SMART TECHNOLOGY EFFICIENCIES GOVERNMENT

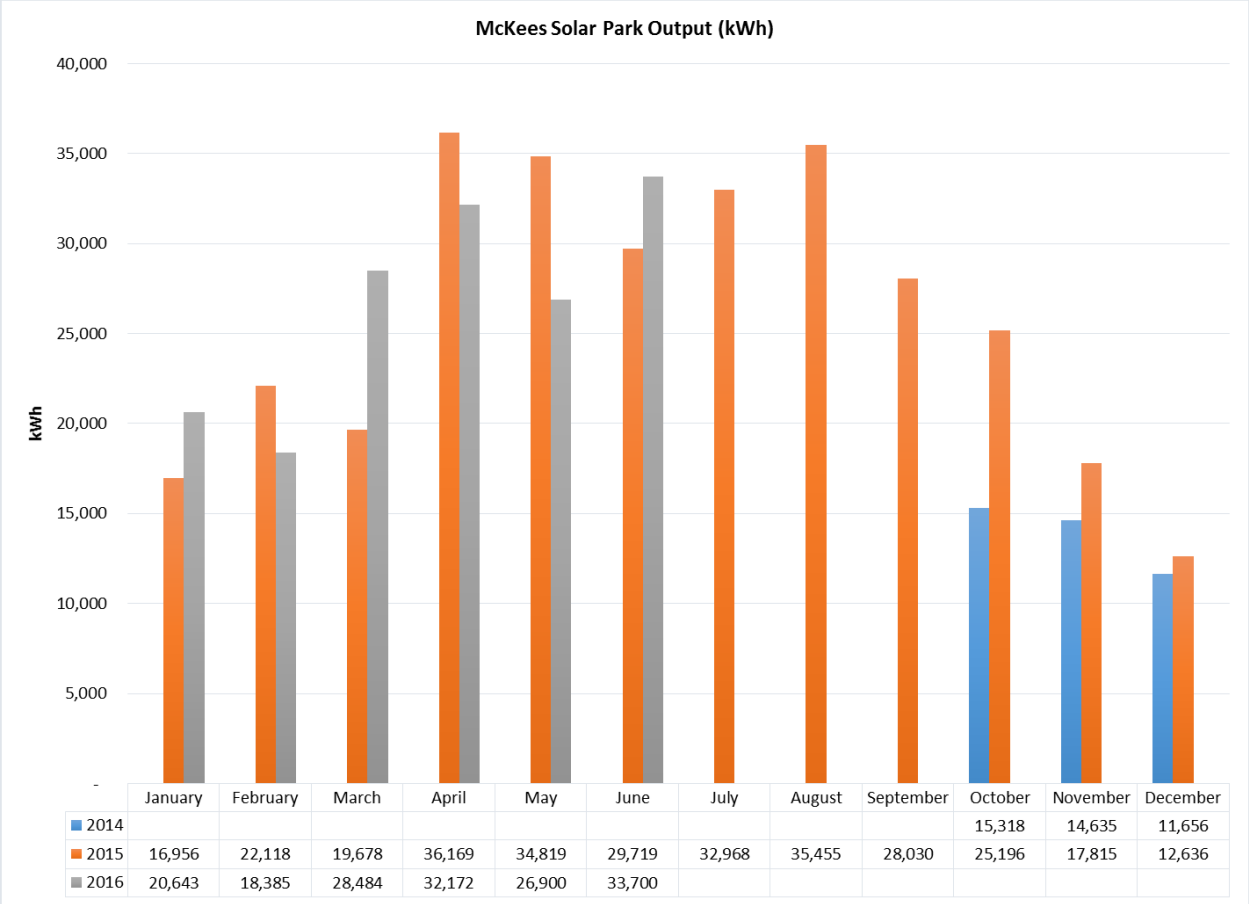
CITY OF NEWARK, DELAWARE
CAROL HOUCK, CITY MANAGER

McKees Solar Park

McKees Solar Park is a 3.91-acre former municipal landfill and brownfield site off East Cleveland Avenue, which was redeveloped for the purpose of creating a 230-kilowatt solar farm using funds from Newark's Green Energy Program and donations from residents in the community. This behind-the-meter, renewable power source serves all residents by reducing the City's peak power demand, lowering the wholesale cost of power, generating solar renewable energy credits, bringing locally produced green energy to the City's electric users, and reducing the City's carbon footprint. The 900-panel array produces enough electricity to power approximately 26 to 36 homes, depending on the season.

The project, which was supported by Newark's Conservation Advisory Commission and the public, was initially approved by City Council in 2012. Following construction of the park, official operations began in October 2014.

Since then, McKees has functioned on a consistent basis. The graph below displays the kilowatt-hour (kWh) production each month since inception.



