



# Commercial Recycling Cost Study HF&H Final Draft Report



Public Workshop  
January 19, 2011



# Overview

- Draft Report—posted September 3, 2010
- Methodology & approach discussed at September 21, 2010 stakeholder workshop
- Final Draft Report—posted January 12, 2011
- Discuss cost results at January 19, 2011 stakeholder workshop



# Major Changes in Final Draft Report

- Updated RERFs
- Common year cost basis (2008 Dollars)
- Implementation profile (2012 - 2020)
- Statewide cost of regulation vs. individual business recycling rates
- Effect on small private sector recyclers
- Cost of advanced technologies for foodwaste
- Transformation tonnage



# Cost Study Objectives

- Estimate System Cost of Mandatory Commercial Recycling Regulation
  - Estimate available tons by material type
  - Calculate tons of each material for 4 recycling program scenarios to achieve 5MMTCO2E reduction
  - Estimate recycling cost for 4 scenarios
  - Forecast cost of proposed regulation from 2012 through 2020

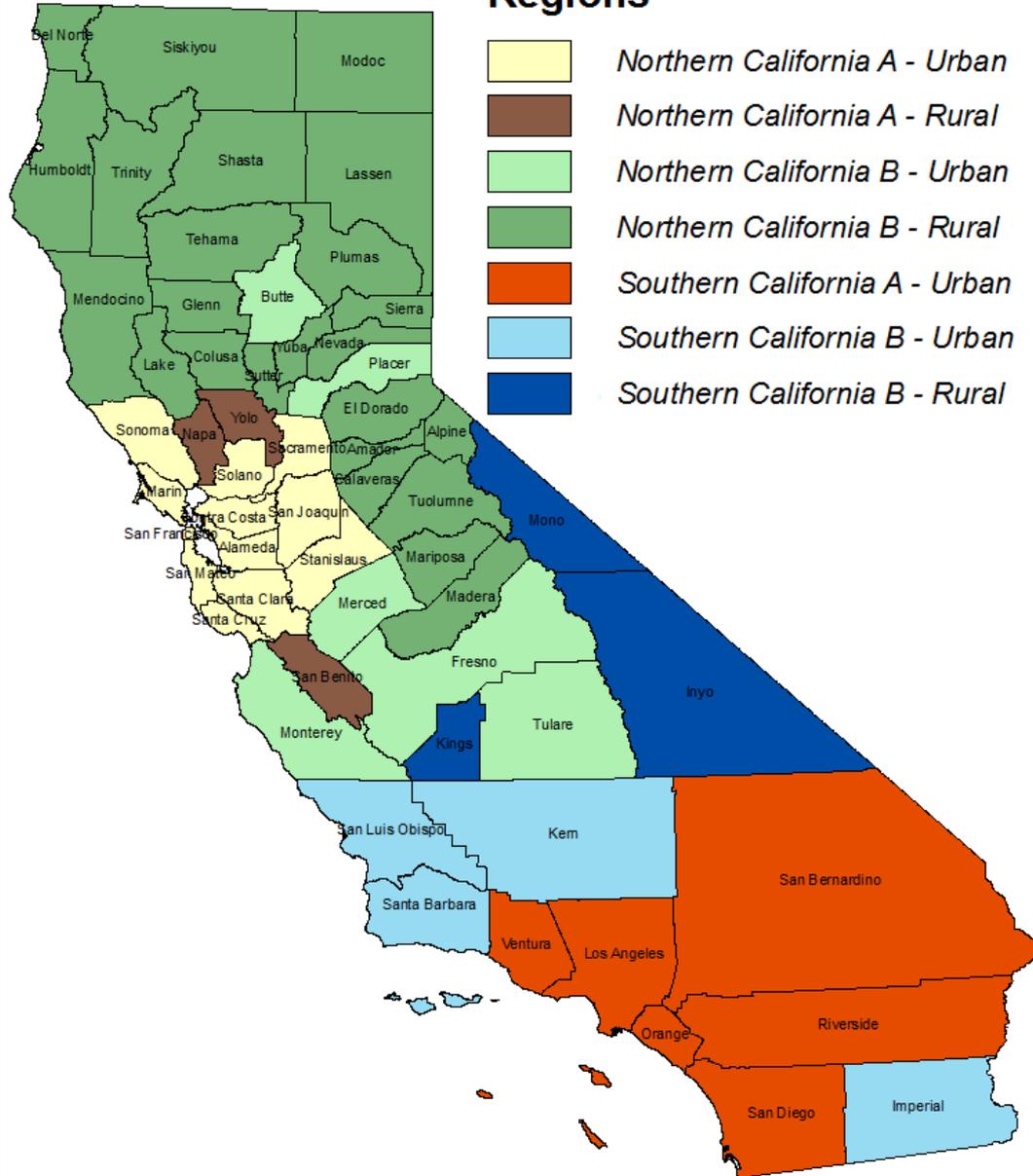


# Tonnage & Composition Methodology

- Data Gathering Process
- Sources of Data
  - Tonnage & Waste Characterization
  - GHG Emissions Reduction Factors (RERFs, CERFs)
  - Operational & Cost Data
- Tonnage Modeling – Quantity & Composition Estimates
- Regional considerations – 7 regions
- Available tonnage by material & region
- Recycling program scenarios – 4 scenarios
- Estimated tons by material, region, scenario to achieve 5 MMTCO<sub>2</sub>e



## Regions



# Program Scenarios

- Baseline – All Materials to Disposal
