Accounting for Employment Effects of Solid Waste Management Programs Across Industrial Categories and Levels of Government in Florida

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ACCOUNTING FOR EMPLOYMENT EFFECTS OF SOLID WASTE MANAGEMENT PROGRAMS ACROSS INDUSTRIAL CATEGORIES AND LEVELS OF GOVERNMENT IN FLORIDA

Prepared for:

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Project Title: Accounting for Employment Effects of Solid Waste Management Programs across Industrial Categories and Levels of Government in Florida

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Project Objectives:

1. To re-define and re-classify the solid waste management (SWM) industry – focusing on recycling activities – to isolate public and private solid waste collection, recycling processing, and scrap materials industries;
2. To construct a longitudinal database of Florida's solid waste and recycling employment at the state, county, and local levels through 2012;
3. To evaluate solid waste and recycling growth and model employment change across industry sectors to identify direct economic benefits across the supply chain; and
4. To survey private recovered materials dealers in Florida to better understand the factors that enhance or impede economic development in recycling related industries.

Keywords:
Solid waste management, SWMA, recycling, solid waste industry, green jobs, recycling industry, Florida recycling, recovered material dealer, scrap materials

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Abstract

This study extends previous study of the employment effects of SWMA1988 in four ways. First, it defines and classifies the solid waste management industry by public and private sectors—isolating solid waste collection, recycling processing, and scrap materials industries. Second, it establishes the longitudinal database of Florida's solid waste and recycling employment at the state, county, and local levels through 2012. Third, it extends the analysis beyond the direct employment effects to examine indirect economic benefits across the supply chain, including recycling based manufacturing industry, waste management facilities construction, reused materials wholesales and merchant businesses. Fourth, it conducts a survey of private recovered materials dealers in Florida to better understand and assist recycling vendors as well as county and states governments in Florida.

We find more growth in private sector than public sector collection and report the strongest job growth in the private solid waste and recycling industry. The survey results reveal that local government communication of programs, and narrow state definitions of recovered materials are perceived as barriers to development. Our regression model estimates indicate a 10 percent increase in the recycling rate produces additional growth in private solid waste and recycling jobs in Florida of 4 percent or more. Thus achieving the 75 percent recycling goal would not only produce tremendous environmental and health benefits to Florida citizens it would add over 3,900 new jobs to this sector to the Florida economy.

EXECUTIVE SUMMARY

Environmental protection programs have often been cast as bad for the economy or even as "job killers". While the environmental benefits of some regulatory programs may need to be balanced against their economic impacts, there is increasing recognition that this can be a false tradeoff; in fact, environmental programs can sometimes produce positive economic effects.

The conventional wisdom of economic development portrays a tradeoff between economic opportunities and environmental sustainability (Portney 2003, 2013; Portney and Berry 2010). Within this framework, economic development is achieved at the expense of environment, and environmental preservation is realized by sacrificing the economic opportunities. Green economic development is an emerging economic development framework that integrates the traditionally contentious relationship between economic development and environmental protection. In practice, an increasing number of local governments are pursuing sustainability policies to gain economic competitiveness and savings, and there is not necessarily a tradeoff between economic development and environmental protection (Feiock and Stream 2001).

The Florida Solid Waste Management Act (SWMA) of 1988 not only laid a solid foundation for sustainable and environmentally responsible solid waste management it has also stimulated job creation in specific industrial sectors of the economy. Large numbers of quality green jobs have been produced in solid waste management in the two decades since implementation of the SWMA, but existing data do not isolate the specific sectors and subsectors influenced by local solid waste management programs or track green jobs over time. Supported by the Hinkley Center for Solid and Hazardous Waste Management, this study extends the ongoing investigation of the employment effects of SWMA1988 in four ways. First, it defines and classifies the solid waste management industry by public and private sectors—isolating solid waste collection, recycling processing, and scrap materials industries. Second, it establishes the longitudinal database of Florida's solid waste and recycling employment at the state, county, and local levels through 2012. Third, it extends the analysis beyond the direct employment effects to examine indirect economic benefits across the supply chain, including recycling based manufacturing industry, waste management facilities construction, reused materials wholesales and merchant businesses. Fourth, it conducts a survey of private recovered materials dealers in Florida to better understand and assist recycling vendors as well as county and states governments in Florida.

This study differentiates between direct and indirect solid waste employment to generate rigorous evaluation of the economic impact of SWMA and county recycling programs, and provide practical policy advices for policy makers and administrators to stimulate solid-waste-based economic development and create more green jobs for Florida. Both the descriptive trend analysis and the panel regression analysis are based on our Florida Dunn & Bradstreet National Establishments Data Base (NETS).

The findings we report demonstrate that green solid waste and recycling jobs in the private sector have increased since SWMA 1988 while government employment for solid waste

management shows fluctuation over time. Within the private solid waste and recycling industry, employment trends vary depending upon business activities—the recycling processing business grew faster than scrap materials business, and the employment in private solid waste collection businesses remains at about the same level over the past decade. We find the strongest job growth in the private solid waste and recycling industry as summarized in the table below.

Green Solid Waste Management and Recycling Employment in Florida

	1989	2001	2006	2007	2008	2009	2010	2011
Public SWM	-	**7,302**	**7,994**	**8,135**	**7,506**	**6,963**	**6,787**	**6,956**
Private Sector	**5,579**	**10,392**	**11,652**	**12,146**	**13,179**	**13,614**	**14,036**	**14,948**
Waste Collection	4,021	6,151	5,610	5,798	6,109	5,907	5,335	5,366
Material Recovery	430	1,832	2,717	2,933	3,421	3,855	4,632	5,411
Scrap Materials	1,128	2,409	3,325	3,415	3,649	3,852	4,069	4,171
Waste-to-Energy	0	30	30	31	31	31	31	31
Total	-	**17,694**	**19,646**	**20,281**	**20,685**	**20,577**	**20,823**	**21,904**

Note: Public SWM employment data source is the Annual Survey of Public Employment and Payroll, Census. Data include full-time equivalent employment at all government levels (state, counties, municipalities, special districts, and school districts) combined. Data are pushed one year back, assuming employment in March reflects the previous year trend. The NETS data is used to measure private sector employment.

Our survey of private recovered materials dealers in Florida found that government can both stimulate or impede economic development in that sector. The survey results indicate that gaps in local government communication regarding available programs and narrow state definitions of recovered materials are sometimes perceived as barriers to development.

Statistical analysis of the data we constructed was undertaken to identify the marginal effects of local recycling on job growth while controlling for alternative explanations. Our regression model estimates indicate a 10 percent increase in the recycling rate produces additional growth in private solid waste and recycling jobs in Florida of four percent or more. This result can be used to project the new jobs that would be created if the state goal of a 75 percent recycling rate were achieved. The results suggest that this increase in recycling from 30.4% in 2010 would not only produce tremendous environmental and health benefits to Florida citizens, it would increase employment by 18 percent from 14,948 employees and add over 3,900 new jobs to this sector of the Florida economy.

PART 1: INTRODUCTION

As state and local governments are increasingly realizing, waste management and recycling is an economic development tool as well as an environmental management tool. For example, a recent report of the Connecticut Department of Energy & Environmental Protection (2012) specifically recommends "making the connection between recycling as a business and creation of green jobs." Reuse, recycling, and waste reduction can contribute to local revenue, job creation, business expansion, and the local economic base. Recycling creates new businesses, in transportation, processing and selling of recovered materials as well as the manufacturing and distribution of products made with recycled materials. Jobs in the recycling industry add value to the materials and thus contribute to a growing labor force of skilled workers.

Green economic development is an emerging economic development framework that integrates the traditionally contentious relationship between economic development and environmental protection. This approach rejects traditional approaches that assume a tradeoff between economic opportunities and environmental sustainability (Portney, 2003). An increasing number of state and local governments are pursuing sustainability policies to enhance their economic competitiveness and to produce costs savings. There is increasing evidence that there is not necessarily a tradeoff between economic development and environmental protection (Feiock and Stream 2001; Portney, 2009; Fitzgerald, 2010).

Most of these green economic development activities capitalize on the emerging opportunities associated with the market potentials of recycled products, so that jobs can be created in a sector contributing to environmental preservation. In fact, as documented by Portney (2003), recycling practices and solid waste management innovations are well integrated with local economic strategies in the 24 major U.S. cities that he examined. To a great extent, solid waste management presents policy makers with a policy venue that could accommodate both job growth and environmental protection. One study reports that the 56,000 recycling and reuse establishments in the U.S. now employ workers at a scale comparable to the automobile and truck manufacturing industry (Beck, 2001). As the market for recyclable materials increases, the revenue generated within the industry increases, so recycling is not only good to the environment but also the economy.

Municipalities are at the forefront of innovation to reduce the amount of waste that goes to landfills as well to increase recycling rates. San Francisco recently enacted a Universal Recycling and Composting Ordinance that requires residents to sort their waste into recyclables, compostables and waste with financial penalties for noncompliance. Florida set a recycling goal

of 30% by 1994 through the Solid Waste Management Act (SWMA) of 1988, which was raised to 75% by 2020 in 2010. The mandatory characteristic of SWMA not only secured the goal of environmental protection but also creates an expected steady growth of the recycling market, which is expected to induce employment in recycling activities directly and indirectly.

In Florida, the SWMA laid a foundation for sustainable and environmentally responsible solid waste management, and it also has greatly stimulated job creation in different sectors of the economy. A large number of quality green jobs have been and continue to be created in the solid waste businesses over the two decades following SWMA. It is reported that recycling and reuse businesses are providing 32,000 jobs to Floridians (RBAC, 2011). Previous research has not systematically identified and tracked employment in solid waste businesses, particularly in the context of Florida, and there are only a few studies of green jobs relevant for this study (Pew Charitable Trust, 2009; Brookings Institution, 2011).

This study applies a comprehensive approach to solid waste and recycling employment that encompass public and private sectors at all levels, and beyond direct job growth. Direct solid waste employment refers to jobs created and maintained for solid waste management and recycling activities defined in 1988 SWMA. Indirect solid waste employment refers to jobs created in upstream and downstream industries related to solid waste management. This approach could provide a comprehensive picture of the broader and long-term impact of solid waste management and recycling on the Florida economy.

PART 2: FLORIDA SOLID WASTE COLLECTION AND RECYCLING TRENDS

Before accounting for the jobs in the solid waste management and recycling industry, we will provide an overview of Florida's trends in solid waste collection and recycling activities. It helps us to understand how the size of the solid waste and recycling market in Florida has changed overtime from 1996 through 2012. The Florida Department of Environmental Protection provides Solid Waste Management Annual Reports, which include tonnages of waste collected, recycled, and disposed by household and commercial sectors at state and county levels.[1]

Florida Total

Figure 1 shows the total amount of municipal solid waste collected and recycled and the recycling rate each year in Florida. The amount of municipal solid waste collected rose steadily from 1996 to 2005. After peaking in 2005 at 36,485,344 tons, there has been a general downward trend in municipal solid waste collection. While staying above late 1990s levels,

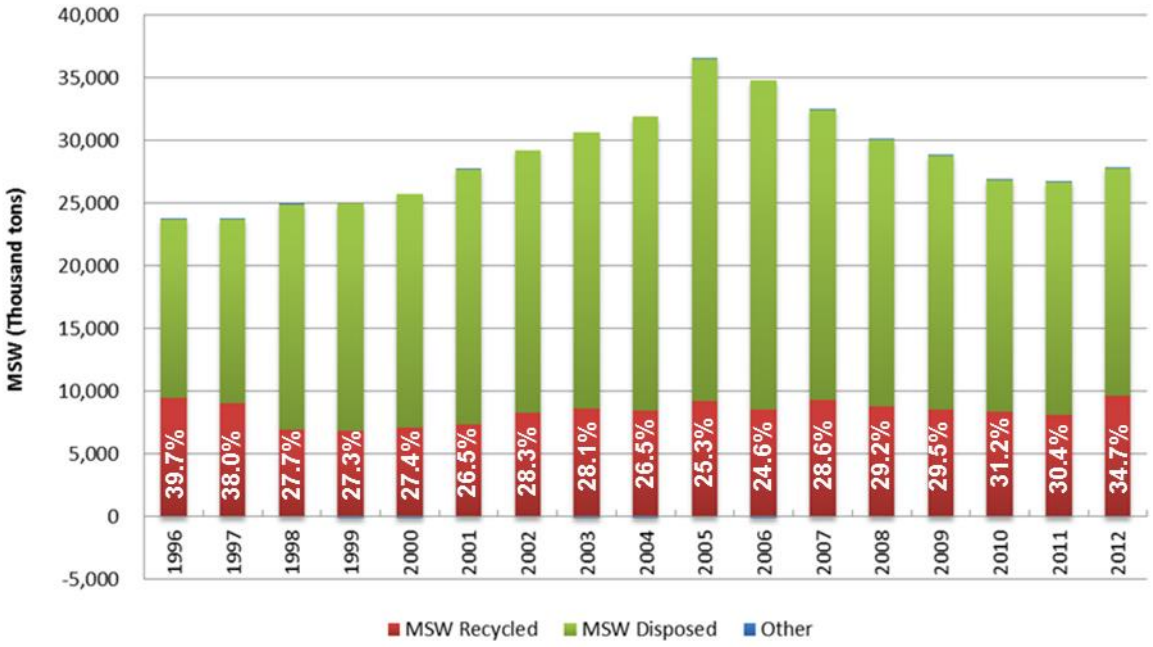
[1] Florida Department of Environmental Projection, *Solid Waste Management Annual Report in Florida*, http://www.dep.state.fl.us/waste/quick_topics/publications/default.htm

collections fell to its lowest post-2005 point in 2011 with 26,667,629 tons. In 2012, overall collections began to show a slight increase, rising over 1.2 million tons from the previous year.

Despite the rebounding increase in overall collection, collection per capita continues to decline. The per capita data mirrors the same period of growth in the late 1990s and early 2000s, and shares the 2005 peak, but dips below 1996 levels in 2012, at 0.95 tons per person. Municipal solid waste disposal followed a similar trend to collection during the sixteen-year period of 1996 to 2012, which reflected an increase from 1996 to 2005 then declining in subsequent years.

Recycling totals have been relatively consistent during this period. With the exception of a downward spike between 1998 and 2001, the State has annually recycled over 8 million tons of municipal solid waste. 2012 was a peak year with 9,659,503 tons recycled. Expressed as a percentage, the recycling rate follows a similar pattern with the most significant change happening between 1997 and 1998, when it dropped from 38.0% to 27.7%. The rate continued to fall until hitting a 2006 low of 24.6%. Data show that in 2012 the recycling rate rose to its highest point since 1997 at 34.7%, which is partly due to the statutory and regulatory changes in what counts towards the recycling goal.

Figure 1. Solid Waste Management in Florida, 1996-2012



Data Source: Florida Department of Environmental Protection

Table 1 compares the amount and percentage changes of Florida's annual total solid waste collection and recycling over years. The recycling rate for the State as a whole saw some interesting changes over the sixteen-year period. The amount of municipal solid waste collected differed by only 3,943,166 tons between 1996 and 2001 – considerably less than the 2001 to 2006 difference – yet the recycling rate dropped by 13.2% over that time, losing roughly a third of the 1996 rate. The rate continued to decrease to a sixteen year low in 2006, despite collecting 34,703,227 tons of municipal solid waste, one of the largest collections of the data period. 2011 to 2012 saw the largest year-to-year growth for statewide recycling with the rate increasing by 4.7%.

Table 1. Solid Waste Management and Recycling, Florida

	1996	2001	2006	2011	2012	2001-2006	2006-2011	2011-2012
MSW Collected (tons)	23,745,911	27,689,077	34,703,227	26,667,629	27,877,202	25.3%	-23.2%	4.5%
MSW Disposed (tons)	14,267,447	20,319,268	26,239,259	18,529,604	18,120,712	29.1%	-29.4%	-2.2%
MSW Recycled (tons)	9,423,784	7,350,290	8,546,596	8,098,961	9,659,503	16.3%	-5.2%	19.3%
Recycling Rate (%)	39.7%	26.5%	24.6%	30.4%	34.7%	-1.9	5.7	4.3

Data Source: Florida Department of Environmental Protection

Florida County Recycling Trends

Nevertheless, the State's overall recycling rates seem to remain stable over the last decade, there are significant variations in recycling rates between counties. We first classified the Florida counties into large and small counties based upon population size and then compared the municipal solid waste collected and recycled, and the recycling rate each year. We define a large county as counties with more than 100,000 population based on the definition of SWMA 1988. SWMA 1988 primarily directed large counties with 50,000 + population which later increased to populations of 100,000. Moreover, the 75% recycling goal as set by the Energy, Climate Change and Economic Security Act of 2008 is also directed to large counties with a population of 100,000 or more or cities with a population of 50,000 +. As of 2012, Florida has 34 large counties with 100,000 population and 33 small counties.

Table 2 shows that larger counties recycle at a higher rate. The amount of MSW collected and recycled in 34 large counties account for about 95% of Florida's total MSW collection and recycling. When looking at all large counties as a whole, the recycling rate was 26.9% in 2001 and with some fluctuation it rose again to a 2012 rate of 35.6%. The smaller counties as a whole show a different story. In 2001, the recycling rate of the smaller counties as a whole was 20%, which was 7% less than the large counties' rate. Over the 2000s, the small counties had a

decreasing recycling rate down to 14.5% and as of 2012 the recycling rate of small counties was 18.7%. The variation in recycling rate in large and small counties gets wider.

Table 2. MSW Recycling Rates in Large and Small Counties, 2001-2012

Year	MSW (1,000 tons)			Recycled (1,000 tons)			Recycling rate (%)		
	State	Large	Small	State	Large	Small	State	Large	Small
2001	27,689	26,384	1,305	7,350	7,089	261	26.5%	26.9%	20.0%
2002	29,204	27,753	1,450	8,272	8,015	257	28.3%	28.9%	17.7%
2003	30,602	29,116	1,486	8,589	8,296	294	28.1%	28.5%	19.8%
2004	31,924	30,380	1,544	8,469	8,179	290	26.5%	26.9%	18.8%
2005	36,485	34,526	1,959	9,239	8,920	320	25.3%	25.8%	16.3%
2006	34,703	32,766	1,938	8,547	8,240	306	24.6%	25.1%	15.8%
2007	32,448	30,706	1,742	9,266	8,994	272	28.6%	29.3%	15.6%
2008	30,087	28,406	1,680	8,787	8,542	244	29.2%	30.1%	14.5%
2009	28,775	27,183	1,591	8,483	8,236	247	29.5%	30.3%	15.5%
2010	26,902	25,382	1,520	8,393	8,112	282	31.2%	32.0%	18.5%
2011	26,668	25,250	1,417	8,099	7,822	277	30.4%	31.0%	19.6%
2012	27,877	26,254	1,624	9,660	9,355	304	34.7%	35.6%	18.7%

Data Source: Florida Department of Environmental Protection

Table 3 shows the population size and recycling rate changes from 2001 to 2012 in large counties, listed in descending order according to the 2012 recycling rate of each county. With a population of 247,337, Alachua County had the highest 2012 recycling rate in the State (55%). Alachua County also experienced the fastest increase in its recycling rate since 2001, with about a 30 percentage point increase. Martin, Brevard, Sarasota, and Collier counties also had 2012 recycling rates exceeding 45%. Of the five largest counties – Orange, Miami-Dade, Hillsboro, Broward, and Palm Beach – only Palm Beach had a regressive recycling rate, declining from a 2001 recycling rate of 39% to a 2012 rate of 32%. Counties such as Okaloosa, Bay, Osceola, and Manatee also experienced decreased recycling rates for the same period. Modest increases were seen in the other counties – similar to the pattern of change in the State's rate. Dade – the most populated county by nearly a million people – showed a considerable increase over the eleven-year period, rising from a rate of 21% in 2001 to a 2012 rate of 30%.

The 33 small counties' recycling rates and percentage point changes are shown in Table 4. From 2001 to 2012 the average recycling rate in small counties decreased by 1.3%, while the State as a whole increased by 8%. Of the small counties, Putnam had the highest recycling rate at 39% in 2012. Holmes, Wakulla, Madison, and Lafayette Counties had a very low level of recycling rate, 1-7% in 2001, but they showed a significant increase of 20% (more or less) over the eleven-year period. Meanwhile, Gulf, Suwannee, Liberty, and Sumter Counties saw a huge

drop in the county recycling rate, more than a 20% decrease, during the same period. Washington County had the lowest 2012 rate in the State at 3%, a decrease from the 2001 average of 7%. Liberty County, the least populated county in the State with a 2011 population of 8,370, had a 2012 recycling rate of 12%.

We will discuss in a later section how these variations and changes in county recycling rates are associated with the green solid waste and recycling employment growth in Florida.

Recycling Bin in Clearwater Beach, FL

Table 3. Recycling Rate of Large Counties

County	Population (2011)	Recycling Rate (Percentage)				2001-2012 Change (Percentage point)	
		2001	2006	2011	**2012**	Total	Average Annual
Alachua	247,337	26%	22%	50%	55%	29.3%	2.7%
Martin	146,689	32%	34%	51%	54%	21.8%	2.0%
Brevard	545,184	35%	35%	45%	48%	13.5%	1.2%
Sarasota	381,319	32%	33%	42%	47%	14.6%	1.3%
Collier	323,785	28%	33%	40%	45%	17.4%	1.6%
Lee	625,310	30%	35%	45%	44%	13.7%	1.2%
Saint Lucie	279,696	40%	11%	37%	44%	3.6%	0.3%
Leon	276,278	40%	24%	41%	43%	3.2%	0.3%
Duval	864,601	21%	23%	34%	42%	21.1%	1.9%
Orange	1,157,342	30%	32%	34%	41%	11.3%	1.0%
Hillsborough	1,238,951	30%	30%	32%	40%	10.2%	0.9%
Escambia	299,261	15%	17%	43%	39%	23.5%	2.1%
Broward	1,753,162	25%	20%	26%	37%	11.9%	1.1%
Indian River	138,694	35%	27%	28%	37%	1.8%	0.2%
Marion	331,745	28%	29%	35%	36%	8.1%	0.7%
Volusia	495,400	32%	30%	31%	35%	2.8%	0.3%
Pinellas	918,496	30%	29%	30%	33%	2.7%	0.2%
Manatee	325,905	37%	40%	35%	32%	-4.6%	-0.4%
Palm Beach	1,352,758	39%	27%	29%	32%	-7.1%	-0.6%
Charlotte	160,463	18%	22%	33%	31%	12.9%	1.2%
Seminole	424,587	23%	26%	33%	31%	7.9%	0.7%
Miami-Dade	2,516,515	21%	19%	23%	30%	9.4%	0.9%
Polk	604,792	22%	30%	29%	30%	8.4%	0.8%
Citrus	140,956	28%	23%	28%	25%	-2.9%	-0.3%
Clay	191,143	28%	22%	29%	25%	-3.5%	-0.3%
Hernando	173,078	28%	21%	26%	24%	-3.9%	-0.4%
Pasco	466,533	16%	28%	24%	24%	7.8%	0.7%
Santa Rosa	154,901	22%	23%	21%	24%	2.5%	0.2%
Saint Johns	192,852	22%	7%	20%	16%	-5.5%	-0.5%
Okaloosa	181,679	27%	13%	21%	15%	-12.3%	-1.1%
Lake	298,265	14%	14%	16%	13%	-0.6%	-0.1%
Bay	168,852	18%	11%	14%	12%	-6.0%	-0.5%
Osceola	273,867	16%	5%	12%	11%	-4.7%	-0.4%
All Large counties	17,650,396	27%	25%	31%	**36%**	8.8%	0.8%
FL State	18,907,759	27%	25%	30%	**35%**	8.1%	0.7%

Data Source: Florida Department of Environmental Protection

Note: Large counties refer the counties with 100,000 population or more.

