



Recyclables and Energy Market Assessment

Technical Memorandum

Solid Waste Master Plan

Pinellas County, Florida
October 2018



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1 Background

The purpose of this Technical Memorandum is to assist Pinellas County (County) in identifying and clarifying the market conditions and potential opportunities for its solid waste, recyclables and energy related investment, for further consideration in the master planning process. This assessment includes the exploration of markets for both energy/waste material-oriented recycling opportunities and industries that might be appropriate for further consideration to inform future tasks of the Master Plan project. This overview includes discussions on impacts of the recent China restrictions on recycling commodities markets, as well as results of recent projects initiated to use specific waste streams as fuel, and other topics identified as having potential impacts on the solid waste industry related markets effecting the County.

2 Waste Material Opportunities

Ideally, materials are sourced from a community's solid waste management system in a variety of ways that allow for marketing the materials as commodities. Recyclable commodities and organic material can be separated, to varying degrees, at the source of generation (e.g., residence or commercial facility) or recovered from mixed waste streams. Marketing opportunities can be increased depending on the community's goals and the marketplace for materials, but generally require increased investment at one or more steps of the waste management system, from generation to collection to processing.

In the County, each of its 24 municipalities bear the responsibility of providing recyclables collection and/or processing to its inhabitants. Municipal programs vary from relying on the individual to arrange for recycling, to providing drop-off locations, to directly providing residential/commercial collection, and even processing (i.e. City of Clearwater consolidates loads of recyclables from other municipalities). In the unincorporated county, there is no mandatory collection (except in the area known as Lealman, which asked the County to establish a Municipal Services Benefit Unit, specifically for solid waste collection services), with recycling provided by each individual hauler on a subscription basis. The recycling services offered by the haulers vary. The County provides 14 recyclables collection drop off centers at locations throughout the county; 25 smaller Beach and Park Recycling locations; offers recycling education to its residents and businesses; and provides as an optional extra curbside recycling in the aforementioned Lealman area, and various programs addressing other components of municipal solid waste (e.g. household electronics and chemicals and yard waste). Please see the Baseline Report for additional detail regarding the County's programs.

2.1 Primary Waste-Based Recyclable Commodities

The worldwide market for recyclable materials is undergoing noticeable change. Recycling programs that were previously profitable in terms of generating more revenues from the sale of commodities than the cost to collect, process and ship the materials to market

destinations, have seen the value of the recyclables decreased precipitously in early 2018. While the pricing of many commodities has rebounded somewhat since early 2018, mixed paper and old corrugated containers (OCC) pricing are still at historic lows. To a large extent, the decline in revenues can be attributed to policy changes in China. Since 2013, although more intensely in the past two years, China has imposed bans and stringent contamination restrictions on importing recyclable materials that have resulted in near turmoil in the recycling industry. It started with a China policy known as Green Fence (February 2013), followed by National Sword (February 2017), and now with Blue Sky (March 2018). Blue Sky will run through December 2018 and is aimed at enforcing import restrictions established under the National Sword policy. The Chinese government has reported large scale smuggling operations and Blue Sky is intended to cease illegal operations. Foreign markets continue to react to the influx of material as a result of China's market ban, including Vietnam which temporarily stopped accepting loads of plastic in June 2018. China banned 24 types of materials last year and will expectedly add 32 more to that list by 2019. These policies resulted in commodity prices dropping nationwide while raising the cost to process recyclables to meet more stringent limits of contamination.

This shift has occurred across all export-based recyclable materials (paper, plastics, metals, precious metals and to some extent textiles). As a result of the difficulty with international markets, many states are actively evaluating recycling programs, markets, and diversion goals. There may be a silver lining to the recycling market difficulties. Many communities are enhancing their education and outreach efforts to reduce recycling contamination. Several states are encouraging communities to "right size" their material mix to remove hard-to-market materials such as mixed paper, #3-7 plastics, and in some cases glass. Materials Recovery Facilities (MRFs) are investing in sorting technology such as near-infrared (NIR) sensors and laser object detection (LOD), as well as reducing processing speeds and increasing manual sorting to improve material quality. Additionally, there has been industry interest in re-starting or upgrading domestic steel and paper mills to manage the abundance of materials.

Additional information about China's influence on the overall market for recyclables is provided in Section 2.4.1. The following is an overview of each of the primary recyclable commodities and their respective market demand.

2.1.1 Paper

Despite our modern society's push to go 'paperless', the need for paper and paper products remains high. Worldwide and domestic demand for paper and paper products, driven by an increasingly literate world, continues to increase. Paper products for shipping (cardboard and paperboard) are increasing as e-commerce competes with "brick and mortar" retail stores. Paper produced from raw materials is increasingly unpopular due to environmental concerns on deforestation and climate impacts. Paper manufacturing in the United States (U.S.) has continued to decline, resulting in increased reliance on paper from international manufacturing. Paper manufacturing in Canada is expected to increase to account for some of the U.S. manufacturing reductions, however reliance on Asia for paper manufacturing remains dominant. Demand for recycled paper products remains high, however, international markets are at present upset caused by changes in the recycled paper markets in China.

Currently, paper and paper products collected as part of the recycling programs in place in the County are being consolidated/processed at the various materials recovery facilities in the Region, including the Waste Management facility in Tampa, the City of Clearwater facility which consolidates recyclables from several County municipalities for delivery to the Waste Management facility in Tampa, the Waste Connections MRF in St. Petersburg and the Waste Pro MRF in Sarasota. MRF Operators are responsible for marketing the recovered materials.

2.1.2 Container Glass

Container glass remains a popular product for various beverage and food products which rely on bottles and jars for commodity sales. However, overall demand for glass containers is continuing to decline as lighter weight, more durable containers are developed. “3 Mix” recycled glass (a combination of flint, amber and green) remains a low value commodity. This situation is due to the relatively similar cost of manufacturing new glass from virgin materials compared to manufacturing glass from recycled glass. The recycled glass market is diversified into three principal product categories which include cullet, crushed glass, and glass powder. The cullet market is further categorized into clear cullet, amber cullet and green cullet.

In addition to competition from composite packaging materials, one of the key challenges of recycling glass is contamination by the unwanted materials present in product waste streams. Contaminated products diminish the value of new products by reducing their salability and by altering their physical properties.

The cost to efficiently and effectively remove containments reduces the financial benefits to the processor that derive from the use of the lower cost contaminated product, thus making the manufacturer reluctant to buy low quality cullet. Variances in contamination can be observed in different collection systems. For example, deposit programs and buy back/drop off programs provide higher quality cullet as compared to mixed or single stream curbside recycling programs.

Markets for glass recycling in Florida are limited. There is currently only one glass processing outlet in Southwest Florida, Strategic Materials located in Sarasota. Strategic Materials has over 40 facilities across the country, including one in Georgia and four in North Carolina. Strategic Materials produce containers, fiberglass, glass abrasives, fillers, highway beads, and specialty glass. There is one glass production facility in Florida, located in Jacksonville, owned by Anchor Glass Container Corporation, based in Tampa. There are several glass production facilities located in Georgia, North Carolina and Virginia. Most of these facilities are over 400 miles from the Tampa Bay area.

2.1.3 Plastics

There are seven categories of plastic resins commonly recycled. These are PET (Polyethylene Terephthalate), HDPE (High-Density Polyethylene), PVC (Polyvinyl Chloride), LDPE (Low-Density Polyethylene), PP (Polypropylene), PS (Polystyrene), and Other (Bisphenol A (BPA), Polycarbonate and LEXAN). Nearly all types of plastics can be

recycled, however, the extent to which they are recycled depends upon technical, economic and logistic factors. The optimum recovery route for most plastic items at the 'end-of-life' is to be recycled, preferably back into a product that can then be recycled again and again. Recycling plastics generally requires the materials to be separated into the seven resin categories, since manufacturers use plastic polymers according to the molecular makeup, which varies by resin category. If blended together, when melted, they tend to phase-separate into different layers according to the resin category. The plastics manufacturing industry has developed remedies to these conditions and has found more ways of using recycled plastics. These include powder impression molding (PIM), in which low value mixed plastic blends are used to create a range of molded pieces, and encapsulating the mixed resins in a layer of higher value plastic, or mixing it with wood fibers. Similar to glass, the percentage of plastic that can be fully recycled is affected by the presence of contamination and the mix of resin categories. Similar to paper, plastics that are recovered from the County's recycling programs via the MRF's discussed above are marketed by the operators of the facilities.

