The Cost and Environmental Benefits of Using Reusable Food Ware in Schools

A Minnesota case study

Minnesota Pollution Control Agency

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Executive summary

Two Minnetonka middle schools, in coordination with TonkaGreen (the parent volunteer organization), received a grant from the Minnesota Pollution Control Agency's (MPCA) Environmental Assistance Grant Program to switch from disposable to reusable food ware and improve their cafeteria waste sorting stations. The purpose of the project was to address the most significant source of non-recyclable, non-compostable waste from the school cafeterias: disposable plastic flatware and Styrofoam bowls. The schools used the grant funds to purchase washable durable utensils and bowls, custom-made waste sorting stations, and a few needed racks and carts to store, move, and wash the reusable food ware. In addition, the project included educating over 2,000 students, staff, and visitors about the benefits of eliminating the disposables and how to properly sort everything from the trays after lunch. The project team analyzed the waste diversion benefits and, with help from MPCA staff, the overall lifecycle environmental footprint change from the source reduction of the disposable items – including carbon emissions, water consumption, and air emissions.

In the first year, the schools saved approximately $3,000 combined by buying the reusable utensils and bowls. The annual per student costs for food-ware dropped from $6.89 to $4.83.

Environmental impacts included prevention of about 6,000 lb of on-site solid waste in the first year. Instead of buying 700,000 plastic utensils, the school purchased just 12,000 metal reusable utensils. In addition, in the first year of use, the change to reusable utensils and bowls are estimated to result in a 44% reduction in life cycle greenhouse gasses and similar reductions in water withdrawals and air pollution emissions versus the disposables. Taken alone, the metal utensils resulted in a 77% reduction in greenhouse gases and water consumption over disposable plastic utensils.

The benefits of reusables increase the longer they are in use. Over three years of use, the schools could anticipate saving an estimated $23,000. Environmental benefits accrue as well. Over three years of use, the reusable utensils (not the bowls) would result in an estimated life-cycle reduction of 88% of greenhouse gasses, air pollutants and water consumption over the disposables. On-site impacts to water and electricity use were found to be negligible and did not change the net overall magnitude of the life-cycle benefits of the reusables. Changes to staff routines were easily accommodated. Several tips for implementing use of reusables in schools were developed.

This case study shows that a return to reusable utensils in schools can be good for the bottom line and the environment. Moreover, the case study shows that common concerns about reusables – that on-site water and electricity use will undercut environmental benefits – are unfounded.

Introduction: Goal of the project

Two Minnetonka middle schools, in coordination with TonkaGreen (the parent volunteer organization), received a grant from the Minnesota Pollution Control Agency's (MPCA) Environmental Assistance Grant Program to switch from disposable to reusable food ware and improve their cafeteria waste sorting stations. The purpose of the project was to address the most significant source of non-recyclable, non-compostable waste from the school cafeterias: disposable plastic flatware and Styrofoam bowls. The schools used the grant funds to purchase washable durable utensils and bowls, custom-made waste sorting stations[1], and a few needed racks and carts to store, move, and wash the reusable food ware. In addition, the project included educating over 2,000 students, staff, and visitors about the benefits of eliminating the disposables and how to properly sort everything from the trays after lunch. The project team analyzed the waste diversion benefits and, with help from MPCA staff, the overall lifecycle environmental footprint change from the source reduction of the disposable items – including carbon emissions, water consumption, and air emissions.

It was important to the funders and project participants that this project considered both the full environmental life cycle and the full financial costs of making this shift. Often with changes such as these, people assume that any increase in on-site water use or electricity to wash dishes will trump the benefits of waste reduction. And similarly, people often only look at the relative initial purchase price of the two types of goods while a host of additional related and sometimes hidden costs and savings are ignored.

In this project however, the team attempted to estimate life cycle greenhouse gas (GHG) emissions and water consumption from raw materials through manufacturing and transport to customer or "cradle to consumer" and to also look at on-site water and electricity use. On the cost side, the team considered not just purchase costs for the reusables compared to the disposables, but also hidden costs in storing, unpacking, and disposing of disposable utensils or added costs to wash the reusables. Could total solid waste costs decline if reduced trash volume led to reduced number of pick-ups necessary from the school? To the extent possible, the schools tried to assess all of these related variables.

