Sustainability Office

Cost considerations for transitioning Durham County operations to renewable fuels

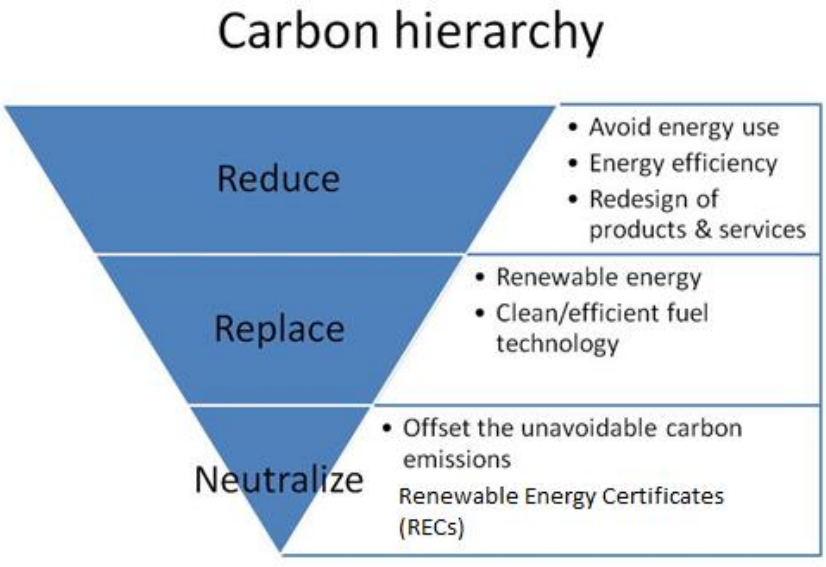
Executive Summary

This white paper outlines the major cost considerations and identifies some current costs and cost trends that might shed light on potential costs of transitioning County government operations to renewable fuels. Staff have compiled the best available information about potential costs for each type of energy the County uses – electricity, natural gas, gasoline, and diesel – as well as factors that might affect those costs. These estimates are based on current prices, trends, and expected incentives. The cost of renewable energy is expected to decrease in the next 15-30 years as technology improves and supply increases. In addition, as the County improves energy efficiency in its operations, the amount of energy needed is expected to decrease.

Major costs and trends in a transition to 100% renewable energy

The ultimate reason for transitioning to renewable fuels is to reduce carbon emissions from fossil-fuels. There are multiple strategies for achieving a transition to low or no-carbon operations. As shown in figure 1 below, there is a hierarchy for prioritizing actions starting with reducing energy use through efficiency, then replacing carbon-based energy with renewables, and finally offsetting carbon emissions that cannot be reduced or replaced.

Figure 1: Carbon hierarchy



Southwest Environmental & Energy Management Groups Carbon hierarchy

Efficiency – Energy efficiency is the lowest cost opportunity for meeting environmental and renewable goals as well as saving tax payer dollars.[1] Improving energy efficiency of buildings, water systems, and fleets should be a priority.

Renewable Electricity Generation – Changes in technology, market forces, financing options, and state legislation have decreased the cost of on-site solar generation significantly and all indications are that costs will continue to decline. Cost estimates based on current and near-term technologies range significantly. Constructing photovoltaic (PV) solar systems for the County to cover current electricity use could cost about $20 million, not including costs to purchase land, if needed, on which to put panels. The rapid decline of the price of utility-scale renewable electricity production and the fact that most existing fossil fuel-based power plants will need to be replaced before 2050 make it likely that market forces will drive a broader market-wide transition to renewable electricity, thus the cost of the transition will not fall entirely on the County.

Offsets – As shown in figure 1 above, Renewable Energy Certificates (RECs) are best used to make up the increment between what can be offset through efficiency or renewable energy generation/purchases and the set goal. For example, if the County were able to install solar PV to generate 70% of its electricity needs in 2030, then it could consider purchasing RECs to cover that last 10% to reach our 80% overall goal. To cover 10% of today's electricity use would cost the County about $4,650 annually. To cover all current electricity use would cost the County about $46,500 annually at today's pricing.

RECs are not a one-time purchase. Most entities using RECs to meet emissions or renewable energy goals buy them each year to cover that years' energy use. Though the prices for RECs will change, the trend has seen significant declines over the past eight years.

Natural Gas – Renewable natural gas (RNG), also called biogas, is just in its infancy as relates to it as a replacement for petroleum natural gas and is not available to PSNC customers at this time. This market is expected to change significantly over the next few decades. National prices for RNG are about four times more expensive than what the County is paying for natural gas. The County were to build a biodigester to create RNG to use in our facilities and vehicles, that could cost many tens of millions of dollars, though there could be grants available to defray that cost and partnerships with the City, Duke University, and private companies could reduce the cost to any particular entity.

