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Alternative Fuel Cost Study

Prepared by:
Mathew Muller
Joseph Lucchetti
Vince Wang

05/05/2016

Introduction

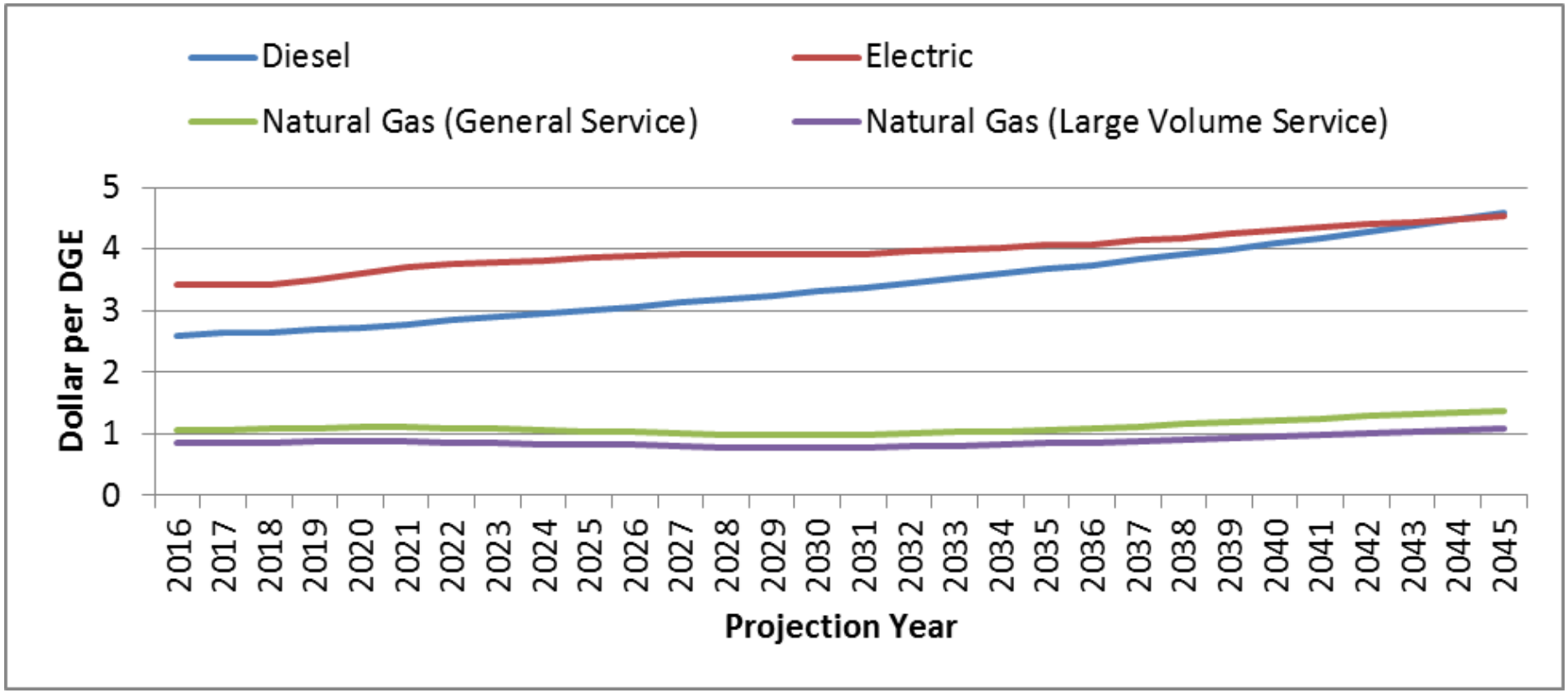
- *Purpose*:
  - Identify whether an alternative fuel source can save RTS money.
  - If savings exist determine whether they can address projected capital funding deficit.
- *Scope*:
  - 40-ft heavy-duty buses
    - Annual mileage (30,200)
    - Useful life (17 years)
  - Three alternative fuel options (plus the base diesel scenario)
    - Compressed Natural Gas (CNG)
    - Hybrid electric
    - Battery electric
  - 30 year project length
  - Primary expansion scenario of 150 buses by year 2045

Annual Cost Differential Analysis - Parameters

Parameter	Fuel Type			
	Diesel	Hybrid	CNG	Electric
Capital Cost Parameters				
Bus Price ($)	447,613	668,334	498,114	800,598
Battery Price ($)	0	0	0	80,160
Battery Service Life (years)	0	0	0	6
Operation and Maintenance (O&M) Cost Parameters				
Average Fuel Price ($ per diesel gallon equivalent (DGE))	3.31	3.31	1.01	3.97
Fuel Economy (miles per DGE)	3.66	4.01	4.40	18.80
Vehicle and Facility O&M Rate ($ per mile)	0.91	0.91	1.05	0.77
Fueling Rate (DGE per minute)	40	40	15	0

Note: All figures unless otherwise noted in this presentation are in real 2016 dollars.

