

Recycling Center Feasibility Study

Indiana University Sustainability Task Force

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Internship Report

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Table of Contents

1 Background.....	3
1.1 Current Recycling Program	3
1.2 Recycling Convenience.....	3
2 Goals	4
2.1 Convenience.....	4
2.2 Participation.....	5
2.3 Education.....	5
2.4 Cost Reduction	5
2.5 Collection of a Variety of Materials	6
3 Proposal	7
3.1 Surplus Store Recycling Center Option.....	7
3.2 Additional Program Improvements	8
4 “Scenario” Research.....	10
4.1 Methods	10
4.2 Results	11
4.3 Discussion	15
5 Recommendations.....	16
6 Project Contacts.....	17

1 Background

1.1 Current Recycling Program

The recycling program in place at Indiana University (IU) currently consists of three divided units that operate separately from one another. Building services, the Memorial Union, and residential halls all have distinct operations that are managed differently.

Besides residential halls and the Memorial Union, the building services department accommodates all campus buildings for recycling and waste disposal. Two dump trucks are leased to collect recyclables and trash on different days. Waste is then transported to Hoosier Disposal, located in Bloomington, Indiana. Waste is collected from large “totes” located in the rear of buildings. One tote holds recyclables and the others hold trash. Totes were purchased in the past, and therefore do not require a monthly fee for rental. Building services commingles all recyclables due to the labor required to separate the materials. Plastic, aluminum, cardboard, and mixed paper are collected from 22-gallon bins and commingled in totes. Hoosier Disposal awards building services with a small profit from aluminum products recycled.

The Memorial Union (IMU) handles waste strictly generated at the union facility. Their operations are much different from building services. Hoosier disposal collects their trash and recyclables from rented totes. Hoosier disposal charges a monthly fee for collection and transport of materials and tote rental. The IMU does not commingle recyclable materials. Materials collected and sorted are: plastic, glass, mixed paper, cardboard, and aluminum. Hoosier Disposal reduces rental and pick-up rates for the IMU in exchange for the profit made off of recyclables.

Residential halls operate similarly to the IMU; Hoosier Disposal collects waste and recyclables and transfers them to their facility and rents totes for trash and recyclables. Recycled material is completely sorted into cardboard, glass, plastic and aluminum, mixed paper, and newspaper. Hoosier Disposal discounts tote rental fee and eliminates pick-up costs in exchange for the profits made from recyclables.

1.2 Recycling Convenience

Students are able to recycle while on campus in any building as all buildings have recycling bins located on various floors. Unity of the recycling bins on campus is lacking from the three divisions purchasing different bins. This may lead to confusion when students are accustomed to a certain bin in a building they spend a majority of their time in and encounter a different colored or sized bin in another building. In addition, bins are disparately located around buildings. Not every floor is equipped with recycling bins; therefore not every trash can is accompanied by a recycling bin. Often, students will not hold on to a bottle until a recycling bin is found or search for a recycling bin within a building.

Outdoor recycling bins are unavailable most of the year. Once a year, the “More Art, Less Trash” competition facilitated by Volunteers in Sustainability, has students create designs to be painted on outdoor recycling bins. A dozen individuals gain the right to paint their design on a bin and see it on campus throughout the spring and summer. These dozen artistic bins however, are the only outdoor recycling bins on IU’s campus and are only available for a few months out of the year.

While off-campus, students may recycle at home if they live in a building with less than 4 units according to Bloomington’s Municipal Code Title 6. 6.04.050. The city is prohibited to pick up trash or recyclables from units that violate this code. Therefore, private companies, such as Hoosier Disposal, are hired to pick up waste from such facilities. Hoosier Disposal has commented that they neglect to pick up recyclables from student apartment complexes because of contamination of recycling bins with trash. Landlords of the complexes are assumed to not invest in recycling totes or pick-up because of the contamination and the need to increase already high rental rates. This leaves students living in off-campus housing with only a few options for recycling. Some choose to not recycle at all and throw all waste into a landfill-destined trash bag. Others may choose to drive to the Monroe County Solid Waste Management (MCSWM) drop off site located on South Walnut Street. Those without cars however, are stuck with option number 1 even if they desire to divert their waste from the landfill and quite often, students are too busy or lazy to drive waste to a site located approximately 10 minutes from campus.

2 Goals

Currently, Indiana University diverts approximately 27% of all waste generated on-campus from going to the landfill. Sources part of IU recycling operations estimate 40 - 50% of material thrown away could be recycled. Causes for the lack of recycling are unknown, but acknowledging the deficiency in recycling on campus can help us to set goals for the future of the IU recycling program. The following recommendations are goals that should be addressed when developing the new recycling program at Indiana University and may be relieved by the construction of an on-campus recycling center.

2.1 Convenience

Students that live off-campus must drop-off recyclable materials downtown at the Monroe County Solid Waste Management (MCSWM) site on South Walnut, have access to a recycling program at home, or throw recyclables in the trash. The MCSWM site downtown is a great model for an IU campus recycling center, however its location is not convenient for students. Most students will not take the time to drive such a far distance from campus. Students may already have recycling at their home, but unless they live in a building with less than 4 units, the city is not required to provide recycling for them. The situation that results is students neglecting to take time to properly dispose of recyclable items. Recycling is not convenient or easy therefore they do not participate.

On-campus the residential halls, building services, and the IMU provide thousands of recycling bins throughout campus buildings. Their presence does not always encourage recycling activity when they are placed in inconspicuous locations or are not accompanied by a trash can. Data collected from the “More Art, Less Trash” outdoor

recycling bin program indicated that in order to maximize the usefulness of trash or recycling bins, they must be placed in convenient locations and both types of bins must be positioned next to one another. Often, recycling bins located in heavy pedestrian traffic areas were overflowing with materials. Also, contamination of recycling bins occurred more often when recycling bins were alone and vice versa for trash cans. When both a recycling bin and a trash bin were next to each other, nearly zero contamination occurred.

