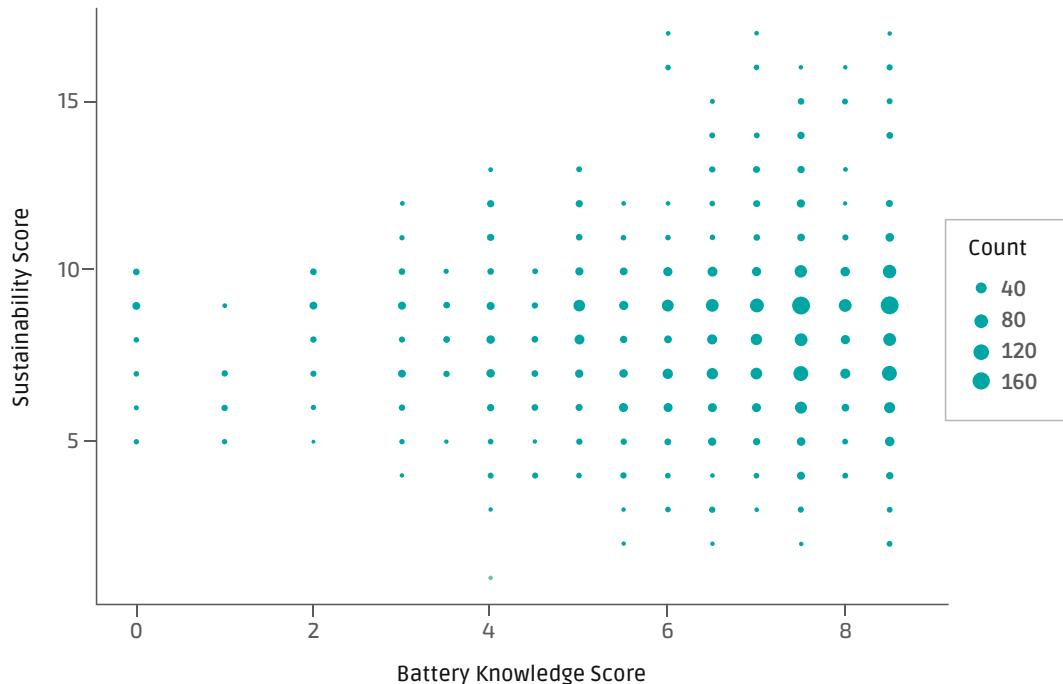
Median score = 9

A second question focused on non-traditional recycling materials. Respondents who answered that they currently recycled the following were awarded 2 points: "Plastic Bags," "Electronics," "Plastic Film," "Metal," "Clothing," and "Paint." These non-traditional materials were deemed more difficult to recycle, as they involve more work from individuals. For example, you can't rely on curbside pick up for these items. Respondents who answered that they recycled "Batteries" were awarded 3 points as these require more complex knowledge and specialty recycling. A separate question asked respondents how they dispose of three varieties of batteries, traditional alkaline batteries, coin batteries, and lithium-ion batteries. Respondents were awarded 1 point for each variety of battery that they went out of their way to recycle. With this rubric, *Sustainable Behavior Scores* ranged from 1-17 points, with a median score of 9 points.

In addition to our *Sustainable Behavior Score*, we composed a *Battery Knowledge Index* based on whether respondents could correctly identify which devices contain batteries. The Battery Knowledge Index ranged from 0-8.5 points with a median score of 7.5 points. **Taken together, the median Sustainable Behavior and Battery Knowledge measurements suggest that high levels of public knowledge about which items contain batteries does not translate into actionable steps, highlighting a gap between knowledge and widespread adoption of appropriate battery recycling practices.**

