Pre-Consumer Food Waste Composting at Carnegie Mellon University

Jared Carling, Paulina Jaramillo, &
Aurora Luscher

12-706 Cost Benefit Analysis

COMPOSTING

What is Compost?

- "A mixture that consists largely of decayed organic matter and is used for fertilizing and conditioning land" (Merriam Webster's 10th Ed.)

- 100 million bacteria
- 800 feet of fungal threads

General Composting

- GREEN
  - Fruit and vegetable scraps
  - Coffee filters & grounds
  - Tea bags
  - Unbleached napkins
  - Meat and dairy
    - At CERTIFIED facilities only
- BROWN
  - Yard waste
    - Leaves
    - Grass clippings
    - Non-seeding weeds
  - Twigs
  - Vines
  - Newspaper
    - Black and white only
    - No more than 10% of pile)
  - Hair clippings

Benefits of Composting

- Promotes soil health.
- Provides nutrients for plants, so it reduces the need for additional fertilizers . . .
- Extends landfill lifetime.
- Reduces greenhouse gas emissions.
- Promotes environmental awareness.
- Can be used as a treatment technique for contaminated soil.

Composting Options

- Residential
  - Aerobic
  - Anaerobic
  - Vermicomposting
- Commercial
  - All of the above
  - In-vessel

Food Waste

- 2.6% of food residuals are recycled/reused in the U.S.
- Food waste is the largest component of waste by weight.
- National Composting Council estimates the average U.S. household generates 650 lbs of compostables every year.
- ~ 10.8% of Southwest PA waste stream by weight is food waste (PA DEP).

Food Waste

- All food waste from CMU currently goes to a landfill:
  - Landfills produce about 4% of total US greenhouse gas emissions.
  - An average factor of 0.15 MTCE emissions are avoided by diverting a ton of food waste from landfills.
  - Space is a limited resource that should be used sparingly.

Composting Project Client

- Barbara Kviz, Environmental Coordinator
- Previous study performed by R.W. Beck
  - "Establishing a Pre-Consumer Food Waste Collection Pilot in Allegheny County, PA"
- CMU is not a solely cost-oriented client

CMU Composting

- Types of food waste:
  - Pre-consumer
  - Post-consumer
- Places to collect food waste at CMU:
  - University Center
  - Food Vendors
    - Eateries
    - Trucks
  - Dorms

On Campus Dining Locations

Asiana	Marketplace Salad Bar
Barista Café	Pennes Intl. Marketplace
CK Pretzels	Pepperazzi
East Street Deli	Schatz All You Care to Eat
Ginger's Coffeehouse - Baker	Schatz Dining Room
Ginger's Coffeehouse - Purnell	Si Senor
Ginger's Deli	Taste of India-4902 Forbes
Grab n' Go	Taste of India-Resnik
La Prima-Wean	The Original Hot Dog Shop
Main Street Market	

CMU Composting Issues

- Allegheny County “composting laws”
- Current CMU yard waste composting
- Volume of waste
- Cost of disposal
- Dining Services
  - Ease of implementation
  - Ease of collection
  - Health code issues

Composting Alternatives

- Agrecycle
  - Certified composting facility in Fox Chapel
  - Cost to pick-up/compost
  - Sells finished compost at a profit

- On-site composting
  - Space is a major issue
  - In-vessel is the only real option

Costs

- Collection
  - Agrecycle
  - Containers
- Dining Services
  - Set-up and Training
  - O&M

Benefits

- Landfill tipping fees avoided (Savings)
- Greenhouse Gas Emissions Reduction (Methane)
- Landfill Space
- Agrecycle
  - Re-sellable product
  - Creation of jobs