Students must have convenient recycling options while and home and at school if increased participation is a goal for the IU recycling program. Providing a recycling center for students who live off-campus is argued to not be the university's responsibility, but the students are the university's responsibility. Creating a recycling center on campus would allow students to travel a short distance to drop off collected materials. Also, a recycling center may prove that the university is making a valiant effort to become more sustainable. In addition, the university can make recycling more convenient on campus. Purchasing more recycling bins and strategically placing them in high pedestrian traffic areas and next to existing trash cans will improve student participation in recycling efforts and decrease the contamination rate of recycling and trash bins.

2.2 Participation

Promotion of recycling on campus is key to increasing student and staff participation in recycling. Attitudes about recycling must be positively altered in order for the "trend" of recycling to flourish. The recent establishment of the IU Office of Sustainability makes this goal more feasible. The Office of Sustainability can be responsible for creating this movement, and can be accomplished much easier if recycling were convenient for students. Creating a recycling center on campus will allow students to participate more because of its convenient location and operation. Also, simply having a recycling center can label IU as a recycling-conscious university and make students more apt or even obligated to participate in recycling.

2.3 Education

Increasing awareness of the life cycle of trash and its deleterious effects on the environment can facilitate more student participation in recycling. Most students are unaware of the harmful effects of decomposing trash in the earth and the energy required to continually produce containers for goods. Education is essential for enlightening students on how recycling mitigates negative environmental effects. Students may acquire this knowledge in classes, however not all students are exposed to such topics. A recycling center on campus can pose as an educational facility to students who are curious or uneducated on the issue. A simple poster display in the recycling center and educating center workers on recycling processes can provide resources for students.

2.4 Cost Reduction

Currently the recycling program does receive much money from the materials generated at the university. Often it is difficult to obtain any profits from a recycling program because of the numerous costs associated with operations. However, the program may generate cost avoidances or cost reductions through the program set-up and selling recyclable materials. The program in place receives discounts on tote rentals and pick-up fees and is exempt from a recycling tipping-fee of \$41/ton by Hoosier Disposal. In exchange, Hoosier Disposal sells IU's recyclables and keeps the profit from the sale of

the commodities. With the economic collapse in the past years, this exchange may have been best for the university; however, prices are quickly recovering and the current agreement may not be the most economically viable option.

In addition to altering the current program set-up, cost reductions may be achieved by increasing recycling rates on campus. As previously stated, recyclable materials are exempt from the \$41/ton tipping fee charged by Hoosier Disposal; however, trash is not excluded and the university must pay \$41/ton. One can therefore conclude that recycling is less expensive than throwing material in the trash. At IU's current recycling rate of 27%, most waste is destined for a landfill. This increases the costs the university is paying for waste disposal (**Figure 1**). The more materials recycled, the less money the university must pay for trash. Of course, there is a limit on what the university can recycle because not all waste is recyclable. However, sources claim up to 50% of materials in trash cans may be diverted from landfills. Increasing recycling on campus can in turn reduce costs the university must pay to dispose of trash.

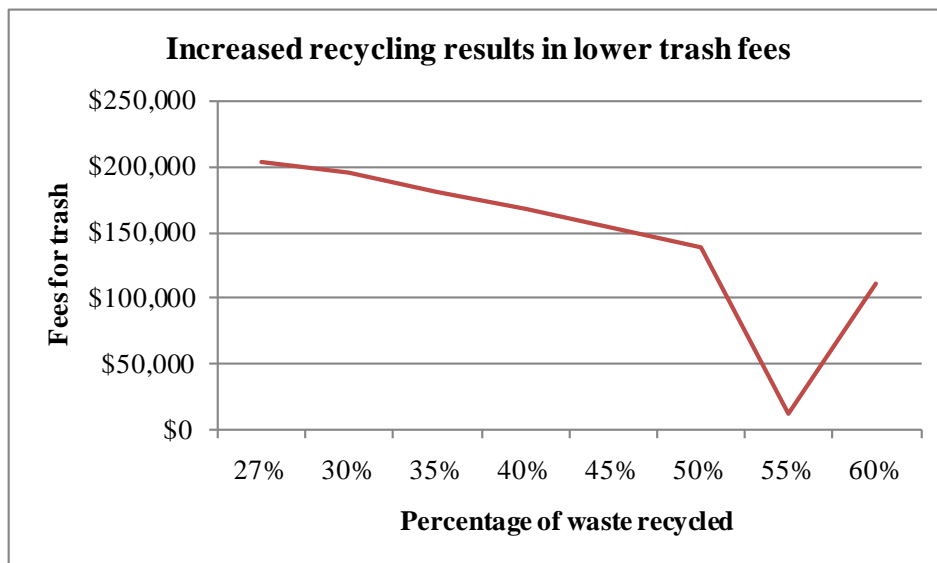


Figure 1. Line plot of trash tipping fees and increased recycling rates. Diverting a greater percentage of the total waste stream from the landfill and increasing the amount of material recycled decreases the amount of money paid to dispose trash.

2.5 Collection of a Variety of Materials

Students may recycle glass, plastic, aluminum, and paper at their homes if recycling is offered. These materials are also collected on campus, with the exception of glass in building service-monitored facilities. Many other materials are capable of being recycled, but students are often unaware of their reuse and recycling potential or of where to dispose them. The MCSWM drop-off site collects a variety of materials, but again, the location of the facility is not convenient for students.

Constructing a recycling center on campus could have a component indoors that collects non-traditional materials. Materials that might be collected are: fluorescent light bulbs, paint, motor oil, books, electronic waste and batteries. These materials can then be

properly disposed of or reused (paint and books) by students if their quality is not compromised from past use.