	January	February	March	April	May	June	July	August	September	October	November	December
2014										15,318	14,635	11,656
2015	16,956	22,118	19,678	36,169	34,819	29,719	32,968	35,455	28,030	25,196	17,815	12,636
2016	20,643	18,385	28,484	32,172	26,900	33,700						

For every 1,000 kWh produced by McKees, the City generates one Solar Renewable Energy Credit (SREC) that it sells to the Delaware Municipal Electric Corporation for $50. Since McKees went online, the City has received $24,150 for the SRECs generated by the solar park while bringing a 50 year old brownfield back to usefulness. In addition, McKees has received another $9,570 in donations from our solar-conscious community. In total, the City has accumulated $33,720 for future green energy community projects as of June 30, 2016.

Going forward, the City is able to use the McKees Solar Park as a means to assist in the funding of future community green energy projects through the sale of SRECs. Residents and businesses alike will benefit from this project for many years to come.

Smart Utility Meters

In 2012, Newark's PWWR Department determined the need to replace a large number of water meters due to age. This requirement brought a renewed interest in considering the move towards smart meter technology. Additional research and auditing occurred and it was determined the installation of smart meters for both water and electric customers citywide could provide increased revenue from water sales due to improved accuracy, operational cost savings, and a base for a limited Wi-Fi mesh throughout the City.

Through the implementation of the new smart meters, the City of Newark sought to achieve:

- More efficient and frequent water and electric meter reading;
- Organizational efficiencies and reduced operating costs;
- A public website with up-to-date utility usage information;
- Increased opportunities for leak detection (reduced waste);
- Outage management improvements (increased reliability); and
- Greater in-field operation capabilities.

To kick-off the project, an Advanced Metering Infrastructure (AMI) meter reading solution was recommended and installed by Honeywell. The AMI system included remote meter reading capabilities for nearly 10,000 water meters and 12,000 electric meters. Both the electric and water meters are equipped with a transmission device that broadcasts meter reading data via a mesh network. This data "hops" to a centralized aggregation point in the network (Gatekeepers). The Gatekeepers transmit the meter reading data via a direct-wired connection to a gateway. The network then transmits the meter reading data to the City's home server.

The mesh AMI system is comprised of 16 Gatekeepers and 31 repeaters. The repeaters and Gatekeepers were installed by the City's Electric Department personnel. In addition, each installed electric meter can function as a repeater.

A. Water Meters

This project included the replacement of analog water meters with nearly 10,000 Sensus Meters to improve the accuracy of our meter reading system by eliminating errors inherent in the old meters along with eliminating misreads and re-reads. With the upgraded meters, leaks are detected and found faster, which reduces water loss and the resulting lengthy investigations and negotiations with customers over disputed bills. Additionally, we are able to perform remote ending and starting meter reads. Continuous leak detection is conducted and is a component of sound water utility conservation measures.

B. Electric Meters

The project included the replacement of electric meters with nearly 12,000 Elster smart meters that allows for the elimination of misreads and re-reads. Remote turn off and on capabilities were also gained and now provide operational efficiencies and improved customer service.

This project also included installation of a wireless mesh network for Newark that is now used by the City for various private municipal wireless applications. This aspect of the project also included seven additional security cameras and 52 mobile routers. The service area coverage is 9.5 square miles within the City boundaries of Newark.

Honeywell, through MeterSense Solutions, installed a meter data management system with a web portal that provides utility information directly to our residents and business owners. Newark's customers are able to log on to a secure website to access their bill, payment and consumption histories, log service calls, review and pay accounts. In addition, not only has it been serving our utility customers well, it has improved City operations.