Table 4. Recycling Rate of Small Counties

County	Population (2011)	Recycling Rate (Percentage)				2001-2012 Change (Percentage point)	
		2001	2006	2011	**2012**	Total	Average Annual
Putnam	74,052	27%	31%	32%	39%	11.5%	1.0%
Bradford	28,662	27%	17%	33%	31%	4.3%	0.4%
Holmes	19,901	5%	7%	23%	29%	24.0%	2.2%
Madison	19,298	7%	13%	39%	29%	21.6%	2.0%
Nassau	73,684	33%	11%	20%	28%	-5.2%	-0.5%
Monroe	72,670	14%	6%	26%	27%	13.4%	1.2%
Lafayette	8,752	4%	14%	30%	23%	18.8%	1.7%
Okeechobee	39,870	24%	19%	26%	23%	-0.7%	-0.1%
Wakulla	30,877	1%	10%	38%	23%	21.8%	2.0%
Columbia	54,918	18%	19%	24%	22%	3.8%	0.3%
Flagler	96,241	38%	33%	30%	21%	-16.8%	-1.5%
Gilchrist	16,983	27%	17%	30%	20%	-6.7%	-0.6%
Union	15,473	18%	15%	24%	20%	2.4%	0.2%
Baker	26,927	13%	11%	22%	19%	6.4%	0.6%
Hendry	38,908	21%	32%	26%	19%	-1.9%	-0.2%
Levy	40,767	10%	13%	28%	18%	7.8%	0.7%
Gadsden	48,200	26%	24%	18%	17%	-8.6%	-0.8%
Suwannee	43,215	45%	23%	18%	17%	-27.9%	-2.5%
Highlands	98,712	21%	12%	8%	16%	-4.6%	-0.4%
Taylor	22,500	24%	25%	17%	14%	-9.8%	-0.9%
De Soto	34,708	11%	14%	8%	13%	1.6%	0.1%
Franklin	11,527	8%	14%	8%	13%	4.6%	0.4%
Jackson	49,964	8%	3%	17%	13%	5.5%	0.5%
Sumter	84,815	33%	10%	21%	13%	-20.4%	-1.9%
Liberty	8,370	40%	27%	13%	12%	-27.5%	-2.5%
Calhoun	14,685	12%	36%	15%	11%	-0.6%	-0.1%
Hamilton	14,744	11%	16%	15%	11%	-0.4%	0.0%
Dixie	16,672	9%	10%	9%	7%	-1.7%	-0.2%
Hardee	27,653	9%	10%	15%	7%	-2.4%	-0.2%
Walton	55,450	4%	3%	7%	7%	3.1%	0.3%
Gulf	15,789	36%	8%	2%	6%	-29.8%	-2.7%
Glades	12,812	9%	5%	7%	4%	-4.6%	-0.4%
Jefferson	14,666	1%	9%	3%	4%	3.2%	0.3%
Washington	24,898	7%	3%	2%	3%	-3.7%	-0.3%
All Small Counties	1,257,363	20%	16%	20%	**19%**	-1.3%	-0.1%
FL State	18,907,759	27%	25%	30%	**35%**	8.1%	0.7%

Data Source: Florida Department of Environmental Protection

Note: Small counties refer the counties with less than 100,000 population.

PART 3: DEFINING THE GREEN WASTE MANAGEMENT AND RECYCLING INDUSTRY

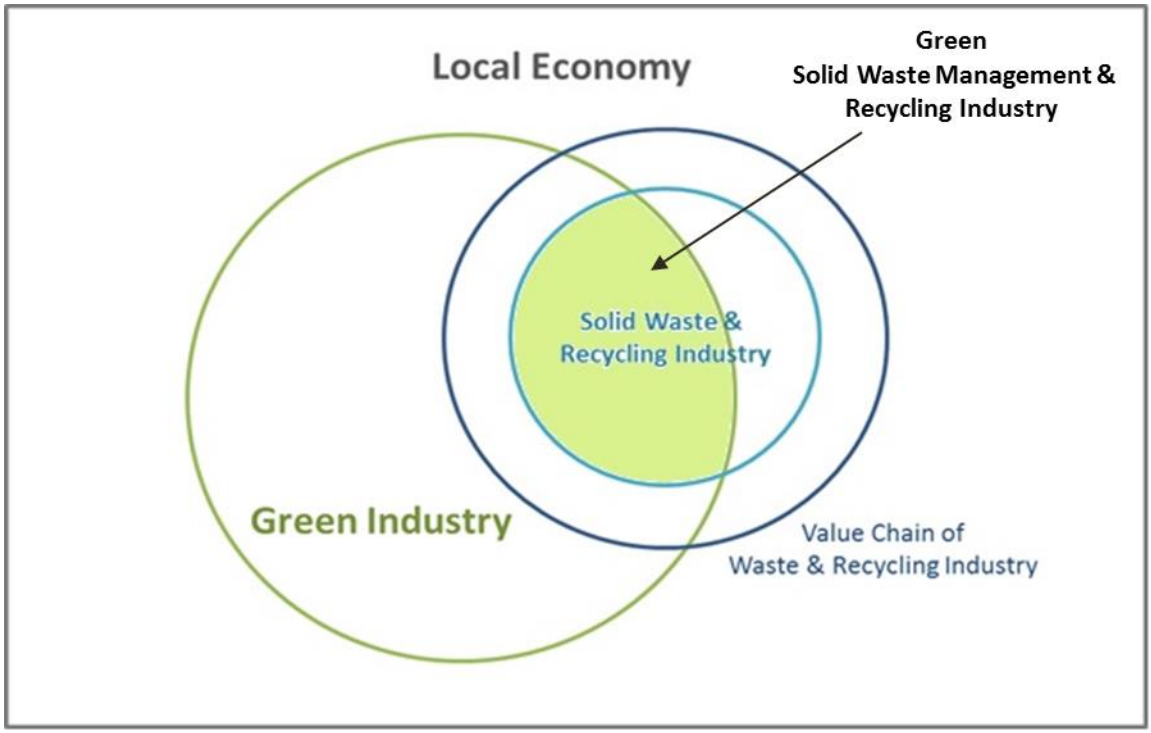
This study is intended to inform the size of solid waste and recycling industry employment in Florida over time. Moreover, this study aims to provide insights on major factors influencing green job growth related to the solid waste and recycling industry.

In order to examine the effect of recycling programs and performance on green job growth in the solid waste management industry, our previous research project (Feiock, 2013)[2] constructed a list of solid waste and recycling industries based on previous studies on green jobs and economic impacts of waste management and refined it considering feedback from experts (Feiock, 2013, p.13). In the report, solid waste management (SWM) related industries were classified into four sub-categories: Waste Collection, Waste Disposal and Treatment, Recycling Reliant industries, and ReUse Industries. In total, 53 6-digit level NAICS codes were included (or 31 4-digit level, 11 6-digit level, and 15 8-digit level SIC codes). Based on the previous definition of the solid waste management industry and the NETS database, as of 2010 there were 221,394 jobs in the overall solid waste management industry: 90,245 in Waste Collection, 27,875 in Solid Waste and Disposal, 31,952 in Recycling Reliant, and 71,322 in Reuse Merchant businesses.

In the second year of research, our research team and the TAG members decided to measure the size of employment in solid waste management and the recycling industry, which is also identified as "green" industry. Thus, this research project attempts to look more closely and precisely at the direct employment effect related to recycling activities among the broadly defined solid waste management and recycling industries. They ranged from waste collection, recycling and disposal to supply and demand chain industries such as construction, manufacturing, and merchant businesses. Figure 2 illustrates the conceptual definition of the "Green Waste Management and Recycling Industry" used in our current research.

[2] Richard C. Feiock (2013). Putting Solid Waste To Work: A Longitudinal Study of Employment Effects of 1988 Florida Solid Waste Management Act. Prepared for the Hinkley Center for Solid and Hazardous Waste Management.

Figure 2. Definition of Green Solid Waste Management and Recycling Industry



Source: By Authors

Our research clarified the extent and structure of solid waste management and recycling businesses that are likely influenced by recycling activities and performance improvement. To identify the green solid waste management and recycling industry, we found conceptual definitions from Florida statue first. We referred to Florida Rule Chapters 62-701 to look at how Florida defines and distinguishes recycling activities and facilities. Florida Rule Chapters 62-701 defines solid waste management as "the process by which solid waste is collected, transported, stored, separated, processed, or disposed of in any other way." It distinguishes resource recovery as "the process of recovering materials or energy from solid waste, excluding those materials or solid waste under control of the Nuclear Regulatory Commission," and recycling as "any process by which solid waste, or materials which would otherwise become solid waste, are collected, separated, or processed and reused or returned to use in the form of raw materials or products." We found that resource recovery and recycling activities are distinguished from a broad definition of solid waste management respectively.

Next, we identified the operational definition of solid waste management and recycling industry measures from previous empirical studies.

Recent Studies on the Solid Waste and Recycling Employment

Conceptual definitions and classifications of recycling industries

In order to re-define and re-classify the solid waste management industry with emphasis on recycling activities, we reviewed previous studies that (1) identify the recycling industry and its supply chain and (2) examine the employment effect of recycling activities. Here we first looked at the studies of the green industry conceptually and operationally, thus we found the very core and common business activities related to "recycling" activities and how they were categorized in previous studies.

Northeast Recycling Council's report (2000), by R. W. Beck, Inc., categorized the recycling and reuse industry into 30 business categories and grouped them into three sectors: Recycling Industry, Reuse and Remanufacturing Industry, and Support Business.

DSM Environmental (2009)[3] followed the methodology developed by NERC and the U.S. EPA (2000)[4] to define the "recycling industry." It includes 26 business sectors, which are divided into three groups: Recycling (supply side), Recycling Reliant (demand side), and Reuse and Remanufacturing industries. This project used various sources of establishment and employment data including Economic Census, County Business Patterns, the Annual Survey of Manufacturers, and the Bureau of Labor Statistics. DSM Environmental also developed a survey instrument based on the original NERC study (2000). 14 out of 26 business sectors were surveyed.

CERC (2012)[5] estimated the direct, indirect, and induced economic impacts of Connecticut's recycling activity by IMPLAN input-output model. The direct effect of recycling industry was measured by number of employees in two industries: Materials Recovery Facilities (NAICS 56292) and Recyclables Material Wholesalers (NAICS 42393). This study used the statewide employment data from the U.S. Census Bureau's County Business Patterns. In 2012, the estimated statewide employees associated with recycling activities in Connecticut were over 4,800 and total value-added, including labor income, indirect businesses taxes, and other type of income, is about $469 million.

[3] DSM Environmental (2009). Recycling Economic Information Study Update: Delaware, Maine, Massachusetts, New York, and Pennsylvania. Prepared for Northeast Recycling Council, Inc.
[4] R.W. Beck, Inc. (2000). US Recycling Economic Information (REI) Study. Prepared for the National Recycling Coalition (NERC). Note: NERC developed methodology to estimate economic impact of the recycling and reuse industries, sponsored by the U.S. EPA in 1997.
http://www.nerc.org/documents/recycling_economic_information_study_final_report_2000.pdf
[5] Connecticut Economic Research Center, Inc. (2012). The Economic Impact on Connecticut Recycling Activity. Prepared for Connecticut Resources Recovery Authority.

NM Recycling Coalition (2013)[6] identified the recycling supply chain, according to DSM Environmental report (2009). This study divided the recycling supply chain into four sectors: collection, processing, manufacturing and converting, and reuse or remanufacturing sectors. Specific NAICS or SIC industry codes, however, were not reported.

Recent studies on economic impact of recycling activities

We also reviewed recent studies on economic consequences of recycling activities in other states and countries. European Environment Agency (EEA)[7] analyzes if promoting recycling creates economic benefits in Europe and how the recycling sector plays a role in the green economy. EEA states that recycling contributes to a green economy in many ways. It plays a substantial role in GDP and international trade, generating green jobs, reducing virgin non-renewable resource use, securing supplies of critical resources, meeting consumption demand for certain materials, opening potential eco-friendly markets, shifting to a circular economy, and reducing financial and environmental burdens related to landfills and incinerators. This report is entirely based on Eurostat's series of research (Eurostat 2010a; 2010b; 2010c; 2010d; 2010e; 2010f).[8]

[6] NM Recycling Coalition (2013). Addition 5,000 Jobs to New Mexico's Economy: A Plan to Increase Jobs Using Recycling-Based Pay As You Throw and Economic Development.

[7] European Environment Agency (EEA). (2011, Dec 5). *Earnings, jobs and innovation: the role of recycling in a green economy*. EEA. Retrieved from http://www.eea.europa.eu/publications/earnings-jobs-and-innovation-the

[8] Eurostat. (2010a). Annual detailed enterprise statistics on manufacturing, subsections DF-DN and total (NACE Rev. 1.1, D). Retrieved from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dfdn&lang=en accessed August 6, 2014.
Eurostat. (2010b). Annual detailed enterprise statistics for trade (NACE Rev. 2 G). Retrieved from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en accessed August 6, 2014.
Eurostat. (2010c). Environmental data centre on waste. Retrieved from http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/database accessed August 6, 2014.
Eurostat. (2010d). EU27 trade since 1988 by CN8. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/show.do?query=BOOKMARK_DS-016890_QID_60911498_UID_-3F171EB0&layout=PERIOD,L,X,0;REPORTER,L,Y,0;PARTNER,L,Z,0;PRODUCT,L,Z,1;FLOW,L,Z,2;INDICATORS,L,Z,3;&rankName1=REPORTER_1_2_0_1&rStp=&cStp=&rDCh=&cDCh=&rDM=true&cDM=true&codelab=L&wai=false&time_mode=FIXED%3E&lang=en accessed August 6, 2014.
Eurostat. (2010e). Prodcom — statistics by product. Retrieved from http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/database accessed August 6, 2014.
Eurostat. (2010f). Eurostat — statistics. Retrieved from http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database accessed August 6, 2014.

EEA emphasizes the economic importance of recycling in Europe. According to EEA (2011), the recycling sector is mostly classified by seven material groups: glass; paper and cardboard; plastic iron and steel; copper, aluminum and nickel; precious metals; and other metals. As one of the sub-sectors of the eco-industry—recycling, waste supply, wastewater treatment and waste management—the recycling sector recorded the fastest growth rate in the period 2004-2008. The annual employment growth rate of the recycling sub-sector in the period 2000-2008 ranked second (10.57%) following the renewable energy sub-sector (16.37%). Although the proportions vary greatly among the resource groups, recycling accounts for a substantial proportion on meeting the needs for iron and steel and paper and cardboard.

Connecticut Resources Recovery Authority (2012)[9] suggests a quantitative framework on how recycling contributes to Connecticut's economy in terms of output and employment for the years 2006 to 2012 through its analysis of the direct, indirect, and induced impacts made by all aspects of the recycling activities in the state of Connecticut. They categorize recycling activities into four groups: Statewide Recycling Wholesalers; Statewide Private Hauling; Statewide Municipal Hauling; and Statewide Materials Recovery Facilities.

Direct impacts are estimated by various data sources, but most of the data are based on the U.S. Census Bureau's County Business Patterns data. The indirect impacts are captured by the IMPLAN input/output model that measures the additional economic activity created by the direct impacts within Connecticut. The induced impacts, also estimated by the IMPLAN input/output model, are additional output and employment "due to the increase in household incomes associated with the direct and indirect activities," specified above. This report also adopts the estimates of DSM Environmental (2009)[10] and CERC (2012) for some calculations.

The direct impacts of the recycling industry are totaled at $3,045 million for the seven years and 2,710 jobs per year. The indirect impacts are a total of $791 million for the period and an additional 755 jobs per year. The induced impacts are totaled at $1,332 million for the period and an additional 1,325 jobs per years. Employment and output from the indirect and induced impacts are also classified by industry sector. This report states that recycling contributes to

[9] Connecticut Economic Resource Center (CERC). (2012, November). *The Economic Impact on Connecticut from Recycling Activity*. CERC. Retrieved from http://www.crra.org/documents/press/Press%20kit/CERC_study_of_economic_impact_of_recycling_full_report_12-20-2012.pdf

[10] DSM Environmental. (2009, February). *Recycling Economic Information Study Update: Delaware, Maine, Massachusetts, New York, and Pennsylvania*. Northeast Recycling Council. Retrieved from https://nerc.org/documents/recycling_economic_information_study_update_2009.pdf accessed August 6, 2014.

decreasing ecological footprint and pressure on the prices of natural resources, and thus economic benefits are brought into Connecticut.

South Carolina Department of Commerce, the South Carolina Department of Health and Environmental Control (SCDHEC), New Carolina and Recyclonomics-SC commissioned a study through a partnership on the impacts of the recycling industry on the state's economy and employment (2014).[11] Two major sources of its measurement are direct survey data from recycling companies and IMPLAN. Major findings are that the total economic impact of recycling is $13 billion, which doubled since 2006. Recycling accounts for 54,121 jobs, which has increased by 44 percent since 2006. The total economic impact includes $2.7 billion in labor income and $329 million in state and local taxes.[12]

According to the report, the State of South Carolina has 524 firms engaged in recycling activities as of 2014, which has also increased by 54 percent from 340 firms in 2006. Collectors, haulers, processors, end-users, exporters, and others are among these companies. The average number of employees of these companies is 63, and the median is 14. The average payroll in the recycling industry is $40,203, whereas the overall average payroll in South Carolina is $38,700.

The Natural Resources Defense Council (NRDC, 2014)[13] projects the job creation potential when the California Assembly Bill 341 (AB341) takes effect. This state law specifies the policy goal that "75 percent of solid waste generated be source reduced, recycled, or composted by the year 2020." This goal is simply to increase California's recycling rate from 50 percent in the year 2012 to 75 percent in 2020. In this regard, NRDC estimates three major figures in order to compute the grand total of jobs associated with the policy: the total amount of waste generated in 2020 by material type; job production factors per 1,000 tons by material type; and the number of jobs produced directly by increased recycling activities.

To calculate job production factors by material type (e.g., paper & paperboard, glass, aluminum, plastics, etc.) for each diversion and disposal activity (e.g., collection, processing,

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[11] South Carolina Department of Commerce (SCDC), South Carolina Department of Health and Environmental Control (SCDHEC), New Carolina, and RecyclonomicsSC. (2014). 2*014 South Carolina Recycling Industry Economic Impact Study*. SCDC, SCDHEC, New Carolina, and RecyclonomicsSC. Retrieved from http://recyclonomicssc.com/UserFiles/screcyc/Documents/RECY%20Economic%20Impact%20Study%202014%20WEB%20DIGITAL%20Report%2020140529.pdf accessed August 6, 2014.

[12] South Carolina Department of Commerce. (2014, June 24). *Recycling industry brings $13 billion boost to SC economy*. South Carolina Department of Commerce. Retrieved from http://sccommerce.com/news/press-releases/recycling-industry-brings-13-billion-boost-sc-economy

[13] Natural Resources Defense Council (NRDC). (2014, March). *From Waste to Jobs: What Achieving 75 Percent Recycling Means for California*. NRDC. Retrieved from http://www.nrdc.org/recycling/files/green-jobs-ca-recycling-report.pdf

manufacturing, landfilling and incineration, etc.) this report applied recently developed national job production factors (*More Jobs, Less Pollution, Growing the Recycling Economy in the U.S.*).[14] Given the estimated additional amount of waste recycled, the composition of the waste, and the job production factors, the NRDC computes the direct job creation potential. According to Table 5, the total number of estimated incremental recycling jobs is 110,305. Of this, plastics contribute the largest proportion (29,150), followed by paper (26,635) and lumber (17,625). However, this report points out that the estimated job production would not necessarily take place within the State of California, nor even in the U.S.

A national study by Tellus Institute (2011)[15] projected the impacts of the increased waste diversion rates of municipal solid waste (MSW) and construction and demolition debris (C&D) on employment and the environment. To analyze these impacts, Tellus Institute compares the year 2008 with two different waste management scenarios' potential in 2030. Total jobs directly related to MSW management system are 666,000 and 86 percent of them, 574,000 jobs, are for recycling and composting activities. For C&D in 2008, 195,000 jobs are estimated and among them more than 161,000 jobs are associated with diversion. Although there are variations in materials or activities, diverted wastes for recycling or composting have far higher job production estimates than disposed wastes.

The New Mexico Recycling Coalition (NMRC)[16] focuses on the job creation potential of the recycling industry in the State of New Mexico. Showing how the estimated number of recycling-related jobs changes as the recycling rate increases from 20.6% to 34%, 50%, and to 75%, this study demonstrates the economic benefit of recycling. NMRC also provides two major strategies for increasing the recycling rate in New Mexico: Pay As You Throw (PAYT), and Waste Bans.