  - 27.6M Tons Disposed
- Scenario 1 – Traditional Recyclables
  - 1.48M Tons Recovered (5% Recovery Rate)
- Scenario 2 – Traditional Recyclables and C&D
  - 1.71M Tons Recovered (6% Recovery Rate)
- Scenario 3 – Traditional Recyclables and Organics
  - 3.43M Tons Recovered (12% Recovery Rate)
- Scenario 4 – Recyclables, Organics, and C&D
  - 3.49M Tons Recovered (13% Recovery Rate)



# Cost Estimate Methodology

## Cost-of-Service Estimation

- Used for Collection Modeling
- Greater Detail, Less Sensitivity
- How It Works:
  - Estimate Operational Demand (Labor & Equipment)
  - Based on Productivity & Customer Demand
  - Applies Direct Cost Factors
  - Applies Overhead Cost Factors



# Cost Estimate Methodology

## Market Pricing-Based Estimation

- Used for Processing, Transportation, and Disposal
- Based on Competitive Pricing
- How it Works:
  - Market Prices (e.g. Tipping Fees)
  - Detailed Data from Limited Sources to Allocate into Cost Categories
  - Use Similar Regions to Fill Data Gaps



# Cost Estimate Methodology

## Commodity Pricing

- Industry Publication Survey Data :
  - Fibers, Metals, Plastics, Glass
  - SecondaryMaterialsPricing.com
  - SecondaryFiberPricing.com
- Industry Data Gathering & Literature Review:
  - Compost, Wood Waste, Inert Materials
- ADC Not Assumed as Market



# Results

- Need to Recover 1.48M to 3.48M MORE Tons per Year to Achieve 5MMTCO<sub>2</sub>e Target by 2020
- Net Statewide System Cost Increase of \$139M (5%) to \$258M (10%)
- Cost per diverted ton: \$58 to \$110
- Cost per MTCO<sub>2</sub>e: \$28 to \$52