2.1.4 Metals

Most metals in the municipal waste stream are relatively easy to reprocess into new metal products offering, as with other materials recycled, attractive environmental cost savings by reducing greenhouse gas emission levels, preserving natural resources, and reducing energy consumption. Increasing scarcity and high value of rare earth metals provides an opportunity in the global market. The metals recycling market is segmented on the basis of metal type, end-user industry, and geography. Based on metal type, the market is further segmented into ferrous metals and non-ferrous metals. By end-user industry, the metals market is classified into automotive, packaging, shipbuilding, industrial machinery, electronics and electrical equipment, and others.

The value chain analysis of the metal recycling market includes various stakeholders including scrap traders, recycling companies, forging companies, end-users and consumers. The scrap traders and dealers are suppliers whereas the end-user industries are the buyers of the market. Automotive, packaging, shipbuilding, and building and construction are some of the end-user industries which are generally offered semi-finished goods from the recyclers for their further production.

Metals recovery in the County comes from three sources; 1) metals separated at the source and delivered separately to scrap dealers; 2) metals contained in the recycled waste stream recovered at MRFs and 3) metals recovered from the ash generated at the County's Waste to Energy (WTE) Facility. One of the potential opportunities under evaluation by the County is the implementation of enhanced metals recovery from the ash at the WTE Facility, increasing the recovery of ferrous, non-ferrous and other precious metals.

The outlets for the metals are dependent on the source. Scrap metal dealers include, but are not limited to, K-G Metal, Trademark Metals, Tarpon Spring Metal, One Street Recycling, DOM Scrap Metal, Best Metal (Clearwater and Tarpon Springs), Pinellas Commercial Scrap Metal (Clearwater), Angelo's, Fortune Plastic and Metal (Tampa) and Anclote Metal Recycling (Tarpon Springs). Metals recovered from the RRF ash are

managed by Covanta, the Facility operator. The County has an agreement with Trademark Metals to handle metals collected at various locations throughout the County. Metals recovered from the recycled waste stream are managed by the operators of the materials recovery facilities and marketed by them through their existing business relationships.

2.2 Other Waste-Based Recyclable Commodities

Revenue potential exists beyond the primary recyclables markets. This includes both organic and non-organic waste which can be source separated or extracted from municipal solid waste (MSW) and includes other potentially valuable materials, such as wood, textiles, electronics, and construction and demolition (C&D) waste.

2.2.1 Organic Fraction of MSW

Materials such as pre- and post-consumer food waste, fats, oils and grease, yard waste and grass clippings can be readily recycled. Recycling organic materials can be generalized into two biologic processes: aerobic processes (composting) or anaerobic processes (anaerobic digestion).

Compostable and digestible organics make up one of the largest components of the countywide waste stream, consisting of nearly a quarter (24.3%, combining yard waste of 8.5% and food waste of 16.3%, as shown on Figure 4.1 below) of the total quantity disposed. Diverting organic waste materials for recycling could provide the largest quantity of recyclables of any of the categories considered.

The market demand for the by-products of organic recycling varies by region. The County commissioned a Food Waste Composting Demonstration Project and Market Study (Compost Study) earlier this year¹. The results of the study are incorporated below.

Aerobic composting is used by numerous communities in commercial operations throughout the U.S. and the world for composting yard and green wastes, which may be blended with food waste or other more putrescible source-separated organics, and takes place with the presence of oxygen. However, it is not used for a mixed MSW feedstock. Although windrow composting is the most common method of processing yard waste, aerated static pile (ASP) composting is generally used for composting more highly putrescible feedstock blends. The products derived from aerobic composting are compost and mulch.

The County's Compost Study evaluated the market potential of compost in the Pinellas County region and concluded a market potential of 30,600 cubic yards per year (cy/yr) could be developed. The following table summarized the market potential analysis:

¹ Food Waste Composting Demonstration Project Results and Market Assessment, Kessler Consulting, July 10, 2018

Table 2.1 Compost Market Potential Summary

Industry	Estimated market potential quantity (cy/yr)
Agriculture	300 - 600
Sports Fields	6,500 -13,100
Golf Courses	2,400
Bulk Suppliers	1,600
Landscaping	2,600
Nurseries	Not quantified
Environmental	2,200 - 2,800
Home Use	15,000
Total	30,600-38,100

Source: Compost Study, Kessler Consulting, Inc., 2018

The estimated market potential of 30,600 cy/yr of finished compost equates to approximately 59,000 tons of organic material diverted from disposal. The Compost Study reports that approximately 55,000 tons per year of food waste is currently being disposed of at the County’s WTE facility from the commercial waste stream alone. In addition to the commercial waste, the Baseline Report² indicates about 1,000,000 tons of commercial waste are generated annually in the County. Using the same 18.5% factor as the Compost Study, the commercial wastes could contain 185,000 tons of food waste per year. Using the same 20% capture rate as the Compost Study, approximately 37,000 tons of food waste could be captured for organics recycling.

The Baseline Report also indicates about 600,000 tons of waste from residential sources are generated in the County. Using the 12.2% factor from the Compost Study, the residential waste stream generates approximately 73,200 tons of food waste. Using the same 20% capture rate as the Compost Study, approximately 15,000 tons of food waste could be captured from residential sources. Combining the commercial and residential values from the Baseline Report, approximately 52,000 tons of food waste could reasonably be assumed to be captured for organics recycling.

Adding to these Market Study findings, based on our experience of compost markets in other regions of the country, we would expect that the agriculture market could be significantly greater than the Market Study found. The predominant markets in the County are for residential, landscaping, and sports field applications.

Although in the County we understand agriculture is a relatively minor market, we would expect out-of-county agriculture to be significant. The development of any new market such as compost requires time and investment to develop. We have included the agriculture market as a possibility based on the understanding the agricultural market can

² Baseline Report, Solid Waste Master Plan, HDR, September, 2018



consume large quantities of compost. Also the agricultural market can typically accept lower grade compost which makes this market sector a potentially attractive option for planning purposes.

The Compost Study also evaluated the price for compost in the region as follows:

Table 2.2 Florida Compost Prices as reported by Compost News, January 2017

Description	High	Low	Ave
Bulk Retail (\$/cy)	\$22.00	\$13.00	\$17.50
Bulk Wholesale (\$/cy)	\$13.00	\$8.00	\$10.50

Source: Compost Study, Kessler Consulting, Inc., 2018

The anaerobic digestion process occurs when organic matter is decomposed using bacteria in the absence of oxygen. By consuming the organic materials, the bacteria produce a biogas (primarily methane and carbon dioxide). Feedstocks for anaerobic digestion vary according to the type of technology, but in broad terms could include MSW-derived organics, manure, food waste, industrial food/beverage wastes and liquids, grass clippings, and, for some technologies, yard waste, brush, and wastewater treatment plant biosolids. Biologically inert materials that might be contained in the digestion feedstock from dry fermentation anaerobic digestion, such as metals, glass, and plastics, are undesirable and considered contamination, and screened-out during or after digestion (for dry type systems). Wet digestion systems (such as wastewater treatment facilities) remove these contaminants prior to digestion. Depending on the quantities generated, the methane produced from anaerobic digestion can be used to produce electricity or can be upgraded into transportation fuel (liquefied or compressed natural gas). In other regions of the U.S. (e.g., California) low carbon fuel standards are creating incentives that make the anaerobic digestion of municipal and industrial food waste for low carbon intensity renewable natural gas, compressed to Compressed Natural Gas (CNG) for transportation fuel, attractive. California reports a half-dozen food waste anaerobic digestion facilities have been developed to date and anticipates the development of many more under recently enacted state mandatory organics diversion regulations.

Currently, the County produces processed mulch from yard waste delivered at the Bridgeway Acres landfill site, and provides the processed mulch to customers and residents free-of-charge from this site, and from four County locations in unincorporated areas. For more detailed information on the County's yard waste and processed mulch program, please refer also to Section 5.3 of the Baseline Report.