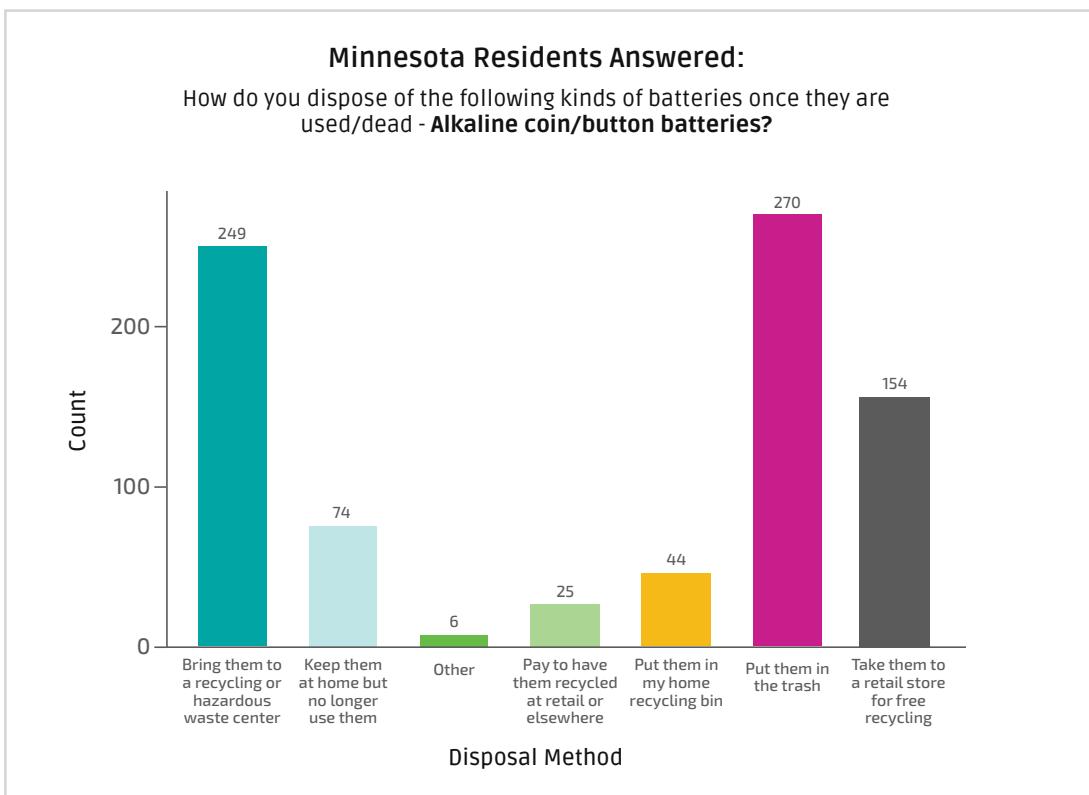
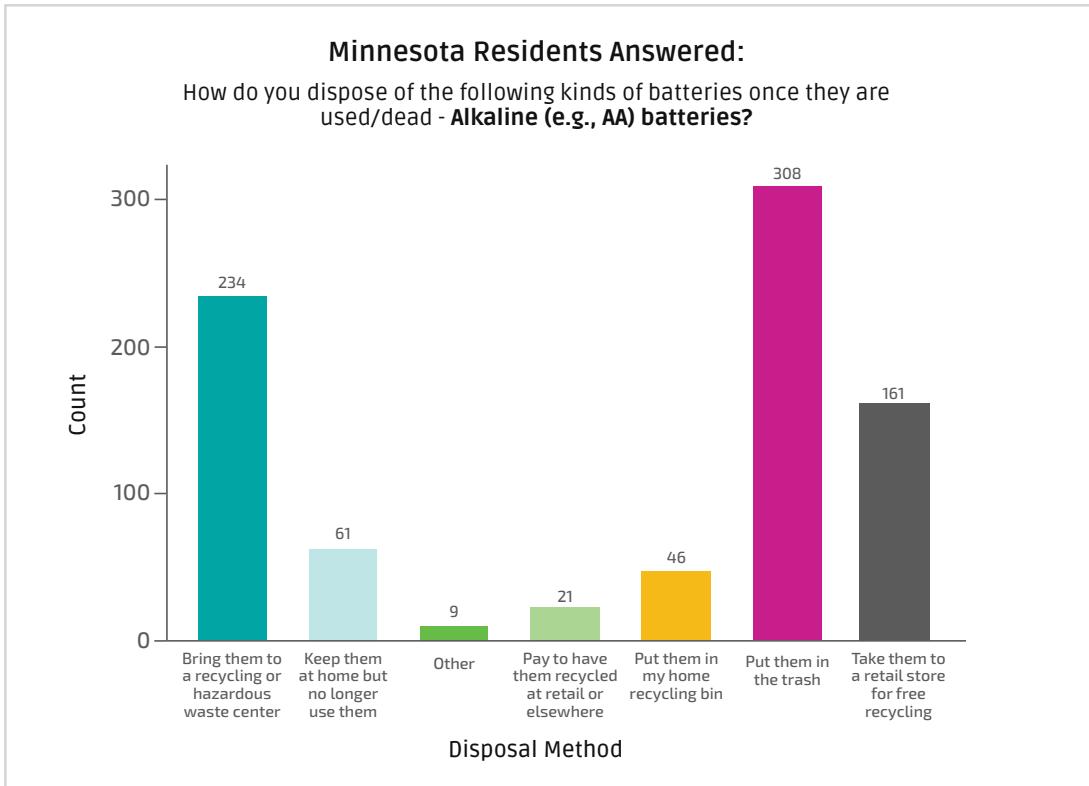