# Available Tonnage by Material & Region

	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
<b>Material Type</b>	<b>TOTAL ALL SECTORS</b>							
HDPE	27,299	1,272	9,019	3,947	84,462	4,883	516	131,398
PET	20,458	907	6,846	3,073	62,475	3,686	398	97,844
Other Plastics	291,021	14,734	100,912	45,002	959,225	58,265	6,275	1,475,433
Aluminum Cans & Nonferrous Metals	15,490	635	4,783	2,180	49,004	2,639	263	74,995
Steel Cans & Ferrous Metals	166,992	7,400	49,549	23,143	572,573	29,068	2,763	851,487
Glass Containers	51,414	2,550	18,377	8,644	147,840	10,304	1,178	240,306
Cardboard & Paper Bags	260,404	12,863	92,618	41,643	853,125	50,919	5,248	1,316,820
Magazines & Catalogs	31,184	1,389	10,015	4,376	93,188	5,481	558	146,190
Newsprint	54,900	2,367	16,970	8,045	163,685	9,876	962	256,806
Office Paper	110,873	5,085	36,821	15,632	339,441	19,833	1,955	529,640
Phone Books	3,277	194	1,289	494	9,609	586	79	15,528
Compostable Paper	328,399	15,879	116,368	51,424	1,028,885	63,302	6,887	1,611,144
Dimensional Lumber	316,951	14,629	92,767	49,758	1,161,694	50,188	4,806	1,690,793
Food	672,589	34,397	252,199	118,709	2,014,157	138,139	15,963	3,246,153
Yard Waste	327,518	12,098	80,850	38,919	973,133	56,838	4,352	1,493,708
Carpet	126,758	4,292	28,363	15,924	466,347	18,428	1,559	661,671
Concrete	107,517	2,770	19,529	8,944	368,803	10,906	1,040	519,509
Tires	6,745	291	2,578	1,183	23,616	1,439	91	35,944
All Other Materials	2,524,177	91,189	611,730	300,371	9,229,765	393,712	36,277	13,187,222
<b>TOTAL</b>	<b>5,443,965</b>	<b>224,943</b>	<b>1,551,584</b>	<b>741,410</b>	<b>18,601,026</b>	<b>928,493</b>	<b>91,169</b>	<b>27,582,590</b>

# Results

## Statewide Cost Estimate

	State of California				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	\$ 1,343,197,612	\$ 1,642,605,330	\$ 1,622,210,509	\$ 1,744,788,293	\$1,691,760,037
Annual Processing Subtotal	\$-	\$ 113,817,041	\$ 111,916,508	\$ 151,349,931	\$ 148,220,204
Annual Transportation Subtotal	\$-	\$ 21,960,657	\$ 25,787,234	\$ 38,417,975	\$ 40,511,202
Annual Disposal Subtotal	\$ 1,199,302,985	\$ 1,134,578,939	\$ 1,124,799,573	\$ 1,049,197,855	\$1,046,742,433
Annual Commodity Subtotal	\$-	\$ (213,595,417)	\$ (212,168,790)	\$ (189,242,463)	\$ (189,657,090)
<b>TOTAL Annual Cost/(Savings)</b>	<b>\$ 2,542,500,596</b>	<b>\$ 2,699,366,550</b>	<b>\$ 2,672,545,035</b>	<b>\$ 2,794,511,592</b>	<b>\$2,737,576,787</b>
<b>Annual Cost Increase</b>					
Collection Increase	\$-	\$ 299,407,718	\$ 279,012,898	\$ 401,590,682	\$ 348,562,426
Processing Increase	\$-	\$ 113,817,041	\$ 111,916,508	\$ 151,349,931	\$ 148,220,204
Transportation Increase	\$-	\$ 21,960,657	\$ 25,787,234	\$ 38,417,975	\$ 40,511,202
Disposal Increase	\$-	\$ (64,724,046)	\$ (74,503,411)	\$ (150,105,130)	\$ (152,560,552)
Commodity Increase	\$-	\$ (213,595,417)	\$ (212,168,790)	\$ (189,242,463)	\$ (189,657,090)
<b>TOTAL Increase</b>	<b>\$-</b>	<b>\$ 156,865,954</b>	<b>\$ 130,044,438</b>	<b>\$ 252,010,996</b>	<b>\$ 195,076,191</b>
Total Tons Managed	27,582,590	27,582,590	27,582,590	27,582,590	27,582,590
Total Tons Recovered	-	1,478,078	1,710,288	3,427,062	3,491,749
MTCO2E	-	5,000,000	5,000,000	5,000,000	5,000,000
Cost per Ton Managed	\$ 92.18	\$ 97.86	\$ 96.89	\$ 101.31	\$ 99.25
Additional Cost per Ton Recovered	n/a	\$ 106.13	\$ 76.04	\$ 73.54	\$ 55.87
Additional Cost per MTCO2E	n/a	\$ 31.37	\$ 26.01	\$ 50.40	\$ 39.02