Gasoline and Diesel – The largest cost for transitioning the County fleet to renewable fuel is the cost to replace the vehicles with electric, natural gas or propane (if biogas could be created or procured). This cost depends on the cost availability of suitable replacements, the rate of replacement, and grants. About 20% of diesel use could be replaced with biodiesel for non-emergency vehicles, at an additional cost of about $0.04/gallon. This would be no more than $3,800 for the County per year in additional costs. Cary and Wilmington are currently

[1] http://www.greenbuildingadvisor.com/blogs/dept/musings/energy-efficiency-pyramid

running all their diesel vehicles except fire apparatus on B20. Raleigh is using B20 in 379 vehicles.

Background

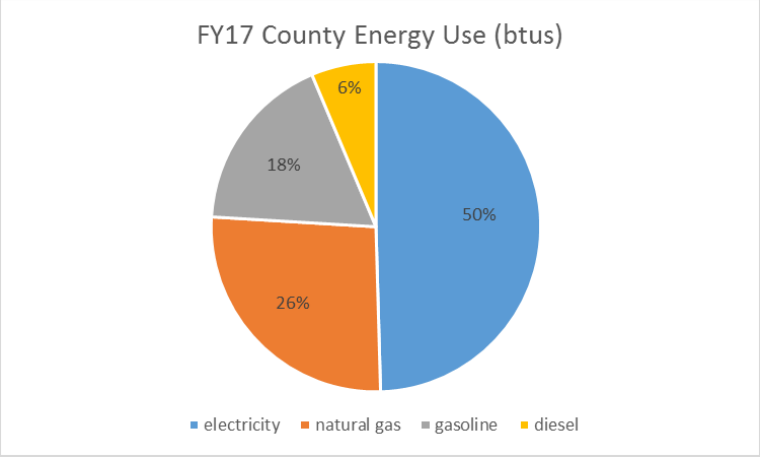
Some version of a renewable energy resolution has been adopted by at least 13 other NC communities and almost 100 communities around the country. Staff researched the communities in North Carolina that have adopted some version of a renewable energy resolution and found none that currently have a plan or cost estimate, though some are now working on a plan. Outside of NC there are a handful of communities that have plans for achieving 100% renewable energy goals and much can be learned from these communities as Durham County develops its own plan. These communities are united in wanting to make a statement about the importance of transitioning towards a more sustainable energy future. Energy policy is set at the state level in North Carolina and utilities are regulated through the NC Utilities Commission. Thus, local communities have limited choices regarding how they procure energy sources.

The County has a commitment to reduce greenhouse gas emissions from operations by 50% by 2030. These goals will help reduce the amount of renewable energy needed and transitioning to renewable energy will help reach our carbon reduction goals.

Increasing energy efficiency/decreasing demand in all aspects of government operations serves the triple purpose of decreasing utility costs, reducing negative environmental impact, and reducing the amount of renewable energy that needs to be generated or purchased. The County does not currently have a complete assessment of what its overall opportunities are for increasing efficiency and what it would cost to achieve those efficiencies. However, this should be an important part of a renewable energy plan and the update to the Greenhouse Gas Emissions Reduction Plan.

The County uses four major types of energy: electricity, natural gas, gasoline, and diesel fuel. Each of these fuels have different options for being replaced by renewable energy.