Mapping Battery Knowledge by Sustainability Score



Battery Recycling Habits in Minnesota

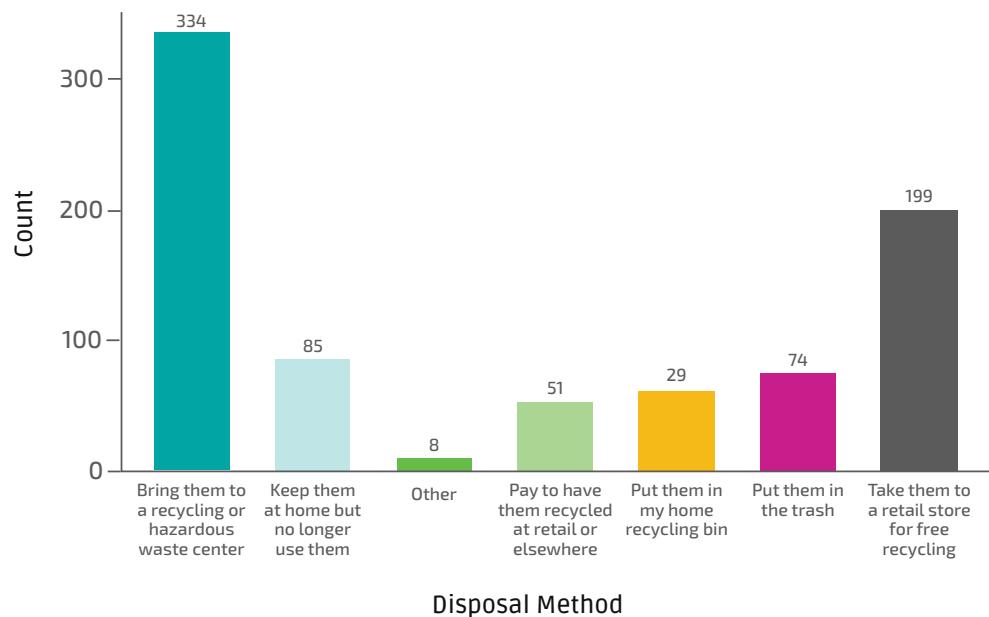
Overall, 70% of survey respondents report recycling at least one type of battery. Lithium-ion batteries are the most likely variety to be recycled, most commonly by bringing them to recycling or hazardous waste centers. Among respondents who do not report recycling batteries, the most common method of disposal was putting them in the trash (43% for lithium-ion batteries, 67% for alkaline coin batteries, 68% for alkaline batteries).





Minnesota Residents Answered:

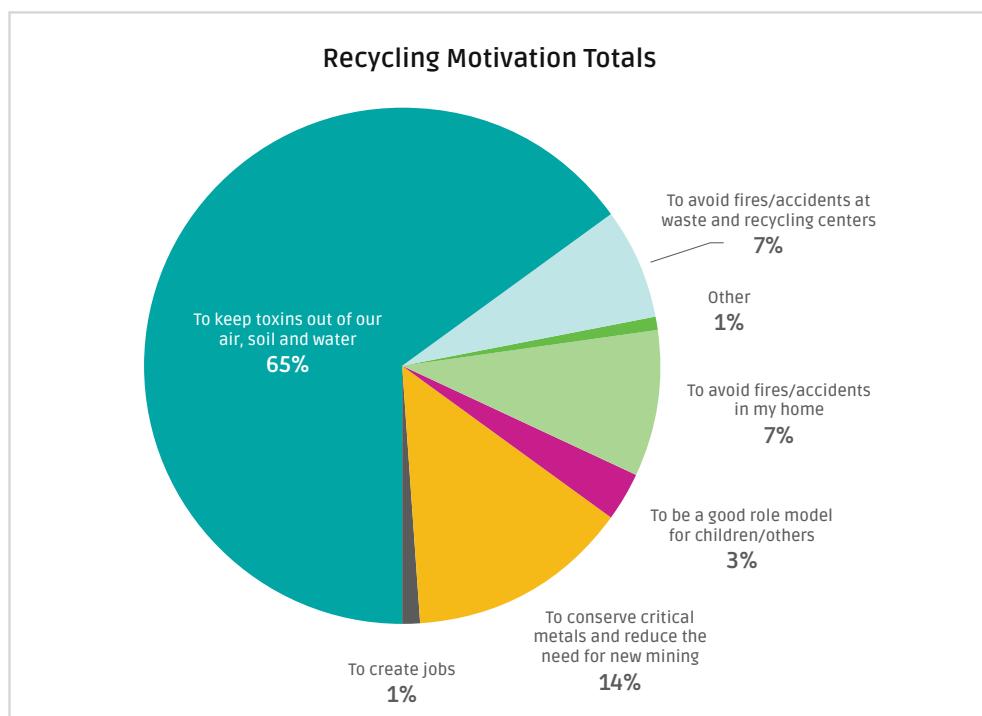
How do you dispose of the following kinds of batteries once they are used/dead - **Lithium-ion batteries**?