It was also important to know if this was a logistically feasible project in busy middle school lunch rooms with all the attendant movement and chaos. Would it work when kids have to eat and sort their waste and trays in less than 30 minutes? Would kids get it? Would they cooperate? What sorting procedures would need to change? What monitoring would be needed?

[1] Prior to the grant, the Minnetonka high schools were already collecting source-separated organics during lunch periods; however the system was not optimized. Initially, this grant project was going to include tracking changes in total trash, compost, and recyclables collected as a result of the improved sorting stations. However, because of difficulties in getting accurate weights and changes in staff this part of the grant project was dropped and the focus was shifted entirely to the switch to reusable utensils and bowls.

Starting out: Before the reusables

Prior to the start of the grant, the two middle schools were already using reusable trays. The schools had functional kitchens with industrial dishwashers and staff who operated them. In addition, they had recently begun to collect organic waste for commercial composting from the cafeteria area – front and back of the house. Staff and volunteers created an educational campaign based on the signage at the sorting station, "3, 2, 1 – You're Done!" The sorting stations were, initially, quite basic, consisting of three large round totes – each with a number (1, 2 or 3) hanging over them along with samples of materials for each bin. The bins themselves were labeled "trash" "food" and "recycling" (see Figure 1).

Figure 1

As this organics recycling program got underway, it became apparent that much of what was left in the trash were disposable utensils and Styrofoam bowls. (It was estimated that 70% of the disposable garbage generated in the cafeterias was plastic flatware, portion bowls, wrappers and bags.) While some places might have decided to switch to *compostable* disposables and *divert* some waste to organics in a case like this, the Minnetonka schools made the better environmental decision to use *reusables* and *prevent waste altogether*.

Once the decision was made to make the switch to reusables, it was obvious that a better sorting line would be needed; one which made capture of the reusables along with the trash, recycling and organics simple and efficient, clear and easy to understand.

Table 1

Middle School Enrollment	2010 – 11	2011 – 12
MMW	704	941
MME	935	989

Readers might presume that use of reusables needs a small school. However, Minnetonka Middle Schools (West and East) were large and growing as is evident from Table 1.

Making the change

Once school leaders decided to make the change to reusables and secured the grant, a team of staff and volunteers from both schools met about five times to think through the details. This team included purchasers and business office staff, kitchen managers and staff, facility engineers, the principal and parent volunteers. It was critical to include all staff whose cooperation was needed and whose job might be touched by the change early in the planning process. The group worked out the design for the sorting station and signage, anticipated changes in the kitchen process, and calculated the amount of reusables to be purchased based on prior purchase of disposables. They also decided how they would teach students about the change and monitor the stations to limit the number of utensils thrown away. The planning and purchases all occurred in the spring, with the intent to launch the program as school began in the fall. All baseline data were collected in the spring as well. (Baseline data and results are presented in the "Results" section of this report).

The lunchroom manager calculated the number of disposables used for each meal based on purchase records and on the number of lunches sold daily. This became the basis for the reusables order– they would need at least a day's worth of utensils. An adjustment was made to anticipate some loss and

breakage. Staff expected that, especially in the first six months, students would throw away some utensils simply out of habit.

Staff designed the sorting stations so that students would discard recyclables, trash and organics first, and then place utensils and bowls in collection bins at the end of the line. Trays were to be returned to the kitchen window. The expectation was that the utensils might be useful in scraping food from trays.

Figure 2

The new sorting station was a stainless steel table with holes cut to accommodate the three main bins (Figure 2). Each circular opening was rimmed with colored plastic to relate to the overall color coding scheme (red =trash, green= organics, blue = organics) and a sign was affixed to the stainless table. A small dish bin was placed at the end of the sorting table for utensils, and a larger bin below that one, on a shelf, to collect the bowls.

When the sorting station was rolled out at Minnetonka Middle School East (MME), it didn't work well with the flow and space of the cafeteria. At the same time, Minnetonka Middle School West (MMW) was realizing that they needed a second sorting line to efficiently accommodate the lunchtime traffic. The solution was to move MME's sorting station to MMW, and to have MME design a new station tailored to the space they had in the lunch room. Lesson number one: one size doesn't fit all.