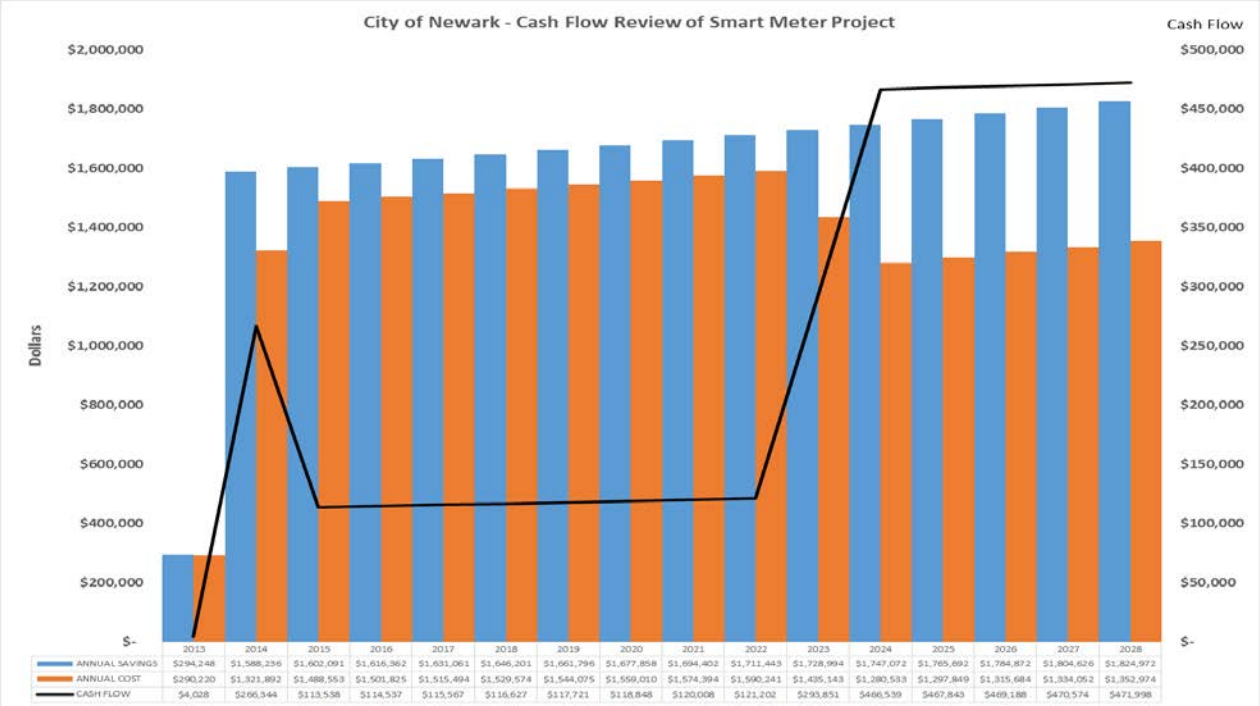
The total project implementation cost was $11.7 million, financed through a tax-exempt lease and enhanced by American Recovery and Reinvestment Act funds (ARRA). Operational savings and increased accuracy generated from the smart meters are being utilized to offset the costs associated with the installation of the new meter system. Meter accuracy is still expected to generate an additional $20.6 million revenue over the fifteen year financing term for the project. In addition, another $5.2 million will be realized from operating and maintenance cost avoidance. Combined together, the improved accuracy revenues and cost avoidance savings are estimated to total $25.8 million over the same fifteen year period. This results in a net positive cash flow of $3.8 million after offsetting debt and operational costs of $21.9 million.

In order to confirm water meter performance, annual performance audit reports (measurement and verification or M & V) are required through the City's performance contract with Honeywell. The first year's M & V, which covered the period of August 2014 to July 2015, showed our water meters were outperforming Honeywell's guarantee of 98% and hitting the best case scenario of the original approved cash flow model. The second full year of M & V received this fall will provide adequate detail to fully update the cash flow model. We look forward to sharing more information at that time. Below is a summary of year one performance results, as provided by Honeywell:

	Unit of Measure	**Previous Water Meters**	**New Meter Guarantee**	**New Meter Actual**
Water Meter Accuracy	% Accuracy Minimum	89%-96%	98%	100%
Water Meter Reliability	Monthly # of Acceptable Non-communicating Meters		115	45*

* Average of monthly non-communicating reports

Cash flow for the term of this project is further evident in this chart below. This project consistently displays a positive cash flow from the beginning of the project to the end of the fifteen years. Once debt is paid off, the cash flow generated from the smart meters will grow larger, while still encouraging conservation in relationship to improved awareness. Likewise, a decision to discontinue measurement and verification (customary after several years of positive experience) can save an additional $60,000 to $78,000 a year beginning in 2018.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
ANNUAL SAVINGS	$294,248	$1,588,236	$1,602,091	$1,616,362	$1,631,061	$1,646,201	$1,661,796	$1,677,858	$1,694,402	$1,711,443	$1,728,994	$1,747,072	$1,765,692	$1,784,872	$1,804,626	$1,824,972
ANNUAL COST	$290,220	$1,321,892	$1,488,553	$1,501,825	$1,515,494	$1,529,574	$1,544,075	$1,559,010	$1,574,394	$1,590,241	$1,435,143	$1,280,533	$1,297,849	$1,315,684	$1,334,052	$1,352,974
CASH FLOW	$4,028	$266,344	$113,538	$114,537	$115,567	$116,627	$117,721	$118,848	$120,008	$121,202	$293,851	$466,539	$467,843	$469,188	$470,574	$471,998

Bigbelly Solar Powered Compactors

In an effort to divert recycling items from the waste stream, decrease the expenses related to the collection of waste from Main Street and reduce our carbon footprint by reducing overall vehicle trips, dual trash and recycling solar compactors were researched and a pilot program was conducted in 2014 to see if the anticipated results could be achieved.