Figure 2: Energy use by type and cost



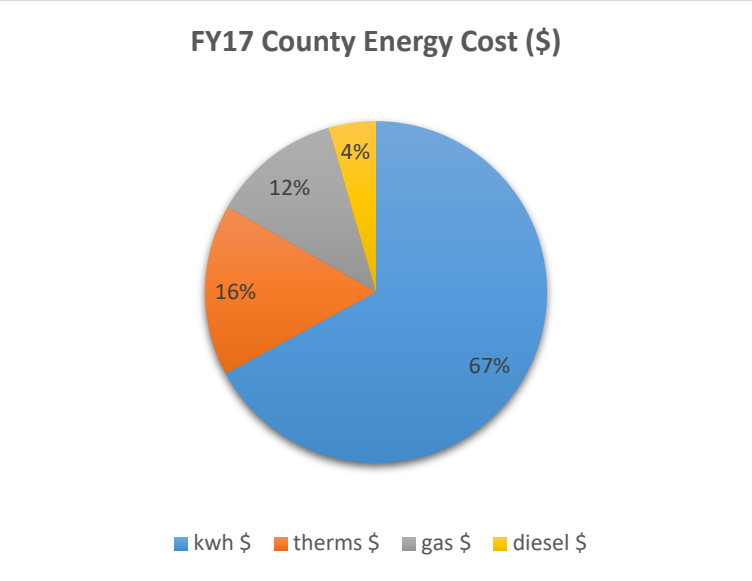
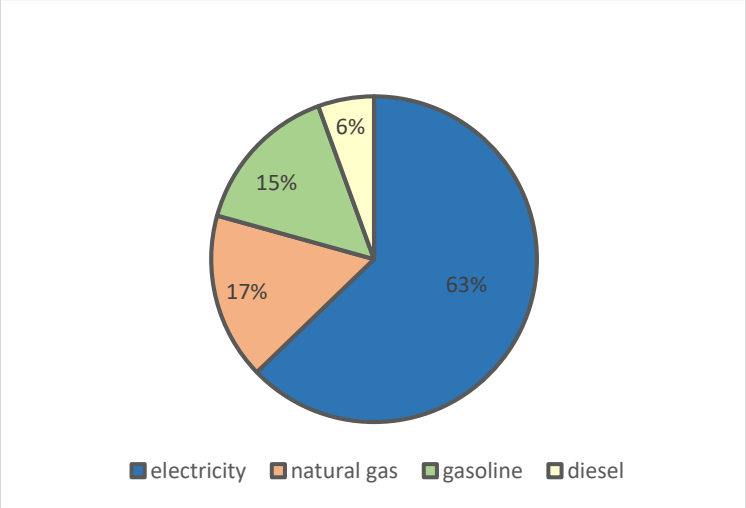


Figure 3: Greenhouse gas emissions by fuel type



Electricity

Electricity is the largest component of energy use (btus), energy cost, and greenhouse gas emissions from County operations (see fig 2 and 3). It is also the easiest energy source to transition to renewable energy. In fact, discussions about transitioning to renewable fuels often prioritizes switching to electricity from other fuels and then using solar or wind to power those needs (e.g. vehicles, heat pumps, water heaters, etc.). The National Renewable Energy Laboratory (NREL) has released studies showing the expected efficiency improvement in commercial space heaters and other equipment that would make it more cost effective to use electricity for some applications that are currently powered by natural gas.[2]

[2] https://www.nrel.gov/docs/fy18osti/70485.pdf

Using renewable electricity could be accomplished in a combination of six options:

1) **Produce renewable energy on-site and use it directly in our facilities, while also maintaining a utility connection.** This would most easily be achieved through installation of solar photovoltaic panels (PV) on government property. This might be rooftops, parking lots, or other open spaces like the closed landfill. To use this energy directly in buildings would require that the PV systems be very near to the facilities using the energy. These facilities would interconnect with the electric utilities in a net-metered arrangement. Under net-metering, any energy not used in the facility would be pushed back onto the regional grid, with a positive/negative balance reflected in monthly billing.

2) **Produce renewable energy on-site but sell it all to the utility.** Again, this is most easily achieved through installation of solar PV on government-owned rooftops, parking lots, or other open spaces like the closed landfill. These facilities would interconnect in a "buy-all/sell-all" arrangement whereby all the PV-generated electricity would be sold to the utility and not used in a facility at all, and a separate metered connection would be retained for grid-purchased power. This is less financially optimal for the County because the wholesale rates are low and Duke does not want to enter into small agreements for wholesale electricity.

3) **Produce renewable energy on-site and use it directly in our facilities, but sever the connection to the utility.** Like the first option, this "off-grid" arrangement would most easily be achieved through installation of solar PV on government property, but would require significant capital and operational investment in battery storage systems to hold energy for non-daylight hours. Again, suitable site-adjacent spaces could host the equipment, but the overall installed PV capacity and cost would need to be higher than the facility demand to produce excess energy to be stored. Due to the battery storage and the over capacity of the system, this would be more expensive than option 1 or 2 above.

4) **Purchase Renewable Energy Certificates (also known as Renewable Energy Credits or RECs).** RECs are a way to commoditize the environmental attributes of renewable energy. A REC is created when a megawatt-hour of renewable energy is generated and delivered onto the grid. With the acquisition of RECs comes the right to say that you are sourcing renewable energy. This renewable energy could be created anywhere in the country and from various sources including solar, wind, biomass, hydropower, and landfill to methane. A variety of third-part entities exist to verify REC legitimacy. This is the easiest and most common way that entities meet renewable energy goals once they have maximized efficiency and affordable on-site generation. However, the County would have to purchase RECs on an on-going basis so the cost would be reoccurring, so this option is best to off-set the margin of energy used that cannot be generated or purchased directly. It is also important to make sure that the renewable energy represented by the RECs is additional generation and not just left-over energy that would have been

generated without buying the RECs.