Depending on several studies by the Institute for Local Self Reliance, DSM Environmental, R.W. Beck, and Tellus Institute, this report estimates total recycling-related jobs (direct, indirect, and induced jobs) along with four different recycling rates: 20.6%, 34%, 50%, and 75%. Total estimated current jobs are 6,746, of which 2,159 are direct jobs. When the State of New Mexico reaches the national average recycling rate of 34 percent, total estimated jobs would be 16,064, of which 5,141 are direct jobs. This increase in the recycling rate would generate almost

[14] Tellus Institute. (2011). *More jobs, Less Pollution: Growing the Recycling Economy in the U.S.* Tellus Institute. Retrieved from http://www.tellus.org/publications/files/More_Jobs_Less_Pollution.pdf
[15] Tellus Institute. (2011). *More jobs, Less Pollution: Growing the Recycling Economy in the U.S.* Tellus Institute. Retrieved from http://www.tellus.org/publications/files/More_Jobs_Less_Pollution.pdf

[16] New Mexico Recycling Coalition (NMRC). (2013, Jan 21). *Adding 5,000 jobs to New Mexico's Economy*. NMRC. Retrieved from http://www.recyclenewmexico.com/jobs.htm

10,000 additional jobs. Increasing the recycling rate in New Mexico to 50 percent, total estimated jobs would be 24,104, of which 7,714 jobs are direct jobs. Therefore, 17,358 new jobs would be created at the 50 percent recycling rate. Increasing the recycling rate to 75 percent, estimated total jobs would be 36,156, of which 11,571 jobs are direct jobs. This figure is more than 5 times the current estimated total jobs, creating additional 29,410 jobs. However, NMRC points out that not all of the newly-created jobs would be within New Mexico.

Classification of Green Solid Waste Management and Recycling Industries

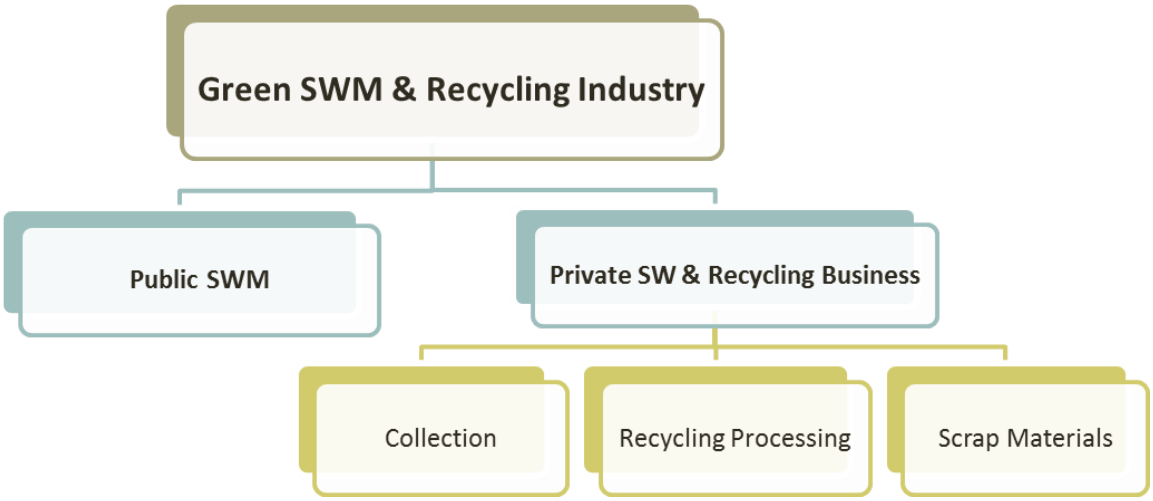
The industries commonly defined as direct recycling businesses in aforementioned studies were Materials Recovery Facilities (NAICS 56292) and Recyclables Material Wholesalers (NAICS 42393). Together with recyclables collection businesses, our research team identified these two industries as core recycling industries that are directly influenced by a state's and county's recycling programs. Businesses on the demand side of recycling activities such as recycling reliant manufacturing and reuse merchant were excluded from the definition of green solid waste and recycling industries.

We also synthesized the recommendations and insight from our expert advisors (TAG members) on the refinement and reclassification of the Green SWM and Recycling Industry. Our research team and TAG members agreed on following elements.

- Limit our focus on industries directly influenced by recycling activities, isolating recycling businesses from other solid waste management businesses such as hazardous waste management, landfill, and combustion.
- Include both public and private sector entities directly related to recycling activities and measure the employment size separately.
- Classify the private industry on its functions in the recycling process and compare the employment size and trends among sub-categories.
- Select the industry classification code to most precisely measure and isolate businesses directly related to recycling and recovering.

Our research team finalized the classificatory scheme of Green Solid Waste Management and Recycling Industry as Figure 3. The industry is classified into public and private sectors. Then the overall private recycling industry can be classified again into three business activities: waste and recyclables collection, recycling processing, and scrap materials.

Figure 3. Classificatory Scheme of the Green Solid Waste Management and Recycling Industry



Source: By Authors

Measurement of Green Solid Waste Management and Recycling Industries

Building on our ongoing work that examines the direct impact of state and county level recycling programs on employment, we conducted an analysis to identify the impact of policy tools and program designs at the state and county levels on job creation and maintenance across the economy from 2000 through 2011.

Most of previous studies on solid waste and recycling employment have not included the public sector in their measurement. Municipalities, however, provide at least a part of in-house public services such as solid waste and recyclables collection and processing. In addition, government employment sometimes plays an important role in the local economy. The measurement of expansion or reduction of public employment serving for solid waste management is expected to be related to private sector employment in recycling businesses.

For measuring public sector employment for solid waste management, we used the *Annual Survey of Public Employment and Payroll* survey published by the U.S. Census Bureau. We decided to use it instead of a privately collected database because this is publicly available survey data and we could isolate how many employees work for solid waste management functions. We counted full-time equivalent employees working at both municipalities and county agencies within each county.

In order to account for private sector recycling employment, we used the National Establishment Time Series database. Employment data were collected from *Walls and Associates* National Establishment Time-Series (NETS) Database based on the list of

establishment codes and then classified and organized by facility type, county, location, primary business activity, and year. This current project expanded and extended that work in several ways.

We took advantage of the NETS database that was released in January 2014 to extend the trends at all governmental levels through 2012. Walls and Associates conducts the establishment survey in January every year. Thus, the most recent data we have is Florida's establishment and employment data as of January 2012. In our project, we assume that employment size in January reflects previous year employment activities and trends, so that we pushed the data one year back. That is, an employment measure in January 2012 from the NETS database was considered as the state of employment in 2011.

We used the most precise industry classification code (8-digit SIC) assigned to each establishment to identify and isolate private solid waste/recyclables collecting, recycling processing, and scrap materials businesses. Table 5 shows the private sector classification and corresponding SIC codes for each business.

Table 5. Industry Codes Defining Private Green Waste Management and Recycling Industry

Industry Category	SIC Code	SIC Description
SW Collection	42129906	Garbage Collection and Transport, no Disposal
	49530201	Garbage: collecting, destroying and processing
	49530200	Refuse collection and disposal services
Recycling Processing	49539905	Refuse systems - Recycling, waste materials
Scrap Materials	5093	Scrap and waste materials
(Waste-to-Energy)	49539903	Refuse systems - Incinerator operation

Source: By Authors
Note: For Scrap Materials industry, a 4-digit SIC was used because all sub-category industries (8-digit SIC) are recyclable materials merchant wholesalers handling different materials.

Using 8-digit SIC codes enabled us to isolate business activities directly related to recycling/material recovery more precisely as well as to identify establishments consistently and exclusively. For instance, when two industrial classification codes were mixed in previous projects, an establishment doing medical waste disposal (SIC 49539904) or dead animal disposal (SIC 49539902) were also identified as our previous definition of solid waste collection or waste treatment business As a result, we were not able to distinguish them from materials recycling activities. Some 6-digit NAICS such as NAICS 462119 "Other waste collection" and NAICS 462219 "Other nonhazardous waste treatment and disposal business" are not always comparable to the most precise 8-digit SICs respectively. Instead they are all considered to be comparable to 6-digit SIC Refuse Systems, which includes seven detailed level industries, SIC

49539901-07: businesses doing ashes, collection and disposal, incinerator operation, waste materials recycling, waste materials disposal at sea, etc. This methodology also resulted in overestimation of solid waste management and recycling employment.

Instead, using 8-digit SIC code we were able to isolate establishments doing waste materials recycling activity (SIC 49539905). By counting all employees in the establishment with SIC 49539905 we can measure number of employees related to waste recycling activities only.

As a measure of economic consequence of Florida's recycling programs and performance, we considered all employees in the establishments identified as green solid waste management and recycling businesses with 8-digit SIC.

Material Recovery Facility in Tallahassee, FL (courtesy of Marpan Recycling LLC)

PART 4: TRENDS IN GREEN SOLID WASTE AND RECYCLING EMPLOYMENT IN FLORIDA

State Trends

The period of 2001 to 2011 saw a steady trend for overall solid waste management and recycling in the State of Florida with totals hovering around 20,000 employees. When the data is broken down into public and private entities, we see that this steadfast total seems to be the product of downsizing in the public sector and complimentary increases among private businesses. Beginning in 2001, the only year in which public sector employment increased was 2010-2011 making a modest move of 2.5%. The eleven-year period as a whole saw a decrease of 4.7%, with the greatest losses happening between 2006 and 2011, coinciding with the economic downturn. Conversely, the private sector, as a whole, experienced consistent increases during the same time period, peaking in 2011 with 14,948 employees. During the 2006 to 2011 period, as the public sector lost 13.0% of its employees, private employment rose by 28.3%. The 2010-2011 data show the continuation of this trend as employment increased by 6.5%.

The three divisions of the private sector did not grow equally, however. While scrap materials and recycling saw significant increases, waste collection had an overall decrease of 12.8% between 1989 and 2011. Peaking in 2001 with 6,151 employees, waste collection employment then fell during the first half of the 2000s. After a short revival in 2008, employment fell once again hitting a decade low in 2010 of 5,335 employees and falling behind recycling as the largest employer in the sector for the first time in 2011. Recycling experienced the largest growth in the sector by far, increasing by 195.4% between 2001 and 2011.

Table 6. Green Solid Waste Management and Recycling Employment in Florida

	1989	2001	2006	2007	2008	2009	2010	2011	% Change, 2001-2011	% Change, 2006-2011	% Change, 2010-2011
Public SWM	-	**7,302**	**7,994**	**8,135**	**7,506**	**6,963**	**6,787**	**6,956**	**-4.7%**	**-13.0%**	**2.5%**
Private Sector	**5,579**	**10,392**	**11,652**	**12,146**	**13,179**	**13,614**	**14,036**	**14,948**	**43.8%**	**28.3%**	**6.5%**
Waste Collection	4,021	6,151	5,610	5,798	6,109	5,907	5,335	5,366	-12.8%	-4.3%	0.6%
Material Recovery	430	1,832	2,717	2,933	3,421	3,855	4,632	5,411	195.4%	99.2%	16.8%
Scrap Materials	1,128	2,409	3,325	3,415	3,649	3,852	4,069	4,171	73.1%	25.4%	2.5%
Waste-to-Energy	0	30	30	31	31	31	31	31	3.3%	3.3%	0.0%
Total	**-**	**17,694**	**19,646**	**20,281**	**20,685**	**20,577**	**20,823**	**21,904**	**23.8%**	**11.5%**	**5.2%**

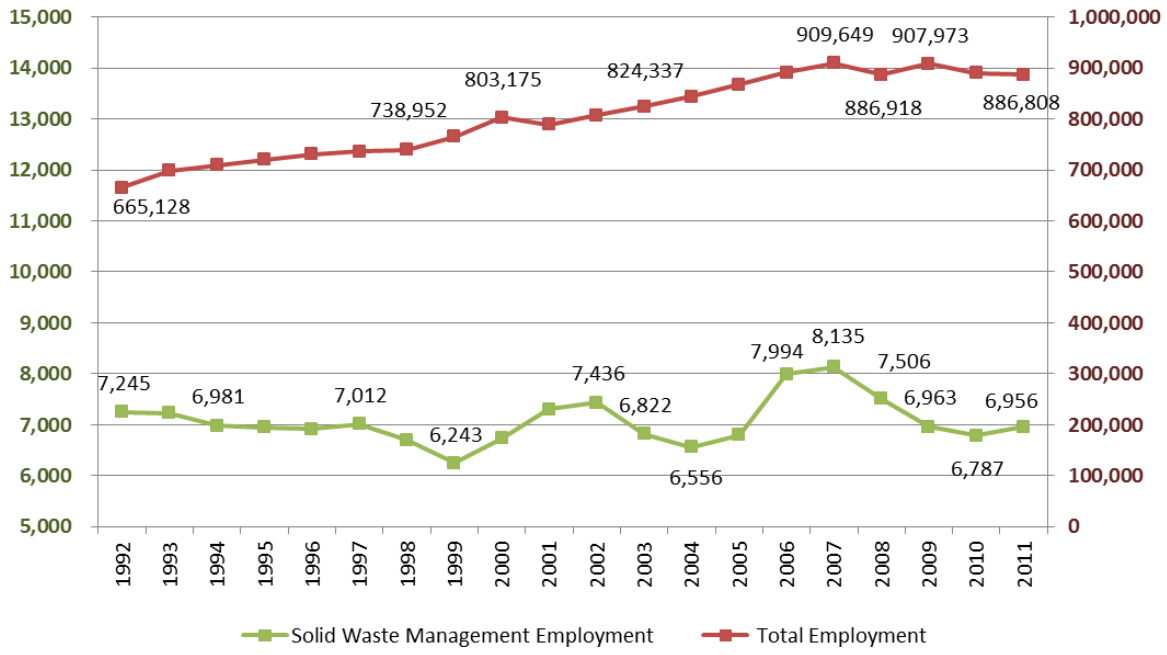
Note: Public SWM employment data source is Annual Survey of Public Employment and Payroll, Census. Data include full-time equivalent employment at all government levels (state, counties, municipalities, special districts, and school districts) combined. Data push one year back, assuming employment in March reflects previous year trend. NETS data are used to measure private sector employment.

Public Sector Solid Waste Management Employment

When comparing total public employment to the portion that is solid waste employment, we find two different descriptions of the public sector. Total employment rose steadily from 1992 to 2007, hitting somewhat of a plateau in the following years with totals hovering around 900,000 employees. Solid waste management employment, however, has not been so steady in recent years. After a period of consistency throughout the early and mid 1990s, employment began to drop in 1998, hitting its lowest point in 1999 with 6,243 employees. From there the numbers begin a pattern of rising and falling, increasing and subsequently decreasing by over 1,000 employees in just 5 years. Like the public sector total, employment peaked between 2007 and 2008 at 8,135 employees; however, where overall public employment saw only a minor drop off after this peak, solid waste management dropped considerably, falling to 6,787 in 2010.

True to the pattern of the previous decade, employment rose modestly in solid waste, growing by 169 in 2011. Despite the recent drop off in employment, the data suggest the emergence of an overall upward trend, as each dip remains higher than previous lows suggesting that while there may be instability in individual positions, the sector as a whole continues to grow.

Figure 4. Public Employment in Florida: Total vs. Solid Waste Management, 1992-2011



Data Source: Annual Survey of Public Employment and Payroll, Bureau of Census.
Note: Data include full-time equivalent employment at all government levels (state, counties, municipalities, special districts, and school districts) combined. Data push one year back, assuming employment in March reflects previous year trend.

Public sector SWM employment can be further broken down into the types of government employing workers. The data list employment numbers for counties, municipalities and special districts from 2006-2011. Municipalities have the largest share, employing 52% of public SWM workers. County governments have a comparable share at 45.5% of employees, leaving 2.6% of the market under the jurisdiction of special districts. While special district employment appears to have remained constant over the time period – moving from 182 employees in 2006 to 181 in 2011 – both county and municipal governments decreased over the 5 years, resulting in a total public sector SWM decrease of 13.0%. Despite municipalities' majority stake in both 2006 and 2011, counties had the largest decrease, losing 555 jobs over the five-year period (-14.9%). Municipalities were not too far behind, however, with a decrease of 11.8%, totaling 482 jobs.

Table 7. Public Solid Waste Management Employment By Government Type, Florida, 2006 and 2011

Type of Government	2006	2011	% 2011	% Change 2006-2011
County	3,716	3,161	45.4%	-14.9%
Municipality	4,096	3,614	52.0%	-11.8%
Special District	182	181	2.6%	-0.5%
Grand Total	7,994	6,956	100%	-13.0%

Data Source: Annual Survey of Public Employment and Payroll, 2007 and 2012.
Note: Data includes full-time equivalent employment. Data pushes one year back, assuming employment in March reflects previous year trend.

When broken down into the top 20 counties for public solid waste management employment, the downsizing trend is seen throughout most of the state. For the largest counties, downsizing was fairly proportional to their size. Miami-Dade, the largest county by far with nearly one thousand more employees than the second largest, Palm Beach, lost 25.9% of their employees between 2006 and 2011. This totaled 552 employees. Palm Beach also saw a considerable reduction in public SWM employment, declining by 21.1%. The third largest county, Pinellas, decreased by 8.9% over the five year period, the same amount as their share of total public solid waste management employment in Florida.

Downsizing was not always proportional to county size. Broward and Escambia Counties, which each account for 4.0% of public SWM, only lost four employees together. Other counties with smaller shares of the sector saw relatively large reductions with Sarasota and Volusia County, which both housed 1.4% of public SWM in 2011, taking the biggest losses of 35 (-26.3%) and 71 (-41.8%) employees, respectively. These reductions left each county with just under 100 public solid waste management jobs in 2011.

Not every part of the state saw declining employment, however. Five counties increased public solid waste jobs in their districts, including: Seminole County (+24.7%), Osceola County (+41.2%), Bay County (+12.5%), Manatee County (+11.6%), and Marion County (+2.5%). Excluding Bay County – located in the western panhandle – all those that experienced job growth between 2006 and 2011 are located in central Florida. Osceola had the largest increase in both the rate of change and the physical number of employees, increasing their workforce by 28 people.

Table 8. Public Solid Waste Management Employment
Large Counties, Florida, 2006 and 2011

County	2006	2011	2011%	Change 2006-2011	Growth Rate 2006-2011
Miami-Dade	2,135	1,583	22.8%	-552	-25.9%
Palm Beach	830	655	9.4%	-175	-21.1%
Pinellas	683	622	8.9%	-61	-8.9%
Hillsborough	400	352	5.1%	-48	-12.0%
Orange	339	323	4.6%	-16	-4.7%
Broward	278	276	4.0%	-2	-0.7%
Escambia	253	251	3.6%	-2	-0.8%
Brevard	238	203	2.9%	-35	-14.7%
Marion	163	167	2.4%	4	2.5%
Polk	191	167	2.4%	-24	-12.6%
Leon	159	132	1.9%	-27	-17.0%
Lee	119	117	1.7%	-2	-1.7%
Manatee	95	106	1.5%	11	11.6%
Duval	133	100	1.4%	-33	-24.8%
Volusia	170	99	1.4%	-71	-41.8%
Sarasota	133	98	1.4%	-35	-26.3%
Bay	86	97	1.4%	11	12.8%
Osceola	68	96	1.4%	28	41.2%
Seminole	77	96	1.4%	19	24.7%
Lake	85	81	1.2%	-4	-4.7%
Alachua	57	79	1.1%	22	38.6%
Indian River	89	73	1.0%	-16	-18.0%
Clay	73	71	1.0%	-2	-2.7%
St. Lucie	46	68	1.0%	22	47.8%
Collier	48	68	1.0%	20	41.7%
Charlotte	56	62	0.9%	6	10.7%
Pasco	63	62	0.9%	-1	-1.6%
Okaloosa	62	56	0.8%	-6	-9.7%
Santa Rosa	33	42	0.6%	9	27.3%
Martin	91	41	0.6%	-50	-54.9%
Hernando	57	38	0.5%	-19	-33.3%
St. Johns	38	37	0.5%	-1	-2.6%
Citrus	25	28	0.4%	3	12.0%
All Large Counties	7,373	6,346	91.2%	-1,027	-13.9%
Total	**7,994**	**6,956**	**100%**	**-1,038**	**-13.0%**

Date Source: Annual Survey of Public Employment and Payroll, 2007 and 2012.
Note: Data is ordered by 2011 SWM employment size. Data includes full-time equivalent employment. Data pushes one year back, assuming employment in March reflects previous year trend.