When we were first contemplating this project, we had the following primary concerns:

1. Will we experience unbalanced loading rates necessitating additional collections for some of the units?
2. Will we need to pay for the software package?
3. Would we receive adequate sunlight to maintain operation on the south side of the street?
4. Will the units be vandalized?
5. Will the compacted bins be too heavy to lift?
6. Will we experience contamination of the recycling bins to a level that it would not be accepted at the single stream recycling center (more than 5%)?
7. Will the new compactors improve cleanliness downtown?

In an effort to determine the answers to the questions above, we performed a pilot study with three units on Main Street near Haines Street. This section of Main Street has historically been one of the heaviest generators, allowing us to get a conservative approximation of performance elsewhere on Main Street. We performed collections on demand based on data available through the online web portal, which was provided free of charge for one year. Based on the pilot study, we determined the compactors would, on average, only need to be collected once every eight days (concern #1). This also meant the data package would be unnecessary due to the fact that we would collect weekly at a minimum, and we would collect all at one time because it is more effective to collect them all while we are on Main Street versus going back several times every week to do partial collections (concern #2). Over the course of the pilot study, all compactors received sufficient sunlight to maintain battery strength (concern #3) and none of the compactors were vandalized (concern #4).

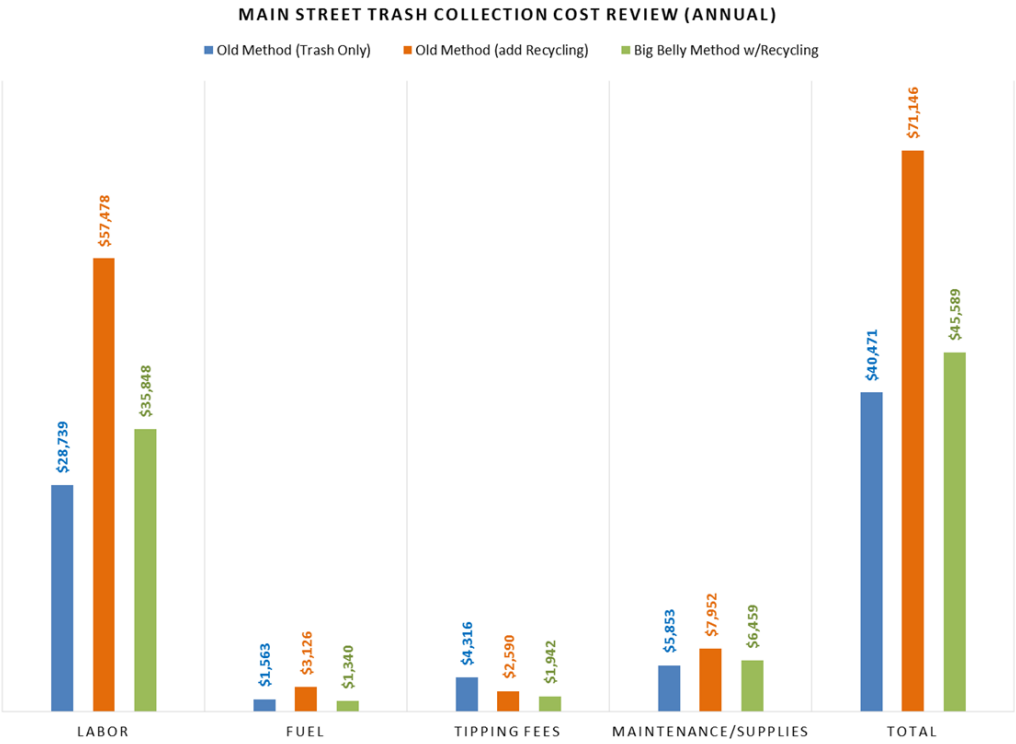
When collecting one day per week, there were times when an individual trash compactor bin could weigh as much as 80 lbs., but normally less, and always less on the recycling side. Additionally, Council provided direction at the time of approval to collect the refuse compactors twice per week to reduce the chance of a back injury (concern #5). We also learned contamination is less of a concern now than in the past, when the standard open-top recycling cans were deployed (concern #6).

With more than a full year of all units in place, we are comfortable stating that results are in line with the findings of the pilot study and that the compactors are performing as good as or better than anticipated. We had a few mechanical problems early on that were corrected under warranty, but otherwise the units are functioning quite nicely! Collection frequency has been maintained at a level of two collections per week for trash, as requested by Council, and one

collection per week for recycling as required by capacity and weight. Additionally, the new collection units have drastically improved the cleanliness of Main Street, reducing odors and spills (concern #7).