2.2.2 Biomass

Biomass recycling includes a variety of materials such as organic residues from plants and animals obtained primarily from the harvesting and processing of agricultural, and forestry crops. Biomass are wastes and by-products that may be utilized as fuels for producing energy, instead of traditional disposal. Examples of some of the biomass residues that are

utilized in direct combustion power plants are: forest slash, urban wood waste, lumber waste, and agricultural wastes such as sugarcane bagasse. The applicability of this potential option is very dependent on the local market conditions. The fact that Wheelabrator recently announced closure of its Ridge Energy Facility in Auburndale, Florida which processes biomass and used tires is not a positive sign. Due to its relatively high energy value, low contamination rate and homogeneous composition, biomass can also be used as feedstock for local WTE facilities.

2.2.3 Textiles

Textiles consist of a wide variety of natural and man-made fibers from used clothing, carpet and other sources. The goal of recycling textiles is driven by the environmental cost of producing textiles. The manufacturing process to produce textiles requires the expenditure of natural resources including oil to produce synthetic fibers, fertilizers to grow cotton, and chemicals to produce, dye, and finish fibers and textiles. The market demand for recycled textiles is in its infancy and varies significantly by region.

In the County, there are several alternatives to disposal for clothing. There are drop off boxes throughout the County, as well as several organizations that accept used clothing for sale/reuse such as Goodwill Industries, The Salvation Army, and various church based programs.

2.2.4 Electronics

Electronic waste (“e-waste”) consists of discarded electronic items such as TVs, monitors, computers, cell phones, laptops, mice, keyboards, small servers, printers/scanners, tablets/e-readers, MP3 players, VCR/DVD/DVR players, fax machines, video game consoles, and cable/satellite boxes. E-waste may contain heavy or precious metals like mercury, lead, lithium, silver, gold and other hazardous materials that might pollute the environment when incinerated (in an uncontrolled manner), or if disposed of improperly.

Properly recycling e-waste requires environmentally controlled processes to protect workers and prevent air contamination. Safely removing substances like mercury, lead, cadmium, and brominated flame retardants and then managing these and other materials as a hazardous waste is required before removing any valuable precious metals. Consequently, recycling e-waste can be complicated and expensive. The demand for precious metals varies by material type. One option the County is considering is processing E-waste at its Waste to Energy Facility, given the pollution control systems in place.

The County owns a Household Electronics and Chemical Collection Center (HEC₃) and contracts with a private vendor for recycling and/or disposal of electronics and chemicals dropped off at the Disposal Complex. County residents are invited to bring select unwanted electronics and chemicals to the HEC₃. The County holds mobile collection events for residents and also holds business collection events for electronics and chemicals. Businesses pay the contractor at the County’s negotiated rates. A private vendor is contracted by the County to dispose of the remainder of the collected electronic waste and chemicals in accordance with Subtitle C of the Resource Conservation and Recovery Act (RCRA).

2.2.5 Construction and Demolition (C&D) Debris

C&D Debris represents a variety of material types including wood of various types, sheetrock, roofing materials, metals of various types, rock, brick, concrete and asphalt, in addition to a variety of undesirable materials such as asbestos. The market demand for inert materials such as rock, brick, concrete and asphalt, varies regionally but can be quite high if raw or native materials are not available locally.

C & D Debris in the County is handled primarily through the private sector, including Angelo's in Pinellas County, Waste Management, Sarnago and Sons, Sonny Glasbrenner, Waste Connections, and Republic Metro Recycling in Hillsborough County. There are also drop off locations available for residents, including at the County Solid Waste Complex.

2.3 Current Markets

Recycling commodity markets have experienced significant challenges over the past year. Recycling in the U.S. has relied heavily on China; however, with China's new contamination limits, it has become necessary to find new U.S. end markets. The financial operating performance of a MRF is dependent on commodity market prices. HDR has recently been in contact with several recyclable materials brokers and end users in order to maintain a good understanding of the current markets. Market pricing is constantly changing and can be affected by many different factors across regions. The discussion here is meant to provide a sense of overall market potential for the County.

While some commodity values have increased since January 2018, such as PET and HDPE plastics, most commodities values have not improved. Mixed plastic and paper market prices are at an all-time low, and some MRFs and brokers are having a difficult time finding end users to accept any mixed paper. According to recyclingmarkets.net, an online pricing index, mixed paper prices dropped from \$70 per ton in 2017 to -\$2.50 per ton in July, 2018, according to the index's Regional Average price. Sorted residential paper has declined in price dramatically as well, averaging \$82 per ton in 2016 but only ~ \$29 per ton in 2018. Similarly, the price for OCC has declined from \$150 per ton in 2017 to \$86 per ton in 2018.

The market price for mixed plastics #3-7 is currently at an average of 0 to -3 cents per pound and has been at this price for almost a year. The value of color HDPE has slightly dropped since April, 2018, when it reached a high of 19.5 cents per pound, and is currently at 15 cents per pound. Plastic commodities that have increased in market price are natural HDPE (8 cents a pound), PET beverage bottles (baled \$0.17 cents a pound), and Grade A and C film (\$0.08 and 0.015 cents per pound respectively), again according to recyclingmarkets.net.

The market for glass, as with all recyclable commodities, is very dependent on its contamination rate. Glass is seen to have a significantly higher market value prior to being processed through a MRF. MRF processors in some cases are reluctant to accept glass due to its abrasive nature and low value or are adding additional processing equipment. According to recyclingmarket.net, mixed glass in the Southeast is sold at -\$22.50 per ton (a cost). Conversely, color separated glass is selling for \$20 to \$32.50 per ton depending on the color (flint \$32.50, amber \$27.50 and green \$12.50). To receive the highest value

for glass, consideration needs to be given to separating glass from single-stream recycling collection programs and setting up instead, drop-off centers where glass can be collected with much less breakage and contamination.

Table 2.3 below shows commodity prices for the Southeast USA (Atlanta Region) (includes the states FL; GA; AL; MS; SC; NC; LA; AR; KY; and TN) as reported by Recyclingmarkets.net as of July 2018.

Table 2-3 Commodity Prices for the Southeast USA (Atlanta Region)

Commodity	Price
Mixed paper	-\$2.5/ton
Sorted residential paper	\$32.50/ton
OCC	\$82.50/ton
PET	\$0.17.25/pound
Mixed plastics (#3–7)	\$-0.015/pound
HDPE natural	\$0.41/pound
HPDE color	\$0.15/pound
HDPE rigid	\$0.115/pound
Grade A film	\$0.13/pound
Grade C film	\$0.015/pound
Mixed glass	-\$22.50/ton
Amber	\$27.50/ton
Green	\$12.50/ton
Aluminum Cans (sorted, baled, picked up)	\$0.775/pound
Steel cans (sorted, baled, picked up)	\$165/gross ton

Note: Prices are regional averages and do not reflect variances such as: premiums, spot loads, freight allowances, regular quantity shipments, contract terms, etc.

Source: Recyclingmarkets.net

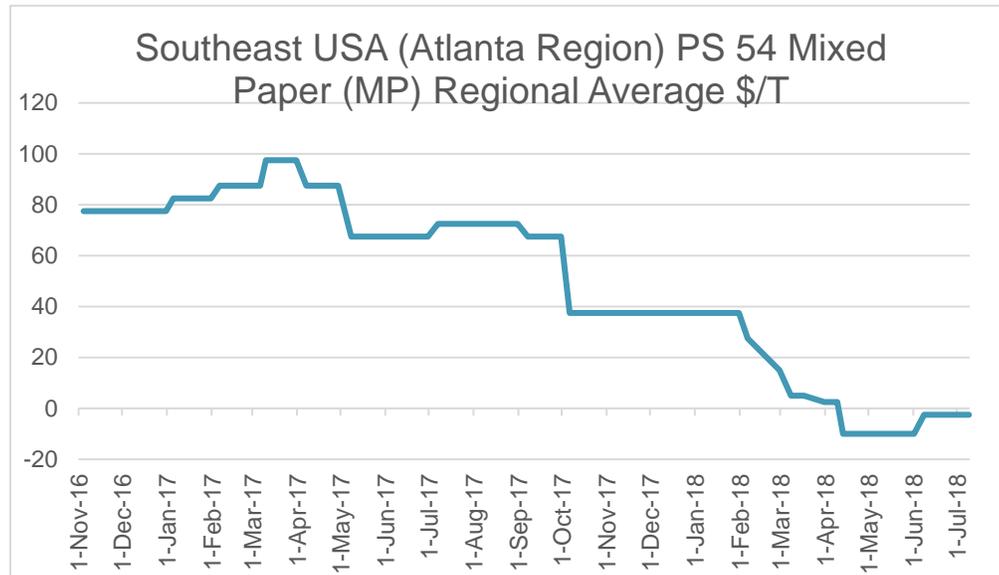
2.4 Market Stability and General Trends

Merely analyzing the history of recyclables market prices cannot accurately predict the future of a market. Many factors influence and effect market prices. The market price of a commodity is very dependent on the quality of the material; therefore, contamination rates are important drivers for commodity prices. Research has also shown that oil prices correlate with the value of recyclables, most directly plastics, but also as it relates to transportation of other materials. The market for recyclables is constantly changing and for many commodities has been on a gradual decline since 2017. Below are figures showing the history of average market prices in the Southeast USA, which were obtained

from Recyclingmarkets.net, and are useful in providing a general understanding of recent overall market trends.