3 Proposal

A material recycling facility was previously operated on the Indiana University campus but failed due to the high cost of operation. When analyzing options available for a new recycling center, we specifically attempted to reduce costs associated with operation to ensure success. We also considered proximity to campus, so that students could easily access the facility, and evaluated the amount space available for material storage. Also, when restoring the recycling program at IU, other areas that need improvement, such as increasing recycling rates, were also considered.

3.1 Surplus Store Recycling Center Option

Adding a recycling center to the existing IU Surplus Store has proven to be the best proposal. The Surplus Store is located on 10th Street past Highway 45/46 (**Figure 2**). Costs would be minimized at this site due to building construction fee avoidance. The store is within close proximity to off-campus housing and on-campus apartments as well as the rest of the university. The Surplus Store has excess parking lot space and ample room inside the warehouse, which can be used for collection sites.

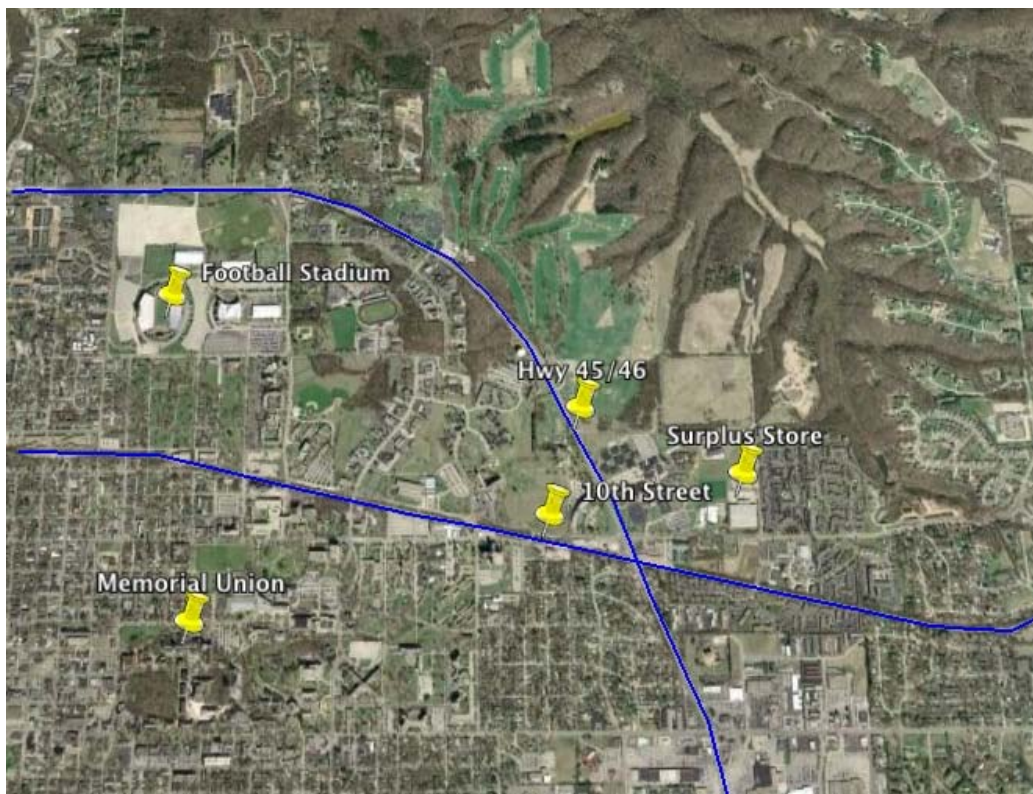


Figure 2. Aerial view of Indiana University campus and the location of the Surplus Store, where the proposed recycling center is to be established.

Three 22-foot long totes would be placed in the parking lot for glass, plastic and aluminum, mixed paper, and cardboard collection. These totes may serve students and faculty that do not have recycling offered at their homes. Once totes are full, Hoosier Disposal would pick up the materials collected for a “hauling fee”. Hoosier Disposal only charges a hauling fee for the totes and does not charge a monthly rental rate. The university would receive a percentage of the profit from the sale of materials and will also be exempt from the recycling tipping fee of \$41/ton of materials.

Inside the recycling center would be a collection center for hazardous and non-traditional material recycling and reuse. Fluorescent light bulbs, books, motor oil, antifreeze, electronics, paint, and batteries would be properly sorted in separate containers. Indiana University Environmental Health and Safety Department would pick-up hazardous materials and arrange for proper disposal and recycling. Fees associated with hazardous waste have not been calculated in this study, and are highly dependent on how much waste is collected. Paint, books and other reusable items would be left at the facility for visitors to take. Besides collection, an educational component would also be implemented. Posters and pamphlets would be available to educate visitors on the benefits of recycling and hazards of land filling waste.

A major component of the facility is having employees present to ensure minimal contamination of totes and hazardous waste materials. Hiring two new full-time employees to operate the facility is necessary to maximize collection efficiency. Also, a supervisor responsible for overseeing employees and the facility would be required. The new director of the IU Office of Sustainability, Bill Brown, has been delegated as the supervisor and assumes responsibility of the center.

3.2 Additional Program Improvements

Unifying the recycling system would assist in operations running more smoothly. A combination of the systems in place provides an option that can maximize recycling efforts and savings.

Similar to the building services operations, recyclables could be picked up from all buildings, including residential halls and the Memorial Union, by Indiana University trucks. Leasing one more truck to accommodate additional buildings would be necessary. Costs associated with the additional truck and employees that operate the truck are included in the estimate. Different days would be designated for trash or recyclable pick-up; trucks would transfer waste collected on-campus to Hoosier Disposal. Recycling tipping fees would still be discounted and compensation for recyclables would be received. Also, pick-up fees charged by Hoosier Disposal to the Memorial Union would be eliminated.