5) **Buy into a community solar project.** The regulatory allowances and requirements for this option are yet to be determined; community solar programs are currently under consideration by the NC Utilities Commission, so this option is still a bit up in the air. Once the parameters of this offering are determined, this will allow for a third-party developer to build a medium to large-scale solar project on private property and sell shares in the project to people and entities that want to offset electricity use with renewables. This arrangement allows for greater project efficiency than having many entities build their own systems and allows entities that do not have sufficient land or roofs on which to install PV to access solar. One benefit is that these projects can be larger than what might otherwise be possible on our own property. One downside is that the systems would be remote from our operations and, therefore, less visible or direct. It is likely this would be more expensive than building our own PV or buying RECs due to transaction costs and 3rd party developer costs.

6) **Work with a developer to build a utility-scale solar project, sell the energy to the utility (either Duke Energy or one of the state's cooperative Electric Membership Corporations), but in the transaction, retain the RECs for the County to claim.** This could take the form of a land lease to a solar developer, for which the County receives the REC and/or some cash payment for hosting the solar PV equipment. This option is potentially attractive because it allows a project to take advantage of utility-scale economics and any under-utilized land. The City and County conducted an Industrial Land Study in 2013, which could potentially be used to prioritize land that is not attractive to industries due to lack of infrastructure, distance from transportation routes, proximity to residential areas, etc. Similar to option 5 above, this option is in flux. The NC Utilities Commission is currently weighing the program rules around how the state's electric utilities must interconnect and compensate solar developers for renewable energy generation.

<u>Natural Gas</u>

Natural gas is the second largest component of the County's energy use (btus), cost, and greenhouse gas emissions. The options for transitioning natural gas to renewables are currently more limited and more expensive than they are for electricity, though this market will change in the next decade or so. There are three options for a transition from natural gas use:

1) **Switch from natural gas to electricity, where possible.** This is not an option for every use of natural gas, but it could be an option for some uses (e.g. hot water). Because it is easier to source electricity from renewable sources, this would make that transition easier and less expensive. Switching from natural gas to electricity would require changing equipment and that would have costs associated with it. It would be possible to accomplish some of this through a phase out program whereby a policy is in place to replace older natural gas equipment with electrical models as that equipment ages out, thus only

incurring the incremental cost of a new electrical model over a new gas model, where such exists. There may also be additional costs to upgrade electrical panels to handle a larger demand.

2) **Purchase biogas, or biomethane, once it becomes available.** Biogas is usually generated through aerobic digestion or decomposition and then cleaned of impurities before being added to existing natural gas pipelines. Sources of biogas could be landfills, animal waste from concentrated animal feeding operations, or biosolids from wastewater. Once it is in the pipeline, biogas can either be used directly as "renewable natural gas" (RNG) or burned to create renewable electricity. North Carolina's Renewable Energy Portfolio Standard (REPS) requires that Duke Energy generate 0.20 percent of its retail sales from swine waste by 2023. Duke University recently committed to increasing its use of biogas to meet their carbon neutrality goals.[3] Both of these factors are creating a market for RNG that will hopefully spur increased supply that could benefit all of Durham if Durham County chooses to purchase it.

3) **Generate our own RNG and burn it in our facilities to offset traditional natural gas use, in partnership with the City.** Taking this to scale would require building and operating a larger biodigester either with our own employees or through a contractor. Biosolids from wastewater would be a likely candidate fuel for the biodigester. The City and County produce about 5,100 metric tons of biosolids at the 3 waste water treatments plants per year. Depending on the type of biodigester and other factors, this could generate about 151,260 therms worth of energy per year. This is about 14% of what the City and County currently use per year put together.

   Raleigh is in the process of building a biodigester at the Neuse River Resource Recovery Facility at a cost of about $90 million. They received a $50 million low-interest loan from the state for the project. The methane generated at the facility will power the plant and may also be used in vehicles or put into the natural gas pipeline. This project also helps address the issue of biosolids disposal, thus reducing associated costs.

<u>Gasoline and Diesel Fuel</u>

Gasoline and diesel fuel are used in the County fleet and equipment. Together they make up almost a quarter of the County's energy use (btus) and greenhouse gas emissions (see fig 2 and 3). There are a few renewable energy options for vehicles and equipment, but replacing existing fleets and equipment would be expensive, though it could be achieved over time as vehicles and equipment are replaced. There are five options for transitioning fleets:

1) **Increase fuel efficiency through behavior change and purchasing more efficient vehicles.** The fleet is the best opportunity for improving efficiency to reduce the amount of fuel used overall. This can be accomplished through better driver behavior and purchasing vehicles that get higher miles per gallon.