Table 9. Public Solid Waste Management Employment
Small Counties, Florida, 2006 and 2011

County	2006	2011	2011%	Change 2006-2011	Growth Rate 2006-2011
Flagler	11	53	0.8%	42	381.8%
Highlands	53	52	0.7%	-1	-1.9%
Suwannee	49	38	0.5%	-11	-22.4%
Madison	37	37	0.5%	0	0.0%
Putnam	37	36	0.5%	-1	-2.7%
Gulf	29	33	0.5%	4	13.8%
Baker	24	29	0.4%	5	20.8%
Lafayette	21	25	0.4%	4	19.0%
Taylor	31	24	0.3%	-7	-22.6%
Hardee	25	23	0.3%	-2	-8.0%
Jefferson	20	22	0.3%	2	10.0%
Dixie	21	22	0.3%	1	4.8%
Walton	21	21	0.3%	0	0.0%
Monroe	20	20	0.3%	0	0.0%
Sumter	20	18	0.3%	-2	-10.0%
Columbia	17	17	0.2%	0	0.0%
DeSoto	15	16	0.2%	1	6.7%
Levy	21	16	0.2%	-5	-23.8%
Gadsden	20	14	0.2%	-6	-30.0%
Franklin	14	13	0.2%	-1	-7.1%
Union	13	12	0.2%	-1	-7.7%
Bradford	15	12	0.2%	-3	-20.0%
Hendry	16	10	0.14%	-6	-37.5%
Gilchrist	10	9	0.13%	-1	-10.0%
Hamilton	10	8	0.12%	-2	-20.0%
Holmes	7	7	0.10%	0	0.0%
Glades	8	5	0.07%	-3	-37.5%
Nassau	11	4	0.06%	-7	-63.6%
Jackson	14	4	0.06%	-10	-71.4%
Calhoun	4	3	0.04%	-1	-25.0%
Liberty	4	3	0.04%	-1	-25.0%
Washington	0	3	0.04%	3	-
Okeechobee	1	1	0.01%	0	0.0%
Wakulla	2	0	0.00%	-2	-100.0%
All Small Counties	621	610	8.8%	-11	-1.8%
Total	**7,994**	**6,956**	**100%**	**-1,038**	**-13.0%**

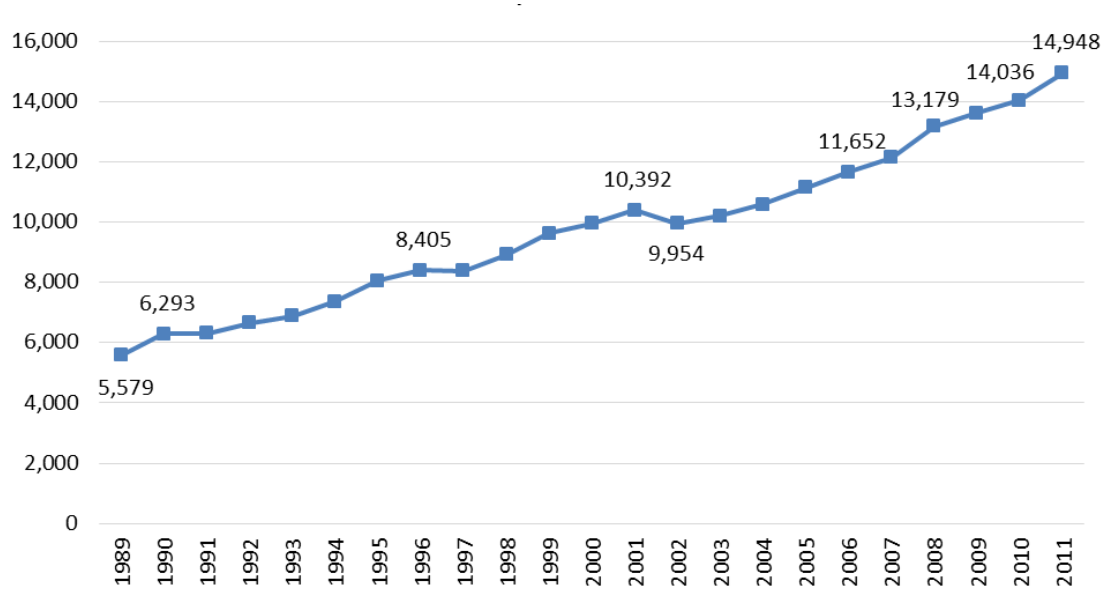
Date Source: Annual Survey of Public Employment and Payroll, 2007 and 2012.
Note: Data is ordered by 2011 SWM employment size. Data includes full-time equivalent employment. Data pushes one year back, assuming employment in March reflects previous year trend.

Private Sector Green Solid Waste and Recycling Employment

Overall Trends in the Private Sector

The portion of private solid waste management jobs that are considered green has been on an upward trend for the last two decades, picking up where public employment has dropped off. Compared to the public sector data, private green SWM employment, as a whole, has much more stability. On average, the industry has grown by 426 jobs a year, increasing from 5,579 employees in 1989 to 14,948 in 2011. Within this upward trend, there have been a few years of minor decline, most recently in 2001-2002, when employment fell by 438 jobs. That same year, jobs in the SWM public sector hit a new high of 7,436. The following year saw the swift drop off of jobs in the public sector and the return to steady increases in the private.

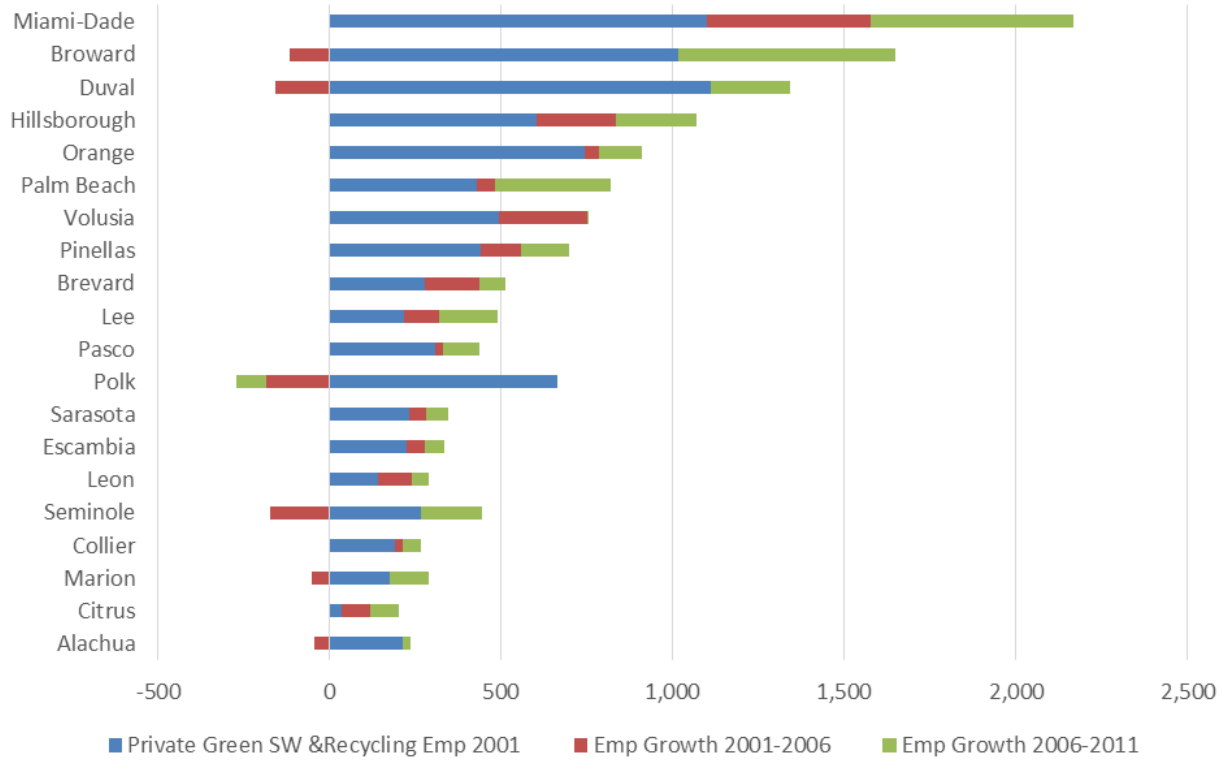
Figure 5. Private Green Solid Waste and Recycling Employment in Florida, 1989-2011



Data Source: NETS 2012
Note: Employment in all three private businesses--solid waste collection, recycling processing, and scrapping businesses.

Looking at the data for total private solid waste and recycling business employment by county from 2001 to 2011, an overall pattern of growth can be seen again. Miami-Dade County consistently has the largest employment numbers, with the majority of jobs (1,098) added in 2001 or previously. The years after 2001 saw increases of 478 jobs in 2006 and 593 jobs in 2011. Of the top twenty counties, Citrus County was the slowest to grow, making greater gains after 2001. While none of the top 20 counties showed losses in 2001, six reported negative employment numbers between 2001 and 2006, including: Broward (-117), Duval (-157), Polk (-184), Seminole (-171), Marion (-53), and Alachua (-44). Polk was also the only county to have a reduction in employment during the 2006 to 2011 period.

Figure 6. Changes in Private Solid Waste and Recycling Business Employment By County, Florida 2001-2011

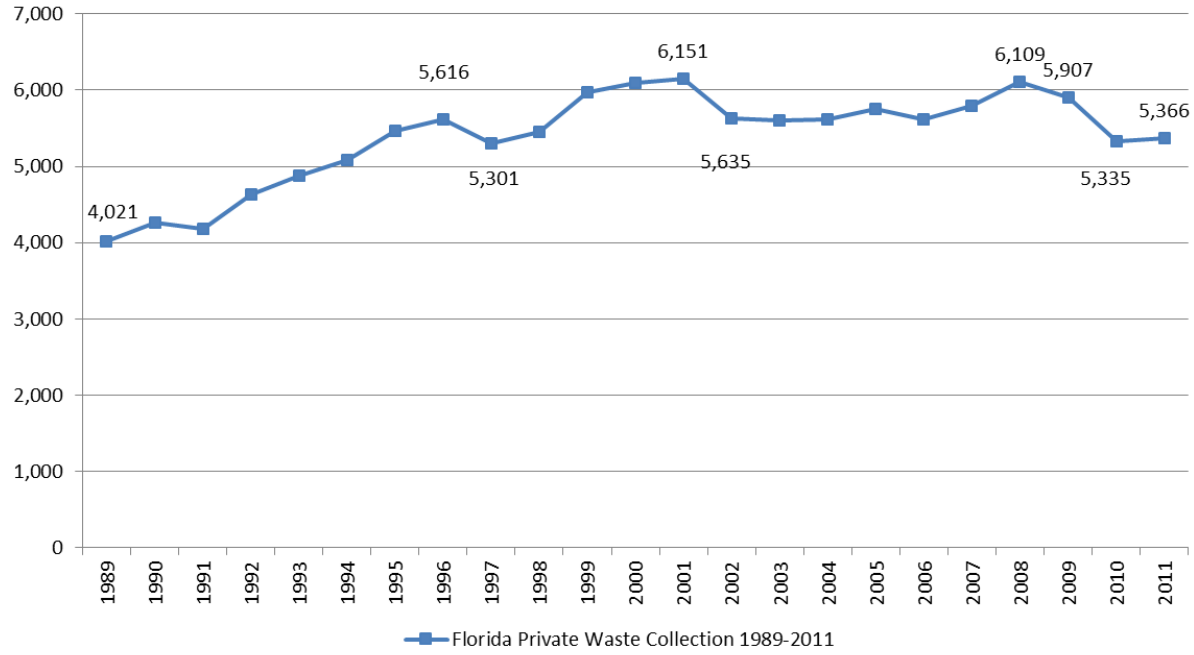


Data Source: NETS 2012
Note: Top 20 counties, ordered by 2011 employment size. Employment in all three private businesses--solid waste collection, recycling processing, and scrapping businesses.

Private Solid Waste and Recyclables Collection Employment

Private solid waste collection employment has not been quite as steady as overall green job growth. Employment climbed in the 1990s, as it did in the SWM industry as a whole, but beginning in 1997 collections followed a pattern of ups and downs more reminiscent of the public sector than its private counterparts. After peaking in 2001 at 6,151 jobs, private collection employment low in 2010 falling to 5,335 with a loss of 572 employees from the previous year. These jumps followed a relatively plateaued period lasting through most of the 2000s, with numbers hovering around 5,635. As of 2011, private solid waste collection employment rests at 5,366 jobs.

Figure 7. Private Solid Waste and Recyclables Collection Employment in Florida, 1989-2011



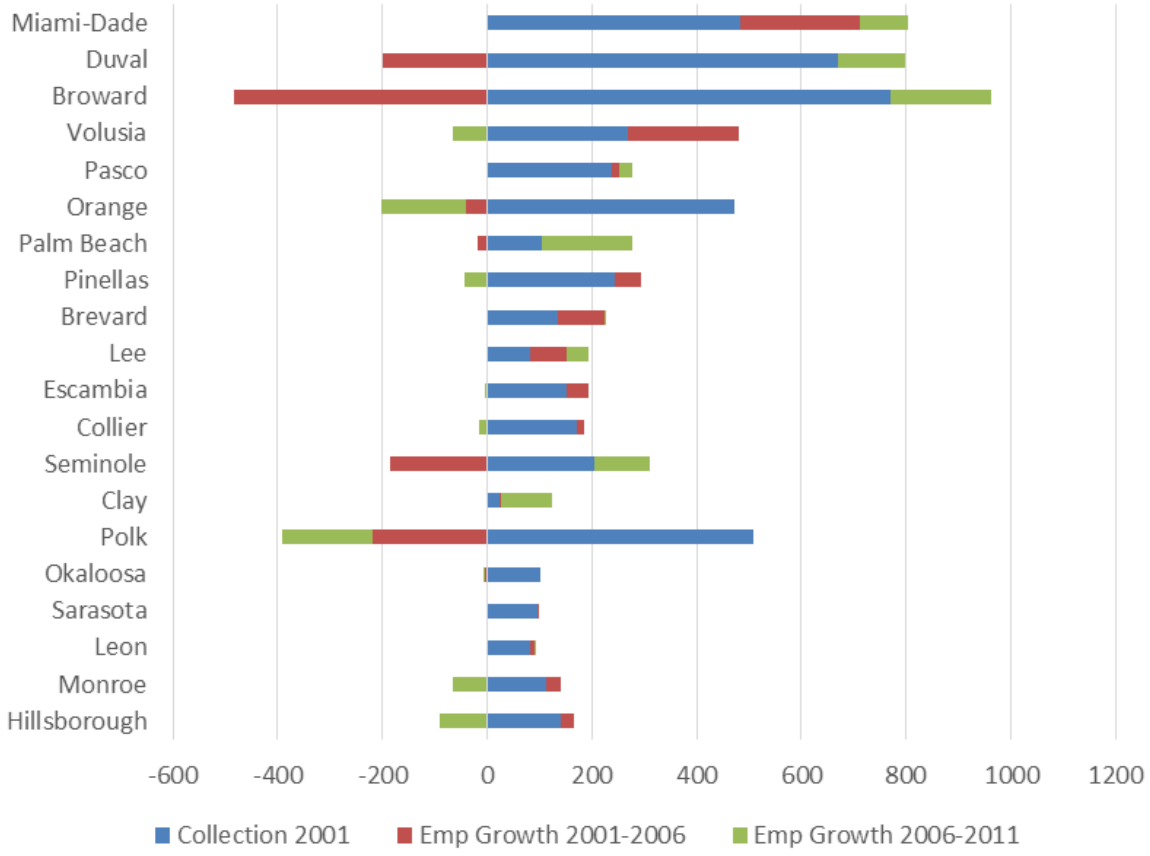
Data Source: NETS 2012
Note: Employment in solid waste collection businesses.

Breaking down private collections employment by county shows greater variation in this subset of private green SWM employment compared to the industry as a whole. The most populated counties again boasted the largest private workforces; however, Broward, rather than the more populated Miami-Dade County, had the highest 2011 employment with 962 private employees. The number remains high in spite of a 2001-2006 loss of 482 employees, the most of any county form 2001 to 2011. Broward is joined by five other counties reporting 2001 to 2006 losses; of the six to see declining employment over those five years, four – Broward, Polk,

Seminole and Duval – also declined in overall private green solid waste management employment during that time. The others, Orange and Palm Beach, only saw minor declines in collections.

Declining employment during the 2006 to 2011 period was also more common in private collections than over all privatized SWM. Five counties declined in private collections employment, with the biggest losses in Clay and Orange County. There was virtually no or very little change after 2001 in several counties, including: Okaloosa, Sarasota, Leon, and Collier. The lack of change suggests few alterations of the collection process or a greater reliance on innovation in the public sector.

Figure 8. Changes in Private Solid Waste and Recyclables Collection Employment By County, Florida 2001-2011

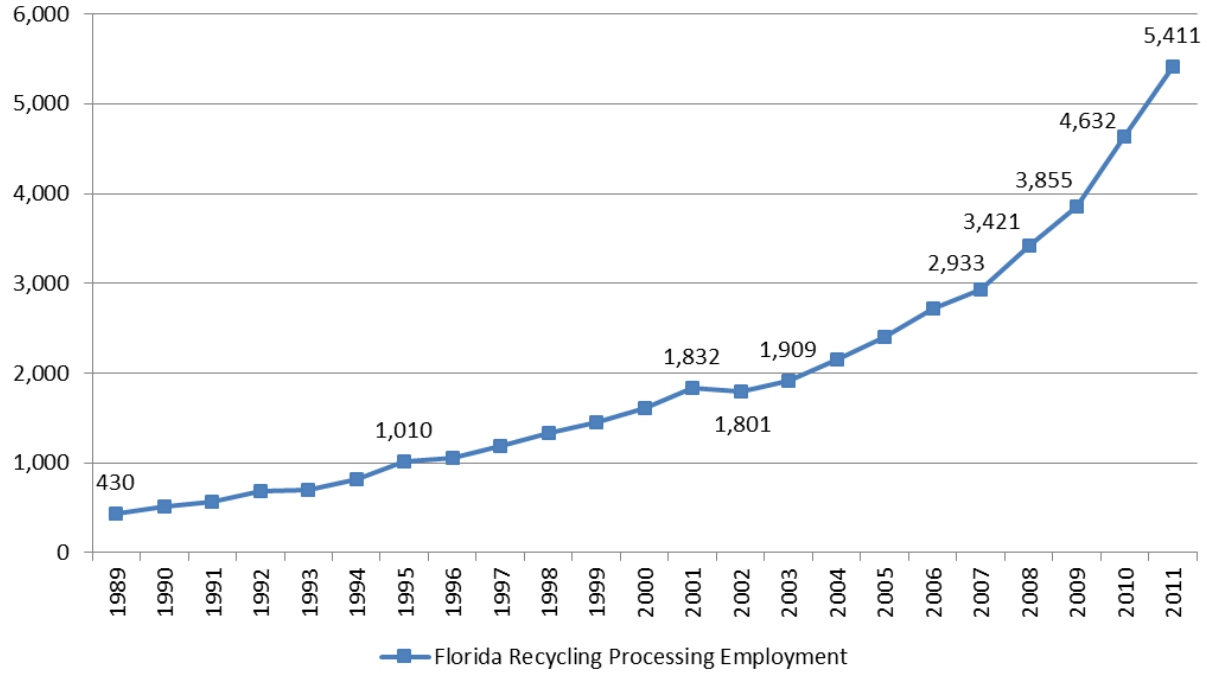


Data Source: NETS 2012
Note: Top 20 counties, ordered by 2011 employment size.

Private Recycling Processing Employment

Making up for these losses, recycling processing jobs have skyrocketed from 1989 to 2011, growing from 430 to 5,411 jobs across the state. Recycling processing jobs grew at an average of 116 jobs per year between 1989 and 2001, and then began increasing at a faster rate into the 2000s. From 2009 to 2011 over 770 jobs were added each year.

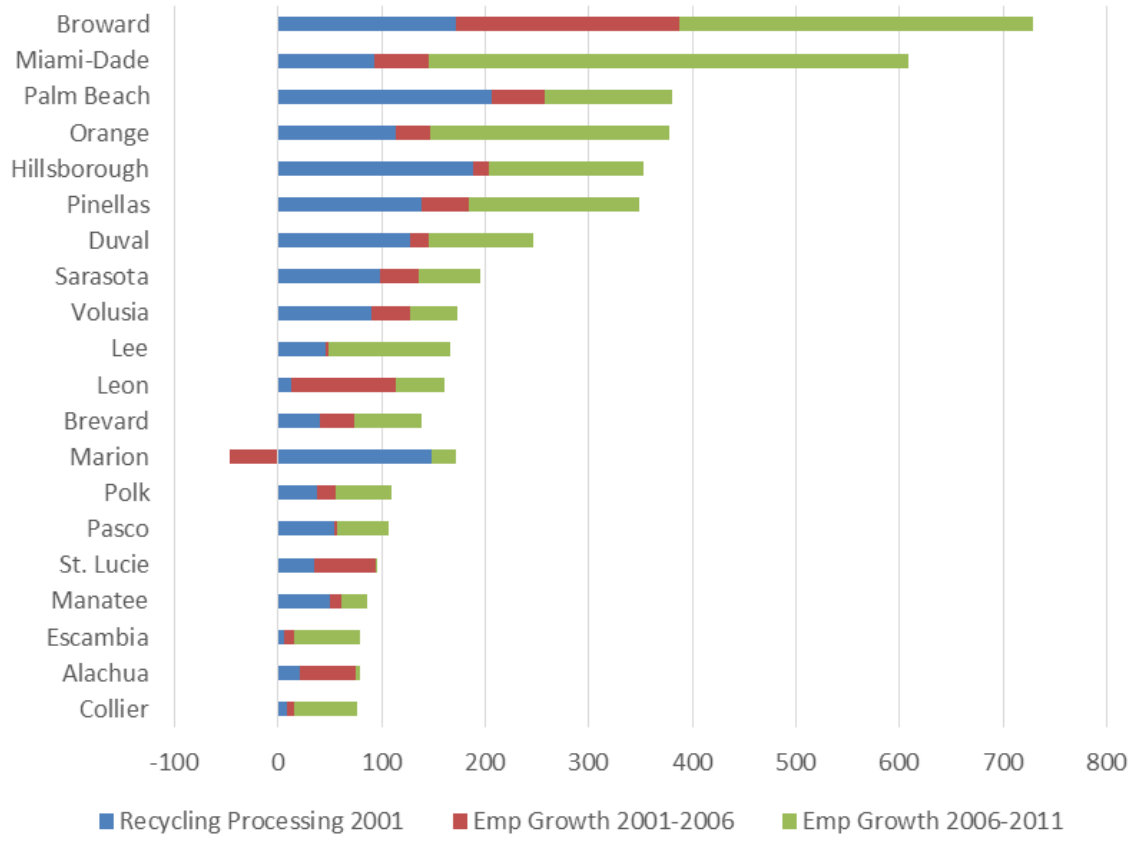
Figure 9. Private Recycling Processing Employment in Florida, 1989-2011



Data Source: NETS 2012
Note: Employment in recycling processing businesses.

When recycling processing business employment is broken down into counties, this pattern is largely upheld. The majority of growth occurred between 2006 and 2011 for most counties, with Broward again leading the way in employment. Alachua and St. Lucie County contrasted with this trend, however, reporting virtually no employment growth after 2006. The 2001 to 2006 period seems to be the slowest time for job creation, with the most jobs being created in Broward – 216 – and a loss of 47 jobs in Marion County. This was the only instance of negative recycling employment during the 2001 to 2011 period for the featured counties.