Totes located in the rear of buildings would need to be purchased for the Memorial Union and residential halls. Currently, totes are rented from Hoosier Disposal and in order to receive profits from recyclables, the exchange of discounted totes for materials must be eliminated. Although Hoosier Disposal claims to discount totes for the university, savings are minimal for residential halls and prices are actually increased for the Memorial Union. Reasons for the IMU rate increase are unknown. Purchasing totes for these buildings would be an initial expense, but would result in saving the university money after only a few years (**Figures 3 and 4**). Tote prices are based on quotes from

Hoosier Disposal and the current amount of totes used by each department. Building services previously purchased totes and does not rent them.

Unifying materials collected in all systems would also be necessary. Currently, residential halls and the Memorial Union collect the same materials as building services division does with the addition of glass. Adding glass collection to building services' repertoire will further unify recyclable material collection. It will also result in less confusion to students who may recycle glass in some buildings but not others.

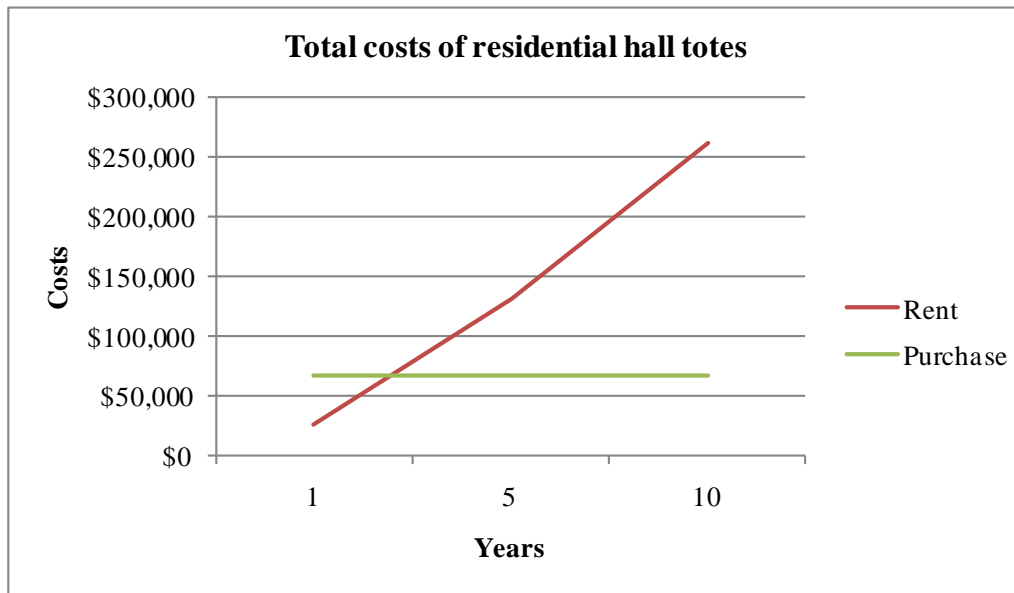


Figure 3. Line plot of total costs over 1, 5, and 10 years of renting and purchasing recycling totes needed for residential halls.

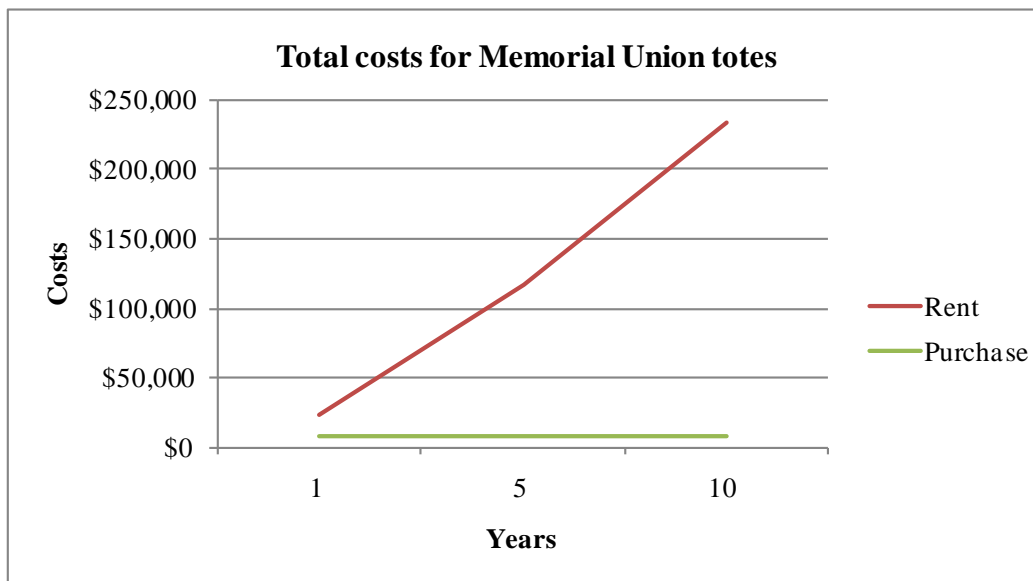


Figure 4. Line plot of total costs over 1, 5, and 10 years of renting and purchasing recycling totes needed for the Memorial Union.

Increasing the amount of waste diverted from the landfill is another improvement that would end up saving the university money (**Figure 1**). To achieve this goal, more recycling bins would need to be purchased and placed next to trash bins. Doubling the amount of recycling bins currently available will be necessary and costs were considered in calculations. Also, a goal of increasing recycling from 27% of the waste stream to 40% was incorporated into the new improvements. Increasing recycling will not only enhance environmental sustainability of IU, but will also reduce the amount of tipping fees paid for the disposal of trash. These extra savings can be applied to the maintenance of the recycling center.