Figure 3

Education efforts: The principal introduced the change to students on the first day of school during an orientation at the start of each lunch period. He emphasized environmental responsibility, but even more so, played to their feeling of maturity, having transitioned to middle school. He emphasized his faith in the students' maturity, now that they were in middle school that they could be responsible for the lunch routine. Staff arranged to have an adult monitor at the sorting stations for the first week of school as students learned the new system and got used to the reusables. Monitors stood at the stations, talked students through the process, and occasionally corrected sorting errors by plucking a fork or milk carton out of the trash. Parent teams then checked in periodically throughout the year to monitor stations. (This monitoring really dropped off in the second half of the year, and the custodian felt like he should be doing more of it, but didn't have much time during lunch periods.)

Results

Costs: First year

Overall, the use of reusables was a wise financial decision for these schools. Compared to the purchase of disposable utensils and bowls for one year, the first year investment in reusables saved the two schools about $3,000 combined. It's notable that even factoring the one-time costs of necessary dishwashing accessories like tubs and racks, the schools still spent about $2,000 less in 2011-12 on reusables than they did on disposables the prior year. The annual per student costs for food ware dropped from $6.89 to $4.83. Figure 4 summarizes the costs for the disposables and the reusables purchased in the respective 10-month school years.

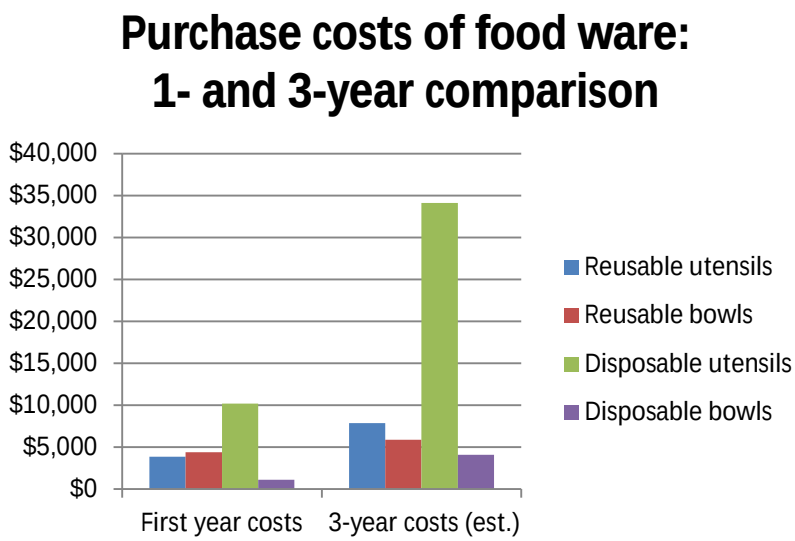

Figure 4

There was dramatic difference in price for the two types of reusable items; metal utensils were less expensive than the durable bowls. The schools saved over $6,000 by buying reusable utensils instead of disposables, but spent about $3,000 more on reusable bowls than they would have for disposable bowls.

Costs: Estimated over three years

The real value of reusables is that they are durable goods with a long life span for use; the longer period of use, the greater the savings. Assuming a 3-year life span of the reusables, even with budgeting for replacement of 20% loss in Year 2 and 3, MPCA estimated the schools would save about $23,000 over three years. The per student cost for food ware, per year, after three years, was estimated to drop from $6.95 for disposables to $2.56 for reusables.

This breaks down such that durable bowls would cost the schools $1,700 more for reusables over three years, while the stainless steel utensils would save the schools over $26,000.

Environmental results:

Many schools that have organics recycling programs put a priority on replacing single-use plastic ware with *compostable* single-use plastic ware, seeking simply to divert waste materials from the trash. In addition, the fact that reusable food ware requires on-site washing is sometimes used as a presumptive case against it when people (mistakenly) assume that added energy or water use on site makes reusables a less environmentally sound choice. It is laudable that the Minnetonka schools looked beyond diversion to *waste prevention*, and considered the *whole environmental life cycle* of their food ware choices.

On-site waste prevention

By making the change, the schools purchased 98% fewer individual utensils from the prior year – dropping by over half a million items from almost 700,000 to just under 12,000. Metal may weigh more than plastic, per utensil, but the sheer amount of plastic used far outweighed the metal.