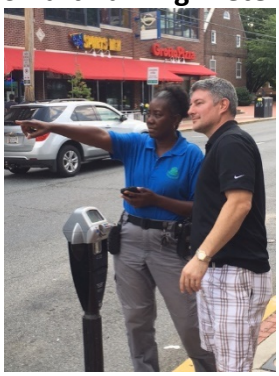
One unexpected difference is an overall reduction in collected weight based on collector feedback since switching to the compactors, which is likely due to the compactor openings being too small for businesses and residents of Main Street to fit personal trash bags into. Additionally, from time to time we find balls of cellophane wrap jammed into the opening of one compactor, which we have been able to determine are from a delivery truck. Staff has been working with the associated business to rectify the situation and have seen a reduction in frequency.

The graph below displays our annual cost for the trash and recycle collection on Main Street. Trash collection alone used to cost $40K annually. Had we continued to use the old, labor-intensive trash removal process and added recycling, the City's annual costs would have exceeded $71K. By purchasing the Bigbelly compactors for both our trash and recycling needs, we were able to add recycling to our services for nearly the same amount of money of just trash collection. The cost avoidance of continuing the old process was $25K.



The total cost of the project was just over $160K, coming in $60K under budget due mainly to the purchase of 25 units versus the 30 initially planned. After DNREC grant funding of $43K, the net cost to the City for this project was about $116K. The payback period for this project is approximately 4.5 years with the per unit minimum life expectancy of 10 years.

Smart Parking Meters



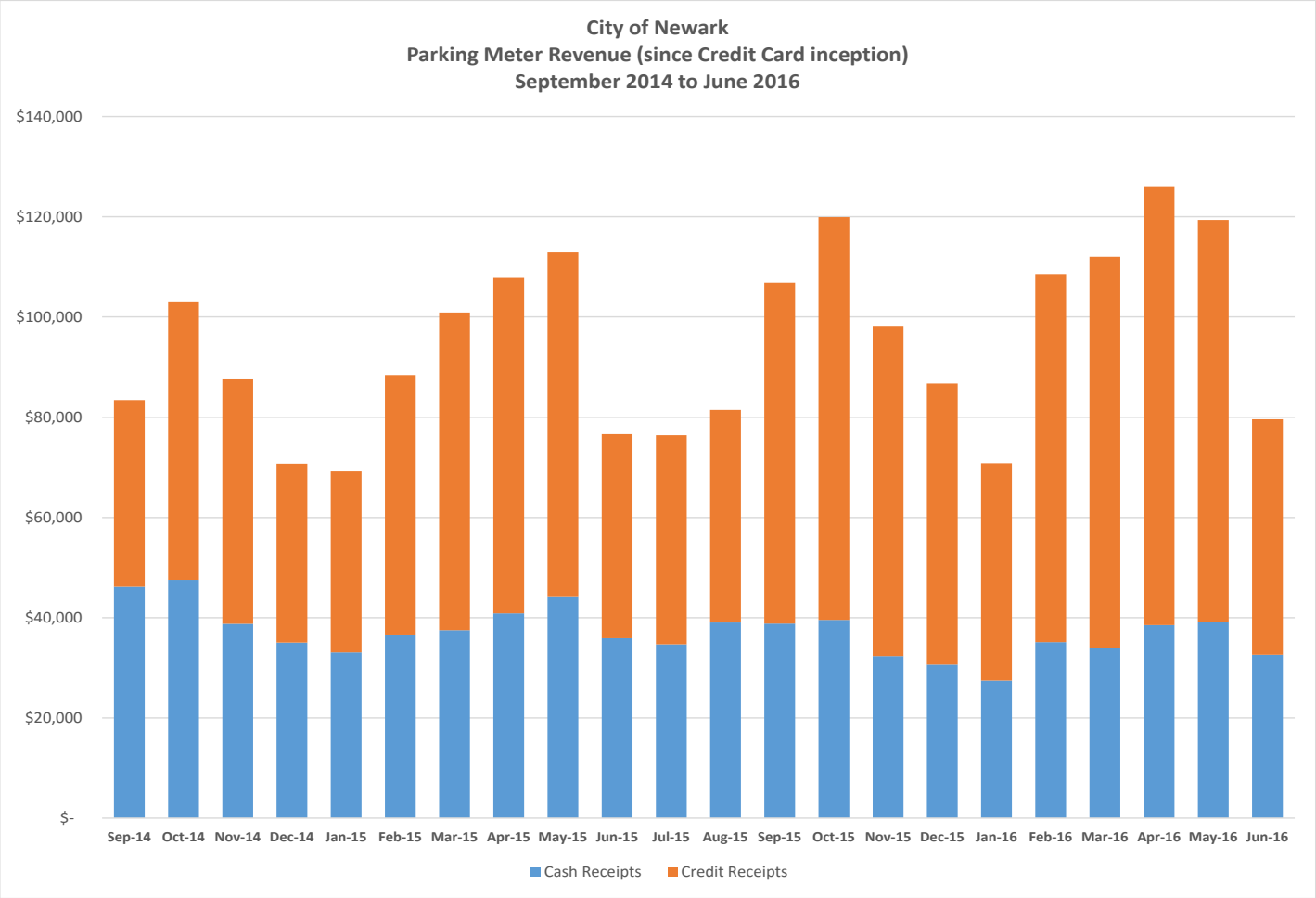
A pilot program for smart, credit card-enabled parking meters was launched on a section of East Main Street in 2014. The goal was to gauge the value of installing smart parking meters along the entire length of East Main Street to increase consumer ease by providing downtown visitors with additional payment options; allow the City to push dynamic messaging to meters throughout the year as needed; and provide the ability to collect real-time data to better address opportunities and challenges related to downtown parking.