4 “Scenario” Research

Five different scenarios were created (**Table 1**) to examine recycling program possibilities and costs and savings associated with the adoption of any one scenario. Scenarios chosen integrate increasing recycling rates with the proposal of the new recycling center, maintaining the program in place, and unifying the program without establishing a recycling center. New scenarios are compared to the current recycling program in place. Monetary costs and savings were only considered although many scenarios offer benefits that have no currency value.

Table 1. Summary of 5 different recycling program scenarios for Indiana University.

Scenario	Description
1	Current Situation in place. Amount of waste stream recycled is 27%.
2	A recycling center is added to the current University Surplus Store. More trucks are rented to accommodate waste and recycling pick up at the IMU and Residential Halls. Recyclables are sold to Hoosier Disposal at current commodity values. The percentage of waste stream recycled is increased to 40%.
3	No recycling center is built. More trucks are rented to accommodate waste and recycling pick up at the IMU and Residential Halls. Recyclables are sold to Hoosier Disposal at current commodity values. The percentage of waste materials recycled is increased to 40%.
4	No recycling center is built. The current program stays in place. The percentage of waste materials recycled is increased to 50%.
5	No recycling center is built. More trucks are rented to accommodate waste and recycling pick up at the IMU and Residential Halls. Recyclables are sold to Hoosier Disposal at current commodity values. The percentage of waste materials recycled is increased to 50%.

4.1 Methods

Costs and savings for each scenario were calculated based on numerous factors.

Influences on costs were from:

- Leasing trucks
- Insurance for trucks
- Maintenance of trucks
- Employee salaries
- Tote purchase or rental
- Trash tipping fees
- Recycling bin purchases

Costs of each item were obtained from administrative individuals in Building Services, Residential Program Services, the Indiana Memorial Union, Hoosier Disposal, and Monroe County Solid Waste Management. Costs used for scenarios are based off of estimates and actual values may vary from the estimate.

Savings were based on:

- Profit from recyclables (commingled glass, plastic and aluminum, mixed paper and cardboard).

Commodity prices used to calculate an estimate of profits were based on values provided by Monroe County Solid Waste Management (MCSWM). Estimates for some commodities were not available through MCSWM and were therefore obtained online from “RecycleNet” (<http://www.recycle.net/price/>). Prices online may not be specified for Indiana and compensation received for recyclable materials may vary from this estimate. Also, prices are likely to fluctuate in the future; therefore analyses of future savings projections may vary from actual commodity prices.

4.2 Results

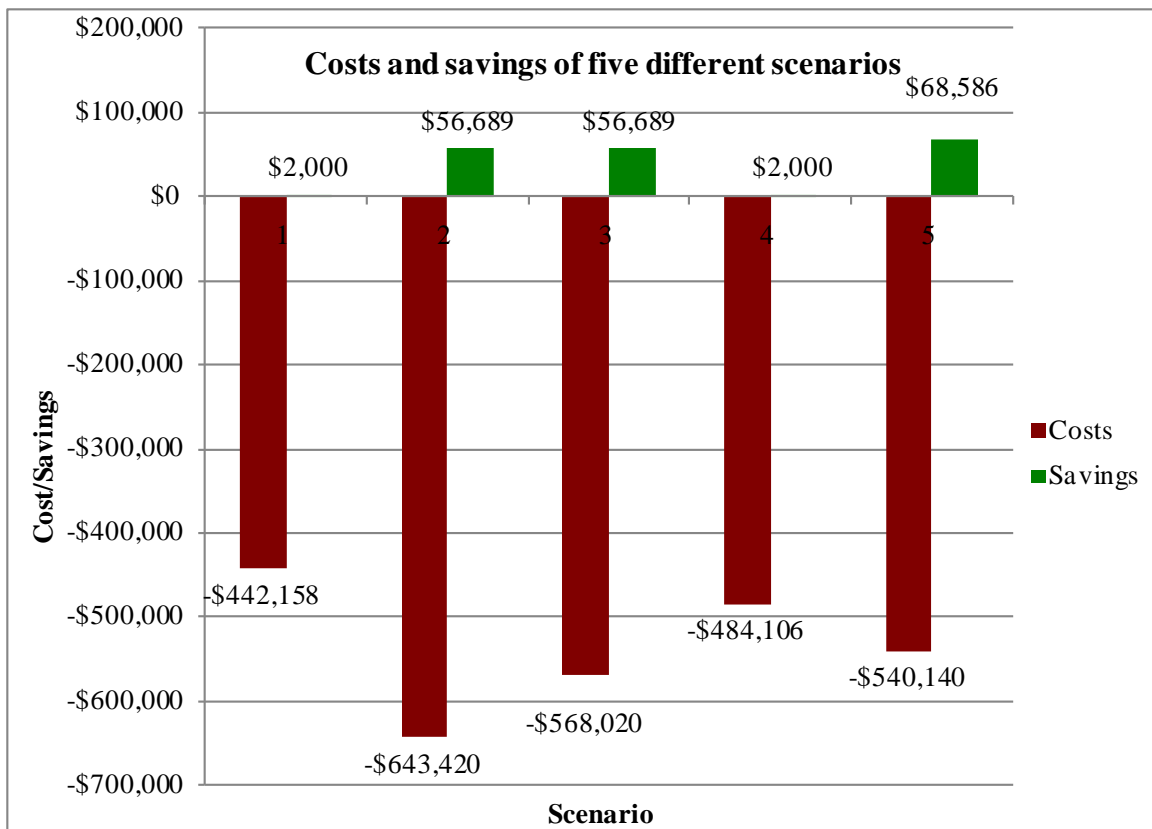


Figure 5. Bar chart of costs and savings associated with scenarios 1 – 5 over a one year time period.