# Summary of Forecasted Cost Increases by Scenario

Increases During Forecasted Period					
	2012	2013	2014	2015	2016
<b>Estimated System Costs</b>					
Annual Baseline Costs	\$ 2,308,784,596	\$ 2,345,010,180	\$ 2,385,953,601	\$ 2,409,174,653	\$ 2,447,306,865
<b>Increase Over Baseline Costs</b>					
Scenario 1	\$ (25,350,747)	\$ (4,782,877)	\$ 15,348,310	\$ 37,598,733	\$ 60,492,410
Scenario 2	\$ (29,290,232)	\$ (11,866,647)	\$ 7,628,900	\$ 26,899,016	\$ 47,247,828
Scenario 3	\$ (11,700,025)	\$ 20,785,810	\$ 52,871,148	\$ 84,141,140	\$ 118,396,760
Scenario 4	\$ (18,067,005)	\$ 8,070,107	\$ 35,042,275	\$ 60,626,333	\$ 89,065,347
	2017	2018	2019	2020	Total 2012-2020
<b>Estimated System Costs</b>					
Annual Baseline Costs	\$ 2,484,639,976	\$ 2,522,227,594	\$ 2,559,142,483	\$ 2,597,179,737	\$ 22,059,419,685
<b>Increase Over Baseline Costs</b>					
Scenario 1	\$ 84,207,627	\$ 109,599,656	\$ 135,850,930	\$ 162,965,833	\$ 575,929,875
Scenario 2	\$ 68,177,024	\$ 91,469,646	\$ 114,767,713	\$ 138,844,295	\$ 453,877,544
Scenario 3	\$ 151,287,131	\$ 186,181,902	\$ 220,843,805	\$ 257,587,906	\$ 1,080,395,577
Scenario 4	\$ 116,324,994	\$ 144,232,691	\$ 173,392,742	\$ 202,341,696	\$ 811,029,179



# Results

## Collection Costs

Scenario 2 - Traditional Recyclable and C&D Materials								
Northern California A (Urban)		Northern California A (Rural)		Northern California B (Urban)		Northern California B (Rural)		
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	\$ 13,849,116	\$ 117,708,116	\$ 938,070	\$ 5,423,089	\$ 6,197,398	\$ 40,839,772	\$ 3,270,531	\$ 20,061,326
Fuel Costs	\$ 2,976,364	\$ 25,494,631	\$ 241,870	\$ 1,482,308	\$ 1,760,211	\$ 11,629,755	\$ 950,094	\$ 5,853,446
Repairs & Maintenance	\$ 5,410,809	\$ 57,418,351	\$ 498,551	\$ 2,909,125	\$ 4,070,573	\$ 23,044,365	\$ 768,543	\$ 7,521,941
Direct Depreciation	\$ 3,176,324	\$ 28,495,447	\$ 324,469	\$ 1,841,942	\$ 2,165,536	\$ 13,586,857	\$ 1,471,149	\$ 8,250,313
Other Costs	\$ 14,714,375	\$ 127,514,091	\$ 1,385,291	\$ 7,577,905	\$ 8,844,603	\$ 52,084,951	\$ 8,928,295	\$ 54,927,483
<b>Annual Collection Subtotal</b>	<b>\$ 40,126,988</b>	<b>\$ 356,630,636</b>	<b>\$ 3,388,251</b>	<b>\$ 19,234,369</b>	<b>\$ 23,038,321</b>	<b>\$ 141,185,699</b>	<b>\$ 15,388,613</b>	<b>\$ 96,614,509</b>
Collection Cost/(Savings) per Ton	\$ 141.75	\$ 89.13	\$ 257.92	\$ 104.44	\$ 238.60	\$ 104.37	\$ 366.01	\$ 159.26
Southern California A		Southern California B (Urban)		Southern California B (Rural)		State of California		
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	\$ 39,944,055	\$ 295,083,581	\$ 2,661,154	\$ 19,460,389	\$ 369,344	\$ 2,112,931	\$ 67,229,668	\$ 500,689,204
Fuel Costs	\$ 10,797,255	\$ 80,096,658	\$ 810,694	\$ 5,934,778	\$ 118,916	\$ 717,895	\$ 17,655,404	\$ 131,209,470
Repairs & Maintenance	\$ 22,003,936	\$ 155,547,571	\$ 1,571,074	\$ 13,029,735	\$ 176,768	\$ 639,361	\$ 34,500,254	\$ 260,110,448
Direct Depreciation	\$ 12,380,520	\$ 87,634,572	\$ 1,015,302	\$ 6,818,863	\$ 183,944	\$ 1,011,529	\$ 20,717,244	\$ 147,639,523
Other Costs	\$ 45,519,563	\$ 308,305,878	\$ 3,762,209	\$ 26,248,116	\$ 1,159,785	\$ 5,903,440	\$ 84,314,122	\$ 582,561,864
<b>Annual Collection Subtotal</b>	<b>\$ 130,645,328</b>	<b>\$ 926,668,259</b>	<b>\$ 9,820,433</b>	<b>\$ 71,491,880</b>	<b>\$ 2,008,757</b>	<b>\$ 10,385,157</b>	<b>\$ 224,416,691</b>	<b>\$ 1,622,210,509</b>
Collection Cost/(Savings) per Ton	\$ 114.72	\$ 75.27	\$ 167.85	\$ 101.79	\$ 339.48	\$ 139.90	\$ 131.22	\$ 84.35