As a result, a full complement of smart parking meters were installed by September 2014. The table and graphs below represent the data available from inception of the program through June 30, 2016.

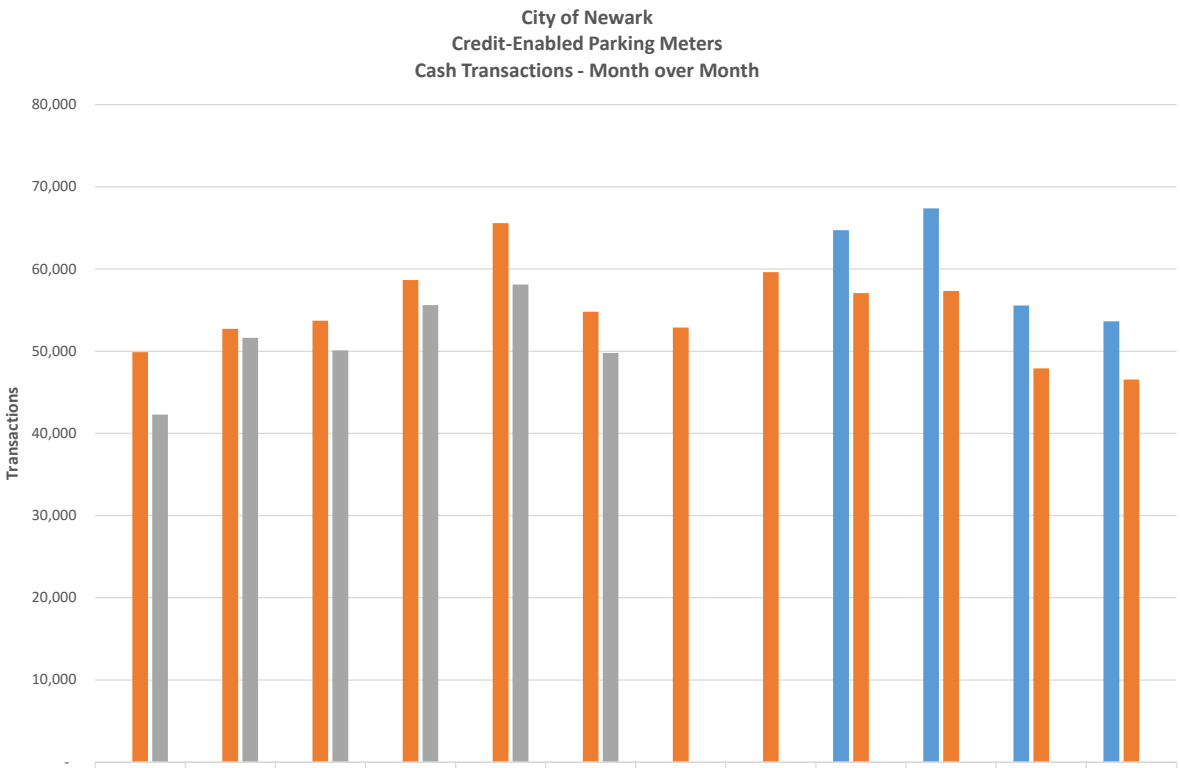
	2014 Monthly Avg. (4 months)	**2015 Monthly Avg. (12 months)**	**2016 Monthly Avg. (6 months)**
Meter Count	435	434	434
Avg. Cash Receipts	$41,887	$36,956	$34,477
Avg. Credit Receipts	$44,267	$56,827	$68,243
Avg. Monthly Revenue	**$86,154**	**$93,782**	**$102,720**
Cash Receipts %	48.6%	39.4%	33.6%
Credit Receipts %	51.4%	60.6%	66.4%
Monthly Cash Receipts Per Meter	$96.24	$85.20	$79.41
Monthly Credit Receipts Per Meter	$101.70	$131.01	$157.18
Total Monthly Revenue Per Meter	**$197.94**	**$216.21**	**$236.59**
Monthly Cash Transactions	60,319	54,729	51,252
Monthly Credit Transactions	22,297	28,063	34,077
Total Monthly Transactions	**82,616**	**82,792**	**85,329**
Cash Transactions %	73.0%	66.1%	60.1%
Credit Transactions %	27.0%	33.9%	39.9%
Average Cash Transaction	$0.69	$0.68	$0.67
Average Credit Transaction	$1.99	$2.02	$2.00
Average Transaction	**$1.04**	**$1.13**	**$1.20**