As a result, the reusables prevented almost 6,000 lb of solid waste in the first year alone. This represents an 89% drop in solid waste by weight, even including the high loss rate of the reusable utensils. The waste prevention was calculated by taking the shipped weight (reported by the vendor) of the disposable items used per year (over 6,700 lb) less about 835 lb of loss in the first year (54% loss of utensils and 19% loss of bowls in the first year). So despite what seems like high loss over the course of the year, replacement of a few hundred metal utensils pales in waste compared to essentially replacing 100% of the disposables each and every day.

There was more loss of the stainless steel utensils and durable plastic bowls than staff anticipated. The schools made a combined initial purchase of reusable utensils and bowls in June 2011 which cost $4,809. By January of 2013, about a quarter of the bowls were damaged from poor performance in the commercial dishwasher, and about half of the first round of purchased reusable utensils were lost or damaged. The accumulated losses led to purchase of $3,416 in replacements 18 months later. The loss did not undermine the ultimate cost and environmental benefits of the reusables, but should be anticipated by those who implement similar projects. (See "Tips for successful implementation" section.)

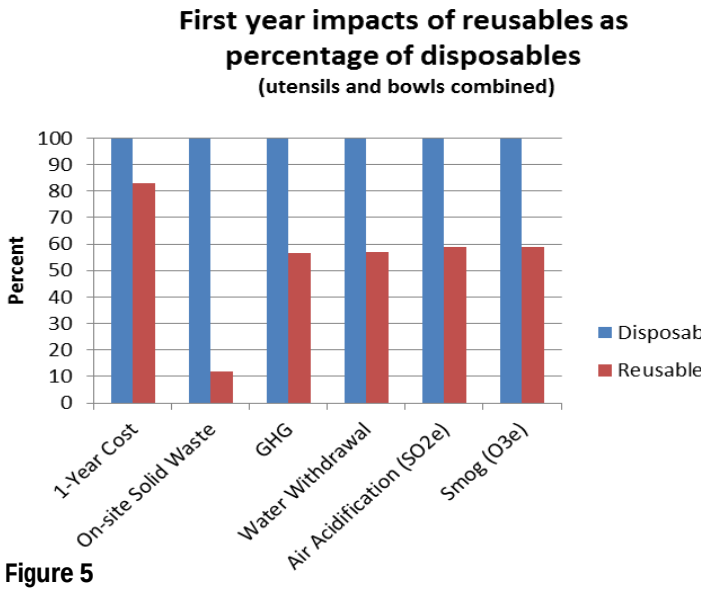

Figure 5

There were no documented changes in the trash hauling schedule or costs of trash hauling as a result of this project. However, custodians were confident that between the shift to reusables, the improved sorting stations, and a coincidental increase in the types of plastics accepted in the recycling program, that total trash significantly declined. The custodial staff reported that the trash at the end of the project was collected in just two small 28-35 gallon containers per school, instead of larger 45-65 gallon containers.

On-site water and energy

In each school, project researchers counted how many dishwasher loads were run for three different days of lunches before the switch and after the switch. Prior to use of the reusable utensils and bowls, staff ran an average of 38 dishwasher loads each day to clean the durable trays that were already in use. Afterwards, the average was 41.5 (increase of just 3.5 loads per day at each school). This was too small a sample to be scientifically representative, but it indicates that if there was an increase in the number of dishwasher loads, it was small – and it was a change the staff considered negligible. State health codes require that utensils be washed twice, but because so many can be washed in one load, even the required double wash did not result in much change for the school.

Based on EPA Energy Star standards, an Energy Star rated, single-door, high temperature industrial washer, such as used in these schools, will use a maximum of .89 gallons per rack. Thus, the extra 3.5

loads per day, means about 3.1 added gallons per day, for 180 days of school, equals about 561 gallons of water per school per year, or 1,122 additional gallons for the two schools to wash the utensils and bowls.

Energy use of the dishwashers was not directly measured during this study. Since dishwasher cycles take about 60-90 seconds, we estimate that washing the reusables meant each of the two schools' dishwashers were in use for just 5-10 minutes more per day.