Figure 10. Changes in Private Recycling Processing Employment By County, Florida 2001-2011

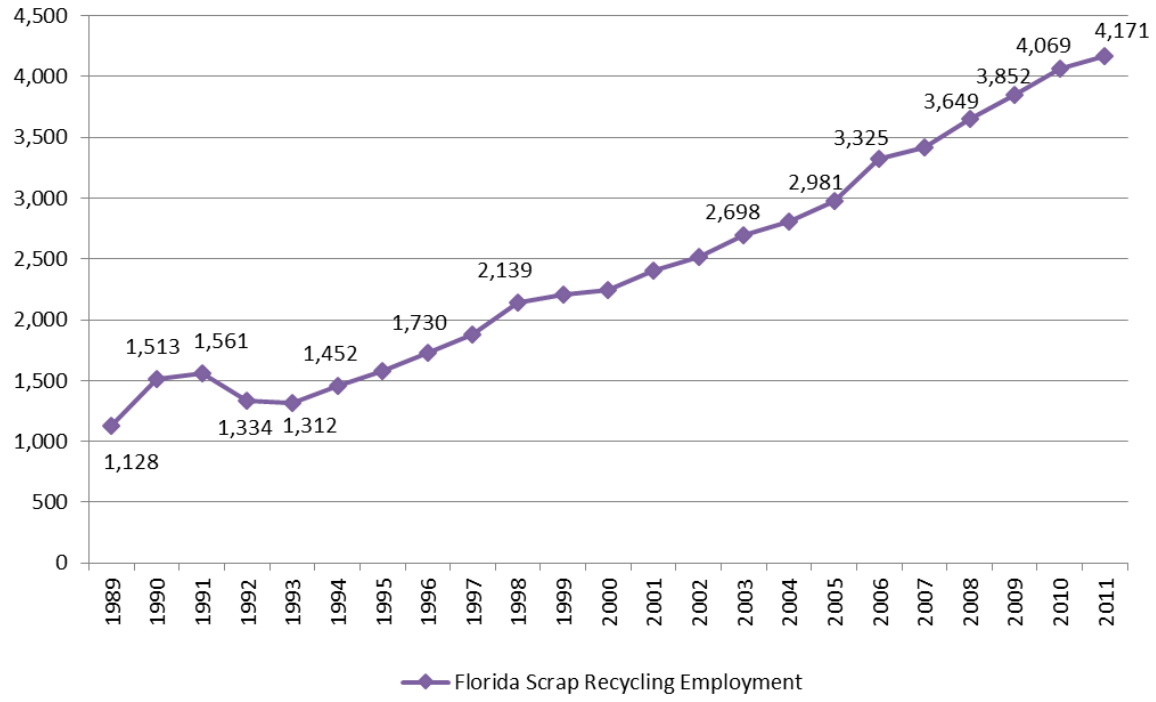


Data Source: NETS 2012
Note: Top 20 counties, ordered by 2011 employment size.

Private Scrap Materials Employment

Despite an interesting bump from 1989 to 1992, employment with scrap materials businesses in the State of Florida has followed an upward trend similar to recycling processing. While employment has increased with little exception since 1989, job growth has been at a more modest rate, increasing from 1,128 employees to 4,171 at an average rate of 138 jobs added a year over twenty-two years. Although job growth for scrap material businesses seems to happen at a slower pace than recycling, it is a longer standing process, already employing over 1,000 people in 1989.

Figure 11. Private Scrap Materials Employment in Florida, 1989-2011

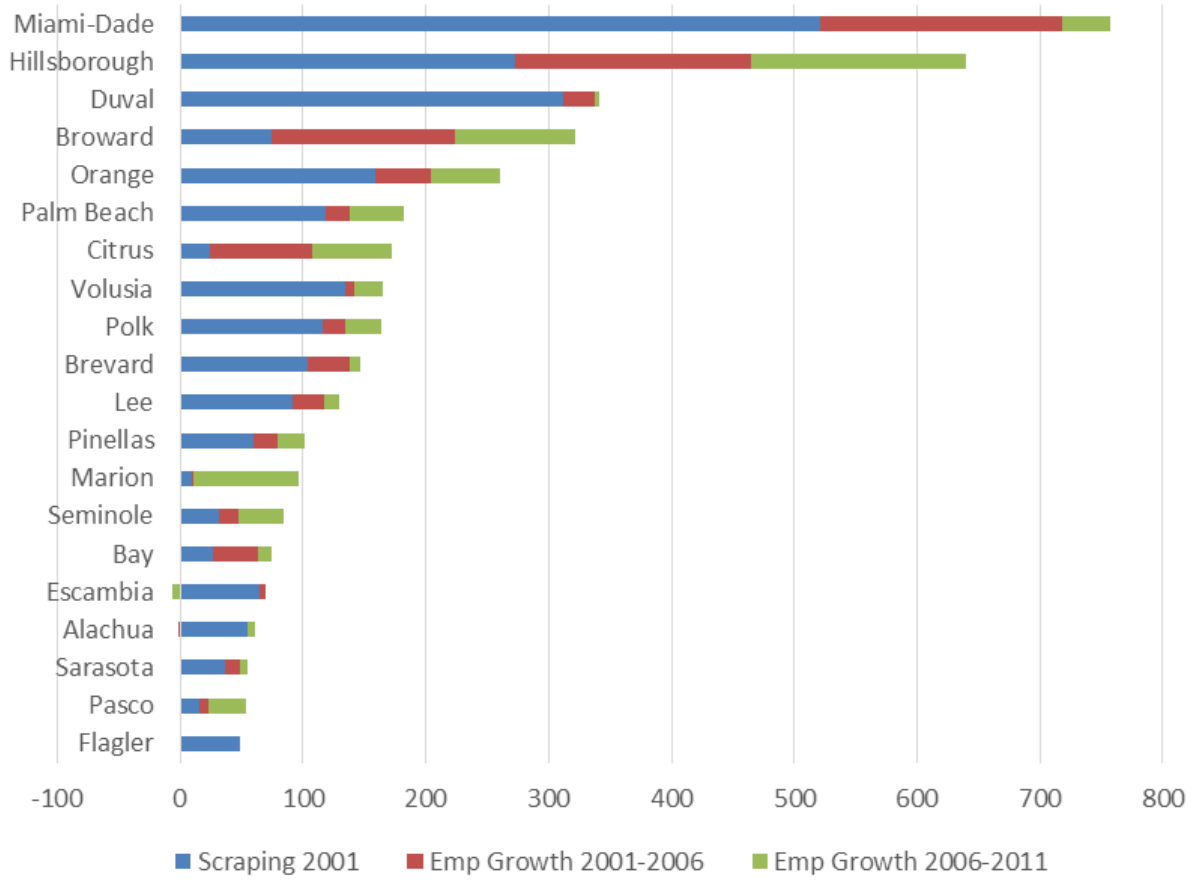


Data Source: NETS 2012
Note: Employment in scrap materials businesses.

Of the 20 most active counties in scrap material processing, only five have over 200 employees, including: Miami-Dade, Hillsborough, Duval, Broward, and Orange. These also happen to be the most populated counties on the list. Even with their domination of the scrap material business, no single county has even 800 employees of the 4,171 employed in the state. Miami-Dade is the leader in scrap materials with 757 employees. The majority of those jobs, 521, were created either in or prior to 2001, a characteristic shared by the second and third highest employers, Hillsborough and Duval. The only instances of employment loss happened in Alachua County,

where employment changed by 1 employee between 2006 and 2011, and in Escambia County where employment was reduced by six people during the 2001 to 2006 period. Businesses in Flagler County, that with the lowest employment of the 20, reported no changes post 2001.

Figure 12. Changes in Private Scrap Materials Employment By County, Florida 2001-2011



Data Source: NETS 2012
Note: Top 20 counties, ordered by 2011 employment size.

PART 5: INDIRECT IMPACT ON SUPPLY AND DEMAND CHAIN OF RECYCLING BUSINESSES

The study also measures the number of employees indirectly related to recycling activities and businesses in Florida in order to examine whether the economic consequence of recycling programs and performance goes beyond the direct recyclables hauling and processing, or scrap materials businesses.

Our previous research defined the solid waste management industry broadly, so that it included all employees in waste treatment facility construction, waste hauling, other electric power generation utilities, recycling reliant manufacturing, reuse and used merchant businesses as SWM employment. Therefore, previous definitions of SWM industry easily overestimated the overall size of SWM employment, which showed a statistically insignificant relationship between recycling performance and the economic consequence, job growth. In our 2013 research, we heavily relied on existing literature and followed the conceptual and operational definitions developed by other studies on solid waste management industries.

This year, our research team attempted to identify the direct and indirect solid waste and recycling industries separately with more precise measurement suitable to capture Florida specific industrial chains. To do this, we employed three approaches: (1) summary of previous input-output analysis on recycling activities, (2) search company profiles, and (3) recovered materials dealers survey. Our previous report (Feiock, 2013) introduced literature and industry codes (NAICS and SIC) corresponding to all industries related to solid waste management and recycling businesses (See Appendix 1). Here we discussed two other methods used for gaining additional information.

Identifying Supply and Demand Industry by Searching Company Profiles

The Florida DEP collects and discloses the name and location information of recycling companies in the Florida recycling market on the Recycling Business Assistance Center (RBAC) web site.[17] Actors in the Florida recycling market are classified into seven sub-sectors as follows:

1. Certified recovered material dealer: "*A certified recovered material dealer is a Florida business dealing with over 600 tons per year of any recovered material (paper, glass, plastic, metals/aluminum, textiles, and/or non-tire rubber) are required by law to apply for annual certification and report their recovered materials*."
2. Collector: "*an individual or party that physically collects recyclable materials*."
3. Transportation Company: "*providing transportation services for recyclable commodities (e.g., baled paper, cardboard, plastics, etc)*."

[17] Florida RBAC (http://www.dep.state.fl.us/waste/rbac/pages/directory.htm).

4. Broker: "*an individual or party that arranges transactions between a buyer and seller of recyclable materials. A broker does not typically take possession of the materials*."
5. A Green Product Vendor: "*a distributor of a product made with recycled content*"; Green Product Manufacturer: "*a producer of a product made with recycled content*."
6. Building Material Reuse Center: "*sells or otherwise provides salvaged and/or reusable building materials such as doors, windows, cabinets, plumbing fixtures, lumber, millwork, metals, flooring, hardware, and more. Reuse centers around the country allow hundreds of thousands of tons of reusable construction materials to be kept out of our alleys, off the streets, and ultimately out of landfills,*" and
7. Educational reuse centers: "*Through an Educational Reuse Center, quality, unwanted manufacturing by-products, once destined for the landfill, now serve as much needed materials for math, science and other creative problem solving programs in the local school system, child care centers, Headstart programs, neighborhood youth organizations, summer camps, retirement communities and other community programs*."

Through a web search, company profiles, particularly primary and secondary business activities classified by SIC and NAICS codes, were gained. Keywords included "*company name*, FL, NAICS (or SIC)." We already counted the sub-groups—certified recovered materials dealers (SIC 4953 Refuse Systems; 509313 Scrap Metals & Iron) and collectors (SIC 509313 Scrap Metals & Iron; 495302 Garbage Collection)—as direct recycling businesses, we consider the industry classification codes for other business sectors in the Florida recycling market.

Brokers include some recyclable material merchant wholesalers, wholesale trade agents and brokers and motor vehicle parts (used) merchants wholesalers (SIC 423140), etc. Transportation business consists of other waste collection (562119) and Trucking (SIC 4213). Primary and secondary industry classifications of companies in the green product vendors group include glass containers, paper, plastic, and metal manufacturing industries. Thrift shops and used merchandise stores (SIC 593222) are also included in building materials or educational reuse groups.

Recovered Materials Dealers Survey Results

Our research team also included several questions in the survey instrument for recovered materials dealers to identify the Florida specific demand chain of recycling processing and scrap materials dealers businesses. The survey question and industries answered by respondents are as follows:

Survey Question. Which industries are the primary buyers of the materials or products you handle?

- Steel mills, foundry, primary metal dealers, aluminum smelter, copper manufacturers, metal manufacturers;
- Paper mills, cardboard mills;
- Concrete and asphalt;
- Recyclers;
- Remanufacturing, mills;
- Retail buyers, thrift stores;
- Construction and demolition; and
- Government units

Considering all previous studies, Florida DEP's RBAC list, and actual recycling vendors' answers, our research identifies the indirect—supply and demand chain—industries of Florida's recycling businesses with SIC codes. Table 9 shows the indirect businesses by industry group, SIC code, and SIC description.

Table 10. Indirect Businesses on Supply and Demand Chain of Recycling Businesses

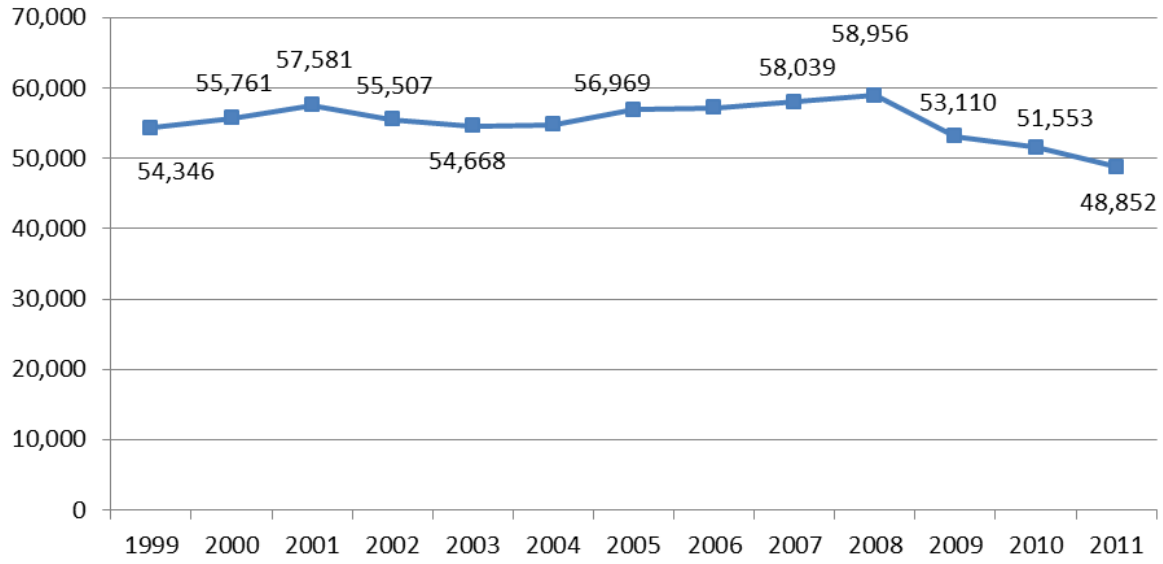
Industry	SIC	SIC Description
Construction Business	16290504	Waste disposal plant construction
Wholesale	50149904	Tires, used
	5015	Motor Vehicle Parts, Used
Merchant	5932	Used merchandise stores
Recycling based manufacturing		
Paper	261103	Pulp mills, mechanical and recycling processing
	2621	Paper mills
	2631	Paperboard mills
Wood	2493	Reconstituted Wood Products
	242102	Sawdust, shavings, and wood chips
Plastic	3081	Unsupported Plastics Film and Sheet
	3083	Laminated Plastics Plate and Sheet
	3085	Plastics Bottles
	3086	Plastics Foam Products
	3087	Custom Compound Purchased Resins
	3088	Plastics Plumbing Fixtures
	3089	Plastics Products, Nec
Textile	229904	Textile mill waste and remnant processing
	3296	Mineral Wool
Glass	3211	Flat Glass
	3221	Glass Containers
	3229	Pressed and Blown Glass, Nec
	3231	Products of purchased glass
Metal	30110301	Retreading materials, tire
	30110305	Tread rubber, camelback for tire retreading
	3312	Blast Furnaces and Steel Mills
	3321	Gray and Ductile Iron Foundries
	3322	Malleable Iron Foundries
	3324	Steel Investment Foundries
	3325	Steel Foundries, Nec
	334199	Secondary Nonferrous Metals, Nec
	3351	Copper Rolling and Drawing
	3353	Aluminum Sheet, Plate, and Foil
	3355	Aluminum Rolling and Drawing, Nec
Other	295100	Asphalt paving mixtures and blocks
	306906	Reclaimed rubber and specialty rubber compounds

Source: By Authors

Employment Trends in Supply and Demand Chain Industries

Using the SIC codes identified as industries in the supply and demand chain of recycling businesses, we measured the employment indirectly related to solid waste management and recycling activities and businesses (the indirect industry) in Florida. The NETS database was used to pull out private establishments in the supply and demand chain and we counted all employees in the establishments. The indirect industry held about 55,000 jobs in the early 2000s and showed a slight increase until 2008. However, the indirect industry has lost 17 percent of their employees from 58,956 to 48,852 from 2008 through 2011. Given the small share of total jobs in these industries linked to recycling, employment trends in the indirect industry are unlikely to move along the increasing trend in recycling processing or scrap materials employment over the last decade in Florida.

Figure 13. Employment in Recycling Supply and Demand Chain Industries Florida, 1999-2011



Data Source: NETS (2012)
Note: Supply and demand chain industry of recycling businesses is defined by the authors. Private sectors only.

PART 6: SURVEY OF RECOVERED MATERIALS DEALERS

Florida DEP maintains a database of recovered materials dealers that was the sample frame for an internet based survey of private recycling vendors. The survey of private recovered materials dealers was developed to provide information on policy impacts, impediments to growth, effective tools of communication, where recovered materials are marketed, industrial chains of recycling markets, etc. Surveys of private firms involved in recycling activities present a challenge. Even well planned and professionally implemented surveys with multiple waves have generated poor response with non-response rates typically above 80%. For example R. W. Beck's survey of the recycling industry in Iowa had an 85% non-response rate despite sending the survey five times. Although this limits the ability to make valid inferences about economic impacts, the survey results can inform the construction of industry classifications and the statistical analysis of the NETS data, as well as giving us insight of the recycling market and policy implications.

Methodology

The survey instrument for recovered materials dealers was initially developed by our research team, and revised several times in response to the comments and ideas from our TAG members and recycling vendors in Florida. In developing this survey instrument, we met with a general manager of the Marpan Recycling facilities located in Tallahassee, Leon County and had a site tour of their Class III materials recovery facility. The conversation with Marpan's Nancy Paul gave us a general and broad understanding of the industrial chain of recycling industry, the different types of recovered materials and processing systems, the public-private relationship, employment size and factors of business expansion, and available government support.

Next, we met with Ron Henricks, Florida DEP administrator in Waste Reduction Section. He has also served as a TAG member for our research projects since 2012. Meeting with Ron provided lots of useful information on how Florida statute directs large and small counties differently, the differences in the recyclables definition and recycling credits before and after 2012, and the data source for contact information of certified recovered materials dealers. He also suggested that our research team communicate with the Florida Recyclers Association in order to get more information from the active group of scrap materials vendors in Florida.

Our researchers also had a conversation with the council members of the Florida Recyclers Association and heard more details from them about the distinction between recycling processing and materials scrapping businesses and public-private relationship in the recycling market.

Our final survey instrument reflected and balanced the information and insights from all three sectors: government, recycling vendors, and academia.

Survey Results

Overall, our Recovered Materials Dealers Survey shows a 22% response rate. We distributed our survey to 170 recyclers who were listed as one of Florida's certified recovered materials dealers in either 2013 or 2014. We received 30 valid responses from the first and second round email surveys[18]; a follow-up mail-in survey was sent and seven recyclers responded (See Appendix for the mail-in survey instrument). We have a total of 37 valid responses from the Recovered Materials Dealers Survey. With current data, some interesting and significant policy implications were found. Here, we illustrate our findings and the basic characteristics of the responding recovered materials dealers.

Among 37 respondents, 14 define their business as recycling processing, 12 classify their activities as scrapping and recycling, 8 recyclers answered that they have mixed activities (Table 11). Metal is the most popular material and more than half of recycling processing and/or scrapping businesses primarily handle this material. Paper is the second most popular material recovered (Table12).

Table 11. Primary Business Activities

Business Category	# Recyclers	Percent
Recycling processing	14	37.8%
Scrapping and recycling	12	32.4%
Recycling-based manufacturing	3	8.1%
Both recycling processing and scrapping	8	21.6%
Total	37	100.0%

[18] We identified 22 completed responses and 8 responses in progress with more than 50% of questions answered as the set of 30 valid responses.

Table 12. Primary Material Handled at the Establishment

Primary Material	# Recyclers	Percent
Metal	19	59.4%
Paper	9	28.1%
Textile	1	3.1%
Glass	1	3.1%
Plastic	0	0.0%
Other	3	9.4%
Total	32	100.0%

We asked recycling businesses to estimate the proportion of green workforce in their establishment, based on the BLS definition of "Green Jobs," in order to understand their self-perception of recycling process/activities/products being "green." Overall, about 70 percent of the workforce in recycling businesses perceives that their respective business is involved in or provides green jobs (Table 13). More specifically, among 28 valid responses to this question, 13 dealers perceived that 100% of their workforce is green jobs and seven dealers answered that more than 80% of their workforce either produces green goods or is involved in an environmentally friendly production processes. However, some recovered materials dealers perceive that their business or activities are least likely "green"; 0% green jobs in four establishments and less than 30% in three dealers. All seven dealers who answered indicated that recycling processing or mixed recycling processing/scrapping is their primary business activities. It suggests that, although materials recovery activities eventually help protect and preserve the environment, (1) there is variation among recycling businesses in how much they perceive themselves as "green" and (2) individual workers in the recycling processing line hardly perceive that their work or work environment is "green."

Table 13. Proportion of Green Workforce in Recycling Businesses

Green Workforce Proportion	# Recyclers	Percent
100%	13	46.4%
80-90%	7	25.0%
60-70%	1	3.6%
40-50%	0	0%
20-30%	3	10.7%
0%	4	14.3%
Total	28	100.0%

Table 14 shows to what extent recovered materials dealers in Florida have perceived public institutions or not-for-profit organizations as facilitating and impeding the expansion of their businesses in terms of employment growth. The majority of dealers said they did not see significant influence from the Federal EPA or Homeowners Association. While some vendors answered the county or local governments and other recycling vendors are helpful to their employment growth, about a quarter of the respondents answered that they felt that Florida DEP and city governments as well as other recyclers are impeding the growth of their business.