Figure 2-1 below shows the pricing trend for mixed paper. Mixed paper consists of all types of paper, but is limited by the soiled and wet paper content, as well as non-fiber materials content. During the interval shown, ISRI has recently changed the designation of mixed paper. Today it is known as a #54 mixed paper (MP) fiber product.

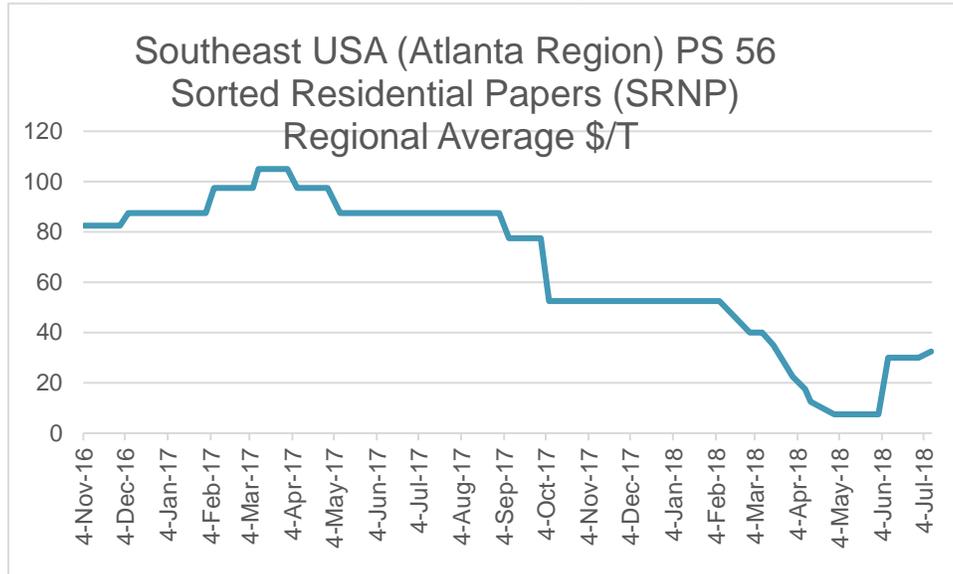
Figure 2-1. Mixed Paper Regional Market Prices (2016-2018)



Source: Recyclingmarkets.net

Figure 2-2 below shows the market history for Sorted Residential Papers since late 2016. Formerly this class of fiber was known as either a #6 or #8 newspaper product, but these classifications have been discontinued. Now, Sorted Residential Papers, ISRI designation #56 (or SRNP), consists of paper such as newspapers, magazines, and printed paper generated in a residential household. The market for Sorted Residential Papers has been significantly declining, starting in the latter half of 2017.

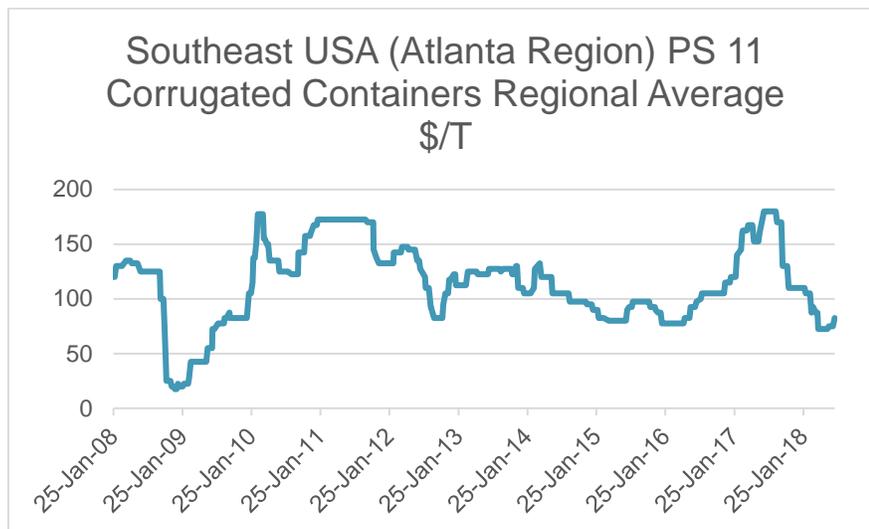
Figure 2-2. Sorted Residential Papers Regional Market Prices (2016–2018)



Source: Recyclingmarkets.net

Figure 2-3 shows the market history for OCC since 2008. OCC consists of lined corrugated containers. The market for OCC began another significant decline in the beginning of 2018.

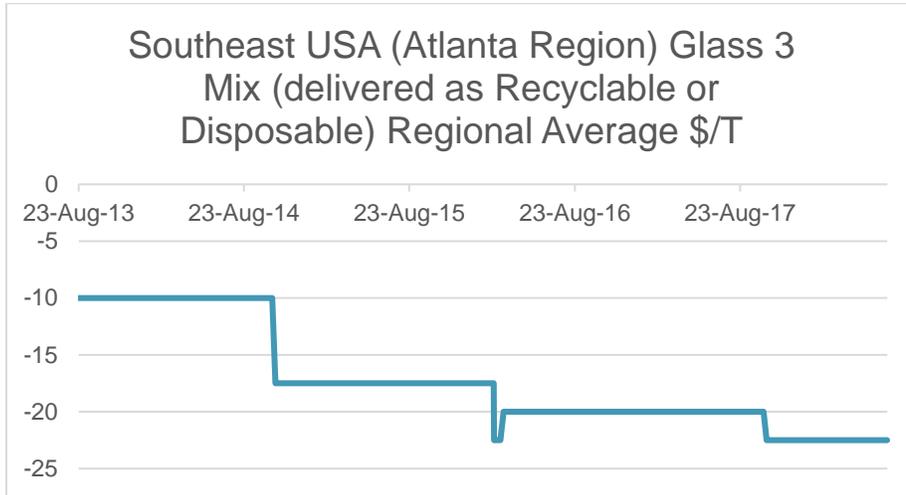
Figure 2-3. OCC Market Prices (2008–2018)



Source: Recyclingmarkets.net

Figure 2-4 shows the market for mixed glass. Mixed glass contains all colors, and has been at a negative market value for several years.

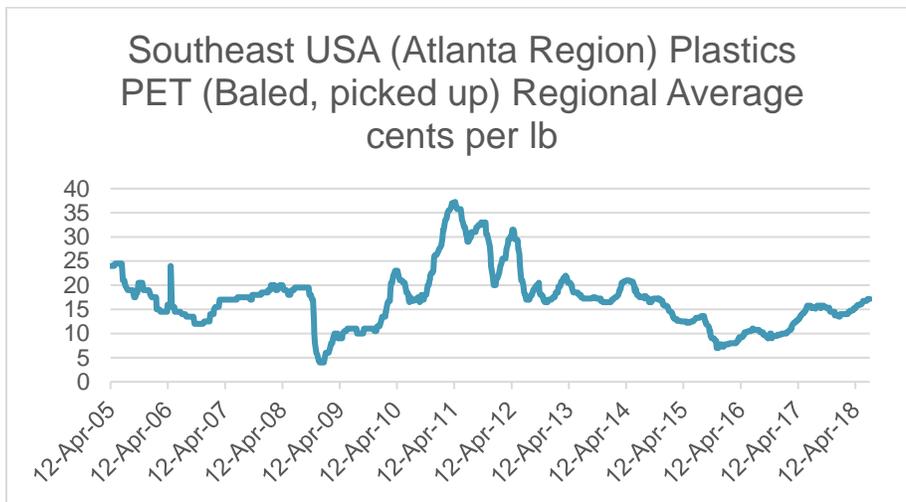
Figure 2-4. Mixed Glass Market Prices (2014–2018)



Source: Recyclingmarkets.net

Figure 2-5 shows the market for baled PET plastic, which were on a steady decline since the beginning of 2017 but have shown some improvement more recently. PET mixed bottles consist of food and beverage bottles that can include up to 30 percent green tinted bottles. Mixed #3–7 plastics are separated from PET bottles, HDPE bottles, and mixed bulky rigid #2 and #5 bottles. Containers in the mixed #3 - 7 category can also include cups, trays, and tubs.