[3] https://today.duke.edu/2018/04/duke-delays-plans-chp-plant-focus-biogas-options

2) **Purchase more electric vehicles.** As with natural gas, switching from fossil fuels like gasoline and diesel to electricity, which can be sourced from renewable options more readily, is one option. There are more electric vehicle types being introduced each year and costs are coming down. Those trends are expected to continue.[4]

3) **Use biofuels.** Diesel vehicles and equipment could be run on biodiesel, though general best practice calls for a B20 blend (20% biodiesel and 80% petroleum diesel). While some vehicles and equipment can be run on B100 (100% biodiesel), that can have some repercussions on warrantees and tends to be a problem when using old equipment that has been using petroleum diesel for years and may result in higher maintenance costs. B20 can be purchased off the state contract but there is no state contract for B100.

   There is a second-generation biofuel called renewable diesel (RD), which is made from many of the same feedstocks as biodiesel but is produced through a different process. RD has the same properties as fossil fuel diesel so it can be used at any blend in any diesel vehicle and even at low temperatures, which is not true for traditional biodiesel. The RD industry is still in its infancy and the product is difficult to procure outside of California.[5]

4) Gasoline vehicles and equipment do not have a ready renewable alternative. **Vehicles that are manufactured to run on E85 ethanol (called Flex Fuel Vehicles or FFVs) can be run on 85% plant-based ethanol.** There is currently about a 15% price premium on E85 compared to regular gasoline.

5) **Some gasoline and diesel vehicles can be converted or purchased from the manufacturer to run on natural gas.** These could be operated on RNG. Raleigh is considering using RNG as they already have natural gas vehicles in their fleet.

[4] https://www.fleetcarma.com/5-electric-vehicle-trends/ and https://cleantechnica.com/2017/12/25/timeline-electric-vehicle-revolution-via-lower-battery-prices-supercharging-lower-battery-prices/ and https://www.forbes.com/sites/energyinnovation/2017/09/18/the-future-of-electric-vehicles-in-the-u-s-part-2-ev-price-oil-cost-fuel-economy-drive-adoption/#7f456705345c

[5] https://www.gladstein.org/the-potential-and-challenges-of-renewable-diesel-fuel-for-heavy-duty-vehicles/

Options for transitioning different fuels to renewables

Electricity	Natural Gas	Gasoline	Diesel
Efficiency	Efficiency	Efficiency	Efficiency
On-site PV, net metering	Switch to electricity	Switch to electric	Switch to electric
On-site PV, buy-all/sell-all	Purchase biogas	Ethanol (E85)	Biodiesel (B20)
On-site PV, off-grid	Generate biogas	Biogas	Biodiesel (B100)
RECs			Renewable Diesel
Community Solar			Biogas
Utility scale PV			
Purchase through Duke Energy			

Cost Estimates

There are several factors that will impact the cost of achieving 80% renewable energy by 2030 and 100% by 2050. **As written in the resolution, a plan would need to be completed to determine the best, most equitable and cost-effective path forward.** Once that plan is complete, the County would have a better idea of what the costs would be based on that path. Some of the factors that will affect the cost are:

- Amount of each type of energy used in our operations in the future. The County has made great strides in reducing energy use in buildings since 2009, even as additional square footage is added to the portfolio. However, there has been increases in energy use in water systems and fleets. How much the County invests in increasing efficiency and reducing waste will affect how much it pays for energy in the future, regardless of what type of fuel it is.

  How aggressively the County switches from natural gas, gasoline, and diesel to electricity when that technology is available and affordable will also determine the cost and level of effort needed to reach renewable energy goals. Electricity is currently the easiest and least expensive fuel to purchase from renewables. Over time, it is likely renewable options for other fuels will become more available, although their costs may not be as competitive as renewable electricity. With solar projects, costs can be locked in for long periods of time, which would be difficult to do with the other fuels.

- Cost of renewable energy in the future. All credible estimates show that the cost of renewable energy will decrease in the next few decades while the cost of fossil fuels will increase. The cost of solar PV has dropped 50% in the last five years while efficiency has increased. The cost of battery storage decreased by 32% between 2015 and 2016 and is expected to drop 8% per year through 2022.[6] Biogas is just making its way into the market, but as it scales up through regulatory requirements as part of the REPS and market forces (more demand for renewable natural gas will spur more supply), the cost is expected to decrease over time.