Evaluated by year, the average cash transaction remains around $0.67, but the number of cash transactions are slowly declining as more and more users are utilizing the convenient credit card feature on the parking meters. The average credit card transaction realized per parking meter in 2014 was $1.04, and has averaged $1.20 per parking event in 2016 (though the 2016 average of $1.20 may come down during the summer months).

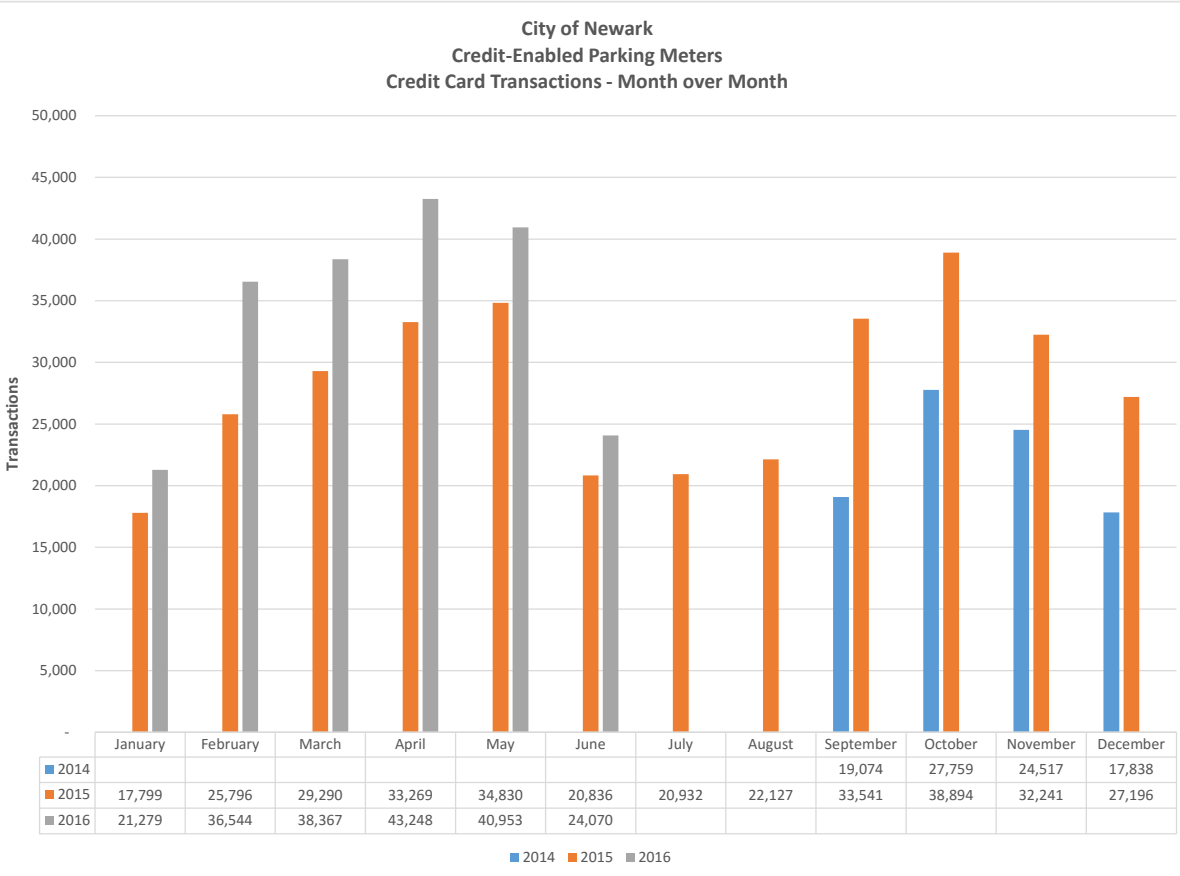
Monthly revenue has been consistent since the new meters have been installed. Credit cards account for two-thirds of the City's parking revenue, and the spread between cash and credit revenue is continuing to grow. Overall, parking revenue totaled $900,000 in 2014, $1.2M in 2015 and we are estimating 2016 to reach budget at $1.4M.