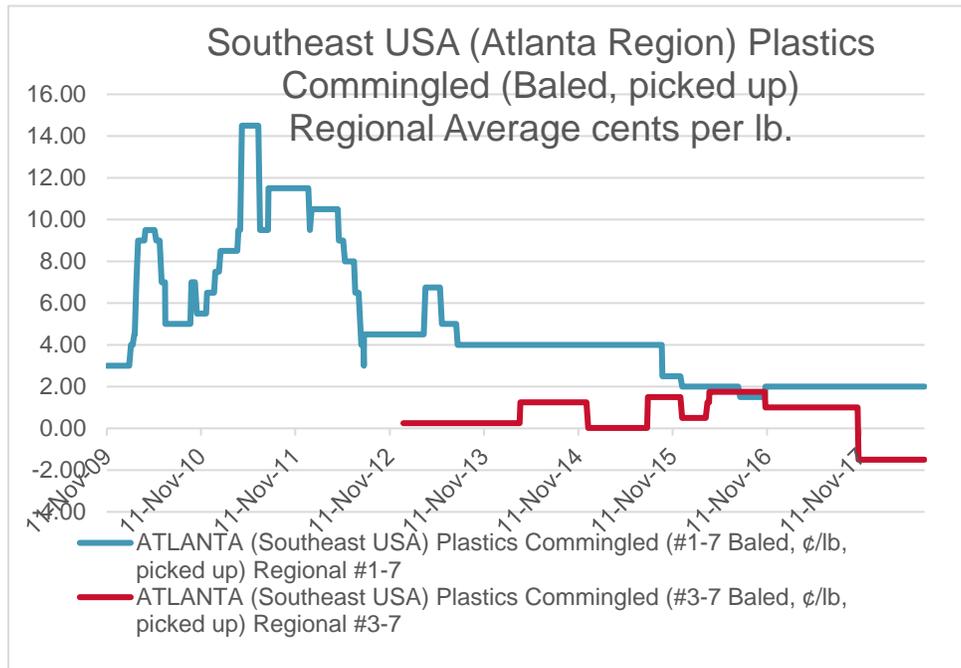
Figure 2-5. PET (Baled) Regional Market Prices (2008–2018)



Source: Recyclingmarkets.net

Figure 2-6 shows commingled mixed plastics. The designations shown in Figure 2-6 include mixed rigid plastics including plastic bottles, thermoform packaging, cups, trays, clamshells, food tubs and pots. The #1–7 baled plastics designation include a mix of all containers without separating the #1, PET and #2 HDPE plastic containers. The #3–7 mixed rigid plastics designation have the more valuable #1 and #2 plastic containers removed, hence the price differential between the two classifications. Both of these categories do not include film plastic. These commodities markets limit the amount of fiber, metal, film plastic, glass, liquids, and other contaminants that can be contained in the bales.

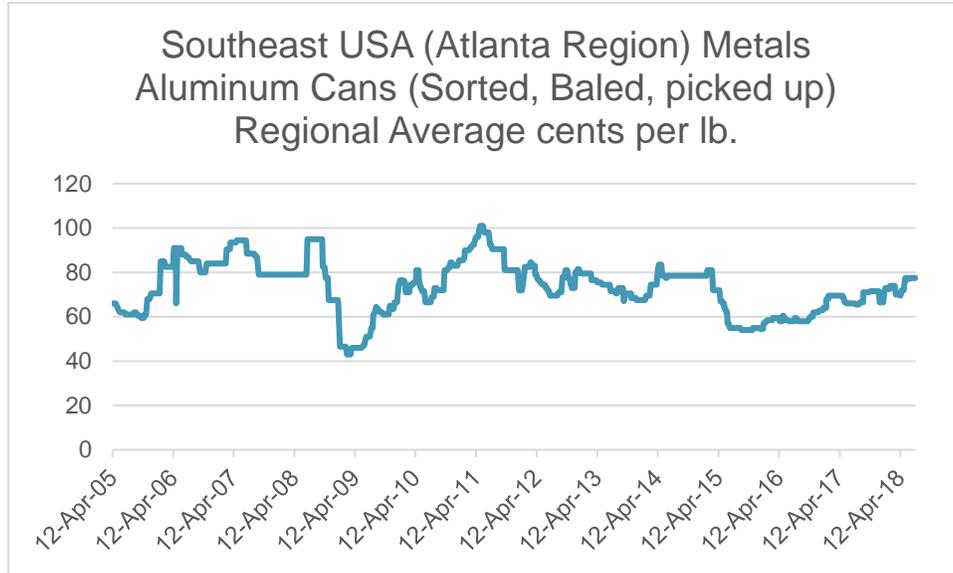
Figure 2-6. Plastic Market Prices (2009–2018)



Source: Recyclingmarkets.net

Figure 2-7 below shows the markets for baled aluminum cans since the beginning of 2008. A sharp decline in prices in late 2008 and early 2009 correlates with an economic downturn, when demand for aluminum cans became lower.

Figure 2-7. Aluminum Can Market Prices (2008–2018)



Source: Recyclingmarkets.net

2.4.1 China’s Influence on Recyclable Materials Markets

China has placed strict contamination standards on many recyclable materials being imported into their country. As of January 1, 2018, under its National Sword Policy, China banned 24 types of scrap materials including unsorted paper and low-grade PET bottles.³ As of March 1, 2018, the contamination standard for plastics and fibers went from 1.5 percent down to 0.5 percent. Another 16 types of waste such as automobile scrap and scrapped ships will be banned from being imported starting December 31, 2018. Starting December 31, 2019, stainless steel scrap will be banned from being imported.⁴

There has been a shortage or lack of inspectors authorized to inspect shipments, and reportedly inspections that are done, are much more comprehensive and take much longer. Just recently, some China inspectors from Canada have been allowed to complete pre-inspections in the United States. At least one U.S. MRF has been approved for shipping to China. When material is shipped, it is not clear whether additional inspections and potential rejection could occur in China, even though the commodities are preapproved.

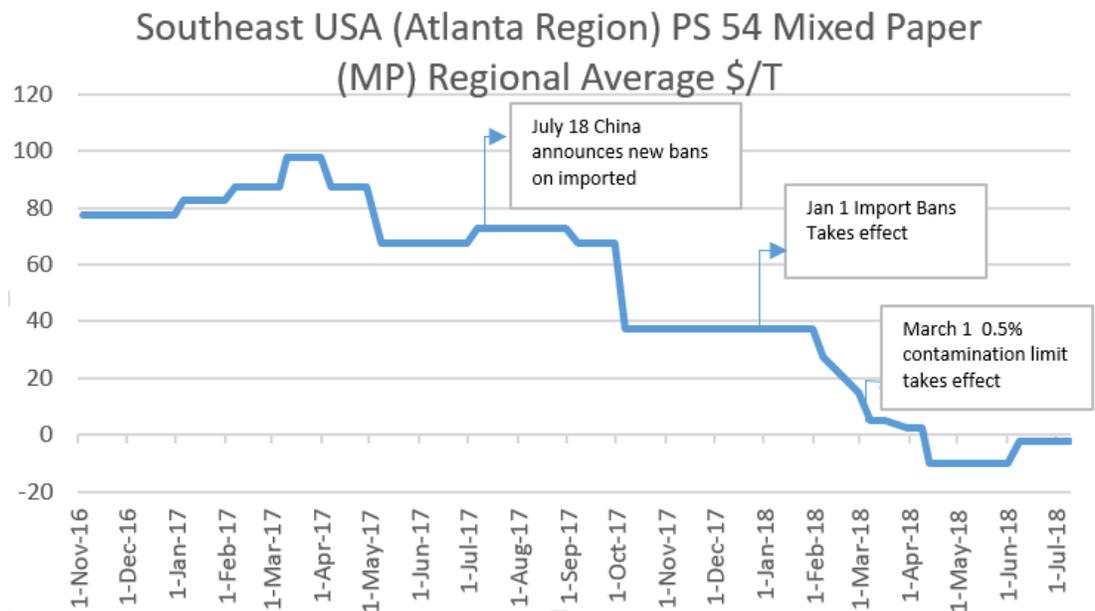
³ Kimiko de Freytas-Tamura, “[Plastics Pile Up as China Refuses to Take the West’s Recycling](#),” The New York Times, January 11, 2018.