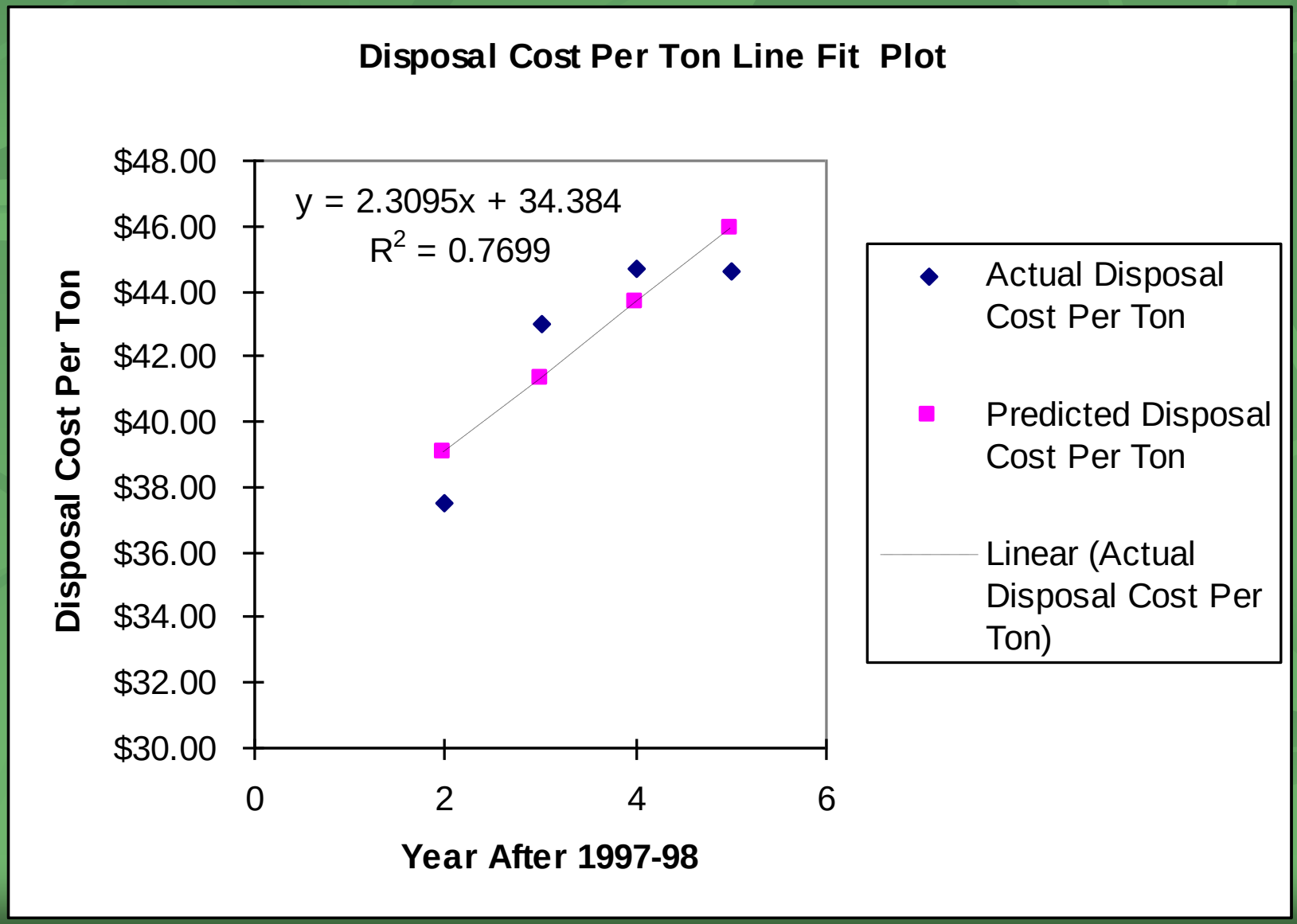
Food Waste Collection Model

- *Status quo*
  - All waste going to landfill
    - Furnished UC data does not include recyclables
- *Phase 1*
  - Pre-consumer food waste
- *Phase 2*
  - Pre and Post-consumer food waste