As shown in the next two graphs, the number of cash transactions are declining year-over-year and month-over-month. At no point did a month outperform the same month from the previous fiscal year for cash. On the contrary, credit card sales are showing increased activity each year and month over month.



	January	February	March	April	May	June	July	August	September	October	November	December
2014									64,714	67,373	55,550	53,640
2015	49,876	52,735	53,710	58,646	65,579	54,815	52,884	59,633	57,075	57,320	47,916	46,561
2016	42,277	51,638	50,090	55,610	58,111	49,786						



	January	February	March	April	May	June	July	August	September	October	November	December
2014									19,074	27,759	24,517	17,838
2015	17,799	25,796	29,290	33,269	34,830	20,836	20,932	22,127	33,541	38,894	32,241	27,196
2016	21,279	36,544	38,367	43,248	40,953	24,070						

In addition, the parking meters are extremely reliable devices. Since inception, the parking meters are averaging a monthly collective reliablity rate of 99.7%. Coin-acceptor blockages have accounted for 97.4% of all parking meter problems, whereas credit card reader issues have only been the problem 2.6% of the time.

Overall, the parking meters have been performing extremely well. Users and merchants have provided positive feedback, mainly due to credit cards being an accepted form of payment. Credit card acceptance is allowing users to track their expenses on their credit card statements, and they are no longer required to keep quarters with them at all times. Additionally, merchants are pleased they no longer need to be in the business of providing change to their customers to feed the City's meters.

LED Streetlights

After receiving enthusiastic support from the Conservation Advisory Commission in September 2015, and approval from Council later that fall, the LED streetlight replacement project began in December 2015. Since then, our Electric department replaced 1,895 streetlights with their equivalent LED fixture. Not only are they 20% brighter, have a more even light distribution, and are a white instead of yellow light, the fixtures are saving the City $92K a year and will pay for themselves in just over six years. It should also be noted there was an upgrade for 802 fixtures from the typical 100 watt fixture on smaller roads in developments to 150 watt equivalent fixtures to improve light coverage. The picture to the right shows the increased visibility during a snow event where the LED lights were installed.

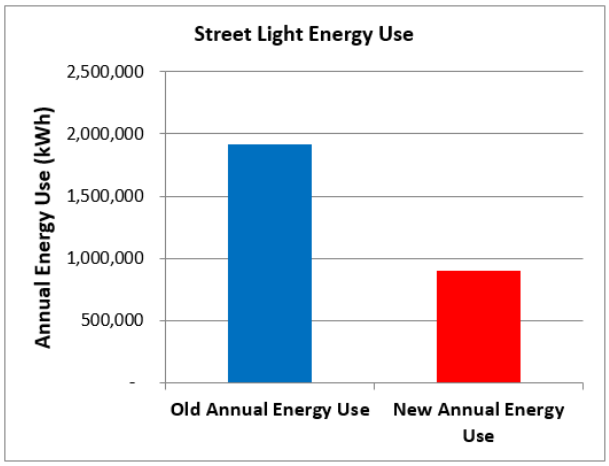
Project Summary

Total Project Cost	$ 567,212
Average Fixture Cost	$ 299

Demand Reduction (kW)	247.0
Annual kWh Savings	1,012,671

Annual Energy Cost Savings	$ 79,191
Annual Maintenance Savings	$ 12,963
Total Annual Savings	$ 92,154

Simple Payback, Energy Savings Only (Years)	7.2
Simple Payback, Energy & Maintenance Savings (Years)	6.2



In closing, I couldn't be more pleased with the outcome of our recent "smart" initiatives, and of our dedicated staff who led the projects. In summary, residents of Newark can now boast that their community:

- Brought life back to a 50+ year old municipal landfill and now have a community solar installation that will fund additional green initiatives right here in Newark;
- Installed progressive technology that allows them to proactively manage their utility usage and costs through a project that created efficiencies and is essentially funding its own implementation;
- Equipped its Great American Main Street with a more efficient, cleaner and greener refuse and recycling operation;
- Installed smart parking meters downtown, providing increased payment choices that are in line with consumer expectations while increasing efficiencies and revenue to support the General Fund;
- Replaced all of its traditional cobra head street lights within the city to increase efficiencies through reduced maintenance, resulting in an average annual savings of $92,000.

Cheers to the Mayor and Council members who championed these initiatives, the city staff that made them happen and our ever supportive and engaged citizens!