Annual Cost Differential Analysis – Fuel Price Projections



Source: Derived from the U.S. Energy Information Administration and adjusted using RTS data.

Annual Cost Differential Analysis – Cost Differential (compared to diesel buses)

	Hybrid	CNG	Electric
Annualized Capital Cost Differential ($)	12,984	2,971	30,194
O&M Cost Differentials ($)			
Vehicle + Facility O&M Cost	0	4,236	-4,236
Fuel Cost	-2,420	-20,416	-20,971
Fueling Cost	-4	52	-43
Annual Cost Differential ($)	**10,560**	**-13,156**	**4,944**

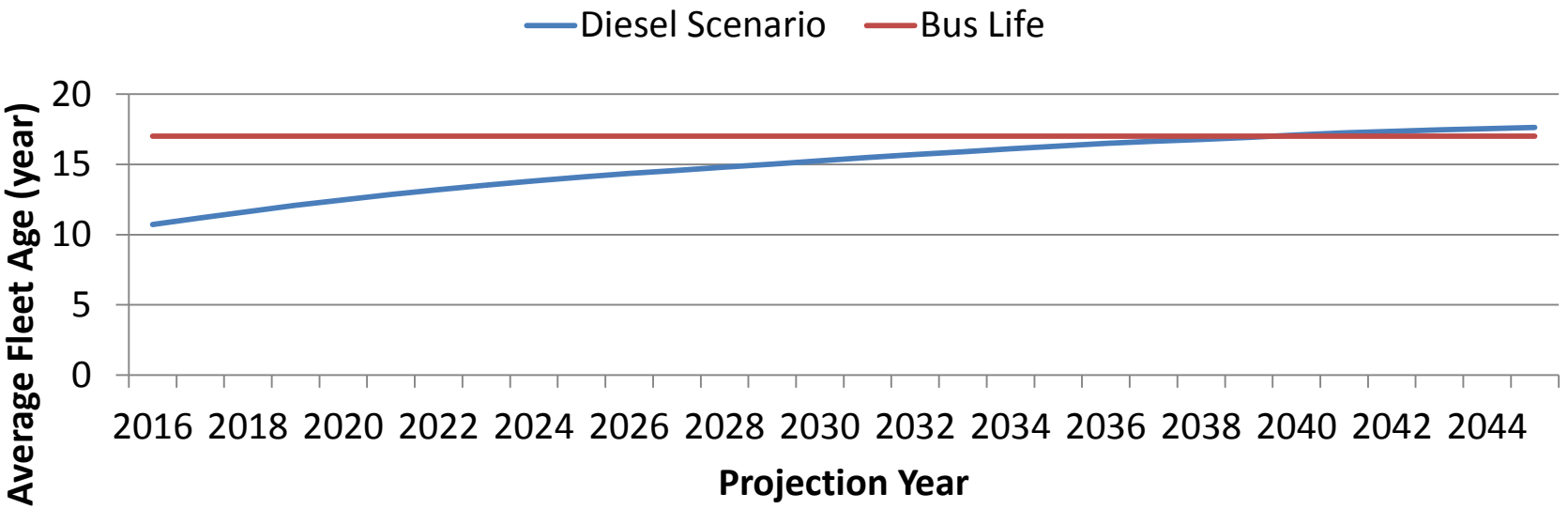
- Only CNG buses are more cost effective than diesel buses.
- Therefore it is the only fuel source considered in subsequent analysis.