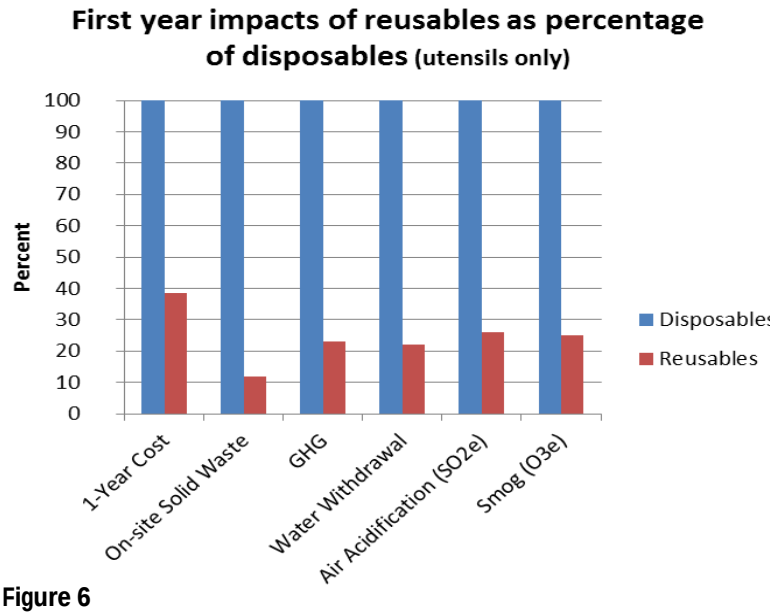

Figure 6

Life cycle emissions: GHG, energy, water, air emissions

In this project, life cycle environmental emissions were estimated using the Carnegie-Mellon EIO-LCA open-source online environmental life cycle assessment tool. "Life cycle emissions" means that the environmental emissions caused by the production of the utensils is taken into account.

Findings show that when upstream production impacts are accounted for, the reusables are environmentally superior, resulting in less air pollution, water use, energy use and GHG pollution. By running the purchase cost of **just the utensils** (forks/knives/spoons), both disposable and reusable, through the Carnegie Mellon EIO-LCA model, we estimate that this change, in its first year, reduced GHG by 77% (from 7.61 to 1.74 metric tons co_2e) and water withdrawals by 78% (87,000 gallons). In addition, the reusables reduced air acidification (sulfur dioxides) and smog (oxides) by 74% over the cradle-to-purchaser impacts of the plastic disposables (See Figure 6).

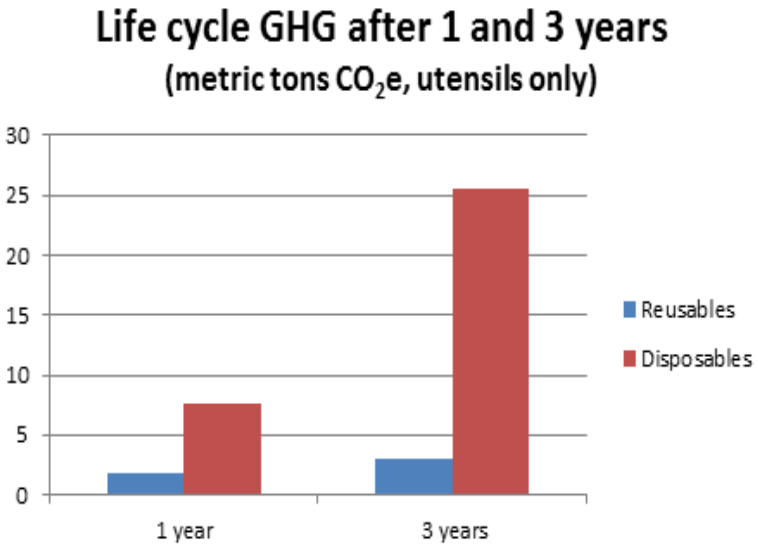

Figure 7

Assuming the utensils are used for three years, with 20% additional replacement for loss in Years 2 and 3, the GHG reductions were estimated to total about 22.5 $mtco_2e$ (an 88% reduction from three years of using disposables). Water withdrawals will be reduced by 329,570 gallons (42,440 gallons for the reusables vs. 372,000 gallons for the disposables). See Figures 7 and 8. Acidification and smog would be similarly decreased over three years. If the water used for on-site washing of the utensils is factored in, that adds about 1,122 gallons per year (3,366 gallons over three years); a literal drop in the bucket. Over three years, net water withdrawal for the disposables is estimated to be eight times more than the reusables.