# Results

## Collection Operational Demand

	State of California				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
<b>Staffing Levels</b>					
Driver	3,653	4,579	4,515	4,847	4,765
Pool Driver	559	538	532	572	564
Container Delivery	158	188	184	211	206
Dispatch	158	182	179	194	192
Route Supervisor	256	288	285	307	302
Operations Manager	186	217	214	234	231
<b>TOTAL Headcount</b>	<b>4,970</b>	<b>5,990</b>	<b>5,908</b>	<b>6,366</b>	<b>6,259</b>
<b>Total Headcount Increase (from Baseline)</b>	-	1,020	938	1,396	1,289
<b>Equipment Needs</b>					
Collection Vehicle - Front End Loader	3,155	3,961	3,870	4,378	4,252
Collection Vehicle - Roll-off	1,180	1,315	1,354	1,186	1,241
Container Delivery Vehicle	158	188	184	211	206
Supervisor Vehicle	442	504	499	541	533
Collection Bins (1 - 8 CY)	762,529	1,266,856	1,241,646	1,257,249	1,233,463
Collection Drop Boxes (10 - 50 CY)	28,575	31,815	32,751	28,696	29,973



# Results

## Processing Costs

Processing Costs	Scenario 2 - Traditional Recyclable and C&D Materials			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
Labor-Related Costs	\$ 12,876,425	\$ 524,966	\$ 2,621,199	\$ 1,601,136
Energy Costs	\$ 612,068	\$ 27,024	\$ 212,749	\$ 122,764
Repairs & Maintenance	\$ 6,711,614	\$ 268,940	\$ 1,405,348	\$ 739,604
Direct Depreciation	\$ 2,611,570	\$ 92,978	\$ 402,059	\$ 211,475
Other Costs	\$ 3,566,794	\$ 165,469	\$ 968,405	\$ 528,112
<b>Annual Processing Subtotal</b>	<b>\$ 26,378,471</b>	<b>\$ 1,079,377</b>	<b>\$ 5,609,760</b>	<b>\$ 3,203,091</b>
Processing Cost per Ton	\$ 77.41	\$ 73.37	\$ 53.77	\$ 67.79
Processing Costs	Southern California A	Southern California B (Urban)	Southern California B (Rural)	State of California
Labor-Related Costs	\$ 33,596,335	\$ 1,472,771	\$ 310,589	\$ 53,003,421
Energy Costs	\$ 1,940,300	\$ 110,409	\$ 15,061	\$ 3,040,374
Repairs & Maintenance	\$ 16,992,663	\$ 735,922	\$ 91,437	\$ 26,945,526
Direct Depreciation	\$ 8,926,565	\$ 204,673	\$ 25,473	\$ 12,474,794
Other Costs	\$ 10,560,310	\$ 598,463	\$ 64,838	\$ 16,452,393
<b>Annual Processing Subtotal</b>	<b>\$ 72,016,173</b>	<b>\$ 3,122,238</b>	<b>\$ 507,398</b>	<b>\$ 111,916,508</b>
Processing Cost per Ton	\$ 63.24	\$ 53.36	\$ 85.75	\$ 65.44