RTS's Pressing Capital Need

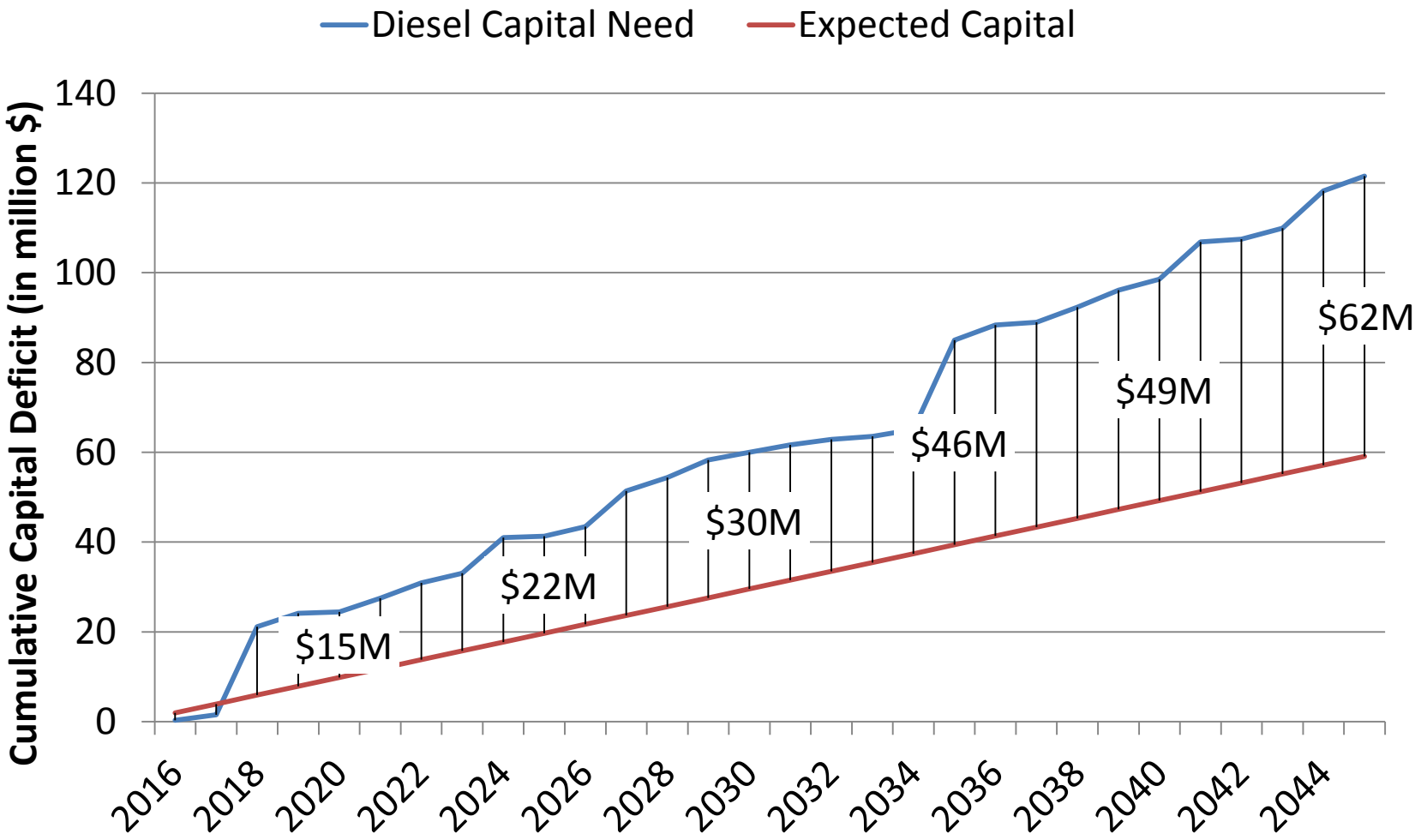
- RTS avg. fleet age is 10.8 years old. This is 4.3 years more than the average for all other similar-sized agencies.

- Maintenance costs can be as much as $0.88 more per mile for an old (≥12 years) vs. new vehicle.

- At current funding levels, RTS average fleet age is set to exceed useful life standards. This means that potentially 50% of all vehicles will be past their useful life.



RTS's Pressing Capital Need



- To replace buses at the end of their useful life (17 years), RTS needs ~$2.08 million more per year of capital funding for buses.

30-Year Cost and Financial Investment Analysis

- **Bus procurement** quantity occurs commensurate with historic acquisition behavior (average number of buses purchased annually in the past five years [$1.95 million]).

- **An additional $5M loan** is taken at the **beginning of the project** to purchase CNG buses (controlling for short-term aging issues).

- **Savings** (operating/capital differential) are used to purchase **new CNG buses** (controlling for longer-term aging issues).

- **Fixed loan payments** occur over a 30-year period.