For the bowls, the life cycle environmental benefits are less marked. Substituting expanded polystyrene (commonly called "Styrofoam") bowls with a durable plastic requires about three years of use to see a net environmental benefit. The reusable bowls actually have a larger environmental footprint in the first year of use. This is because the school used relatively few Styrofoam bowls and there is so little material in Styrofoam (it's mostly air). If the life span of the bowls can be assured to be three years or longer, it is worth using the reusable bowls.

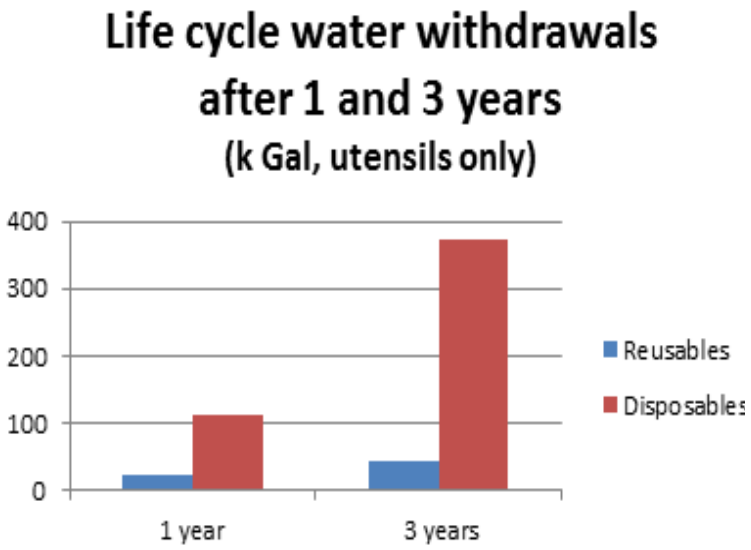

Figure 8

Figure 5 shows the first year cost and estimated environmental benefits of the utensils and bowls combined: about a 44% reduction in GHG, water withdrawal and air pollutants. Figure 6 shows the first year cost and estimated environmental benefits of the utensils **only**. In sum, the reusable bowls are both more expensive than and have a less marked environmental benefit over their disposable counterpart.

Additional environmental benefits from reductions in packaging and transportation accompanied the shift to reusables, but these were not included in the life cycle estimate. The disposables were trucked from distributors to the schools at least monthly, and required over 700 boxes. The reusables were shipped just twice per year and had fewer than 50 packages.

Behaviors, attitudes, staff time:
As in most organizational changes, a shift to reusables requires the partnership of staff from several departments and the cooperation of both the staff and students. At the end of the project, while staff were unified in their opinion that using the reusables was a good idea, there were different perspectives on the degree of success and causes of difficulties.

There was agreement across the board that the change was readily accommodated into the current staff routine. No additional staff were hired. Staff estimated about 20 minutes of added time each lunch period to wash and sort the reusables. On the flip side, staff spent less time ordering, receiving, opening boxes and refilling supplies of disposables.

There was also agreement that more station monitoring and education of students was needed. The schools only communicated directly to students for three days at the start of school. Other schools with comprehensive waste stations often have adults or students monitor the stations. It is helpful to have monitors who can ensure that things are getting into the proper bins. Students may intend to be cooperative, but lunch time is a short, loud, busy time, and by the time they are sorting their trays they may mentally already be in their next class.

While some staff thought of students as "lazy" and blamed them for the lion's share of the utensil loss – "intentionally" throwing them away or bending them into sculpture – others felt that the change was more challenging for staff than for students. Success seemed to depend on education of and buy-in from staff and students and a willingness to make adjustments along the way. Photos documented that some "fork art" was created during the lunch hour. This tipped off the kitchen staff and purchasers that

heavier-duty utensils were needed. On the other hand, the principal reported that a lackluster custodial employee had been sweeping up utensils that fell on the floor and throwing them away.

Overall, the students "got" the change and staff, students, and leaders were pleased with the results. Schools interested in implementing such a system will benefit from giving thought to setting up the best sorting station, and if there are problems, tweaking station set up.