Recycling Motivations

Keeping toxins out of the air, soil, and water was the most common reason respondents gave for why battery recycling is important, followed by a desire to conserve critical minerals and reduce the need for new mining. Given the abundant information Minnesota residents receive about the potential for battery fire hazards, on billboards, mailers and in product information, it was surprising that avoiding fires at home or at waste centers motivated only 14% of respondents.



We also asked participants for their opinions on how a hypothetical state-funded battery recycling program might work. In the 2025 session, the MN legislature debated new e-waste collection and battery laws. The majority of respondents (55%) were in favor of manufacturers paying for the program, and building the cost into the price of products containing batteries.

Respondents also favored drop off points at supermarket/retail locations, over drop off at public buildings (e.g. libraries) or recycling/hazardous waste centers, for a hypothetical state-wide battery recycling program. This suggests that convenience and accessibility would be important considerations for any effort to increase battery recycling.

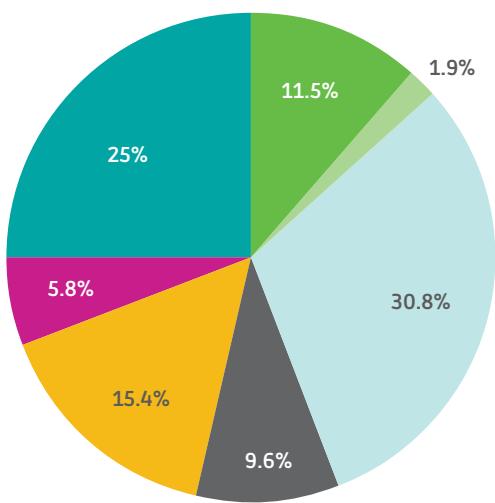


Recycling Information and Barriers

Among respondents who do not currently recycle batteries, confusion about what type of batteries are recyclable and where to recycle them are the most common barriers to action. Confusion about what type of batteries are recyclable was a similarly common barrier among respondents in income groups \$25,000 - \$150,000, but reports of this barrier were much higher among respondents with a household income of under \$25,000. **This suggests that a social marketing campaign focused on which batteries are recyclable should more intentionally target lower-income Minnesotans.**

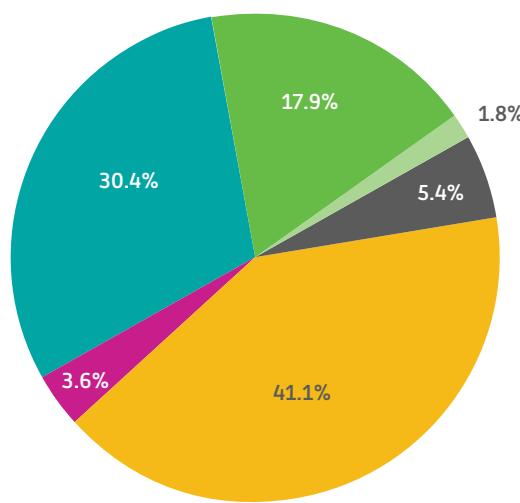
Among respondents with high *Battery Knowledge Index* scores but low *Sustainable Behavior Scores*—that is, respondents who know which common items contain batteries but don't report recycling often—there was widespread confusion about which batteries are recyclable and where to recycle them (55.8%). And, among those with high *Sustainable Behavior Scores*, there was confusion about which batteries can be recycled and skepticism regarding if batteries can really be recycled.