Scenario 2 accumulates the most costs out of any scenario, followed by scenario 3, 5, 4, and 1 (**Figure 5**). Savings are greatest when recycling rates increase and materials are transported by the university to Hoosier Disposal (Scenario 5). Overall, benefits will increase if recycling rates increase and the university is rewarded money for the quantity of recyclables given to Hoosier Disposal (Scenarios 5, 2, and 3). Scenarios are compared based on the initial implementation year.

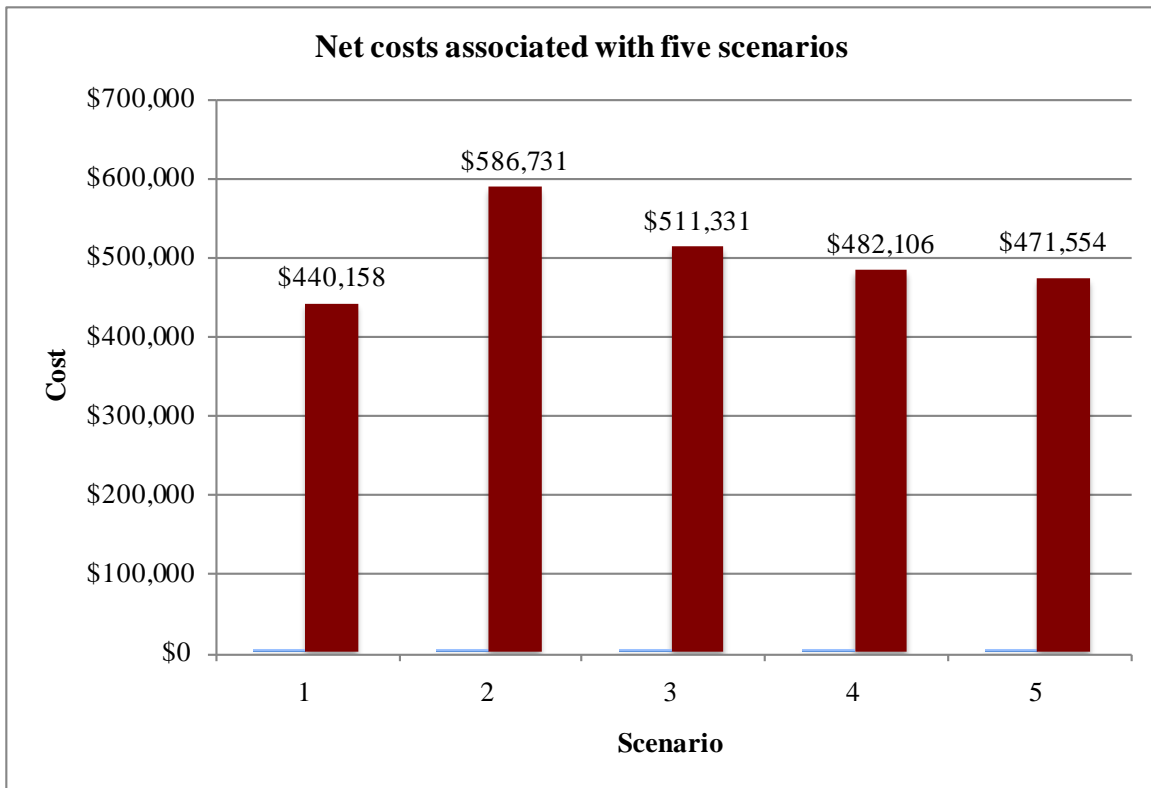


Figure 6. Bar chart of net costs associated with each scenario in one year.

Net costs were calculated by subtracting the amount of savings generated by each scenario. Scenario 2 still accumulates the most costs out of any scenario, followed by scenarios 3, 4, 5, and 1 (**Figure 6**). The current scenario (1) accrues the least amount of costs in a one year time period. Increasing recycling rates generally reduces net costs by producing more savings from the sale of recyclable materials. Scenario 5 net cost decrease is highly dependent on the increase in the percentage of the waste stream recycled. Costs of each scenario are based on the initial implementation year costs.