Actual Disposal Costs

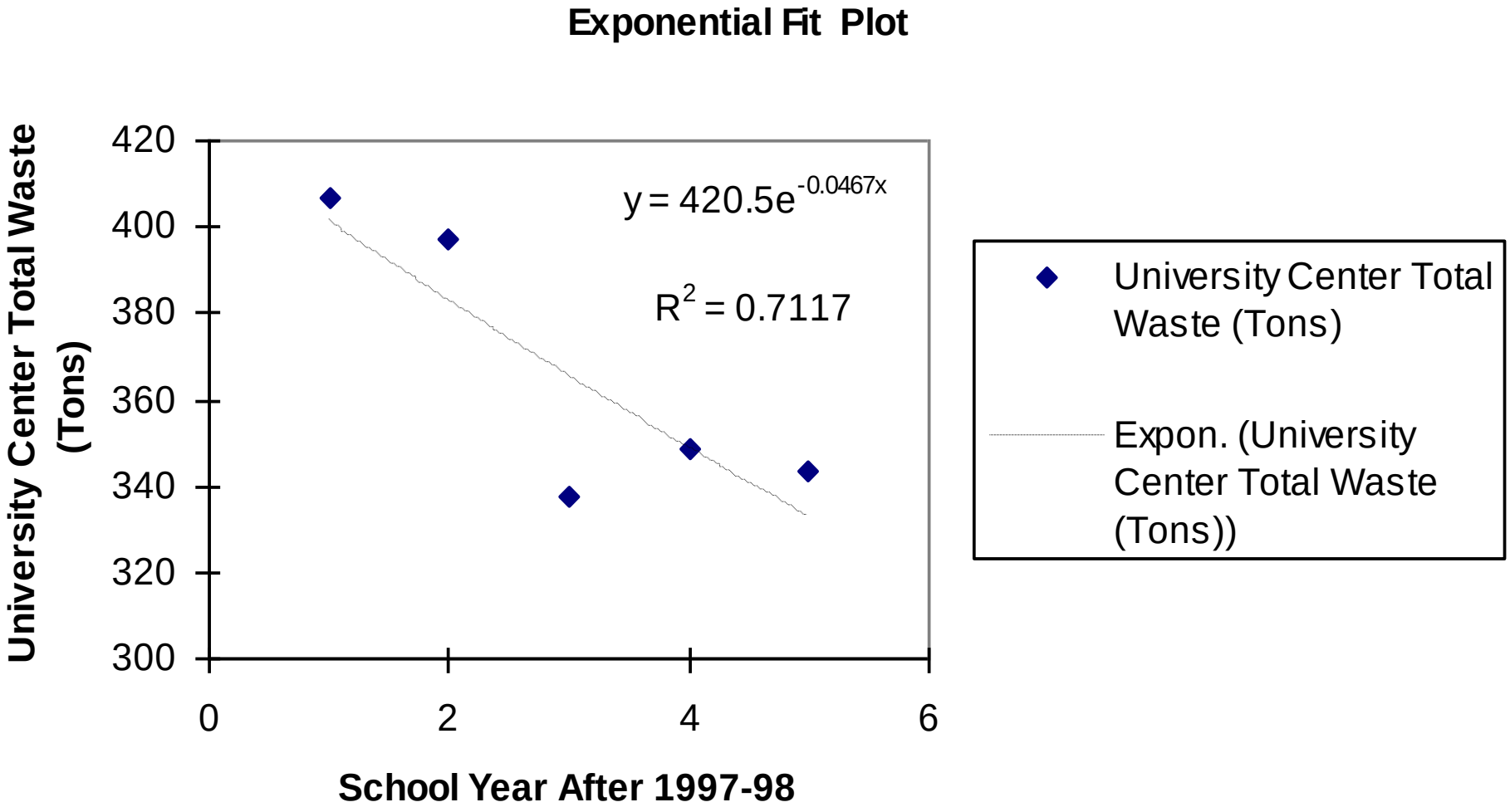
Year	Year after (1997-98)	Waste Produced (Tons)	Total Disposal Costs	Disposal Cost Per Ton
July 98 - June 99	1	406.58	Unknown	Unknown
July 99 - June 00	2	397.06	$ 14,892	$ 37.51
July 00 - June 01	3	337.44	$ 14,517	$ 43.02
July 01 - June 02	4	348.59	$ 15,581	$ 44.70
July 02 - June 03	5	343.53	$ 15,337	$ 44.65