Low SS High Battery Knowledge Answered:
What are the Difficulties to Recycling? (n = 37)



- I am confused about which batteries can be recycled
- I am skeptical that batteries actually get recycled
- I do not want to pay to dispose of old batteries

High SS High Battery Knowledge Answered:
What are the Difficulties to Recycling? (n = 45)



- I am confused about which batteries can be recycled
- I don't know where to recycle
- Not applicable (because I already recycle batteries)
- I am skeptical that batteries actually get recycled
- I do not want to pay to dispose of old batteries
- Recycling/hazardous waste centers far from my household



To further understand the current state of battery knowledge in Minnesota, we asked participants where they got their information about battery recycling. Most respondents (43.2%) report getting their information from a local county/community mailing or website, emphasizing the importance of communications from public agencies. Many respondents (23.5%) also reported getting information from friends and family.

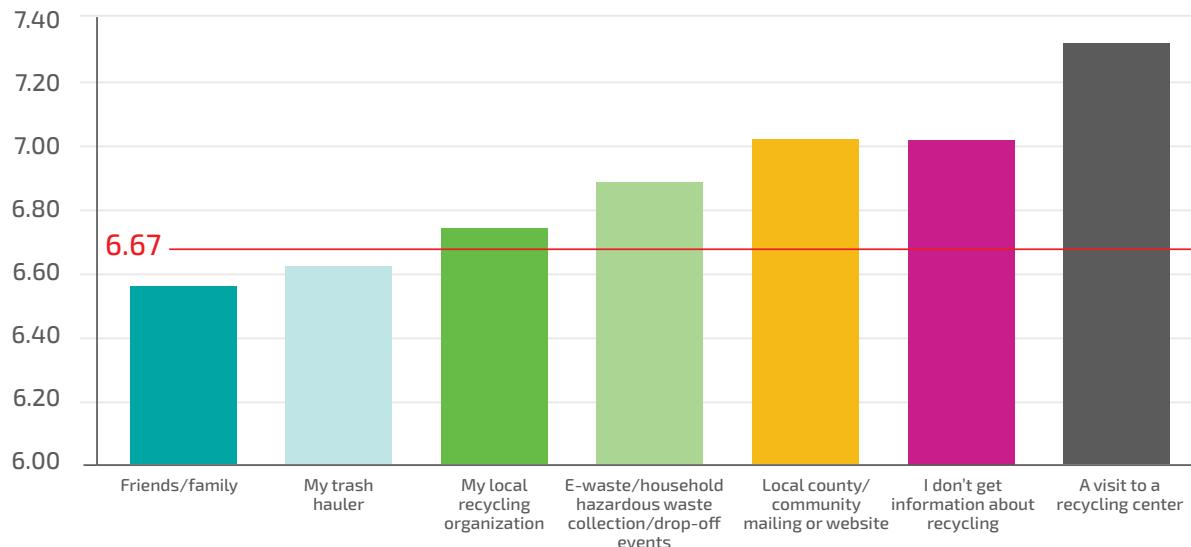
We also set out to understand how the source of recycling information affects battery knowledge. Respondents with the highest scores on the *battery knowledge index* got their recycling information from a visit to a recycling center, and the lowest scorers reported getting information from friends and family.

Taken together, this data suggests that word-of-mouth communication about battery recycling is a significant source of confusion for Minnesotans. However, this data also makes the case for the potential effectiveness of a social messaging campaign. People trust friends and family as a source of information on battery recycling even if those networks are not currently providing reliable and accurate information. **This data also suggests that mailers and websites are valuable places to share information about battery recycling, as these are by far the greatest existing source of information for Minnesotans.**

Using the Battery Knowledge Index, we also found that respondents who have greater awareness of what items contain batteries also have higher rates of recycling batteries, suggesting more general battery knowledge correlates to better disposal methods. Another interpretation of this data is that more educated people may have more time to devote to researching where and how to dispose of batteries.



Battery Knowledge Scores by Recycling Information Sources



Conclusions

Minnesotans are eager to properly dispose of batteries, but there still remains general confusion around what kind of batteries can be recycled and where to recycle them. Of our 1,000 respondents, 70% currently recycle at least one type of battery, most commonly lithium-ion batteries, indicating a willingness to learn about, and take steps to participate in battery recycling programs. The lowest rate of participation in battery recycling programs is among low-income households, with the most common barrier reported as confusion about what type of battery can be recycled and where to recycle. All of that suggests that a social messaging and education campaign is both an important and effective strategy to increase battery recycling in Minnesota.