⁴ The People’s Republic of China, Ministry of Ecology and Environment, “[China Announces Import Ban on 32 Types of Solid Waste](#),” April 19, 2018.

Because of this rigorous standard (and for other reasons) the result has been falling market prices for plastics and fibers. Prior to the stricter China contamination standards, MRFs would be able to push large volumes of materials through their systems. Due to the stricter contamination standards, MRFs need to more efficiently sort and complete QC measures, which slows down the process line, resulting in longer operating hours and increased processing costs.

As an example of how this has affected markets around the country, Figure 2-8 below shows the market for mixed paper in the Southeast, in relation to important dates beginning with China’s policies. The current price of mixed paper (July 2018) has dropped to - \$2.50 per ton since the enforcement of the Policy.

Figure 2-8. Mixed Paper Market in Southeast (2016–2018)



Source: Recyclingmarkets.net

Experts in the recycling industry believe that the National Sword Policy could only be a phase. However, forcing U. S. facilities to lower contamination rates, may ultimately turn into a positive for the future of the industry. Such actions seem necessary since there are recent indications that point to other countries tightening their contamination requirements, as well.

How to react to recyclables market forces and contamination are key issues that must be considered by the County, especially if inclusion of construction and operation of a County-owned MRF is to be considered as part of the Solid Waste Master Plan. Tools to help address these issues include standardization of recycling practices/contracting terms and conditions and consistent outreach/education programs. Any attempt at attracting new markets to the region or significant investment in new infrastructure will require mechanisms in place to ensure an adequate supply of material that can meet the evolving market requirements.

3 Energy

Pricing in the energy markets affects the solid waste market in a variety of ways, especially in communities with waste to energy disposal. For example, waste to energy facilities generating electricity for sale are, obviously, very dependent on the market for electricity. Another common application is utilizing collected landfill gas to generate electricity, as a replacement/complement for natural gas or as a feedstock for fuel production. Some waste-based commodities, such as biomass, can be used as fuel in energy markets. Other waste-based materials can be converted to energy commodities; for example, when an anaerobic digestion facility converts food waste to natural gas. Even waste processing facilities themselves (for example, closed landfills), can be used to house solar arrays that produce renewable energy.

Energy markets also have a significant impact on the financial viability of waste-based commodities, as fuel and power costs influence the cost of collection, processing, and hauling the commodities, and determine the cost of generating raw materials relative to the cost of using recycled materials for products. As mentioned previously, research has shown that oil prices correlate closely with the value of recyclables.

This section contains an overview of the different energy markets in Florida, in order to show how the County's solid waste management system is already integrated with the energy sector and where there may be additional opportunities for profitable integration in the future.

3.1 Electrical

Florida is one of the largest producers of electricity in the United States. Florida produces most of its electricity from natural gas (second only to Texas in 2014 in net electricity generation from natural gas), which according to the most recent Energy Information Agency data for June 2018 accounted for 72 percent of Florida's net electrical generation. Coal accounted for nearly 13 percent of the state's electrical generation, and two nuclear power plants account for approximately 12 percent of Florida's electrical generation. Other resources, including renewable energy, supplied the remaining electricity generation, approximately 3 percent. The state retains petroleum fueled backup electrical generation capacity in the event of disruptions in the natural gas supply. The following table illustrates the sources of energy and their relative Btu (British Thermal Unit) consumption values for the state. Florida ranks 39th in the U.S. for the average retail price of electricity at \$0.1137

per kilowatt. This somewhat favorable price is due to the strong reliance on piped in natural gas for the majority of its power.

Although Florida is one of the largest producers of electricity in the nation, the state also imports electricity from adjoining states to meet demand. As the state continues to grow in population, electricity demand in Florida is also expected to increase.

The residential sector consumes more than half of Florida's electricity. More than 90 percent of Florida households use electricity as their primary energy source for home heating, and even a higher percent of households use electricity for air conditioning. Florida's per capita residential retail sales of electricity is among the highest 25 percent of states, but total retail sales of electricity per capita is below the national average because industrial use is small.

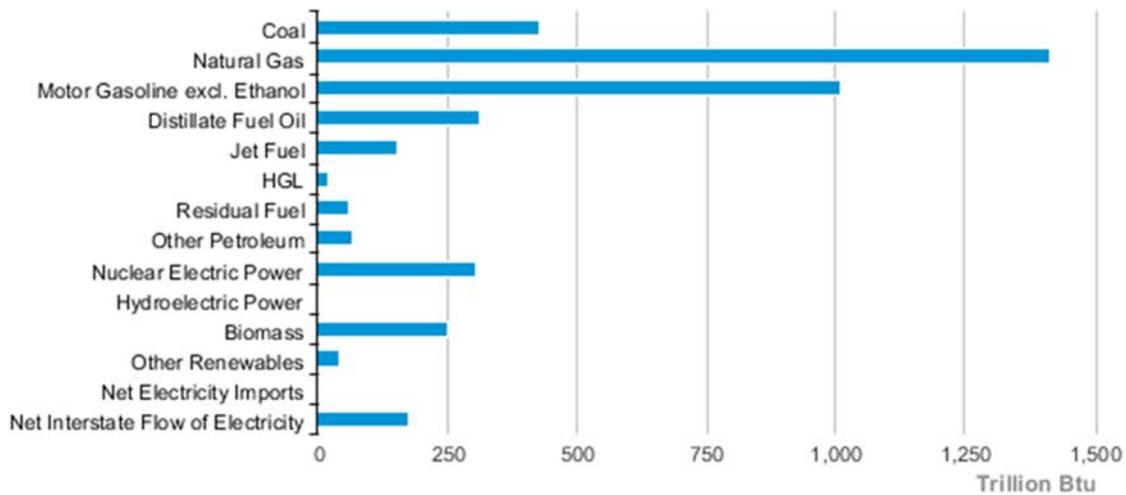


Figure 3-1. Florida Energy Consumption Estimates, 2016

Source: Energy Information Administration, State Energy Data System.
<https://www.eia.gov/state/?sid=FL>.

3.2 Natural Gas

Florida has no significant natural gas reserves and only a small amount of natural gas production, all from the same fields that produce crude oil. Almost all of the state's natural gas is produced from the Jay Field in the Florida Panhandle. Florida's natural gas production peaked in the late 1970s. By 2009, production had fallen to its lowest level, at less than 1 percent of peak production.

Florida receives nearly all of its natural gas supplies from the Gulf Coast region by way of five major interstate pipelines. Two pipelines run along the Gulf Coast entering Florida

through Alabama, two enter the state through Georgia, and one runs underwater, forming a direct link from Mississippi and Alabama to central Florida.

Most of Florida's natural gas is consumed in electric power generation. The industrial sector is the second-largest natural gas-consuming sector in the state but uses no more than one-tenth as much natural gas as the electric power sector. Only slightly more than 1 percent of the natural gas delivered directly to consumers in Florida goes to the residential sector, where fewer than 5 percent of households use natural gas as a primary home heating fuel.

3.3 Coal

Florida does not have any coal reserves or production. Coal arrives in the state from several states and from overseas. Tampa, Florida, was in 2017 the nation's leading coal import port, receiving coal primarily from Colombia in South America. Almost all coal consumed in the state was used for electricity generation. Domestic supplies for Florida's coal-fired electricity generating plants were delivered by railroad and barge, mostly from Illinois, Kentucky, and Indiana. Coal-fired electricity generation in Florida has been decreasing with the phasing out of coal fired facilities, including recent closures by Duke Energy, Florida Power & Light and Jacksonville Electric Authority. Tampa Electric Company (TECO) is seeking approval to convert from coal to natural gas, which will further decrease coal consumption in Florida.