Rise in Disposal Costs



Annual UC Waste Collection

- Constant vs. Exponential Decline of Waste Production



Present Value of Total Disposal Costs

Year	Year after 2003	Constant Waste Produced (Tons)	Exponential Waste Produced (Tons)	Disposal Cost Per Ton	Total Disposal Costs (Constant Waste)	Total Disposal Costs (Exponential Waste)	Present Value (Constant Waste)	Present Value (Exponential Waste)
July 03 - June 04	1	344	318	$ 47	$ 16,130	$ 14,920	$ 15,525	$ 14,360
July 04 - June 05	2	344	303	$ 49	$ 16,924	$ 14,939	$ 15,677	$ 13,839
July 05 - June 06	3	344	289	$ 52	$ 17,717	$ 14,926	$ 15,796	$ 13,307
July 06 - June 07	4	344	276	$ 54	$ 18,511	$ 14,883	$ 15,884	$ 12,771
July 07 - June 08	5	344	264	$ 56	$ 19,304	$ 14,813	$ 15,943	$ 12,234
July 08 - June 09	6	344	252	$ 59	$ 20,097	$ 14,718	$ 15,975	$ 11,699
July 09 - June 10	7	344	240	$ 61	$ 20,891	$ 14,601	$ 15,982	$ 11,170
July 09 - June 10	8	344	229	$ 63	$ 21,684	$ 14,464	$ 15,967	$ 10,650
July 10 - June 11	9	344	219	$ 65	$ 22,477	$ 14,309	$ 15,930	$ 10,141
July 11 - June 12	10	344	209	$ 68	$ 23,271	$ 14,138	$ 15,873	$ 9,644
TOTAL							**$ 158,552**	**$ 119,814**

$120,000 to $160,000 spent over next 10 years

Phase 1

- Pre-consumer waste:
  - Food Waste Audit:
    - Preliminary data
      - 1 day
      - 2 employees
      - 42 lbs for one day
    - Need more info from Dining Services

Food Waste is 15-25 % of Waste Stream

$18,000 to $40,000 <u>saved</u> over next 10 years

ASSUMING	15%	OF WASTE STREAM IS FOOD WASTE			
Year	Year after 2003	Constant Food Waste Produced (Tons)	Exponential Food Waste Produced (Tons)	Present Value of Landfill Disposal Costs Saved (Constant)	Present Value of Landfill Disposal Costs Saved (Exponential)
July 03 - June 04	1	52	48	$ 2,329	$ 2,154
July 04 - June 05	2	52	45	$ 2,352	$ 2,076
July 05 - June 06	3	52	43	$ 2,369	$ 1,996
July 06 - June 07	4	52	41	$ 2,383	$ 1,916
July 07 - June 08	5	52	40	$ 2,391	$ 1,835
July 08 - June 09	6	52	38	$ 2,396	$ 1,755
July 09 - June 10	7	52	36	$ 2,397	$ 1,676
July 09 - June 10	8	52	34	$ 2,395	$ 1,598
July 10 - June 11	9	52	33	$ 2,389	$ 1,521
July 11 - June 12	10	52	31	$ 2,381	$ 1,447
				$ 23,783	**$ 17,972**

ASSUMING	25%	OF WASTE STREAM IS FOOD WASTE			
Year	Year after 2003	Constant Food Waste Produced (Tons)	Exponential Food Waste Produced (Tons)	Present Value of Landfill Disposal Costs Saved (Constant)	Present Value of Landfill Disposal Costs Saved (Exponential)
July 03 - June 04	1	86	79	$ 3,881	$ 3,590
July 04 - June 05	2	86	76	$ 3,919	$ 3,460
July 05 - June 06	3	86	72	$ 3,949	$ 3,327
July 06 - June 07	4	86	69	$ 3,971	$ 3,193
July 07 - June 08	5	86	66	$ 3,986	$ 3,058
July 08 - June 09	6	86	63	$ 3,994	$ 2,925
July 09 - June 10	7	86	60	$ 3,996	$ 2,793
July 09 - June 10	8	86	57	$ 3,992	$ 2,663
July 10 - June 11	9	86	55	$ 3,982	$ 2,535
July 11 - June 12	10	86	52	$ 3,968	$ 2,411
				$ 39,638	**$ 29,954**

Reduction of Methane Emissions

- 0.15 MTCE per ton of food waste diverted from landfill
- $13 (1992 $) per ton of carbon equivalent.
- Converted to 2003 $ by federal reserve rate

- *WHY ARE THESE VALUES SO LOW?*

Preliminary Conclusions

- **Low Benefits for CMU alone**

- Costs not yet included
  - Training
  - Collection bins
  - Agrecycle collection
- Social benefits not monetized
  - Jobs created
  - Resellable product
  - Landfill space

- Sensitivity Analysis

Questions
&
Suggestions