Green vs Green

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CNG Conversion

Introduction

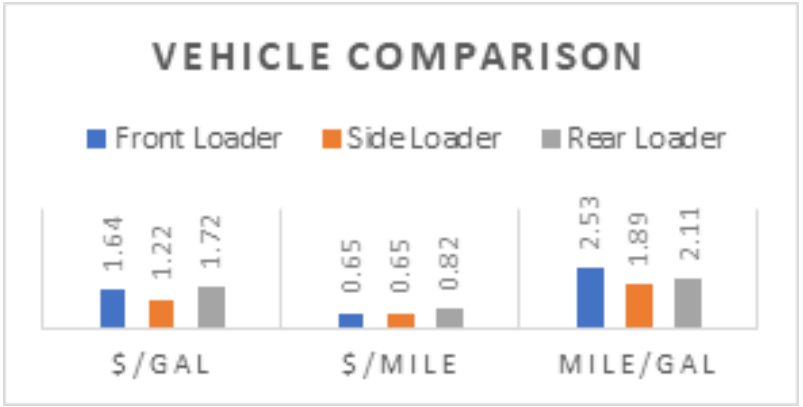
- Transportation is a critical operation
  - Diversity
  - environmental, social and economic impacts
- Sustainable metrics
  - Fuel type *
  - Emissions
  - Costs per gallon/ costs per mile
- City of Scottsdale has made significant investments in alternative fuels for their government fleet vehicles.
  - Reduce environmental impacts
  - Higher capital costs but long term economic benefits
- Interested in quantifying some of the benefits and tradeoffs.
- For this report we focused on CNG and solid waste trucks

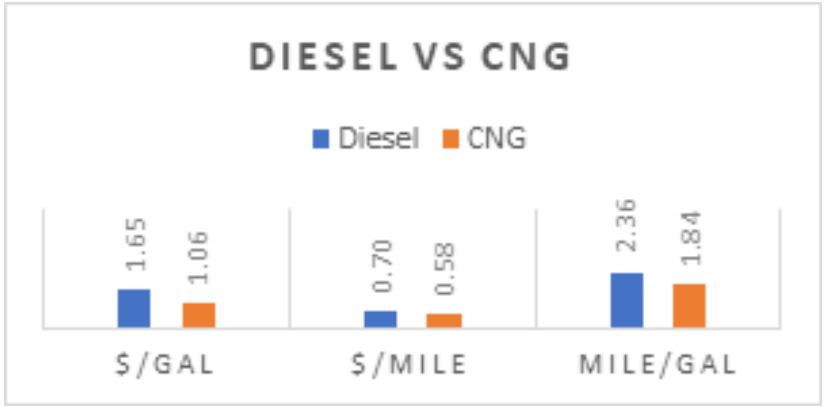
Diesel vs CNG

- Buying Costs
  - Incremental cost of CNG solid waste truck is $30,294
  - Average life span is 12 years
- Maintenance costs
  - CNG compared to Diesel shows a cost increase and a cost decrease
- Market Factors
  - Natural Gas prices are stable and relatively low, while diesel prices are volatile

Tempe Case Study

- Side loaders had the least cost per mile and per gallon over for FY 2016-17 primarily due to 70% of the category being run on CNG.
- Running on CNG reports 36% and 20% reduction in cost per Gallon and cost per mile.





Denver Case Study

- Total fleet: 1098 vehicles and 198 vehicle classes
- 491 and 16 vehicle classes identified for possible CNG part replacements
- Average miles travelled by trucks: 5468 miles/year – Better returns on more miles
- Fuel price of $1.55/ gasoline gallon equivalent for CNG - 259 vehicles in 38 vehicle classes would get paybacks without any grants or incentives – ROI 5.1 years with average saving/ vehicle = $3,486.
- Cumulative saving/vehicle over a lifetime - $429,555 (based on CNG tank configuration)

USDE Report - Business Case for CNG

- Analyzed the profitability of converting fleet vehicles to CNG
  - Used VICE Model (CNG Vehicle and Infrastructure Cash-Flow Evaluation)
  - Analyzed 3 vehicle types
    - Waste Trucks, Transit Buses, School Buses
- Results
  - Larger transit and refuse fleets (75+) tend to be profitable and resilient
  - School buses are only economically viable when paired with other vehicles run on CNG