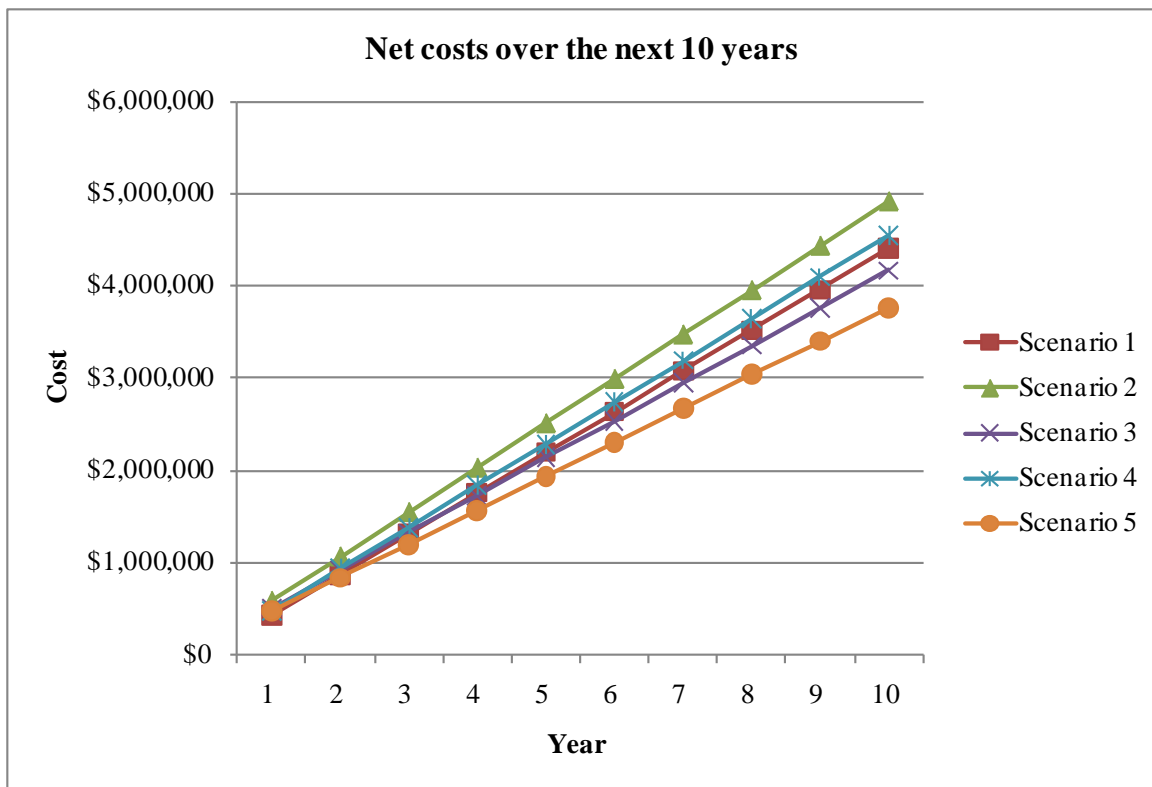


Figure 7. Line plot of net costs for each scenario over a 10-year time span.

Net costs over a 10-year time period were calculated for each scenario. Savings were based on present day commodity prices. Costs associated with only the first year were deducted from the following year cost estimates. Scenario 2 continues to have the highest net costs over 10 years, followed by 4, 1, 3, and 5 (**Figure 7**). In the first year net costs for scenario 3 are greater than scenarios 1 and 4 but are less after 10 years due to the accumulation of savings from the sale of recyclable materials. Scenarios 3 and 5 save a difference of \$233,270 and \$631,040 from scenario 1 in 10 years.

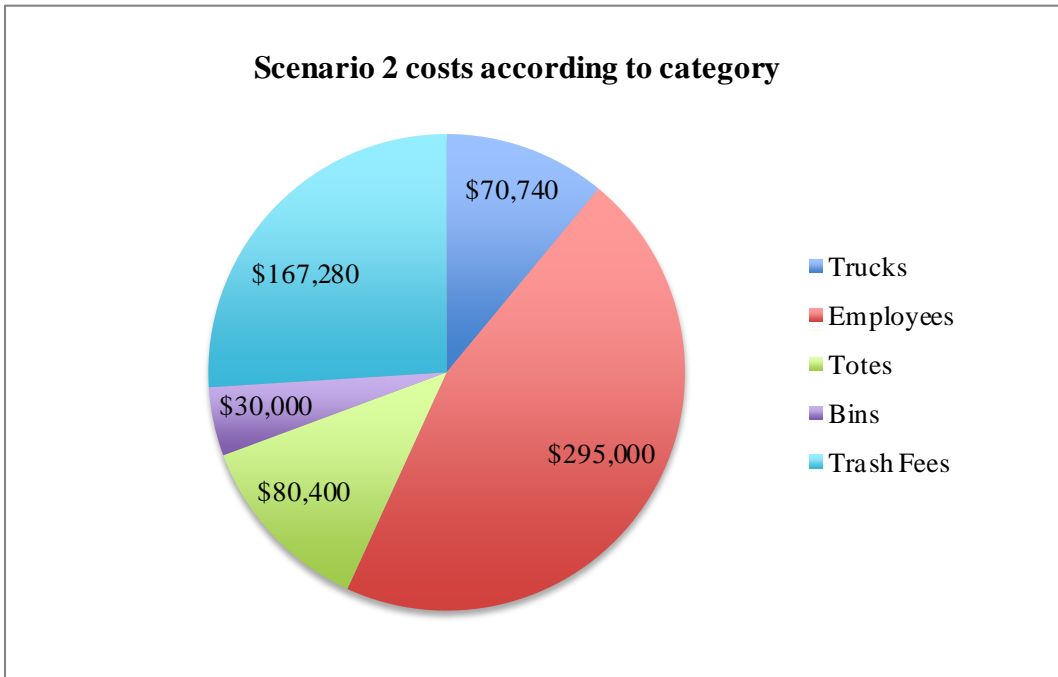


Figure 8. Pie chart of costs for scenario 2 according to trucks, employees, totes, bins and trash fees.

The proposed recycling center scenario costs are broken down according to trucks, employees, totes, bins and trash fees. Employees account for the majority of costs followed by trash fees, totes, trucks, and bins (**Figure 8**). Hiring employees to monitor the recycling center and to operate trucks are included. Costs are based on the initial year of implementation of the program.