3.4 Petroleum

Florida does not have any crude oil refineries and relies on petroleum products delivered by tanker and barge to Florida marine terminals, primarily at Jacksonville, Port Canaveral, Port Everglades, and Tampa. Florida enacted a drilling ban for state waters as of 1990, and, in 2006, Congress banned leasing of federal offshore areas within 125 miles of Florida's Gulf of Mexico coast until at least 2022. Legislation has been introduced at the federal level that would extend the moratorium until 2027. Petroleum products, including residual fuel oil, jet fuel, motor gasoline and motor gasoline blending components, low-sulfur distillate, and asphalt, arrive in Florida from around the world. Ethanol imports also arrive in the state, mainly from Brazil, and biomass-based diesel arrives from Argentina.

About 90 percent of Florida's petroleum consumption occurs in the transportation sector, and most of the remainder is used in the industrial and commercial sectors. In part because of Florida's tourist industry and the heavy passenger and cargo traffic through its international airports, state demand for motor gasoline and jet fuel is among the highest in the United States. Florida does not require that motor gasoline be blended with ethanol, and federal requirements for lower vapor pressure summer gasoline in Florida's urban areas were lifted beginning in 2014.

3.5 Renewable Energy

Florida obtains only a small portion of its energy from renewable resources. Most of the state's renewable electricity generation comes from biomass, with the remainder coming from several solar energy facilities scattered around Florida and from two hydroelectricity

generators in the state's northern Panhandle. The state's biomass resources include municipal waste (waste-to-energy), sugarcane waste (bagasse), citrus pulp, and other plant and animal agricultural residues, as well as yard waste and woody biomass. There are 11 operating waste-to-energy facilities in Florida, one of which is in the County's WTE Facility. Florida also has several dozen small combined-heat-and-power facilities at industrial sites, including food processing and chemical facilities that can use biomass-based fuels. Many sugarcane mills get their energy from burning bagasse and can burn other biomass wastes as well. Almost one-fifth of Florida's renewable energy capacity additions through 2024 are expected to use biomass.

Solar energy is projected to have the most new capacity additions within the next decade. More than four-fifths of the planned additional utility-scale renewable energy capacity is expected to be solar photovoltaic (PV). In areas with suitable wind profiles, combining solar with micro wind turbines presents another potential opportunity.

Florida is one of only four states with utility-scale electricity generation from solar thermal technologies and includes the world's largest combined-cycle natural gas generating plant, (located in Martin County), which is the only concentrating solar thermal generating facility east of the Rocky Mountains. However, the state's amount of electricity generation from solar thermal facilities is only a small fraction of the nation's total.

Florida has few other renewable assets. The state has limited wind resources and no installed utility-scale wind capacity, although some wind power components are manufactured in Florida. Wave/ocean current energy is a potential future source of renewable energy being investigated.

Florida does not have a renewable energy portfolio standard, but it does have state and local incentives for certain renewable energy technologies. The state allows net metering for qualifying customer-sited renewable energy facilities limited to no more than 2 MW. State requirements vary between investor-owned electric utilities and municipal and cooperative electric utilities. Municipalities with power purchase agreements coming up for renewal could consider requiring that a percentage of energy come from renewable resources.

3.6 Market Stability and General Trends

3.6.1 Energy Production Trends

Florida has already shifted away from coal and into increased natural gas fired electrical generation, Florida does not have a renewable energy standard or portfolio. Several investor owned utilities have made strides in the investment into solar energy but the overall production from all renewable energy facilities (wind, solar, biomass/WTE) represents less than three % of overall production and is not expected to increase significantly based on industry projections without external incentives. The majority of generation is invested in natural gas with some additional investment in CHP units as part of this trend.

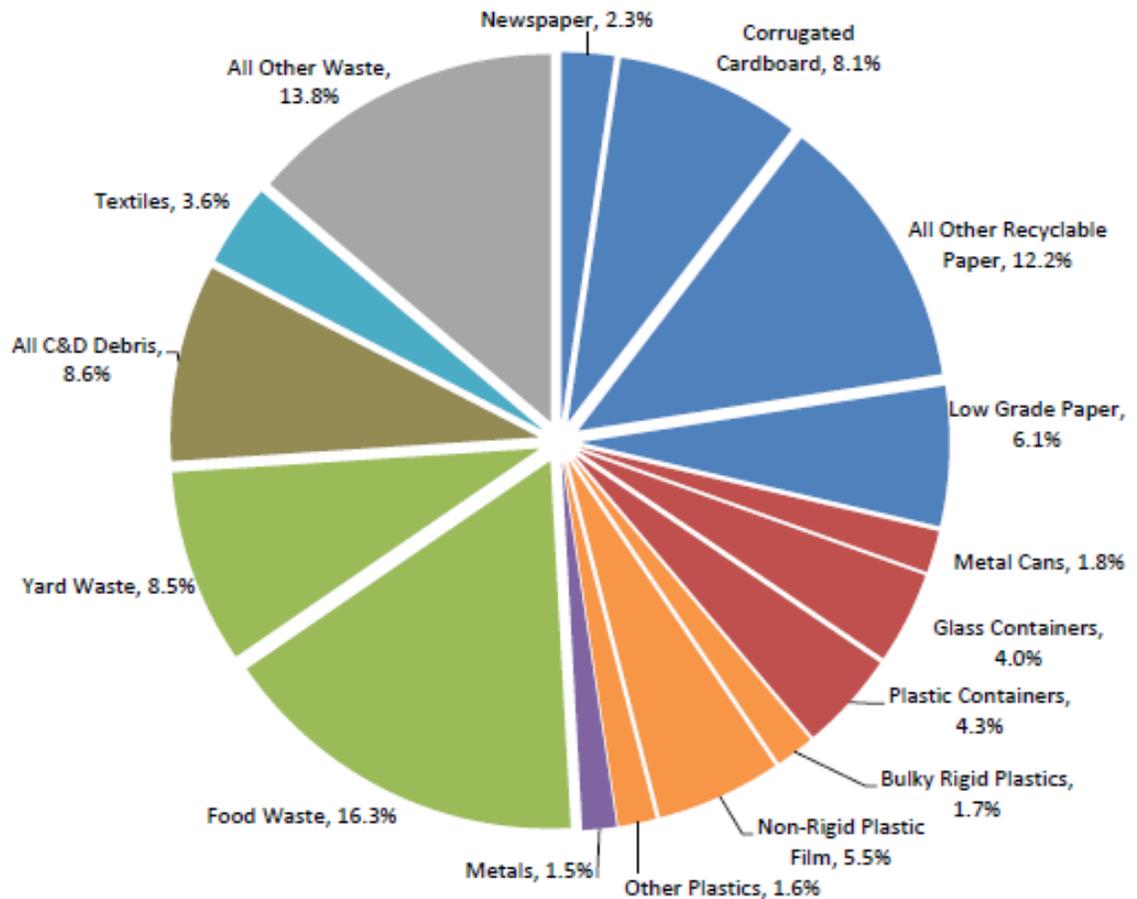
3.6.2 Power Purchase Agreements

Power Purchase Agreements (PPA) for energy or Offtake Agreements for materials can be beneficial by providing stabilization of the market price. The County's current power purchase agreement, which runs through 2024, has been a significant contributor to keeping the cost of waste management economical and stable in the County. The County is preparing for the reduction in electricity revenues anticipated under the replaced or renegotiated agreement.

4 Material Quantities

To put the potential asset value of recyclable materials in perspective, the composition and quantity of recyclables has been evaluated. The County commissioned a Waste Composition Study in 2014 that provided insight to the quantities and types of recyclable materials that are currently disposed at the Waste-to-Energy facility or the landfill. Figure 4-1 shows the composition of municipal solid waste delivered to the County's Disposal Complex for disposal over 10 days of sampling in 2014. Figure 4.1 shows the same data, further broken down by sector (single-family, multifamily, and commercial).

Figure 4-1. Waste Composition Study Results, August 2014



Source: Kessler Consulting, Inc. Pinellas County, Florida, 2014 Waste Characterization Study. January 2015.