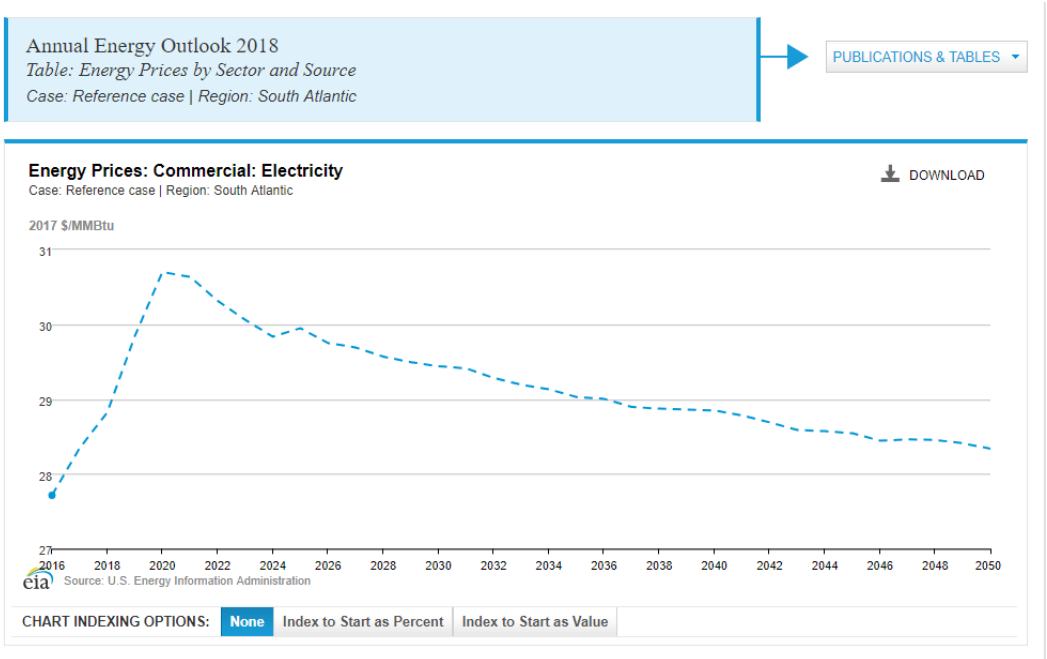
[6] https://www.utilitydive.com/news/not-so-fast-battery-prices-will-continue-to-decrease-but-at-a-slower-pace/518776/

The National Renewable Energy Laboratory reported that fuel economy for all types of on-road vehicles is expected to continue to increase while the cost of electric versions of these vehicles is expected to decrease through 2050.[7] However, none of the scenarios that were modeled showed cost parity with combustion engine vehicles until 2050. The cost of maintenance for all-electric vehicles is estimated to decrease due to the fact that they have fewer systems to maintain (no transmissions, no oil changes, etc.). However, there will be upfront costs to install charging infrastructure for these vehicles and training staff to service them.

- The mix of renewable energy provided by Duke Energy and PSNC. The NC REPS requires utilities to provide renewable energy and energy efficiency for 12.5% of its retail electricity sales by 2020. The utilities are currently producing less than 5%. Assuming the utilities fulfill these requirements, the County will benefit by having the percentage of its energy supplied through renewable resources.

Part of this analysis also has to include the estimate of business as usual – not transitioning to renewable energy. The cost of traditional electricity energy is estimated to increase between now and 2030. By locking in more stable rates either through purchasing solar PV systems or entering into long-term leases, the County can avoid future electricity cost increases. Though it is impossible to forecast energy costs out to 2030 or 2050, the Energy Information Agency's Annual Energy Outlook for 2018 shows a steep increase in electricity cost in the near-term and then a slow decrease, but still to a price point higher than it is now.

Figure 4: Electricity cost outlook



Source: EIA.gov

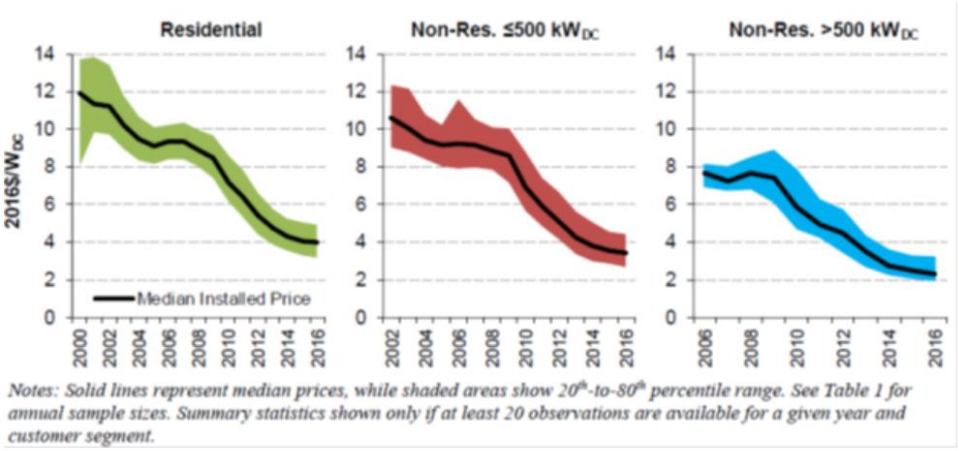
[7] https://www.nrel.gov/docs/fy18osti/70485.pdf