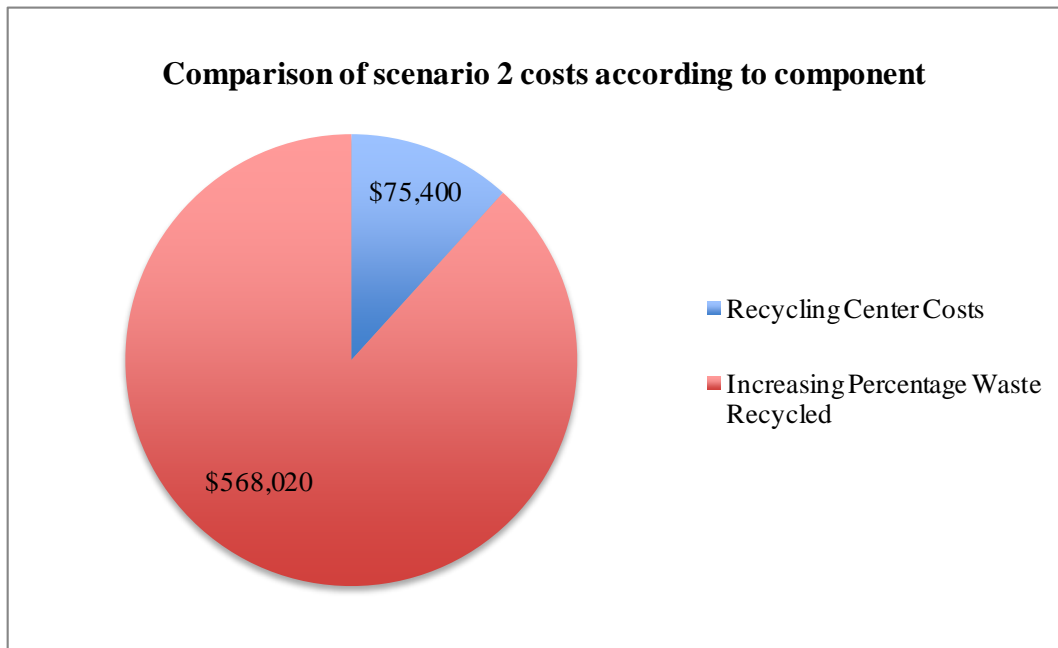


Figure 9. Pie chart of the costs of scenario 2 associated with the recycling center and increasing the percentage of the waste stream recycled.

Costs of scenario 2 are mainly due to the proposal to increase the amount of waste diverted from a landfill (**Figure 9**). Developing the Surplus Store recycling center accounts for a small percentage of the total scenario costs. Savings are not accounted for when calculating costs of each component.

4.3 Discussion

Costs and savings associated with each scenario were calculated according to estimates given by a variety of sources. Estimates were made based on the best knowledge available, yet variations from actual amounts paid and received will occur.

Costs associated with the disposal of hazardous waste materials collected at the recycling center in scenario 2 were not included. Costs are dependent on the quantity of material collected and may vary month by month. An estimate may be calculated in the future, but was not prepared in time for this study. Also not included in costs is the set-up of the recycling center. Some labor may be involved in organizing and constructing the facility inside the existing Surplus Store; actual construction of the recycling center building is not needed.

Cost avoidances were generated when rental and pick-up fees charged by Hoosier Disposal were eliminated by tote purchase and IU truck materials transfer. These values were not included in calculated savings because payments were simply avoided and money was not directly given to the university. Also, scenario 2 does not consider profit from recyclable collected at the recycling center. An estimate of the quantity of recyclables that would be collected at the center could not be quantified. Of course, materials collected and sold to Hoosier Disposal could assist in decreasing the total amount of costs.

The recycling center scenario proved to be the most expensive of all options. This occurred from scenario 2 including not only the development of the recycling center, but also increasing recycling rates and changing the recycling program. Increasing recycling and changing the program actually account for more costs than the recycling center. The recycling center accumulates little costs itself over the next 10 years since many costs are only required for the initial establishment of the center. Net costs of the recycling center may change due to unaccounted costs of hazardous waste material pick-up and disposal, costs of the center set-up and savings generated from the materials collected at the facility.

Although the current program (scenario 1) and the current program with increased recycling rates (scenario 4) require less costs than scenarios that alter the current program (scenarios 2, 3, and 5) in the first year, scenarios 3 and 5 have less costs after year 1. More savings are generated in programs that dismiss rental and pick-up fee discounts in exchange for recyclables. Totes are purchased in the first year; therefore costs associated with totes are nonexistent in following years. Also, more savings accrue from the sale of the thousands of tons of recyclable materials generated every year. Currently, the university only receives a small profit of approximately \$2,000/year from building services' collection of aluminum products.

The scenario analysis is solely based on economic benefits of recycling; environmental and sociological benefits are not accounted for. A calculation of the approximate savings environmental and sociological factors experience from recycling may be calculated through models in future studies for IU's recycling program. Environmental savings from recycling include but are not limited to: decreased water and soil pollution, decreased carbon dioxide and methane emissions, and decreased wildlife mortality from exposure to toxins produced from decomposing materials. Sociological benefits that may result from recycling are: decreased negative health effects (i.e. toxin exposures) and increased aesthetic beauty of landscapes (psychological effects).

5 Recommendations

Developing a recycling center on campus is an excellent idea for increasing participation in recycling. The center would provide services that only the MCSWM drop-off center provides; however the MCSWM facility is out of reach for many students. If students are not willing to transfer materials to the MCSWM site downtown, we must also ask if they are willing to drive to the on-campus facility despite the closer location. We must gauge how much students will use the recycling center and if developing such a large project is the proper next step for improving IU's recycling program.

With only 27% of the on-campus waste stream being recycled, ample room for improvements exist. Increased recycling awareness and education and more conveniently located recycling bins will assist in improving the percentage of the waste stream diverted from the landfill. A survey analyzing students' opinions on the IU recycling program has been conducted but not analyzed. Results from the survey will assist in pinpointing areas in need of improvement.

Determining whether to first build the recycling center or attempt to increase recycling efforts on-campus is a difficult decision. There is obviously a need for a facility on-campus that collects recyclables; thousands of students do not have recycling at home. However, we are unsure if students are interested in recycling enough to transfer their own recyclables to another location. Perhaps the development of the recycling center alone will trigger students to respond and participate. Increasing recycling efforts on-campus has the potential to generate the same effects. If students become accustomed to recycling while on-campus, they may be more compelled to recycle waste at home. Weighing the benefits of the recycling center and increasing recycling rates on-campus could be the focus of a future internship.

Summary of Recommendations:

- Develop a recycling center on campus that services students that do not have access to city or private recycling programs at home.
- Increase the percentage of waste recycled on-campus.
- Increase the amount of recycling bins on-campus (indoors and outdoors).
- Increase student awareness, education and participation in the recycling program.
- Unify the separate recycling departments.
- Revise IU's contract with Hoosier Disposal to ensure maximal benefits for IU.

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