Table 4-1. Characterization of Class 1 Waste Disposed (Percent by Weight)

Material Category		Single-Family Residential	Multi-Family Residential	Commercial	Aggregate
1	Newspaper	2.0%	3.0%	2.2%	2.3%
2	Corrugated Containers	5.0%	5.9%	10.5%	8.1%
3	Office Paper	0.8%	0.8%	1.1%	1.0%
4	Other Recyclable Paper	9.3%	11.8%	11.3%	10.8%
6	Aseptic Containers	0.3%	0.6%	0.4%	0.4%
RECYCLABLE FIBER		17.3%	22.1%	25.5%	22.5%
7	PET Bottles	1.4%	2.4%	1.5%	1.6%
8	HDPE Bottles	0.7%	1.4%	0.8%	0.9%
9	Non-Bottle Plastics #1 and #2	0.8%	1.2%	0.9%	0.9%
10	Other Plastic Containers (#3-#7)	0.8%	1.0%	1.0%	0.9%
15	Tin/Steel Cans	1.0%	1.4%	1.0%	1.1%
18	Aluminum Cans	0.7%	1.1%	0.7%	0.8%
20	Glass Containers	3.4%	6.3%	3.7%	4.0%
RECYCLABLE CONTAINERS		8.7%	14.8%	9.5%	10.2%
11	Bulky Rigid Plastics	1.9%	1.7%	1.6%	1.7%
16	White Goods/Small Appliances	0.0%	0.0%	0.0%	0.0%
17	Other Ferrous	0.9%	1.0%	1.3%	1.2%
19	Other Non-Ferrous	0.3%	0.4%	0.3%	0.3%
24	Electronics	2.0%	1.8%	1.6%	1.7%
OTHER POTENTIALLY RECYCLABLE MATERIALS		5.1%	4.9%	4.8%	4.9%
5	Low Grade Paper	5.2%	5.2%	6.9%	6.1%
26	Clean Wood Waste	1.0%	0.2%	3.5%	2.2%
30	Yard Waste	21.7%	2.2%	3.3%	8.5%
31	Food Waste	12.2%	16.5%	18.5%	16.3%
POTENTIALLY COMPOSTABLE MATERIALS		40.1%	24.2%	32.3%	33.2%
12	Non-Rigid Plastic Film	4.3%	5.1%	6.2%	5.5%
13	Expanded Polystyrene	1.0%	0.8%	1.0%	0.9%
14	All Other Plastics	0.5%	0.9%	0.7%	0.7%
21	Other Glass	0.2%	0.2%	0.3%	0.3%

Table 4-1. Characterization of Class 1 Waste Disposed (Percent by Weight)

Material Category		Single-Family Residential	Multi-Family Residential	Commercial	Aggregate
22	Textiles	5.4%	4.5%	2.3%	3.6%
23	Special Wastes	0.4%	0.1%	0.1%	0.2%
25	Household Batteries	0.1%	0.1%	0.1%	0.1%
27	Treated Wood Waste	3.5%	0.5%	2.8%	2.6%
28	C&D Debris	2.1%	5.7%	4.2%	3.8%
29	Tires and Rubber	1.2%	0.3%	0.5%	0.7%
32	All Other Garbage	9.5%	14.2%	7.8%	9.4%
33	Liquids	0.6%	1.4%	1.2%	1.0%
34	Grit	0.1%	0.2%	0.6%	0.4%
ALL OTHER MATERIALS		28.7%	34.0%	27.9%	29.2%
TOTALS		100.0%	100.0%	100.0%	100.0%
PERCENTAGE OF WASTE STREAM		29.5%	17.1%	53.4%	100.0%

The waste composition study shows that there are still significant resources being sent for disposal that could be diverted to other recycling or energy markets. Food waste is the largest single component of the waste stream at 16.3 percent and represents potential compost and natural gas market value. This is the most obvious investment opportunity, given the state’s increasing use of natural gas, or the use of natural gas locally in the future, such as in county, or other, vehicles. Yard waste may also have value when converted to compost or mulch or used for bulking material at an anaerobic digestion facility, depending on local markets.

C&D debris may represent market opportunities, depending on its composition. Although various paper products make up a significant portion of the waste stream, their value has been reduced enough during recent market trends that the capture and diversion of that material may not provide enough revenue to justify the processing cost now or in the near future. OCC remains to be a valuable commodity if it is clean, and it represents 8 percent of the waste stream. However, future recyclable commodity markets remain uncertain and highly dependent on contamination rates.

5 Next Steps

As discussed above, managing the solid waste in Pinellas County requires participation in commodity materials and energy/fuel markets. Markets are subject to changes in supply and demand and over the 30 year planning horizon, things will change. The current disruption in the materials markets is not the first time that prices have tumbled and resolution of the impacts may take some time. However, there is need to stay the course. Longer term initiatives will be driven by the need to reduce generation and conserve resources. One such initiative on the horizon is the concept of sustainable materials management, which will help shift the production cycle from a one and done to a more

circular economy, where materials are reused and repurposed several times. There are near term opportunities and longer term possibilities that warrant closer examination as part of this Master Plan. Based on the conditions described above, the following represent potential opportunities for consideration/vetting as we proceed with the Master Plan process.

5.1 Increasing the Quality/Quantity of Marketable Materials

The recyclable commodity markets appear to be depressed for the foreseeable future, so planning efforts will need to consider the significant reduction in revenues from historical highs. As discussed above, China's National Sword contamination requirements equate to a ban on importing any material that could contain contamination. Investment in additional sorting infrastructure to improve the quality and quantity of the material may be required which will increase the cost to process in the near term. As commercial recyclables cannot be controlled by a local government per state law, the most likely source of clean OCC would be a market area not controlled by the County. The state of the export market places additional emphasis on the importance of supporting expanding the domestic end user infrastructure.

Inert C&D material diversion (concrete, brick, asphalt) is clearly an attractive outlet depending on market conditions/disposal fees. Depending on the market for aggregates and the cost of separating the materials or creating incentives for haulers to separate them, the processing and marketing of inert materials can be financially attractive, as evidenced by the amount of C&D recycled. The County currently does not control the collection, processing or disposal of C&D debris other than the small amounts delivered to the Disposal Complex. The quantities of C&D recycled/diverted reported are significant. It may be that no change in current practices are warranted.

Recovery of additional metals/ enhanced reuse of ash is an area that shows promise. The waste to energy industry has seen considerable activity in this area over the past few years, including here in Florida. The County is actively considering options related to this initiative.

5.2 Alternative Energy Markets

Even though the state does not have Renewable Portfolio Standards (RPS), the demand for renewable energy is on the rise. To the extent that the amount of waste available for processing at the County's Waste-to-Energy facility exceeds the processing capacity (currently ~ 930,000 tons per year), taking into account expansion of existing diversion programs and potential implementation of additional programs targeting, for example organics, one possible option the County could consider evaluating is diverting biomass to energy (as fuel for cement /coal replacement, as wood burner/power or for use in smaller institutional energy complexes). There are nine cement production facilities in Florida, with CEMEX in Brooksville and Suwannee American in Sumterville being the closest and a dozen biomass facilities, the closest being the CEMEX facility in Brooksville. High Btu value materials could be extracted from the waste stream in excess of the processing capacity at the existing facility and marketed as a renewable fuel in the alternative energy market. C&D debris and yard/brush/grove/orchards may also be a rich

source for biomass, and biomass is one of the largest components of the potentially recyclable materials in the waste stream. Also, low grade paper and MRF fines that are no longer marketable in China could be blended with other high Btu materials to use in the alternative energy market. Implementation of such an initiative would likely involve a public private partnership to develop the additional processing capacity capable of producing the engineered fuel and confirmation that the technology and market demand are adequate to support project financing. Ultimately, any potential alternative will need to be evaluated and compared to the existing system.

Food waste is a significant component of the potentially recyclable materials in the County's waste stream. Since federal incentives for transportation fuels are still in place this would encourage food waste to CNG using Renewable Identification Number (RIN) and Renewable Energy Credit (REC) funding to improve the financial terms. One potential option to consider is diversion/processing of food wastes into fuel/energy.

5.3 Programs

Implementing new processing infrastructure (be it a MRF, a mixed waste processing facility, a composting facility, a fuel production facility or a metals processing facility) can benefit from economies of scale. Partnerships within the County (i.e. among municipalities and with private sector businesses), and Tampa Bay region to help provide sufficient supply of the feedstock may be needed to support project feasibility/financing.



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