Electricity

The County used about 31 million kWh (31,000 MWh) of electricity in FY17 at a cost of $2.4 million. This includes electricity used in buildings, lights, wastewater systems, and vehicles.

The renewables market is changing rapidly throughout the country and especially in North Carolina. Across the country, solar PV costs have decreased by more than 50% in the last five years.[8]

Figure 5: Price of solar electricity over time



Median installed price per watt of self-supplied solar arrays (Source: Lawrence Berkeley National Laboratory)

In particular, North Carolina House Bill 589, which was passed in summer of 2017, made some significant changes that have already brought down the cost of solar and will have further impact on purchasing renewable electricity. Of particular note for the County:

- Duke Energy has a new rebate program for solar installations for non-profit organizations and local governments. The rebate is for $0.75 per watt up to $75,000 (for a 100kw system). There are caps on how much Duke Energy has to allow each year and the program is only set for 5 years, so there is no guarantee that the funding will be available for County projects. The sooner the County acts, the more likely it would be to get some rebates. Staff are currently evaluating properties to prioritize which might be good opportunities for solar installations.

- HB589 authorized leasing programs for solar PV. This would allow the County to have solar PV installed on our facilities with no up-front cost and to be able to purchase the systems outright for a lower cost after the terms of the lease are over. Because this is a new program, prices for leasing panels still need to be approved by the Utilities Commission.

[8] https://www.seia.org/solar-industry-research-data

- Community solar is another new option authorized under HB589. Because this is a new program, there are no cost estimates on how much a share of a project would cost.

- The Green Source Rider program has been expanded through HB589 to include existing customers (it formerly was only for new customers). Customers who have at least 1 MW of demand at one facility or 5 MW demand throughout NC can contract long-term for renewable energy. The costs for this are yet to be defined. In general, this has not been the most cost-effective way to source renewable energy in the past.

If the County wanted to generate electricity from solar PV, it could take advantage of one or more of the programs mentioned above. Depending on which incentive is used, the prices could be lower than the estimates below. These estimates are for large-scale, commercial solar farms. The range given shows the difference between density of solar panels on the farm.

- To meet the County's current electricity needs (19MW) by solar PV, one would need about 112-185 acres of solar panels with today's technology. This would cost roughly $20 million with today's pricing, assuming the County did not have to purchase additional land.

In addition, as noted above, the County can buy RECs on the open market for all or some of our electricity use. The cost of RECs has declined sharply over time.

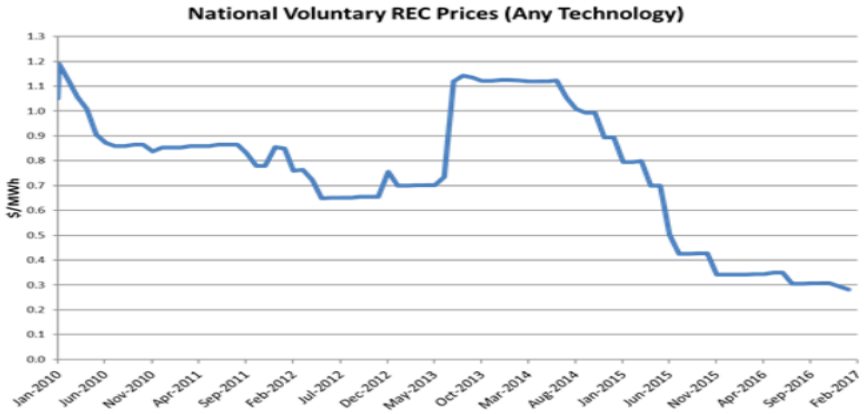


Figure 3: Voluntary national wholesale REC prices (Source: National Renewable Energy Laboratory)

- Prices for RECs vary based on the type of renewable energy, market demand, and size of purchase. The least expensive RECs are wind recs from the middle of the country (TX, OK, KS, etc.) and are currently around $0.80-$0.90 per REC when purchasing at the volume of the county. However, these RECs are inexpensive in part because they are from excess electricity generation, not additional generation, therefore not creating additional environmental benefit. North Carolina solar RECs are around $1.50 per REC and are considered to be more preferable in terms of supporting new generation. The estimates below are for all of the County's current electricity use. However, as mentioned above, buying RECs should be reserved for covering electricity that cannot be offset

through efficiency or on-site renewable generation.

