Alternative Fuels
Technical Assistance Program

TransNet
SUBURBAN TRANSIT NETWORK, INC.

Suburban Transit Network: TransNet

ALTERNATIVE FUELS, VEHICLES & TECHNOLOGIES FEASIBILITY REPORT

Prepared by Eastern Pennsylvania Alliance for Clean Transportation (EP-ACT)
With Technical Support provided by: Clean Fuels Ohio (CFO); & Pittsburgh Region Clean Cities (PRCC)

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Analysis Background:

Beginning as a small pilot program and developing into a large and diverse regional transportation resource, TransNet® has been in operation since 1980. The organization has grown by being responsive to the community and consistently delivering high quality, safe, and reliable service.

TransNet® is a transit option designed to provide convenient, low-cost transportation. Initially it focused on meeting the needs of senior citizens and persons with disabilities, doing so through exclusive relationships with existing Montgomery County taxicab companies. Today the organization is complex and comprehensive, the direct result of decisions made in the late 1980s. TransNet® serves groups of seniors and persons with disabilities, and contracts with school districts, colleges, and private companies to offer specialized transit services and commuter shuttles.

Part of TransNet's® overarching goals are Sustainability and Air Quality. Noting, that their fleet often helps people with disabilities. The converting of their fleet to alternatives to gasoline and diesel, hinge on the economic benefits, return on investment and environmental stewardship. They have added 15 vehicles that run on Compressed Natural Gas in the past 4 years, to their fleet of over 280 vehicles. Unfortunately, since they house their vehicles at 3 separate sub-contractor's locations and do not have a CNG fueling location of their own. They are often stymied by the cost in time and effort it takes to fuel these vehicles.

Suburban Transit Network or "TransNet®" has applied to The Commonwealth of Pennsylvania's newly developed Alternative Fuels Technical Assistance Program (AFTA) run by the Department of Environmental Protection seeking other recommendations for their fleet. This report is a culmination of meetings, information gathering and analysis specific to TransNet's® vehicles and fleet usage of those vehicles and best reflects recommended practices and technologies that will best help TransNet® achieve their desired objectives.

1.0: Introduction – Fleet Feasibility Analysis:

This Alternative Fuel Vehicle (AFV) Fleet Performance Feasibility Study is designed to examine the feasibility and cost-savings potentials of deploying a range of commercially available alternative fuel, advanced vehicle, and efficiency solutions in the TransNet® fleet. As with many transit agencies, the TransNet® fleet performs a range of essential mobility services for their clients, including disability services, medical assistance, school and camp transportation, ride share, shuttle services, and more. Providing these services account for large and ever-growing expenses for agency budgets, and the majority of these expenses come in the form of vehicle acquisition prices, fuel purchases, and equipment maintenance costs. However, a range of advanced vehicles, alternative fuels, and efficiency technologies are currently available and have the potential to significantly reduce both annual and lifecycle fleet operational costs when deployed in the right applications.

2.0: Fleet Management Goals – Scope of Work & Criteria for Analysis:

Eastern Pennsylvania Alliance for Clean Transportation (EP-ACT), Pittsburgh Region Clean Cities (PRCC) and Clean Fuels Ohio (CFO) are pleased to present the following detailed AFV Options and Feasibility report. This report is designed to provide the following core deliverables: 1) Detail the priority criteria and goals for the fleet in evaluating technologies; 2) Provide a baseline analysis of current fleet operations with Key Performance Indicators (KPIs) on the fleets vehicles and operations; 3) Outline alternative fuel vehicle and efficiency technology options relevant to fleet operations; 4) Assess the operating costs and other investments needed to implement the various technology options; and 5) Provide Return on Investment (ROI) scenarios and recommendations based on the analyses above. We would like to thank TransNet® for their assistance in gathering data and providing feedback for this report.

Our team has met with TransNet® and have discussed their fleet and operation of it. They have outlined a set of broad goals and criteria for evaluating new technologies for fleet operations. These criteria are outlined in the table below and used throughout this report to evaluate various technology options for the TransNet® fleet.

Priority Review Criteria for Analysis:
1. *Use life cycle cost effectiveness and return on investment projections as the primary tool for evaluating each potential fuel, vehicle technology, and station option.*
2. *Include data on environmental performance; factor into decision matrix as a secondary evaluation tool.*

We have used these criteria to evaluate alternative fuel and efficiency technologies that are most relevant and effective for the fleet's operations. In addition to these criteria, our staff have used the real-world fleet data provided by the TransNet® to create key current vehicle performance profiles. Our staff utilizes these profiles to create alternative fuel vehicle replacement scenarios, charting out similar models of alternative fuel vehicles (including cost differences, mpg differences, maintenance cost differences, etc.).