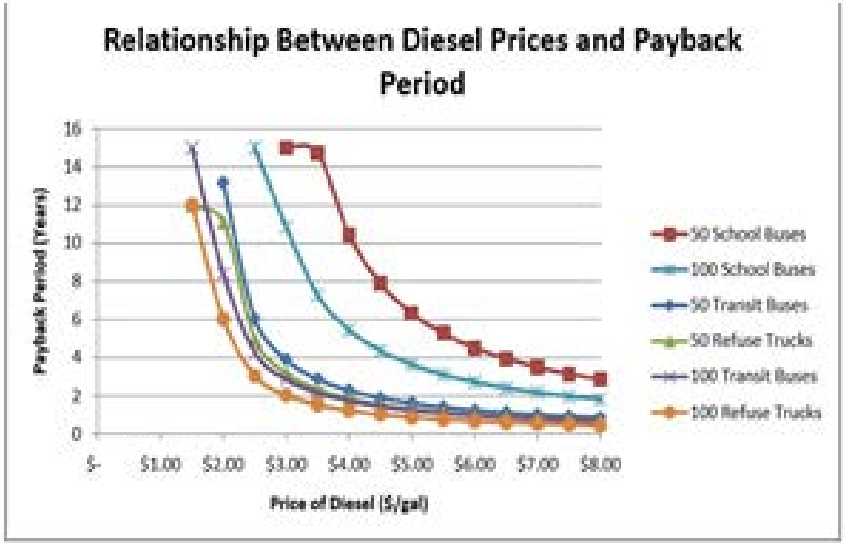


Figure 10. Relationship between diesel prices and payback period

Recommendations

- Gradually phase out diesel vehicles for CNG at the end of the vehicle's life cycle.
- Large Transit and refuse fleets (75+) that are run on CNG tend to be more profitable and resilient.
- Maintain diversity of fuel types within fleet
  - Different vehicle types run more efficiently on different alternative fuels
    - Large buses and Trucks - CNG & LNG
    - Vans and Vocational Trucks - diesel/electric hybrids
    - Smaller vehicles (Admin and police) - electric or hybrids
- Apply to Federal Tax credits
- Scheduling waste pickups efficiently by getting more miles on newer trucks running on CNG than older ones running on diesel due to better mileage and lower costs on the former

Energy Efficiency

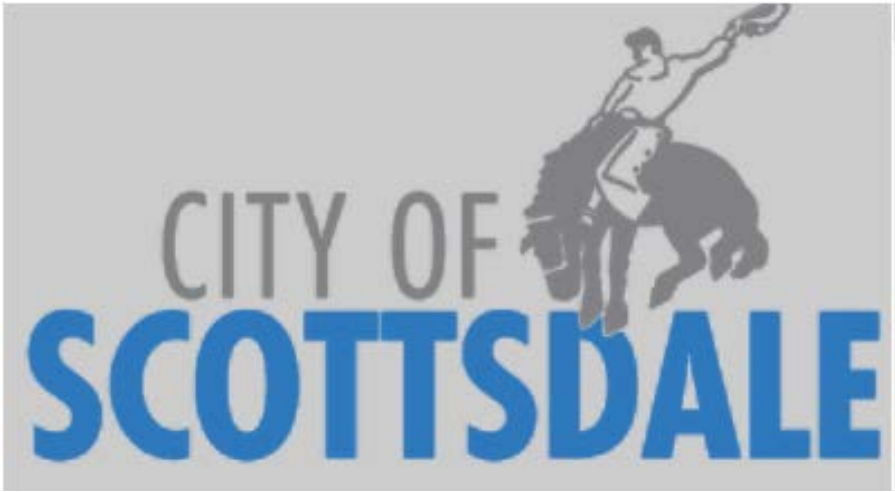
Introduction

Energy Efficiency

- They have recently been implementing HVAC system upgrades and tankless water heaters in public buildings.
- interested in research on potential cost savings and pay-back periods for their investments in these improvements.