Table 14. The Role of Institutions/Organizations in Recycling Employment Growth

	Strongly Impede	Somewhat Impede	No Influence	Somewhat Facilitate	Strongly Facilitate	Total
Federal Environmental Protection Agency	1	6	27	2	1	37
Florida Department of Environmental Protection	2	7	23	4	1	37
County Solid Waste Management Division	0	6	27	2	2	37
Municipal Government	3	7	19	6	2	37
Homeowners Association	0	3	31	2	1	37
Environmental organizations	0	5	28	2	2	37
Other recycling vendors	1	8	20	7	1	37

The next question was how recovered materials dealers felt about how county or local recycling programs—curbside recycling, single stream recycling, and mandatory commercial recycling—influence the employment growth of their businesses. Although about 55 % of the respondents answered that the public recycling programs had no influence on hiring in their business, more than 10 recyclers said that local recycling programs facilitated employment growth in their recycling facilities (Table 15). It gives us an insight that counties or municipalities with various recycling programs and better recycling performance are more likely to facilitate employment growth in the recycling industry. Several dealers, however, perceived the recycling programs rather impeded the expansion of their businesses.

Table 15. Impact of Recycling Programs on Recycling Employment Growth

	Strongly Impede	Somewhat Impede	No Influence	Somewhat Facilitate	Strongly Facilitate	Total
Mandatory Commercial Recycling	0	2	20	10	3	35
Curbside Recycling	2	3	21	8	2	36
Single Stream Recycling	0	3	23	7	3	36

We asked whether the recovered materials dealers have been awarded a county or municipality contract over the last five years. Ten of 37 respondents were awarded county contracts on recycling hauling or processing and only three dealers said that they were city contract awardees since 2009 (Table 16). Recyclers were also asked whether they were awarded any government programs that support the start-up or expansion of recycling companies over the last 5 years. The Florida DEP website introduced these programs: Florida Recycling Loan Program, Recycling Tax Incentives, State Small Business Credit Initiatives, Florida Economic Development Resource, and Federal (EPA) Recycling Grants and Financing. However, only a few said that they were awarded government financial support: two companies answered they received Recycling Tax Incentives and one received Florida Economic Development Resource.

Table 16. Recent Recipient of Government Contracts

	Yes	No	No Answer
County Contract	10	25	2
City Contract	3	29	5

We asked recovered materials dealers what the most important factors are for them to expand their businesses. They stated that it was to provide state and county recycling coordinators with policy advice as well as to develop explanatory regression models for finding determinants of employment growth in the recycling industry. Respondents choose between 1 and 5 on a Likert scale, ranging from not important to very important. Table 17 shows the results. All five factors listed were considered important to some extent. Among these factors, recyclers felt that contract awards from local governments are the most important for their business expansion, although we saw that the majority of recycling vendors have not been awarded county or city government contracts recently. Government contracts facilitated and helped awardees' businesses to expand employment in some cases, while in other cases these firms competed with local government or other contract awardee vendors over recycling markets. Overall, the national economy and governments' financial support were indicated to be the next important factors.

Table 17. Important Factors of Recycling Business Growth

Factors	Mean	Std. Deviation
Overall national economic condition	3.9	1.2
Financial support from governments	3.6	1.3
Recycling/recovered materials market	3.2	1.3
Contract awards from local governments	4.1	1.3
Recycling rates	3.1	1.4

Lastly, we wanted to know which information recyclers find useful in relation to their business and how often and where they interact with government agencies, other vendors, or professional/interest groups (Table 18). Recyclers answered that the information via direct contact from government entities by phone calls, emails, or in-person is the most useful (34.5%) and the next useful source of information on possible government support is from other recycling vendors (24.1%).

Table 18. Useful Source of Information on Possible Government Programs and Resources

	Frequency	Percent
Direct contact from government (in-person, phone call, emails, etc.)	10	34.5%
Government websites	2	6.9%
Professional meetings	2	6.9%
From other companies in the same business network	7	24.1%
Mail-in promotion	5	17.2%
Others (please list)	3	10.3%
Total	29	100.0%

However, Table 19 shows that recovered materials dealers do not frequently interact with government institutions. Since certified recovered materials dealers are required to report their activities to the Florida DEP, most of them interact with the DEP annually but private recycling vendors interact with county and municipal governments much less frequently or never. On the other hand, recycling vendors more frequently interact and communicate with professional waste management associations, including the Solid Waste Association of North America (SWANA) and Florida Recycle Today (FRT). Ten respondents said they interact with professional associations on a daily basis and another ten communicate with the associations more than once a month. Those professional waste management associations consist of private solid waste and recycling vendors, county and municipality coordinators, recycling consultants, and not-for-profit organizations. Recovered materials dealers also interact relatively often with other recycling vendors and the Florida Recyclers Association, a group of scrap materials businesses.

Table 19. Frequency of Interaction with Public and Not-for-Profit Institutions and Organizations

	Never	Annually	Monthly	Weekly	Daily
Federal Environmental Protection Agency	11	14	3	0	1
Florida Department of Environmental Protection	2	20	5	1	1
Florida Department of Economic Opportunity	21	4	3	0	1
County Solid Waste Management Division	11	10	5	0	3
Municipal Government	15	9	2	0	3
Homeowners Association	21	1	4	0	3
Environmental organizations	16	7	3	0	3
Other recycling vendors	13	7	4	1	4
Professional waste management associations	4	5	4	6	10
Florida Recyclers Association	4	14	5	2	4
Other not-for-profit organizations	11	9	6	0	3

Findings and Implications

Based on insight from the survey results, our research team contacted and interviewed several recycling vendors and learned in-depth about private recycling processing and materials scrapping businesses. Here are some findings and policy implications that our research team wants to share:

1. A public-private partnership in recycling processing activities is likely to help increase the jobs in existing recycling facilities, or sometimes it facilitates a start-up of recycling processing facilities. It is also likely to result in an increased overall recycling rate for the area. For instance, a material recovery facility, Marpan Recycling, began its recycling materials processing business in Tallahassee, FL in 2008, handling Class III materials. Since 2009, Marpan Recycling has been in a public-private partnership with Leon County and diverted about 67% of materials previously buried in landfills. Marpan expanded their employment gradually in the Class III materials recovery facility (MRF) and as of 2012 they have 57 employees working at the Class III facility in Tallahassee. Moreover, Marpan Recycling expanded to another facility in Tallahassee to handle curbside material in 2012 and began to process all residential curbside recycling in the City of Tallahassee area in October 2013.

2. Another interview was conducted with several scrap materials dealers in Florida. First of all, scrap materials dealers define themselves differently from recycling processing businesses and wanted to be distinguished from other industries. Some scrap materials dealers perceive local governments as their competitors; they see private and public sectors as competing with each other for a limited recycling market. As municipal governments provide direct or in-house services for recycling pick-up and processing, the remaining market, available materials to be scrapped and recovered, gets reduced. This conversation supports our survey results that some private vendors felt that local government institutions and recycling programs impede the employment growth of existing recovered material dealers in Florida. It is also said that private vendors are competing for the recycling market, but they also meet regularly to share information and participate in the policy process as a policy stakeholder group.

3. The other recycler group we talked with was a hauler council in Florida. When we asked about any possible policy changes or government efforts to help recycling and waste management expand their employment, it was revealed that the current definition of “recovered materials” in state law is so restrictive that it is a barrier to the expansion of

the private SW & Recycling industry in Florida. The statutory definition of recovered materials in Florida Statute 403.703(24)[19] is as follows,

> *"Recovered materials" means metal, paper, glass, plastic, textile, or rubber materials that have known recycling potential, can be feasibly recycled, and have been diverted and source separated or have been removed from the solid waste stream for sale, use, or reuse as raw materials, whether or not the materials require subsequent processing or separation from each other, but the term does not include materials destined for any use that constitutes disposal. Recovered materials as described in this subsection are not solid waste.*

This haulers council argued that the current "list" of recovered materials is incomplete and some materials that are known to have recycling potential are missing. For instance, one of these materials is wood waste. Since it is not mentioned in the statute, it is classified as solid waste rather than as a recyclable. They said that municipalities use the "list" as an impediment to recycling because only the materials on the "list" are considered recovered materials, which makes them exempt from franchise fees. Some municipalities charge recyclables and solid waste hauling companies almost a quarter of gross receipts for collection of "solid waste," which includes materials not listed as recovered materials in the State statute.

[19] http://www.flsenate.gov/Laws/Statutes/2012/403.703

PART 7: STATISTICAL ESTIMATION OF EMPLOYMENT IMPACT OF RECYCLING PERFORMANCE

Research Design

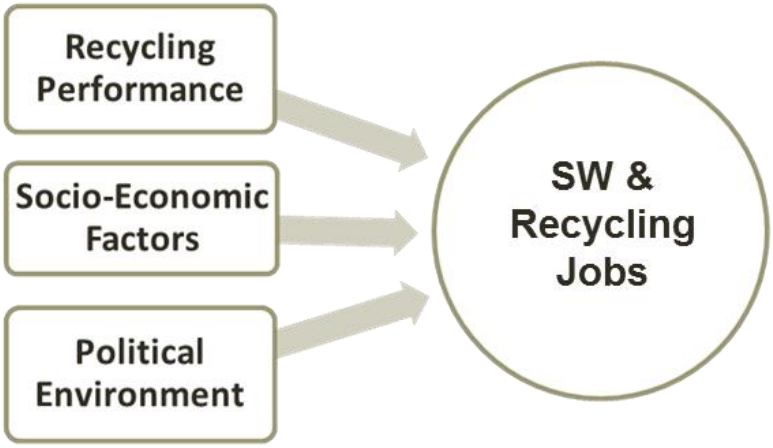
The project was aimed to establish a longitudinal database of Florida's solid waste and recycling employment as well as to evaluate the employment impact of the Florida Solid Waste Management Act of 1988 and county recycling programs. So far, we observed that the overall green solid waste and recycling businesses in Florida has been growing in terms of employment over the last decade. At the same time, we saw that there existed variations in employment size, growth patterns, and growth rates by recycling business and by county.

- ***Research Question 1:*** **Is there evidence of a causal relationship between recycling programs and employment trajectories for solid waste and recycling management in Florida?**
- ***Research Question 2*****: Do characteristics of counties and of county solid waste programs influence employment trajectory over time?**

In this section, our research team generated rigorous econometrics analyses to identify the extent to which the recycling employment growth is related to county level recycling performance. This is an important question in aspects of both practical public management as well as environmental economics. It is often times said that recycling and environmental programs have a negative economic consequence. With Florida's case, we attempted to identify the economic consequence of recycling performance (Research Question 1).

Our second research question was used to identify other factors resulting in variation in recycling performance among counties and over time. Finding possible determinants of county level recycling performance enables us to isolate and identify the association between county recycling performances. In previous empirical studies on green economies (Yi and Feiock, 2011; Bowen, Park, Elvery, 2013; Yi, 2013) it was generally found that socio-economic characteristics and political economy of a state or region explain most of the segment of green job growth in the area, and that environmental policies or government support the influence marginal changes. We also considered counties' socio-economic characteristics and political environment as important determinants of county green job growth, which includes recycling employment and, in addition, that county level recycling performance is expected to have more direct and positive impact on the expansion of solid waste and recycling employment (Figure 3).

Figure 14. Conceptual Design of Research Analysis



By Authors (2014)

Variables and Data

We examine the direct and indirect economic impact of recycling programs in Florida by using our longitudinal county level database on green solid waste and recycling employment. The current data set is a panel data set which includes 67 counties' information from 2000 to 2010.

Dependent Variable: Green Solid Waste and Recycling Employment by County

Model1: Estimation of Direct Impact on Overall Private SW & Recycling Employment

First of all, we estimated whether and how much county recycling performance has influenced the job growth in businesses that are directly related to recycling activities. As a measure of direct employment effects, we used the total number of employees in all private green solid waste and recycling businesses, located within each county in a given year.

Model 2: Estimation of Direct Impact upon Business Activities

In the next analytic models, we examine the direct impact of recycling performance on the employment in three individual business activities: solid waste and recyclables collection, recycling processing, and scrap materials businesses. This provided further understanding of the structure and characteristics of Florida's recycling markets more closely.

Model 3: Estimation of Indirect Impact on Supply and Demand Chain

We also attempted to analyze whether county level recycling performance also shows a positive economic consequence beyond the direct recycling businesses. To measure the indirect economic impact of recycling programs, we identified the value chain of recycling activities and counted the total number of employees in supplier or buyer industries of recycled, recovered, and reused materials by county and by year.

Explanatory Variable: County Recycling performance

Our primary research questions estimate the isolated influence of county recycling performance on direct employment growth. Under the same state level policy direction, we hypothesized that a county with successful recycling programs and increasing recycling performance is more likely to attract and/or facilitate the businesses that are directly related to recycling activities. We assumed that a county's overall recycling performance is an outcome of county recycling efforts including recycling programs and activities; hence, we used the county recycling performance as the explanatory variable which explains the marginal increase or decrease of recycling employment in counties.

The county recycling performance variable was measured as recycling rates (%, tons solid waste recycled divided by tons solid waste collected within a county). This measure of county level recycling rate is broadly used and known as an efficient tool to measure the outcome of recycling activities and effort in certain areas. The State of Florida also has directed counties with recycling goals expressed as recycling rates, like 35% or 75% in their statutes.

Florida DEP provides a set of data on the total amount of solid waste collected and recycled, and recycling rates by county and year. We computed the recycling rate (%) of 67 counties from 2000 through 2010, by the amount of solid waste collected, divided by amount SW recycled in percentage in order to measure the variation between counties at a more detailed level (DEP only provides recycling rate data at 2 decimal places).

Control Variables: County Characteristics

To isolate the impact of county recycling performance on direct employment growth in private recycling businesses, our analytical models include alternative variables that are considered to explain either general economic development and/or green job growth. This also includes control variables that measure the overall size of the county economy or economic conditions and helped isolate recycling employment growth influenced by county recycling performance.

County's socio-economic factors

To explain the significant difference between counties in terms of size of population and employment, we include the overall size of the workforce within counties as a control variable. In addition, the annual unemployment rate was also included as a proxy measure of overall state economic condition to isolate the recycling employment changes affected by Florida's overall economic trends.[20]

Per capita personal income ($) was included in the models as a proxy measure of county wealth. The assumption behind this is that a wealthier group of people or society is more likely to be interested in environmental issues and go green, so that the recycling industry and employment were also expected to increase upon an increase of per capita income of county residents.

An innovative variable, agglomeration of tourist places, was included in order to consider Florida's specific characteristics in having popular tourist places. It can be assumed that a popular tourist county has more accommodations and restaurants which are subject to mandatory commercial recycling programs or voluntarily commit to recycling activities, which consequentially attract or expand recycling businesses in that area. Hence, it was hypothesized that a county with more tourist places is likely to have a larger recycling business. The total number of licensed units of accommodations in a county was used as a proxy measure of agglomeration of tourist places.

All county level socio-economic factors were collected at the Florida Bureau of Economic and Business Research website. The annual total measures are from 2000 through 2010.

County's political environment

A region's political preference, stakeholder groups, and administrative capacity can also affect the location or growth of green businesses (Bowen, Park, and Elvery, 2013; Yi, 2013). Previous empirical studies showed that state legislators' preference for environmental issues is positively and significantly related to the adoption of environmental policies and programs that support green industries. Often times, Democratic legislators are more likely to be supportive of environmental issues. We assumed that the solid waste and recycling industry is a subset of green businesses, which would be influenced by political environment. As a county level measure of political preference toward environmental issues, we used the proportion of Democrats' voter registration in the county.

[20] Florida Bureau of Economic and Business Research (http://www.bebr.ufl.edu/data/series/catalog/groups).

Social interest or citizen participation in environmental issues is also considered as a factor to facilitate green job growth. As a proxy of county level social interest in pro-environmental activities, number of environmental organizations was used.

Lastly, at the county or local level, governments play important roles not only in public service provision but also in local economic development. In previous chapters, we discussed the different employment trends in public and private solid waste management and recycling activities and possible competitive relationships between the two sectors. We included a measure of county government capacity to provide public services to identify the relationship between public and private entities in solid waste and recycling businesses. However, the Census data for county and local employment for solid waste management is not available for all research periods between 2000 and 2010. Instead, we used a county's total expenditure in a given year as a proxy of county government's capacity to provide public services including solid waste management. Data were available at Florida's Comprehensive Annual Financial Report (CAFR).[21]

Statistical Analysis Results

A panel data analyses with fixed effect regression models were employed to estimate the influence of changes in county recycling performance, socio-economic factors, and political environment on the trend of solid waste and recycling employment. Dummy variables for each year were included to capture the unexplained county specific changes in SW and Recycling employment.

SW and Recycling employment measures and independent variables were log transformed in order to fix the skewed distributions of data. It also helped readers interpret the statistical analysis results in meaningful ways.

Private SW & Recycling Employment

Table 20 shows the panel analysis results with the county employment in all green solid waste and recycling businesses. So, coming back to our primary research questions, whether county recycling performance influenced the green job growth in private solid waste and recycling businesses in Florida. The quick answer is YES. The results from our model indicated that an increase of county recycling rate is positively associated with overall solid waste and recycling jobs growth. The coefficient value says that alongside a 10% increase in county recycling rate there is a 4% employment growth in the corresponding industry.

[21] Florida's Comprehensive Annual Financial Report (http://www.myfloridacfo.com/Division/AA/Reports/#.VC-P5Baz5aA).

County specific characteristics also influence the job growth in green solid waste and recycling businesses. A county is also more likely to have increasing employment in recycling industries when it has more labor force and lower unemployment rate. Citizen preference and participation in environmental issues, measured by number of environmental organizations located in the county, is positively related to recycling employment within the county.

Table 20. Fixed-Effect Panel Regression Result: All Private SW & Recycling Employment

Variables	Coef.	S.E.	t	P>t
Recycling Rate (%)	**0.004***	0.002	1.99	0.047
Labor force (ln)	0.477*	0.219	2.18	0.029
Unemployment Rate (ln)	-0.183*	0.092	-1.99	0.047
Per capita personal income (ln)	0.196	0.237	0.83	0.407
Citizen Ideology (ln)	0.231	0.225	1.02	0.306
County Expenditure (ln)	-0.004	0.061	-0.06	0.953
# Accommodations (ln)	-0.013	0.089	-0.14	0.886
Environmental Org. (ln)	0.146*	0.067	2.19	0.029
Year 2000	-0.481**	0.168	-2.86	0.004
year 2001	-0.463**	0.143	-3.24	0.001
Year 2002	-0.503**	0.127	-3.95	0.000
Year 2003	-0.482**	0.131	-3.69	0.000
Year 2004	-0.477**	0.139	-3.42	0.001
Year 2005	-0.450**	0.155	-2.90	0.004
Year 2006	-0.461**	0.170	-2.70	0.007
Year 2007	-0.338**	0.142	-2.37	0.018
Year 2008	-0.145	0.099	-1.46	0.145
Year 2009	-0.013	0.077	-0.17	0.862
Year 2010	0.053	0.073	0.72	0.472
Constant	-2.826	3.195	-0.88	0.377

N = 803
R-sq: overall = 0.8518
within = 0.2918
between = 0.8787

Note: *p<.05, **p<.01

When we looked at the influence of recycling performance on the employment in subsectors (Table21), the results were not uniform. The effect of county's recycling performance, recycling rate (%), was concentrated in the recycling processing business. The coefficient for the regression model with recycling processing employment can be interpreted that a 10% increase in county recycling rate then there is an 8% employment growth in the recycling processing business located in the county. The recycling employment is also likely to grow as there is a

larger labor force and county residents become wealthier (per capita income). Interestingly, the number of accommodations in a county is significantly and positively related to the size of recycling processing employment. It can be said that popular tourist places that have more hotels and restaurants committed to recycling programs would attract and/or create more recycling processing jobs in the region.

The solid waste and recyclables hauling businesses are unlikely to be influenced by county's recycling performance or economic and political characteristics. It just reflected the employment rate of the region. Interestingly, counties where the labor force and unemployment rate increased there were more jobs in scrap materials business for the same time period.

Table 21. Fixed-Effect Panel Regression Result: Collection, Recycling Processing, Scrap Materials

Variables	SW Collection		Recycling Processing		Scrap Materials	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Recycling Rate (%)	0.004	0.003	0.008*	0.004	-0.006	0.003
Labor force (ln)	-0.116	0.375	2.069**	0.400	2.340**	0.353
Unemployment Rate (ln)	-0.407**	0.158	0.040	0.168	0.402**	0.148
Per capita personal income (ln)	0.643	0.406	0.874*	0.433	0.260	0.382
Citizen Ideology (ln)	0.386	0.386	-0.622	0.412	0.775*	0.363
County Expenditure (ln)	0.146	0.104	-0.229*	0.111	0.004	0.098
# Accommodations (ln)	-0.171	0.153	0.457**	0.164	-0.038	0.144
Environmental Org. (ln)	0.127	0.115	0.229	0.122	0.106	0.108
Year 2000	0.001	0.289	-0.773**	0.308	0.166	0.272
year 2001	-0.055	0.245	-0.770**	0.262	0.125	0.231
Year 2002	-0.119	0.218	-0.767**	0.233	0.040	0.205
Year 2003	-0.128	0.224	-0.701**	0.239	0.053	0.211
Year 2004	-0.243	0.239	-0.603**	0.255	0.093	0.225
Year 2005	-0.350	0.266	-0.640	0.284	0.242	0.250
Year 2006	-0.445	0.292	-0.492	0.312	0.350	0.275
Year 2007	-0.249	0.244	-0.457	0.261	0.259	0.230
Year 2008	-0.002	0.170	-0.225	0.182	0.062	0.160
Year 2009	0.177	0.131	-0.070	0.140	-0.106	0.123
Year 2010	0.108	0.125	0.084	0.134	0.023	0.118
Constant	-3.369	5.485	-28.735	5.851	-26.128	5.156
N	803		803		803	
R-sq: overall	0.0175		0.6302		0.7234	
within	0.0472		0.5211		0.2648	
between	0.0165		0.6787		0.7435	

Note: *p<.05, **p<.01

Indirect Employment Impact on Supply and Demand Industries of Recycling Businesses

Both county recycling rate and amount of solid waste recycled within a county did not have significant impacts on the employment changes in supply and demand chain industries related to SW & Recycling industry (Table 22). While the indirectly related industries showed slightly declining employment trends, county economic factors such as labor force, unemployment rate, and per capita income mostly explain this. A county with higher per capita personal income and lower employment rate has more jobs in recycling supply and demand industries.