The core work in this report focuses on comparing the operational costs and return on investment between the current fleet's vehicle performance and usage profiles and various alternative fuel replacement vehicle scenarios. Finally, we have looked at the Total Cost of Ownership (TCO) and Return on Investment (ROI) based on three fuel price models (a low oil model, status quo or "median" oil model, and a high oil price model). These models come from the U.S. Energy Information Administration (EIA), which collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy's interaction with the economy and environment. A summary of the current performance of the fleet is detailed on the following page.

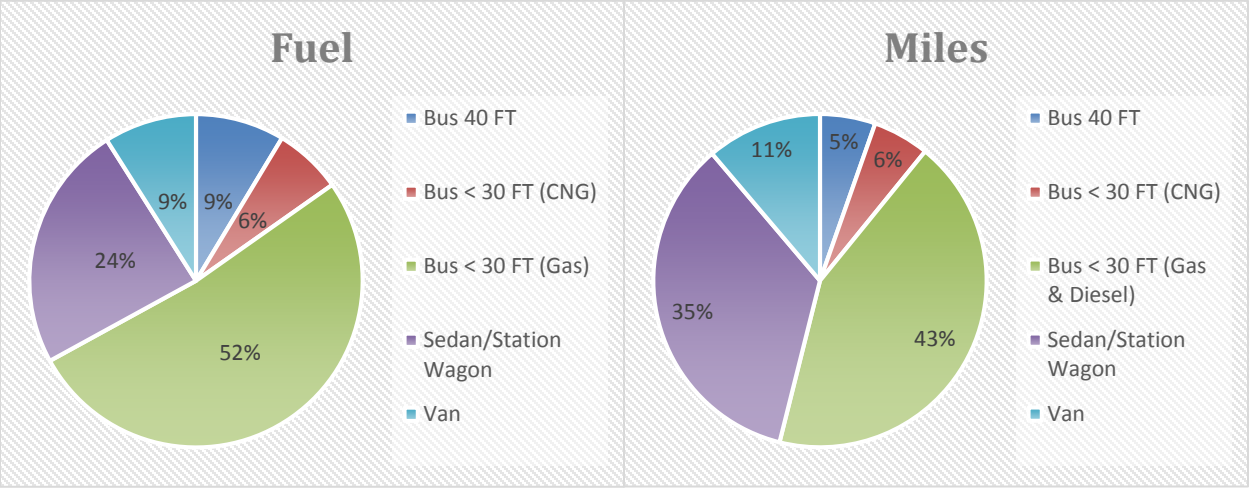
3.0: Key Performance Indicators – Existing Fleet Analysis

We generally recommend replacing vehicles at appropriate intervals to minimize fleet repair costs and maximize performance and efficiency. Therefore, our staff collected data including fleet vehicle inventory data, refueling practices data, and replacement plan data. Based on this data, we have performed a

baseline analysis and identified six key indicators that provide a summary of the fleet's current operating parameters. These Key Performance Indicators (KPIs) are designed to provide a baseline overview of current make up and operations of the fleet, as well as provide a high-level context for the recommendations outlined in the report that follows.

KPI – TransNet® Fleet Detailed Breakdown								
Vehicle Type	**Units**	**% Unit**	**Fuel**	**% Fuel**	**Avg Fuel/Unit**	**Miles**	**% Miles**	**MPG**
Bus 40 FT	4	1%	58,800	9%	14,700	352,800	5%	6
Bus <30 FT (CNG)	15	5%	44,957	7%	2,997	359,652	5%	8
Bus < 30 FT (Gas & Diesel)	132	47%	352,688	52%	2,672	2,821,504	43%	8
Sedan/Wagon	101	36%	163,339	24%	1,617	2,286,746	35%	14
Van	27	10%	61,247	9%	2,268	734,964	11%	12
Total	**279**	**-**	**681,031**	**-**	**4,851**	**6,555,666**	**-**	**9.6**

The on-road fleet vehicles can be divided into five broad categories of units and are analyzed as follows.



As the table above details, two groups of vehicles do the bulk of the work and account for most fleet operational costs, mileage, and idle hours. These fleet segments are the "Bus < 30 FT (Gas)" (52% of fuel use), "Sedan/Station Wagons" (24% of fuel use). Focusing on these fleet segments and vehicles in this priority order will offer the largest economic and environmental benefits moving forward. With this in mind, the recommendations in the report below have been specifically designed to help minimize the costs associated with the fleet's operations.