Current Practices

The City of Scottsdale has recently been investing in improving their energy efficiency by replacing traditional water heaters with tankless water heaters and they have been replacing their HVAC systems with more efficient systems.



Data Analysis

Eight locations identified that could benefit from energy efficiency improvements.

Location	***Concern***
Cactus Park	*One meter, no meter on the pump house*
Chaparral Park	*No meter on the ballfield lights*
Eldorado Park	*No meter on the Boys and Girls Club*
Mtn View Park	*No meter on the ballfields*
Paiute	*Eight buildings one meter only, we rent out two to the buildings*
Scottsdale Ranch Park	*No meter on the tennis court lights*
Grayhawk Park	*No meter for either the tennis courts or the ballfield lights*
Indian School Park	*Only metered on Club Sar and the Giants Training Center*

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Recommendations

- To install sub-metering capabilities on the eight identified locations.
- There are 2 different recommendations regarding the sub-metering of the City of Scottsdale
  - Contract with a third party to perform an energy audit to review potential areas of improvement
  - Perform an internal energy audit and install sub-metering.

Recommendations

- Contract with a third party to perform an energy audit to review potential areas of improvement
  - Investment grade audits
  - Possible guarantee return on investment
  - Long-term service contracts

Recommendations

- Perform an internal energy audit and install sub-metering.
  - Greater autonomy
  - Able to manage in-house
  - Responsible for entire investment

Veris E51C2 : Single Circuit Energy Meter

Sources

- *City of Scottsdale logo* [Image]. (2016, May). Retrieved from https://www.google.com/maps/uv?hl=en&pb=!1s0x872b0bc760b4c785:0x716cb0a9c8d38b34!2m22!2m2!1i80!2i80!3m1!2i20!16m16!1b1!2m2!1m1!1e1!2m2!1m1!1e3!2m2!1m1!1e5!2m2!1m1!1e4!2m2!1m1!1e6!3m1!7e115!4shttps://picasaweb.google.com/lh/sredir?uname%3D100263797237377765680%26id%3D6285740490525985154%26target%3DPHOTO!5stown+of+scottsdale+city+hall+-+Google+Search&imagekey=!1e3!2s-wRMyacKgaow/VztvrEAXSYI/AAAAAAAAABo/52pwVKAXsJU2M2Nm8pI4nji8ebEbpyxpgCLIBGAYYCw&sa=X&ved=0ahUKEwiN-a--teXXAhXQ-lQKHaMcCcsQoioIiAEwCg
- [Climatec]. (2015). Retrieved from http://www.climatec.com/
- [Trane]. (2016). Retrieved from http://www.trane.com/Index.aspx
- *Veris* [Image]. (2017). Retrieved from https://www.energycontrol.com/Veris-E51C2-Single-Circuit-Energy-Meter-p/E51C2.htm?gclid=Cj0KCQiA0vnQBRDmARIsAEL0M1lstFdKTexoMl89mxh4zWorYY5PE5EGpPDXMp804EVPlLQYY8bM66saAgquEALw_wcB
- Weekly Retail Gasoline and Diesel Prices. (n.d.). Retrieved October 19, 2017, from U.S. Energy Information Administration website: https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_a.htm
- CNG Truck Image from: Garbage Collection. (n.d.). Retrieved November 30, 2017, from http://www.brandonms.org/departments/public-works/garbage-collection/
- Fun Family Outings To Do Around Scottsdale. (2016, March 10). Retrieved November 30, 2017, from http://beginwithinscottsdale.com/fun-family-outings-to-do-around-scottsdale/

Sources

- http://beginwithinscottsdale.com/fun-family-outings-to-do-around-scottsdale/
- https://www.afdc.energy.gov/
- Johnson, Caley (2010). Business Case for Compressed Natural Gas in Municipal Fleet. National Renewable Energy Laboratory. USDE.
- City of Scottsdale. (n.d.). About Scottsdale. Retrieved November 21, 2017, from http://www.scottsdaleaz.gov/about
- City of Scottsdale. (n.d) “West's Most Western Town.” Retrieved November 21, 2017, from www.scottsdaleaz.gov/about/history.