# Results

## Transportation Costs

	Scenario 2 - Traditional Recyclable and C&D Materials			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
<b>Transportation Costs</b>				
Labor, Equipment, and Other Costs	\$ 3,405,446	\$ 190,828	\$ 2,066,088	\$ 1,046,185
Fuel Costs	\$ 1,818,929	\$ 36,573	\$ 366,394	\$ 194,791
<b>Annual Transportation Subtotal</b>	<b>\$ 5,224,374</b>	<b>\$ 227,400</b>	<b>\$ 2,432,481</b>	<b>\$ 1,240,977</b>
Transportation Cost per Ton	\$ 15.33	\$ 15.46	\$ 23.32	\$ 26.26
<b>Transportation Costs</b>	Southern California A	Southern California B (Urban)	Southern California B (Rural)	State of California
Labor, Equipment, and Other Costs	\$ 10,517,846	\$ 1,112,451	\$ 163,486	\$ 18,502,329
Fuel Costs	\$ 4,641,759	\$ 193,759	\$ 32,700	\$ 7,284,905
<b>Annual Transportation Subtotal</b>	<b>\$ 15,159,606</b>	<b>\$ 1,306,210</b>	<b>\$ 196,186</b>	<b>\$ 25,787,234</b>
Transportation Cost per Ton	\$ 13.31	\$ 22.33	\$ 33.16	\$ 15.08



# Results

## Disposal Costs

	DISPOSAL COSTS							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A	Southern California B (Urban)	Southern California B (Rural)	State of California
<b>Disposal Costs</b>								
Disposal Costs per Ton	\$ 43.48	\$ 49.88	\$ 57.22	\$ 46.59	\$ 42.19	\$ 41.83	\$ 49.53	\$ 43.48
Annual Baseline Disposal	\$ 236,678,053	\$ 11,220,769	\$ 88,783,766	\$ 34,539,568	\$ 784,725,189	\$ 38,840,396	\$ 4,515,244	\$ 1,199,302,985
Scenario 2 - Annual Disposal	\$ 221,863,367	\$ 10,486,885	\$ 82,813,939	\$ 32,338,282	\$ 736,681,992	\$ 36,392,916	\$ 4,222,192	\$ 1,124,799,573
Scenario 2 - Avoided Disposal (savings)	\$ (14,814,686)	\$ (733,884)	\$ (5,969,827)	\$ (2,201,286)	\$ (48,043,197)	\$ (2,447,480)	\$ (293,052)	\$ (74,503,411)



# Results

## Commodity Value

	Scenario 2 - Traditional Recyclable and C&D Materials							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
<b>Commodity Costs (Savings)</b>								
Paper	\$ (10,610,552)	\$ (490,536)	\$ (3,559,921)	\$ (1,531,938)	\$ (31,334,199)	\$ (1,925,434)	\$ (191,070)	\$ (49,643,649)
Cardboard	\$ (10,774,388)	\$ (532,230)	\$ (3,832,136)	\$ (1,722,988)	\$ (35,298,581)	\$ (2,106,813)	\$ (217,125)	\$ (54,484,261)
Metals	\$ (14,789,040)	\$ (629,167)	\$ (4,483,341)	\$ (2,066,422)	\$ (48,617,801)	\$ (2,545,014)	\$ (248,132)	\$ (73,378,916)
Wood Waste	\$ (85,754)	\$ (1,449)	\$ (4,820)	\$ (2,395)	\$ (383,647)	\$ (3,149)	\$ (301)	\$ (481,514)
Green Waste	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Compostables	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Mixed Plastics	\$ (6,807,001)	\$ (314,080)	\$ (2,293,488)	\$ (1,012,373)	\$ (20,646,950)	\$ (1,234,062)	\$ (131,876)	\$ (32,439,831)
Glass	\$ (372,405)	\$ (18,592)	\$ (133,889)	\$ (63,030)	\$ (1,068,981)	\$ (75,135)	\$ (8,588)	\$ (1,740,620)
<b>Total Commodity Costs (Savings)</b>	<b>\$ (43,439,140)</b>	<b>\$ (1,986,053)</b>	<b>\$ (14,307,594)</b>	<b>\$ (6,399,146)</b>	<b>\$ (137,350,159)</b>	<b>\$ (7,889,606)</b>	<b>\$ (797,091)</b>	<b>\$ (212,168,790)</b>