- This strategy requires $1.9 million in additional funding in the first seven years to cover fixed loan payments before yearly fuel savings are sufficient to cover them.

Cost Categories

- *Capital costs*:
  - Fleet expansion (128→150 vehicles)
  - Fleet replacement
- *O&M costs*:
  - Vehicle and Maintenance facility O&M costs
  - Fuel costs
  - Fueling costs
- *Upfront lump sum costs*:

Parameters	Values
Staff Training ($)	5,767
External Pipeline ($)	169,538
Facility Conversion ($)	4,364,355
Total ($)	**4,539,660**

Financial Investment Analysis

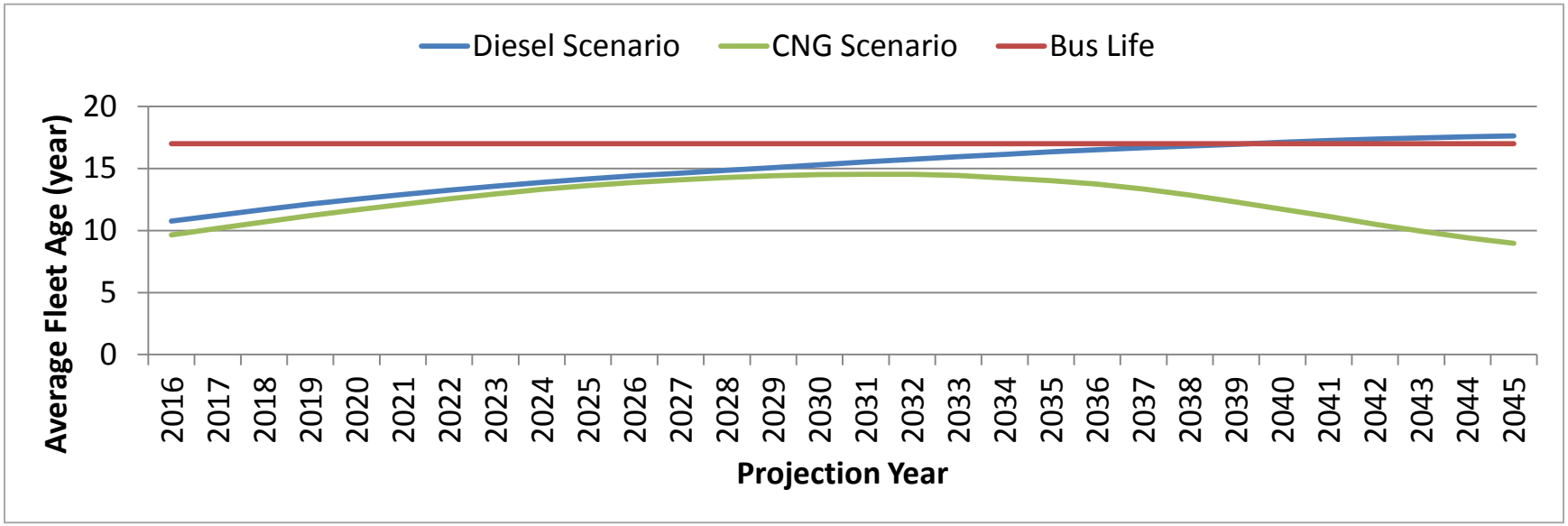
Items	Amount
Total Loan Principal ($)	9,540,000
Total Loan Interest ($)	6,691,000
Total Loan Cost ($) [1]	13,722,000
Total Savings ($)	50,452,000
Total Net Savings (savings less full loan cost) ($)	36,730,000
Project Payoff Year	2045
Year to Start Reinvesting in Buses	2023
Year Entire Fleet Becomes CNG	2040
Total Additional Buses from Savings and Initial Loans	88 (74 more than diesel)

Note:

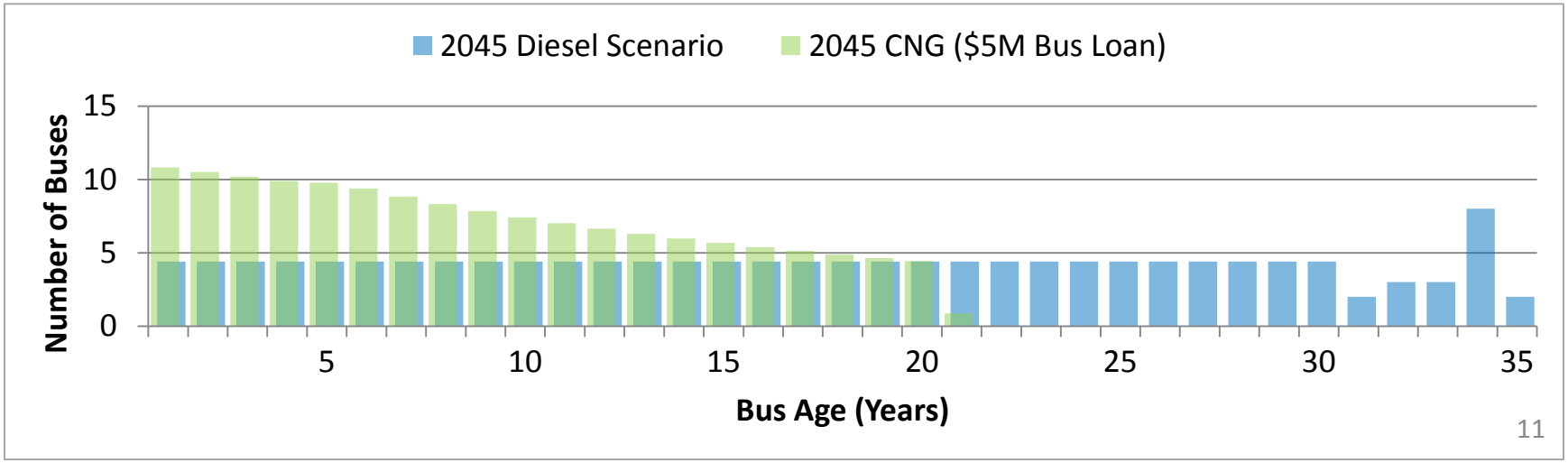
1. Loan cost does not equal principal + interest in this scenario since it includes the affects of inflation and is derived from the loan payment schedule. Specifically, (the nominal value of) loans do not change with inflation and given the duration and timing of payments a large share of the loan will be paid with “less valuable” money, i.e., a $1 today may equal $0.80 ten years later.

Fleet Age and Composition Analysis

Average Fleet Age:



Fleet Composition in 2045:



Financial Investment Analysis – Financial Metrics

- *Net Present Value (NPV)*:
  - The sum of Present Values (both inflows and outflows) in all future years for a given scenario, including initial loan amount and repayment schedule.

- *Internal Rate of Return (IRR)*:
  - The discount rate that makes the NPV equal to zero.

- *Return on Investment (ROI)*:
  - The total gain (savings obtained by converting to CNG) minus the total cost (sum of loan payments) divided by the total cost.

- *Rate of Return (ROR)*:
  - The geometric mean of the ROI over the project duration (30 years).

Financial Investment Analysis – Financial Metrics

Loan Size (million $)	Average Change in Average Age (years)	NPV[1] (million $)	IRR (%)	Adjusted[2] ROI (%)	Adjusted ROR (%)	Years to Annual Profit > Payment	Cost Before Savings Cover Payments (Real 2016 million $)
0	-2.1	26.43	28.9	619.6	6.8	6.0	0.7
5	**-2.6**	**23.51**	**20.0**	**267.7**	**4.4**	**7.9**	**1.9**
10	-3.0	20.55	15.8	157.4	3.2	9.0	3.2
15	-3.4	17.62	13.1	103.5	2.4	10.0	4.5

Notes:

1. The study used the City's weighted average cost of capital of 3.75% for the discount rate.
2. "Adjusted" means adjusted for inflation. The study used the 10-year average of 1.8%.

Conclusion

- CNG buses are the cost-effective alternative to the current diesel-dominant RTS fleet.

- Transitioning to this fuel source will also help to mitigate and eventually solve the aging fleet issue that will likely grow more severe as federal funding diminishes.

- The costs presented are an indication of the annual savings differential between scenarios. The savings in any one year critically depends on the reinvestment of prior savings into more CNG buses. If profits are not spent in this way, these savings will not occur.

- All efforts were made to build results from conservative assumptions but the energy sector is inherently prone to fluctuations and risk that are difficult to fully account for.

Recommendations

- Regardless of whether CNG is pursued allow RTS to use surplus funds (when available) for capital replacement.

- Allow RTS to apply for applicable capital grants.

- Allow RTS to issue a Request for Proposals (RFP) to evaluate implementing CNG fueling through a public-private partnership (P3).

Questions/Comments?