Conclusions

In this case study of two large middle schools that already had dishwashers on site, switching from disposable plastic knives forks and spoons to reusable stainless utensils and from Styrofoam bowls to durable reusable plastic bowls resulted in first year cost savings of about $3,000 and on-site waste prevention of almost 6,000 lb (3,000 lb per year per school). This case study reinforced that environmental benefits of waste prevention go well beyond the simple reduction of waste tonnage. The switch resulted in first year life-cycle environmental benefits estimated to include a 44% drop in GHG, water withdrawal and key air pollutants that cause air acidification and smog. Cost and environmental savings are estimated to increase as the useful life of the reusables reaches three years.

The switch in utensils resulted in significantly more cost and environmental savings than did the switch in bowls. The utensils were cost and environmentally beneficial (GHG, water consumption, air pollution) in the first year. Calculations suggest, however, that the reusable bowls would remain more expensive than disposable foam bowls even after three years of use, and wouldn't net environmental benefits until three years of use. (This is probably because comparatively few disposable bowls were used in the first place.) Schools looking to make similar changes might consider focusing their efforts on utensils rather than bowls, if those bowls aren't used often.

This case study shows that a return to reusable utensils in schools can reduce both costs and life cycle environmental impact. Moreover, the case study shows that common concerns about reusables – that on-site water and electricity use will undercut environmental benefits – are unfounded.

Tips for successful implementation

Rare is the project that is perfect right out of the gate; and this case study was no exception. Here are some tips gleaned from this project for making your switch to reusable utensils as successful as possible:

1. **Anticipate loss**. Do all you can to prevent loss, but still anticipate and budget for 40-50% utensil loss in the first year and for about 20% loss in in future years.
2. **Buy heavy duty utensils**. A key way to prevent loss is to buy *the most durable* reusable utensils practicable. After seeing many of the initially purchased less expensive, light weight utensils end up bent into "fork art" the schools shifted to buying heavy gauge stainless, which helped reduce loss.
3. **Buy best-quality bowls, and test them**. Some of the bowls had to be "tossed" when they blistered from the chemicals and heat during dishwashing.
4. **Set up sorting stations for success**. Design stations so that the correct behavior is the easiest behavior. Putting the utensil buckets at front end of the sorting line will reduce loss. At first, staff allowed student to scrape plates with utensils and drop them off at the end of the line. At the end of this project, the cafeteria managers said "we will look at getting the sorting carts set up so they can take care of the utensils first."
5. **Educate and monitor**. Plan for education and station monitoring throughout the year, not just in the first week.. Education and monitoring can be done by principal, cafeteria or custodial staff, other students, parents, or teachers. The key to the education is to make it fresh and noticeable. A posted sign, for example, will work when it is first posted, but will "wear off" when it is no longer novel..
6. **Reward the right behavior**. While the schools didn't try this, social psychology that intermittent reward should foster good sorting behavior. Give out a surprise, occasional prize, or praise, to students when sorting is done well. A meaningful intermittent reward is a powerful shaper of behavior in such situations.

Furthermore, staff and students seemed pleased with the change. Amy LaGrange, cafeteria and foodservice manager, Minnetonka Middle School East, said "Overall, I am so glad we changed to real serving ware. I was apprehensive at first with the added labor for my staff. I am happy to say we have worked it into our day and the staff and students have a better dining experience with the reusable serving pieces."

The principal and champion for the project, Bill Jacobson, principal, Minnetonka Middle School West, said "My personal opinion is that the program was very successful. But lessons have been learned along the way. Most importantly, students did buy into recycling and weren't intentionally throwing the flatware in the trash. Additional and frequent communication with students is needed; and higher quality flatware should be used. Also, even if the comparative costs are similar, then the program has been a success! We didn't do this to save money....we wanted to encourage students to understand the impact they can have on improving the environment."

What happened down the road?

After the second full year with the reusables, a committed district purchaser reported that the schools have had to continue replacing reusables, but less than in the first year. "I think that as the novelty has worn off, the flatware loss has been less. I have told the schools if they wish to have flatware, they need to 'participate' and not just toss it in the trash; it defeats the purpose to put metal in the trash. Things got better when I threatened to put plastic back in. One of the schools has done much better than the other in keeping their flatware inventory intact. Adult supervision and support has made a huge difference."