Table 22. Indirect Employment Effect

Variables	Coef.	S.E.	Variables	Coef.	S.E.
Recycling Rate (%)	0.001	0.001	**SW Recycled (ln)**	0.028	0.026
Labor force (ln)	0.359*	0.165	Labor force (ln)	0.344*	0.164
Unemployment Rate (ln)	0.268**	0.069	Unemployment Rate (ln)	0.267**	0.069
Per capita personal income (ln)	0.384*	0.178	Per capita personal income (ln)	0.380*	0.178
Citizen Ideology (ln)	0.276	0.169	Citizen Ideology (ln)	0.283	0.169
County Expenditure (ln)	-0.088	0.046	County Expenditure (ln)	-0.089	0.046
# Accommodations (ln)	-0.024	0.067	# Accommodations (ln)	-0.024	0.067
Environmental Org. (ln)	-0.042	0.050	Environmental Org. (ln)	-0.040	0.050
Year 2000	0.406**	0.127	Year 2000	0.404**	0.127
year 2001	0.446**	0.108	year 2001	0.443**	0.107
Year 2002	0.325**	0.096	Year 2002	0.321**	0.096
Year 2003	0.352**	0.098	Year 2003	0.347**	0.098
Year 2004	0.331**	0.105	Year 2004	0.325**	0.105
Year 2005	0.464**	0.117	Year 2005	0.455**	0.117
Year 2006	0.522**	0.128	Year 2006	0.516**	0.128
Year 2007	0.453**	0.107	Year 2007	0.448**	0.107
Year 2008	0.335**	0.075	Year 2008	0.334**	0.075
Year 2009	0.048	0.058	Year 2009	0.048	0.057
Year 2010	0.029	0.055	Year 2010	0.030	0.055
Constant	-0.829	2.406	Constant	-0.862	2.400
N = 803			N = 803		
R-sq: overall = 0.7985			R-sq: overall = 0.8091		
within = 0.0955			within = 0.0961		
between = 0.8242			between = 0.8335		

Note: *p<.05, **p<.01

PART 8: CONCLUSION AND POLICY IMPLICATIONS

The results reported here have important implications for 1) researchers studying recycling and green economic development; 2) state and local governments seeking to simultaneously promote economic development and environmental goals; and 3) businesses in solid waste management related industries hoping to expand and grow.

The first objective for this project was to re-define and re-classify the solid waste management (SWM) industry focusing on recycling activities to isolate public and private solid waste collection, recycling processing, and scrap materials industries. Part 3 of this report documents how we identify and measure the extent and structure of solid waste management and recycling businesses that are likely influenced by recycling activities and the green economy. Large numbers of quality green jobs have been produced in solid waste management in the two decades since implementation of the Florida Solid Waste Management Act (SWMA) of 1988. Existing data have not isolated the specific sectors and subsectors influenced by local solid waste management programs or tracked green jobs over time.

Our analysis extends previous works by defining and classifying the solid waste management industry by public and private sectors—isolating solid waste collection, recycling processing, and scrap materials industries. Important outputs of this project are the classification system developed to categorize green jobs and isolate those most affected by solid waste management and recycling and the data base built on this classification system. Disaggregating industries at the city level is another unique contribution. This classification system and database will be valuable for future academic research on recycling and green economic development. It is also useful for local governments in their efforts to gain green jobs. This system of classification will inform future research and provide a systematic method to measure green jobs to evaluate the economic impact of recycling in Florida going forward.

The second objective was to construct a longitudinal database of Florida's solid waste and recycling employment at the state, county, and local levels through 2012. This has important implications for both research and practice. In Parts 4 and 5 of the report we compile data that extend previous work and provides a valuable research tool. Variations exist among counties in both size and growth rate of SWM industry. The longitudinal database of Florida's solid waste and recycling employment in now complete at the state, county, and local levels through 2012. This resource will facilitate future research in this area. It also provides a base line to evaluate the performance of state and local efforts in the future.

The third objective was to evaluate solid waste and recycling growth and model employment change across industry sectors to identify direct economic benefits across the supply chain. The original analyses we conducted confirm that the Florida Solid Waste Management Act (SWMA) of 1988 not only laid a solid foundation for sustainable and environmentally responsible solid waste management, it has also stimulated job creation in specific industrial sectors of the economy.

This study differentiates direct and indirect solid waste employment in a rigorous economic impact analysis of county recycling programs. The findings we report demonstrate that green solid waste and recycling jobs in the private sector increased since 1988 while government employment for solid waste management fluctuates over time. Within the private solid waste and recycling industry, employment trends vary depending upon business activities—the recycling processing business grew faster than scrap materials business, and the employment in private solid waste collection businesses remains about the same level over the past decade. We find the strongest job growth in the private solid waste and recycling industry. The regression analysis reported here finds strong statistical evidence that the local government recycling rates have positive impacts on economic development.

These results have important implications for state level environmental and solid waste policy actions. The findings strongly rebuff the argument that recycling requires tradeoff among environmental and economic goals. Moreover, evidence that solid waste programs targeted to recycling can produce measureable positive economic effects provides support for greater state investment in local solid waste management and recycling efforts. This investment produced jobs for Florida's economy along with environmental and health benefits.

The fourth objective was to survey private recovered materials dealers in Florida to better understand the factors that enhance or impede economic development in recycling related industries. Recovered materials dealers are an important constituency of DEP and local recycling programs. The survey results suggest that state actions can support this sector and help it grow and be more successful. On the other hand, state and local governments are sometimes seen as imposing barriers to expansion and job growth by these dealers. Stronger communication channels and working relationships with governments are desired. Lack of information, especially at the local level, was prominently cited for lack of participation in programs. At the state level a more encompassing definition of recovered materials was seen as needed in order for significant industrial expansion to occur.

Taken together the analyses undertaken here provide a pathway for a cleaner, safer and more economically prosperous future for Florida through recycling.

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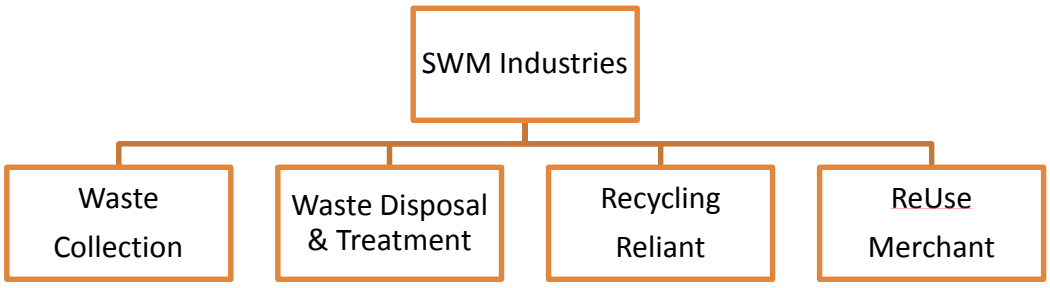
Appendix A. Solid Waste Management Related Business in Previous Study (Feiock, 2013)

Appendix A-1. Definition and Classification of Solid Waste Management Related Business in Previous Study (Feiock, 2013)



SWM Subcategory1	NAICS Code	NAICS Description
Waste Collection	237110	Water and Sewer Line and Related Structures Construction (Sewage collection and disposal line construction)
	236210	Industrial Building Construction (Materials recovery facility construction)
	237990	Other Heavy and Civil Engineering Construction (Nuclear waste disposal site construction)
	238910	Site Preparation Contractors (Dirt moving for construction, underground tank removal, and wrecking, building or other structure)
	484230	Specialized Freight Trucking, Long distance (Long-distance trucking of waste and hazardous materials)
	562111	Solid Waste Collection (Nonhazardous), within a local area
	562119	Other Waste Collection, within a local area
	562910	Remediation Services (Waste water treatment)
	562920	Materials Recovery Facilities (Facilities for separating and sorting recyclable materials from nonhazardous waste streams)

SWM Subcategory2	NAICS Code	NAICS Description
Waste Disposal & Treatment	221119	Other Electric Power Generation (except hydroelectric, fossil fuel, Nuclear; waste-to-energy)
	541620	Environmental Consulting Services (remediation)
	562212	Solid Waste Landfill
	562213	Solid Waste Combustors and Incinerators
	562219	Other Nonhazardous Waste Treatment and Disposal (except landfills, combustors, incinerator)
	924110	Admin. of Air and Water Resource and Solid Waste Management Programs

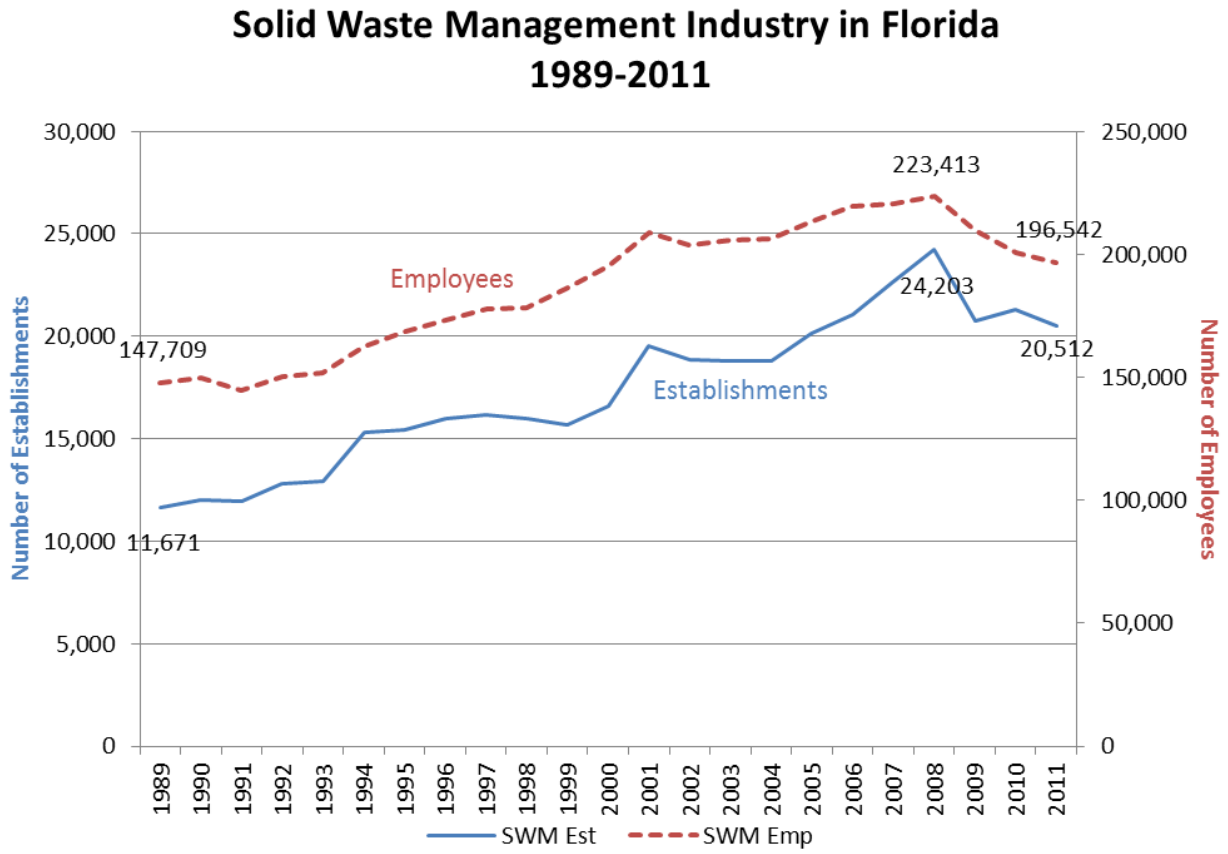
SWM Subcategory4	NAICS Code	NAICS Description
ReUse Merchant	424110	Printing and Writing Paper Merchant Wholesalers
	424120	Stationery and Office Supplies Merchant Wholesalers
	424130	Industrial and Personal Service Paper Merchant Wholesalers
	424610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers
	423130	Tire and Tube Merchant Wholesalers
	423140	Motor Vehicle Parts (Used) Merchant Wholesalers
	423930	Recyclable Material Merchant Wholesalers
	441310	Automotive Parts and Accessories Stores
	441320	Tire Dealers
	453310	Used Merchandise Stores

SWM Subcategory3	NAICS Code	NAICS Description
Recycling Reliant Industries	322110	Pulp Mills (Pulp is partly made by used or recycled rags, linters, scrap paper, and straw)
	322121	Paper (except Newsprint) Mills
	322122	Newsprint Mills
	322130	Paperboard Mills
	326212	Tire Retreading
	321219	Reconstituted Wood Product Manufacturing
	325311	Nitrogenous Fertilizer Manufacturing (From sewage or animal waste)
	325991	Custom Compounding of Purchased Resins (reformulating plastics resins from recycled plastics products)
	327213	Glass Container Manufacturing
	327211	Flat Glass Manufacturing
	327212	Other Pressed and Blown Glass and Glassware Manufacturing
	327993	Mineral Wool Manufacturing
	331314	Secondary Smelting and Alloying of Aluminum
	331420	Copper Rolling, Drawing, Extruding, and Alloying
	331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)
	331315	Aluminum Sheet, Plate, and Foil Manufacturing
	331318	Other Aluminum Rolling, Drawing, and Extruding
	324121	Asphalt Paving Mixture and Block Manufacturing
	32611	Plastics Bag and Pouch Manufacturing
	32612	Plastics Packaging Film and Sheet (including Laminated) Manufacturing
	326160	Plastics Bottle Manufacturing
	326191	Plastics Plumbing Fixture Manufacturing
	326199	All Other Plastics Product Manufacturing
	326299	All Other Rubber Product Manufacturing
	331110	Iron and Steel Mills and Ferroalloy Manufacturing
	331511	Iron Foundries
	331512	Steel Investment Foundries
	331513	Steel Foundries (except Investment)

Appendix A-2. Solid Waste Management Related Employment in Previous Study (Feiock, 2013)

SWM Category	2001	2006	2011	2011 %	Growth Rate 2006-2011
Waste Collection	81,153	84,932	78,018	39.7%	-8.1%
Waste Disposal & Treatment	20,486	21,871	22,784	11.6%	4.2%
Recycling Reliant	35,917	38,907	29,908	15.2%	-23.1%
ReUse Merchant	71,338	67,704	65,832	33.5%	-2.8%
Total SWM Employment	**208,894**	**213,414**	**196,542**	**100.0%**	**-7.9%**

Appendix A-3. Employment Trends in Solid Waste Management Related Industry (Feiock, 2013)



Data Source: 2012 National Establishment Time-Series (NETS) Database
Note: SWM definition from Feiock (2013)

Appendix B: Public Solid Waste Management Employment by County and Municipality in Florida, 2012

County	Type of Government	Government Name	FTE Employees 2012
ALACHUA	County	ALACHUA	49
	Municipality	GAINESVILLE	30
BAKER	County	BAKER	3
	Municipality	MACCLENNY	9
	Special District	NEW RIVER SOLID WASTE ASSOCIATION	17
BAY	County	BAY	24
	Municipality	CALLAWAY	4
		LYNN HAVEN	12
		MEXICO BEACH	5
		PANAMA CITY	40
		PARKER	2
		SPRINGFIELD	10
BRADFORD	County	BRADFORD	12
BREVARD	County	BREVARD	131
	Municipality	MELBOURNE	3
		ROCKLEDGE	40
		TITUSVILLE	29
BROWARD	County	BROWARD	67
		DAVIE	2
		DEERFIELD BEACH	63
		FORT LAUDERDALE	70
		HALLANDALE BEACH	20
		HOLLYWOOD	4
		LAUDERDALE BY THE SEA	6
		LAUDERHILL	1
		OAKLAND PARK	23
		POMPANO BEACH	15
		TAMARAC	2
		WILTON MANORS	3
CALHOUN	County	CALHOUN	2
		BLOUNTSTOWN	1
CHARLOTTE	County	CHARLOTTE	43
	Municipality	PUNTA GORDA	19
CITRUS	County	CITRUS	28
CLAY	County	CLAY	38
	Municipality	GREEN COVE SPRINGS	6
		ORANGE PARK	27
COLLIER	County	COLLIER	25

	Municipality	EVERGLADES CITY	1
		MARCO ISLAND	17
		NAPLES	25
COLUMBIA	County	COLUMBIA	16
	Municipality	FORT WHITE	1
DE SOTO	County	DE SOTO	8
	Municipality	ARCADIA	8
DIXIE	County	DIXIE	22
DUVAL	Municipality	JACKSONVILLE	100
ESCAMBIA	County	ESCAMBIA	45
	Municipality	PENSACOLA	50
	Special District	EMERALD COAST UTILITIES AUTHORITY	156
FLAGLER	County	FLAGLER	4
		FLAGLER BEACH	5
		PALM COAST	44
FRANKLIN	County	FRANKLIN	13
GADSDEN	County	GADSDEN	5
	Municipality	CHATTAHOOCHEE	4
		GRETNA	2
		QUINCY	3
GILCHRIST	County	GILCHRIST	9
GLADES	County	GLADES	2
	Municipality	MOORE HAVEN	3
GULF	County	GULF	25
	Municipality	PORT ST JOE	8
HAMILTON	County	HAMILTON	5
	Municipality	JASPER	3
HARDEE	County	HARDEE	9
	Municipality	BOWLING GREEN	5
		WAUCHULA	6
		ZOLFO SPRINGS	3
HENDRY	County	HENDRY	4
	Municipality	CLEWISTON	6
HERNANDO	County	HERNANDO	27
	Municipality	BROOKSVILLE	11
HIGHLANDS	County	HIGHLANDS	23
	Municipality	AVON PARK	7
		LAKE PLACID	4
		SEBRING	18
HILLSBOROUGH	County	HILLSBOROUGH	98
	Municipality	PLANT CITY	41
		TAMPA	197
		TEMPLE TERRACE	16

LEON	County	LEON	43
	Municipality	TALLAHASSEE	89
LEVY	County	LEVY	16
LIBERTY	County	LIBERTY	3
MADISON	County	MADISON	25
	Municipality	GREENVILLE	1
		MADISON	3
	Special District	AUCILLA AREA SOLID WASTE ADMINISTRATION	8
MANATEE	County	MANATEE	40
	Municipality	BRADENTON	63
		BRADENTON BEACH	2
		PALMETTO	1
MARION	County	MARION	75
		OCALA	92
MARTIN	County	MARTIN	17
	Municipality	JUPITER ISLAND	11
		STUART	13
MIAMI-DADE	County	MIAMI-DADE	940
		BISCAYNE PARK	12
		CORAL GABLES	26
		GOLDEN BEACH	3
		HIALEAH	118
		HIALEAH GARDENS	24
		HOMESTEAD	28
		MIAMI	202
		MIAMI BEACH	104
		MIAMI SHORES	16
		MIAMI SPRINGS	12
		NORTH BAY VILLAGE	4
		NORTH MIAMI	5
		NORTH MIAMI BEACH	38
		OPA-LOCKA	15
		SOUTH MIAMI	11
		SUNNY ISLES BEACH	4
		SURFSIDE	9
		SWEETWATER	7
		WEST MIAMI	5
MONROE	County	MONROE	13
		KEY WEST	7
NASSAU	County	NASSAU	4
OKALOOSA	County	OKALOOSA	12
	Municipality	FORT WALTON BEACH	19

		NICEVILLE	12
		VALPARAISO	13
OKEECHOBEE	County	OKEECHOBEE	1
ORANGE	County	ORANGE	138
	Municipality	APOPKA	16
		EATONVILLE	2
		MAITLAND	1
		OCOEE	15
		ORLANDO	131
		WINTER GARDEN	19
		WINTER PARK	1
OSCEOLA	County	OSCEOLA	21
	Municipality	KISSIMMEE	44
		ST CLOUD	31
PALM BEACH	County	PALM BEACH	389
	Municipality	BELLE GLADE	17
		BOCA RATON	47
		BOYNTON BEACH	41
		DELRAY BEACH	6
		LAKE PARK	10
		LAKE WORTH	30
		LANTANA	5
		MANALAPAN	1
		NORTH PALM BEACH	19
		PALM BEACH	36
		WELLINGTON	2
		WEST PALM BEACH	52
PASCO	County	PASCO	47
	Municipality	NEW PORT RICHEY	5
		ZEPHYRHILLS	10
PINELLAS	County	PINELLAS	58
	Municipality	BELLEAIR	6
		CLEARWATER	127
		DUNEDIN	24
		GULFPORT	16
		INDIAN ROCKS BEACH	9
		LARGO	71
		MADEIRA BEACH	10
		OLDSMAR	1
		PINELLAS PARK	2
		SAFETY HARBOR	19
		ST PETERSBURG	265
		TARPON SPRINGS	4

		TREASURE ISLAND	10
POLK	County	POLK	43
	Municipality	AUBURNDALE	10
		BARTOW	15
		HAINES	2
		HILLCREST HEIGHTS	1
		LAKE ALFRED	4
		LAKE HAMILTON	1
		LAKELAND	65
		WINTER HAVEN	26
PUTNAM	County	PUTNAM	19
	Municipality	PALATKA	16
		WELAKA	1
SANTA ROSA	County	SANTA ROSA	32
	Municipality	GULF BREEZE	2
		MILTON	8
SARASOTA	County	SARASOTA	23
	Municipality	NORTH PORT	30
		SARASOTA	23
		VENICE	22
SEMINOLE	County	SEMINOLE	69
	Municipality	ALTAMONTE SPRINGS	25
		SANFORD	2
ST JOHNS	County	ST JOHNS	15
	Municipality	ST AUGUSTINE	16
		ST AUGUSTINE BEACH	6
ST LUCIE	County	ST LUCIE	34
	Municipality	FORT PIERCE	34
SUMTER	County	SUMTER	9
	Municipality	BUSHNELL	2
		COLEMAN	1
		WILDWOOD	6
SUWANNEE	County	SUWANNEE	38
TAYLOR	County	TAYLOR	16
	Municipality	PERRY	8
UNION	County	UNION	12
VOLUSIA	County	VOLUSIA	65
	Municipality	DAYTONA BEACH	2
		DELTONA	2
		EDGEWATER	25
		ORMOND BEACH	3
		PORT ORANGE	2
WALTON	County	WALTON	13

	Municipality	DEFUNIAK SPRINGS	8
WASHINGTON	County	WASHINGTON	2
		CHIPLEY	1
Grand Total			**6,956**

Data Source: Census, Government Employment & Payroll, 2012 (https://www.census.gov/govs/apes/)
Note: Full-time equivalent employment working for Solid Waste Management government function as of March 2012.