# Results

## Assumed Per Ton Commodity Value

Material	\$/Ton Revenue						
	1	2	3	4	5	6	7
	Northern A Urban	Northern A Rural	Northern B Urban	Northern B Rural	Southern A	Southern B Urban	Southern B Rural
HDPE	\$ 351	\$ 351	\$ 351	\$ 351	\$ 351	\$ 351	\$ 351
PET	\$ 370	\$ 370	\$ 370	\$ 370	\$ 370	\$ 370	\$ 370
Aluminum cans and nonferrous metals	\$ 1,254	\$ 1,254	\$ 1,254	\$ 1,254	\$ 1,254	\$ 1,254	\$ 1,254
Steel cans and ferrous metals	\$ 102	\$ 102	\$ 102	\$ 102	\$ 102	\$ 102	\$ 102
Glass containers	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18
Cardboard and paper bags	\$ 102	\$ 102	\$ 102	\$ 102	\$ 102	\$ 102	\$ 102
Magazines and catalogs	\$ 82	\$ 82	\$ 82	\$ 82	\$ 82	\$ 82	\$ 82
Newsprint	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85	\$ 85
Office paper	\$ 177	\$ 177	\$ 177	\$ 177	\$ 177	\$ 177	\$ 177
Phone books	\$ 93	\$ 93	\$ 93	\$ 93	\$ 93	\$ 93	\$ 93
Compostable paper	\$ 8	\$ 8	\$ 5	\$ 5	\$ 7	\$ 7	\$ 5
Dimensional lumber	\$ 2	\$ 2	\$ 1	\$ 1	\$ 2	\$ 1	\$ 1
Food	\$ 8	\$ 8	\$ 5	\$ 5	\$ 7	\$ 7	\$ 5
Yard waste	\$ 8	\$ 8	\$ 5	\$ 5	\$ 7	\$ 7	\$ 5



# Cost Forecasting Methodology

- 2008 Baseline Estimates
- Growth/Contraction in Tons
  - Source: LAO Economic Forecast
  - Employment Rate (Non-C&D Tons)
  - Housing Permits (C&D Tons)



# Conclusions

- Scenario 2 (Traditional Recyclables, C&D) is typical or average scenario
  - Recovers 1.68M MORE Tons per Year
  - Achieve 5MMTCO<sub>2</sub>e Target by 2020
  - Costs \$139M or 5% increase over BAU
  - Cost Effectiveness: \$28/MTCO<sub>2</sub>e; \$82/diverted ton recyclables
- Scenario 4 (Traditional Recyclables, C&D, Organics) is upper range scenario
  - Recovers 3.48M MORE Tons per Year
  - Achieve 5MMTCO<sub>2</sub>e Target by 2020
  - Costs \$202M or 8% increase over BAU
  - Cost Effectiveness: \$40/MTCO<sub>2</sub>e; \$58/diverted ton recyclables



# Conclusions

- High GHG Material Programs = Lowest Tons to Target
- Programs Including C&D = Low Cost
- Programs Including Organics = High Cost
- Economies of Scale are Significant
  - Available Tons, Density
- Avoided Disposal is Significant



# **PUBLIC COMMENTS, QUESTIONS & ANSWERS**