- If the County wanted to buy RECs to offset all current electricity, it would cost somewhere in the range of $24,800 - $27,900 per year for wind RECs (or roughly 1% of the total $2.4 million electricity expenditure for the County in FY17) and $46,500 for NC solar RECs (roughly 2% of the County's FY17 total electricity expenditure). **If the County wanted to buy NC solar RECs to cover 10% of its electricity use, that would cost about $4,650 per year.**

Natural Gas

The County used 564,085 therms of natural gas at a cost of $579,459 in FY17.

Renewable natural gas prices have recently been around $20/mmbtu.[9] At this price, it would cost the County approximately $1.4 million per year total, if it could access the fuel. PSNC does not currently have a tariff for RNG and is not supplying it or know of any NC suppliers. There is an RNG standard in front of the NC Utilities Commission and once that is approved it will clear the path for more RNG production. As previously mentioned, it is expected that as the supply for renewable natural gas grows and the technologies improve, the prices will come down.

Raleigh is in the process of building a biodigester at the Neuse River Resource Recovery Facility at a cost of about $90 million. They received a $50 million low-interest loan from the state for the project. The methane generated at the facility will power the plant and may also be used in vehicles or put into the natural gas pipeline. This project also helps address the issue of biosolids disposal.

Gasoline and Diesel

The County used 312,900 gallons of gasoline at a cost of $435,300 and 98,700 gallons of diesel fuel at a cost of $159,600 in FY17. The fleet has a combined efficiency of 8.82 mpg for gasoline vehicles and 1.62 for diesel vehicles. The County is paying roughly $0.23/mile for gasoline vehicles and $1.44/mile for diesel vehicles just in fuel costs. There are two electric vehicles in the County fleet.

There is a great opportunity to increase fleet fuel efficiency to decrease the amount of fuel used and greenhouse gas emissions. This can be achieved by purchasing more fuel-efficient vehicles, including more hybrids, and by improving driver behavior through telemetrics and training. The County is implementing some of this, but there are many opportunities to expand these efforts to reduce fuel use more.

Each year, auto manufacturers release more models of all-electric vehicles (EVs) and those vehicles have improved systems to increase range. As more vehicle manufacturers offer more types of electric vehicles (EVs), prices come down, and ranges expand, the County could purchase more of these vehicles. Maintenance

[9] Duke University is finding biogas at about $25/MMBtu for agriculture gas and less than $20MMBtu for some landfill and WWTP gas. This estimate uses the higher number of $25/MMBtu

costs for EVs is significantly less than traditional vehicles because there are fewer systems and parts to be maintained. Current EVs get about 3 miles/kWh, which comes out to about $0.03/mile in fuel costs, comparted to the County's fleet average of $0.23/mile for gasoline vehicles and $1.44/mile for diesel vehicles. Nissan has a $3,000 rebate on Leafs for Duke Energy customers in North Carolina. This would bring the purchase cost down to about $23,000 (per state contract) in comparison to about $16,500 for a non-hybrid sedan. While it is true that not all functions can be served with electric vehicles, a switch to EVs when it is financially feasible from a life-cycle perspective would help the transition to renewables, assuming the electricity is sourced from renewables.

The County could also explore leasing EVs as part of our fleets to avoid the higher cost of the vehicles and to be able to take advantage of the rapidly changing offerings. Other NC municipalities are leasing vehicles, though none that staff received information from are currently leasing EVs.

The County has invested in more fuel-efficient ambulances that get close to double the fuel economy of traditional ambulances and have idle control technologies that shut the engine off when not needed. They also have benefits that improve the safety and comfort of the crew and allow them to better treat patients on board. These ambulances need less maintenance than the older units, which saves money and reduces waste.

As noted above, the largest cost associated with transitioning fleets to renewable energy is the cost of replacing the vehicles. One exception is to switch diesel to B20 (20% biodiesel). The state contract price for B20 is about $0.04/gallon more than diesel. This would be about $3,800 more for the County (2%). Fuel prices are notoriously volatile, so this price difference is likely to vary. For example, the cost difference the week of March 20, 2018 was about 9% less than the week of May 1, 2018. Cary, Wilmington, and Raleigh are all using B20 extensively in their fleet. To use this in all diesel vehicles other than emergency vehicles would entail purchasing and installing a separate tank and identifying an appropriate tank location due to current space constraints.