Appendix C-1. Private Solid Waste and Recyclables Collection Employment by Large Counties

County	2001	2006	2011	% County 2012	Change 2006-2011	Growth Rate 2006-2011
Miami-Dade	484	713	804	15.0%	91	12.8%
Duval	670	470	597	11.1%	127	27.0%
Broward	769	287	480	8.9%	193	67.2%
Volusia	268	481	415	7.7%	-66	-13.7%
Pasco	239	252	276	5.1%	24	9.5%
Orange	473	433	272	5.1%	-161	-37.2%
Palm Beach	104	85	257	4.8%	172	202.4%
Pinellas	244	295	251	4.7%	-44	-14.9%
Brevard	135	225	227	4.2%	2	0.9%
Lee	81	152	194	3.6%	42	27.6%
Escambia	153	193	190	3.5%	-3	-1.6%
Collier	172	185	169	3.1%	-16	-8.6%
Seminole	206	22	126	2.3%	104	472.7%
Clay	24	27	125	2.3%	98	363.0%
Polk	509	290	118	2.2%	-172	-59.3%
Okaloosa	103	100	99	1.8%	-1	-1.0%
Sarasota	97	98	98	1.8%	0	0.0%
Leon	81	90	94	1.8%	4	4.4%
Hillsborough	141	166	76	1.4%	-90	-54.2%
Bay	83	70	71	1.3%	1	1.4%
Alachua	138	41	54	1.01%	13	31.7%
Indian River	11	45	42	0.78%	-3	-6.7%
Santa Rosa	29	47	32	0.60%	-15	-31.9%
Lake	95	95	31	0.58%	-64	-67.4%
Charlotte	0	15	25	0.47%	10	66.7%
Marion	17	10	15	0.28%	5	50.0%
Citrus	13	6	9	0.17%	3	50.0%
St. Lucie	60	81	8	0.15%	-73	-90.1%
Manatee	330	311	5	0.09%	-306	-98.4%
Osceola	1	6	3	0.06%	-3	-50.0%
Hernando	8	2	2	0.04%	0	0.0%
Martin	102	0	1	0.02%	1	-
St. Johns	6	13	0	0.0%	-13	-100.0%
All Large Counties	5,846	5,306	5,166	96.3%	-140	-2.6%
Total	6,151	5,610	5,366	100.0%	-244	-4.3%

Data Source: NETS 2012

Note: Counties are ordered by 2011 employment size.

Appendix C-2. Private Solid Waste and Recyclables Collection Employment by Small Counties

County	2001	2006	2011	% County, 2012	Change 2006-2011	Growth Rate 2006-2011
Monroe	112	142	77	1.4%	-65	-45.8%
Sumter	51	38	40	0.7%	2	5.3%
Hendry	22	22	22	0.4%	0	0.0%
Levy	17	12	14	0.3%	2	16.7%
Wakulla	7	7	8	0.15%	1	14.3%
Walton	20	25	7	0.13%	-18	-72.0%
Highlands	51	31	6	0.11%	-25	-80.6%
Columbia	0	3	5	0.09%	2	66.7%
Suwannee	6	7	5	0.09%	-2	-28.6%
Okeechobee	0	2	4	0.07%	2	100.0%
Bradford	4	3	3	0.06%	0	0.0%
Calhoun	2	4	3	0.06%	-1	-25.0%
Franklin	0	2	2	0.04%	0	0.0%
Holmes	5	4	2	0.04%	-2	-50.0%
Taylor	0	0	2	0.04%	2	-
Baker	4	0	0	0.0%	0	-
DeSoto	0	0	0	0.0%	0	-
Dixie	0	0	0	0.0%	0	-
Flagler	2	0	0	0.0%	0	-
Gadsden	0	0	0	0.0%	0	-
Gilchrist	0	0	0	0.0%	0	-
Glades	0	0	0	0.0%	0	-
Gulf	0	0	0	0.0%	0	-
Hamilton	0	0	0	0.0%	0	-
Hardee	0	0	0	0.0%	0	-
Jackson	0	0	0	0.0%	0	-
Jefferson	0	0	0	0.0%	0	-
Lafayette	0	0	0	0.0%	0	-
Liberty	0	0	0	0.0%	0	-
Madison	0	0	0	0.0%	0	-
Nassau	2	2	0	0.0%	-2	-100.0%
Putnam	0	0	0	0.0%	0	-
Union	0	0	0	0.0%	0	-
Washington	0	0	0	0.0%	0	-
All Small Counties	305	304	200	3.7%	-104	-34.2%
Total	6,151	5,610	5,366	100.0%	-244	-4.3%

Data Source: NETS 2012

Note: Counties are ordered by 2011 employment size.

Appendix C-3. Private Recycling Processing Employment by Large Counties

County	2001	2006	2011	% County 2012	Change 2006-2011	Growth Rate 2006-2011
Broward	171	387	729	13.5%	342	88.4%
Miami-Dade	93	145	608	11.2%	463	319.3%
Palm Beach	206	258	380	7.0%	122	47.3%
Orange	113	147	378	7.0%	231	157.1%
Hillsborough	188	203	353	6.5%	150	73.9%
Pinellas	138	184	348	6.4%	164	89.1%
Duval	128	146	246	4.5%	100	68.5%
Sarasota	99	136	195	3.6%	59	43.4%
Volusia	90	128	173	3.2%	45	35.2%
Lee	46	49	166	3.1%	117	238.8%
Leon	13	114	160	3.0%	46	40.4%
Brevard	40	73	139	2.6%	66	90.4%
Marion	148	101	125	2.3%	24	23.8%
Polk	38	55	110	2.0%	55	100.0%
Pasco	54	57	106	2.0%	49	86.0%
St. Lucie	35	94	96	1.8%	2	2.1%
Manatee	50	61	86	1.6%	25	41.0%
Alachua	21	75	79	1.5%	4	5.3%
Escambia	6	16	79	1.5%	63	393.8%
Collier	8	15	76	1.4%	61	406.7%
Seminole	29	26	64	1.2%	38	146.2%
Martin	9	34	60	1.1%	26	76.5%
St. Johns	5	32	49	0.9%	17	53.1%
Okaloosa	1	5	44	0.8%	39	780.0%
Lake	8	5	41	0.8%	36	720.0%
Hernando	2	10	38	0.7%	28	280.0%
Clay	1	1	28	0.5%	27	2700.0%
Citrus	0	4	20	0.4%	16	400.0%
Osceola	0	7	20	0.4%	13	185.7%
Bay	0	0	17	0.3%	17	-
Charlotte	10	10	13	0.2%	3	30.0%
Santa Rosa	4	6	11	0.2%	5	83.3%
Indian River	0	0	3	0.1%	3	-
All Large Counties	1,754	2,584	5,040	93.1%	2456	95.0%
Total	1,832	2,717	5,411	100.0%	2694	99.2%

Data Source: NETS 2012

Note: Counties are ordered by 2011 employment size.

Appendix C-4. Private Recycling Processing Employment by Small Counties

County	2001	2006	2011	% County 2012	Change 2006-2011	Growth Rate 2006-2011
Liberty	5	11	45	0.8%	34	309.1%
Columbia	24	23	40	0.7%	17	73.9%
Monroe	3	4	27	0.5%	23	575.0%
Flagler	0	3	25	0.5%	22	733.3%
Putnam	2	6	23	0.4%	17	283.3%
Suwannee	12	12	23	0.4%	11	91.7%
Gadsden	7	19	21	0.4%	2	10.5%
Nassau	0	5	21	0.4%	16	320.0%
Okeechobee	5	3	21	0.4%	18	600.0%
Jackson	3	3	19	0.4%	16	533.3%
Highlands	10	12	17	0.3%	5	41.7%
Levy	0	5	17	0.3%	12	240.0%
Hendry	0	3	13	0.2%	10	333.3%
Walton	0	6	13	0.2%	7	116.7%
Sumter	0	2	10	0.2%	8	400.0%
Madison	2	2	7	0.13%	5	250.0%
Bradford	2	2	5	0.09%	3	150.0%
Washington	1	3	5	0.09%	2	66.7%
Gilchrist	0	0	4	0.07%	4	-
Holmes	0	0	3	0.06%	3	-
Taylor	2	3	3	0.06%	0	0.0%
Wakulla	0	0	3	0.06%	3	-
Calhoun	0	3	2	0.04%	-1	-33.3%
DeSoto	0	0	2	0.04%	2	-
Hardee	0	3	2	0.04%	-1	-33.3%
Baker	0	0	0	0.0%	0	-
Dixie	0	0	0	0.0%	0	-
Franklin	0	0	0	0.0%	0	-
Glades	0	0	0	0.0%	0	-
Gulf	0	0	0	0.0%	0	-
Hamilton	0	0	0	0.0%	0	-
Jefferson	0	0	0	0.0%	0	-
Lafayette	0	0	0	0.0%	0	-
Union	0	0	0	0.0%	0	-
All Small Counties	78	133	371	6.9%	238	178.9%
Total	1,832	2,717	5,411	100.0%	2694	99.2%

Data Source: NETS 2012

Note: Counties are ordered by 2011 employment size.

Appendix C-5. Private Scrap Materials Employment in Large Counties

County	2001	2006	2011	% County 2012	Change 2006-2011	Growth Rate 2006-2011
Miami-Dade	521	718	757	9.2%	39	5.4%
Hillsborough	273	465	640	7.8%	175	37.6%
Duval	312	337	341	4.1%	4	1.2%
Broward	75	224	322	3.9%	98	43.8%
Orange	159	204	260	3.2%	56	27.5%
Palm Beach	118	138	182	2.2%	44	31.9%
Citrus	24	108	173	2.1%	65	60.2%
Volusia	134	142	165	2.0%	23	16.2%
Polk	116	134	164	2.0%	30	22.4%
Brevard	104	138	147	1.8%	9	6.5%
Lee	92	117	130	1.6%	13	11.1%
Pinellas	60	79	101	1.2%	22	27.8%
Marion	10	11	96	1.2%	85	772.7%
Seminole	32	48	84	1.0%	36	75.0%
Bay	27	64	74	0.9%	10	15.6%
Escambia	65	70	64	0.8%	-6	-8.6%
Alachua	55	54	60	0.7%	6	11.1%
Sarasota	36	49	55	0.7%	6	12.2%
Pasco	16	23	54	0.7%	31	134.8%
Leon	46	35	34	0.4%	-1	-2.9%
Charlotte	4	3	26	0.3%	23	766.7%
Collier	9	14	20	0.2%	6	42.9%
Okaloosa	2	1	19	0.2%	18	1800.0%
Santa Rosa	9	19	19	0.2%	0	0.0%
Manatee	7	10	18	0.2%	8	80.0%
Indian River	6	8	12	0.15%	4	50.0%
Clay	4	6	11	0.13%	5	83.3%
Lake	4	5	10	0.12%	5	100.0%
St. Lucie	3	5	9	0.11%	4	80.0%
Osceola	0	2	6	0.07%	4	200.0%
Hernando	4	3	5	0.06%	2	66.7%
St. Johns	0	5	5	0.06%	0	0.0%
Martin	4	2	2	0.02%	0	0.0%
All Large Counties	2,331	3,241	4,065	49.4%	824	25.4%
Total	4,740	6,566	8,236	100.0%	1670	25.4%

Data Source: NETS 2012

Note: Counties are ordered by 2011 employment size.

Appendix C-6. Private Scrap Materials Employment in Small Counties

County	2001	2006	2011	% County 2012	Change 2006-2011	Growth Rate 2006-2011
Flagler	49	49	49	0.6%	0	0.0%
Highlands	2	4	8	0.10%	4	100.0%
Holmes	5	7	7	0.08%	0	0.0%
Suwannee	3	3	7	0.08%	4	133.3%
Columbia	2	2	6	0.07%	4	200.0%
Putnam	5	5	5	0.06%	0	0.0%
Dixie	0	2	4	0.05%	2	100.0%
Okeechobee	2	4	4	0.05%	0	0.0%
Walton	2	1	4	0.05%	3	300.0%
Nassau	3	3	3	0.04%	0	0.0%
Sumter	0	0	3	0.04%	3	-
DeSoto	0	0	2	0.02%	2	-
Gadsden	3	2	2	0.02%	0	0.0%
Jackson	1	1	1	0.01%	0	0.0%
Lafayette	1	1	1	0.01%	0	0.0%
Baker	0	0	0	0.0%	0	-
Bradford	0	0	0	0.0%	0	-
Calhoun	0	0	0	0.0%	0	-
Franklin	0	0	0	0.0%	0	-
Gilchrist	0	0	0	0.0%	0	-
Glades	0	0	0	0.0%	0	-
Gulf	0	0	0	0.0%	0	-
Hamilton	0	0	0	0.0%	0	-
Hardee	0	0	0	0.0%	0	-
Hendry	0	0	0	0.0%	0	-
Jefferson	0	0	0	0.0%	0	-
Levy	0	0	0	0.0%	0	-
Liberty	0	0	0	0.0%	0	-
Madison	0	0	0	0.0%	0	-
Monroe	0	0	0	0.0%	0	-
Taylor	0	0	0	0.0%	0	-
Union	0	0	0	0.0%	0	-
Wakulla	0	0	0	0.0%	0	-
Washington	0	0	0	0.0%	0	-
All Small Counties	78	84	106	1.3%	22	26.2%
Total	4,740	6,566	8,236	100.0%	1670	25.4%

Data Source: NETS 2012

Note: Counties are ordered by 2011 employment size.

Appendix D. Recovered Materials Dealers Survey Instrument

14. Which of the following sources do you consider to be the most useful source of information regarding possible government programs and resources available to your business?

- ☐ Direct contact from government (in-person, phone call, emails, etc.)
- ☐ Government websites
- ☐ Professional meetings
- ☐ From other companies in the same business network
- ☐ Mail-in promotion
- ☐ Others (please list)

_____

15. Bureau of Labor Statistics defines "Green Jobs" as either:

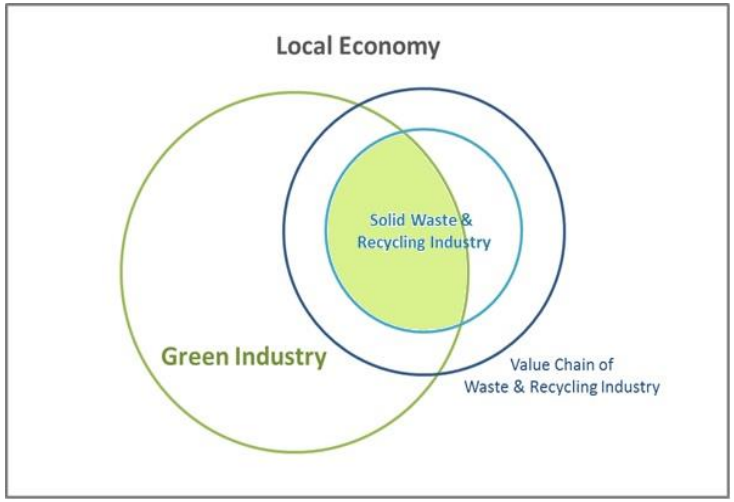
- ***a. Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources; or***
- ***b. Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources***

Based on this definition, about what percentage (%) of the workforce at your establishment were employed in green jobs in the last year?

…….%

16. Please identify your position/role in the company/establishment

FLORIDA RECOVERED MATERIALS DEALERS SURVEY



This questionnaire is designed to assist us investigate the impact of Florida's solid waste and recycling programs on the employment growth in recycling markets to better understand and assist recycling vendors and recovered materials dealers in Florida. This project is supported by Florida Department of Environmental Protection through the Hinkley Center for Solid and Hazardous Waste Management. This questionnaire will take only about 15 minutes to complete and responses will remain confidential to the full extent allowed by law. If you have any questions concerning this research, please contact Dr. Richard Feiock at rfeiock@fsu.edu or at (850) 644-3525.
Thank you.

For the following questions, answer with regard to your largest establishment if your company has multiple establishments.

1. Choose the category below that best fits your firm's primary business activity

☐ Recycling processing

1. a. Please estimate the percentage (%) of total solid waste handled by your business/establishment that is accounted for by each of the generator types

_____% residential single family
_____% multi-family
% commercial

☐ Scrapping and recycling

1. b. What is the primary material handled at your establishment?

☐ Metal ☐ Paper ☐ Textile ☐ Glass ☐ Plastic ☐ Others _____

☐ Both recycling processing and scrapping

1a. Please estimate the percentage (%) of total solid waste handled by your business/ establishment that is accounted for by each of the generator types

_____ % residential single family
_____ % multi-family
_____ % commercial

1. b. What is the primary material handled at your establishment?

☐ Metal ☐ Paper ☐ Textile ☐ Glass ☐ Plastic ☐ Others _____

☐ Recycling-based manufacturing

13. Please indicate about how often your business/establishment interacts with each of the listed government agencies and non-governmental organizations?

	Never	Annually	Monthly	Weekly	Daily
Federal Environmental Protection	☐	☐	☐	☐	☐
Florida Department of Environmental Protection	☐	☐	☐	☐	☐
Florida Department of Economic Opportunity	☐	☐	☐	☐	☐
County Recycling Coordinator	☐	☐	☐	☐	☐
City/Town Recycling Coordinator	☐	☐	☐	☐	☐
Homeowner's Association	☐	☐	☐	☐	☐
Environmental Organizations	☐	☐	☐	☐	☐
Other recycling vendors	☐	☐	☐	☐	☐
Professional waste management associations	☐	☐	☐	☐	☐
Florida Recycler Association	☐	☐	☐	☐	☐
Other not-for-profits	☐	☐	☐	☐	☐

12-a. What other policy actions have Federal/county/city/state governments taken to assist with <u>expansion</u> of your business over the last 5 years?

12-b. To what extent have bureaucratic requirements and red tape been barriers to participation in these programs?

None	Little	Some	A lot
☐	☐	☐	☐

2. About what percentage (%) of the materials your establishment uses for production come from recyclable materials? _____ %

3. Which industries are the primary buyers of the materials or products you handle?

4. In your opinion, to what extent do the following institutions/organizations facilitate or impede employment growth (number of employees) of your establishment?

	Strongly Impede	Somewhat Impede	No Influence	Somewhat Facilitate	Strongly Facilitate
Federal Environmental Protection Agency	☐	☐	☐	☐	☐
Florida Department of Environmental Protection	☐	☐	☐	☐	☐
County Solid Waste Management Division	☐	☐	☐	☐	☐
Municipal Government	☐	☐	☐	☐	☐
Homeowners Association	☐	☐	☐	☐	☐
Environmental Organizations	☐	☐	☐	☐	☐
Other Recycling Vendors	☐	☐	☐	☐	☐

11-b. What other policy actions have federal/county/city/state governments taken to assist with the start-up of your business?

12. Please indicate if your business/establishment been awarded any financial support (such as grants, tax-breaks, loans, etc.) to assist with the expansion of your business over the last 5 years. If any, please indicate the purpose of the award.

	Award of Financial Support		For	For	For
	Yes	No	Economic Development	Environmental Protection (recycling, air/water quality)	Energy Efficiency/ Renewable Energy
Federal	☐	☐	☐	☐	☐
State	☐	☐	☐	☐	☐
County	☐	☐	☐	☐	☐
City/Town	☐	☐	☐	☐	☐

10. To what extent did the bidding processes facilitate or impede your participation in county or local government contracts?

Strongly Impede	Somewhat Impede	No Influence	Somewhat Facilitate	Strongly Facilitate
☐	☐	☐	☐	☐

11. In what year was your business established?
(If prior to 2010 skip to question 12)

_____**Years**

11-a. Please indicate if your business/establishment has been awarded any financial support (such as grants, tax-breaks, loans, etc.) from the government institutions listed below for the start-up of your business.
If any, please indicate the purpose of the award.

	Award of Financial Support		For	For	For
	Yes	No	Economic Development	Environmental Protection (recycling, air/water quality)	Energy Efficiency/ Renewable Energy
Federal	☐	☐	☐	☐	☐
State	☐	☐	☐	☐	☐
County	☐	☐	☐	☐	☐
City/Town	☐	☐	☐	☐	☐

5. In your opinion, to what extent do local government recycling programs facilitate or impede employment growth (number of employees) of your establishment?

	Strongly Impede	Somewhat Impede	No Influence	Somewhat Facilitate	Strongly Facilitate
Mandatory Commercial Recycling	☐	☐	☐	☐	☐
Curbside Recycling	☐	☐	☐	☐	☐
Single Stream Recycling	☐	☐	☐	☐	☐

6. How important are each of the following factors in whether your business will expand (new establishment or new hiring) in the next year?

	Little Importance 1	2	3	4	Great Importance 5
Overall national economic condition	☐	☐	☐	☐	☐
Financial supports from governments (including tax-breaks, loans, grants, etc.)	☐	☐	☐	☐	☐
Recycling/ Recovered materials market (Demand for recycled/ recovered materials)	☐	☐	☐	☐	☐
Contract awards for local governments	☐	☐	☐	☐	☐
Recycling rates	☐	☐	☐	☐	☐

7. Have you been a recipient of any of the following government programs over the last 5 years?

	Yes	No
Florida Recycling Loan Program	☐	☐
Recycling Tax Incentives	☐	☐
State Small Business Credit Initiatives	☐	☐
Florida Economic Development Resource	☐	☐
Federal (EPA) Recycling Grants and Financing	☐	☐

Others (Please list) _____

8. Has your establishment worked as a contractor for any Florida county governments in the last 5 years?

☐ Yes

☐ No (Go to 9)

8a. If yes, about how many county contracts has your establishment been awarded over the last 5 years?

_____ **Number of Contracts**

8b. For the largest county contract in terms of the weight of waste/recyclables, what was the first and last year of your establishment's largest county contract?

Name of County	First year of the contract	Last year of the contract

9. Has your establishment worked as a contractor for any Florida city governments in the last 5 years?

☐ Yes

☐ No (Go to 10)

9a. If yes, how many city contracts has your establishment been awarded over the last 5 years?

_____ **Number of Contracts**

9b. For the largest city contract in terms of the weight of waste/recyclables, what was the first and last year of your establishment's largest city contract?

Name of County	First year of the contract	Last year of the contract

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