In addition to breaking down the TransNet® fleet by vehicle segments, the fleet also bases its vehicles out of six different locations serving differing client communities to meet the ever-growing transportation needs of Montgomery County. TransNet® achieves this through partnership with three private for-profit transportation companies, with six facilities that are decentralized throughout their service area. TransNet® is the County Coordinator for the Senior Citizen Shared Ride and Persons with Disabilities (PwD) programs, funded through PADOT and the State Lottery Fund. In addition, TransNet® is the primary transportation contractor for the Medical Assistance Transportation Program (MATP), Intellectual Disabilities, Office of Aging and Adult Services, and the Pennsylvania Department of Aging in Montgomery County. TransNet® also holds contracts with the Montgomery County Intermediate Unit, numerous School Districts, and a number of Colleges, Corporate Centers, and private businesses.

KPIs: Fleet Breakdown by Location

TRI Fleet: 114 Vehicles; 45% Overall Fuel Use

Vehicle Type	Number	Fuel	% Fuel	Miles	Avg Fuel/Unit	Current $/gallon avg.	Total Cost
Bus < 30 FT (CNG)	10	31,387	10%	251,096	3,139	$2.30	$72,190
Bus < 30 FT (Gas & Diesel)	59	176,322	58%	1,410,576	2,989	$2.30	$405,540
Sedan/Station Wagon	34	63,713	21%	891,982	1,874	$2.30	$146,540
Van	11	34,246	11%	410,952	3,113	$2.30	$78,766
BUX Fleet: 100 Vehicles; 27% Overall Fuel Use						**Total $$**	**$703,036**
Vehicle Type	**Number**	**Fuel**	**% Fuel**	**Miles**	**Avg Fuel/Unit**	**Current $/gallon avg.**	**Total Cost**
Bus < 30 FT (CNG)	4	12,069	6%	96,548	3,017	$2.30	$27,759
Bus < 30 FT (Gas & Diesel)	43	92,207	49%	737,656	2,144	$2.30	$212,076
Sedan/Station Wagon	45	71,369	38%	999,166	1,586	$2.30	$164,149
Van	8	10,849	6%	130,188	1,356	$2.30	$24,953
NO Fleet: 36 Vehicles; 12% Overall Fuel Use						**Total $$**	**$428,937**
Vehicle Type	**Number**	**Fuel**	**% Fuel**	**Miles**	**Avg Fuel/Unit**	**Current $/gallon avg.**	**Total Cost**
Bus < 30 FT (CNG)	1	1,501	2%	12,008	1,501	$2.30	$3,452
Bus < 30 FT (Gas & Diesel)	17	51,061	65%	408,488	3,004	$2.30	$117,440
Sedan/Station Wagon	13	17,602	22%	246,428	1,354	$2.30	$40,485
Van	5	8,769	11%	105,228	1,754	$2.30	$20,169
SJU Fleet: 4 Vehicles; 9% Overall Fuel Use						**Total $$**	**$181,546**
Vehicle Type	**Number**	**Fuel**	**% Fuel**	**Miles**	**Avg Fuel/Unit**	**Current $/gallon avg.**	**Total Cost**
Bus STD 40 Ft	4	58,800	100%	352,800	14,700	$2.30	**$135,240**

MI Fleet: 23 Vehicles; 7% Overall Fuel Use							
Vehicle Type	**Number**	**Fuel**	**% Fuel**	**Miles**	**Avg Fuel/Unit**	**Current $/gallon avg.**	**Total Cost**
Bus < 30 FT (CNG)	0	-	0%	-	0	0	0
Bus < 30 FT (Gas & Diesel)	13	33,098	69%	264,784	2,546	$2.30	$76,125
Sedan/Station Wagon	7	7,340	15%	102,760	1,049	$2.30	$16,882
Van	3	7,383	15%	88,596	2,461	$2.30	$16,981
MA Fleet: 1 Vehicle; 0.26% Overall Fuel Use						**Total $$**	**$109,988**
Vehicle Type	**Number**	**Fuel**	**% Fuel**	**Miles**	**Avg Fuel/Unit**	**Current $/gallon avg.**	**Total Cost**
Sedan/Station Wagon	1	1,755	100%	24,570	1,755	$2.30	**$4,037**
VA Fleet: 1 Vehicle; 0.23% Overall Fuel Use							
Vehicle Type	**Number**	**Fuel**	**% Fuel**	**Miles**	**Avg Fuel/Unit**	**Current $/gallon avg.**	**Total Cost**
Sedan/Station Wagon	1	1,560	100%	21,840	1,560	$2.30	**$3,588**

As can be seen from the table above, though the TransNet® fleet is divided into six locations, two of the locations use 72%. These two locations are TR – or vehicles serving the Tri County, Valley, Sanatoga, and Red Hill locations (45% of overall fuel use); and BU - or vehicles serving the BuxMont and Willow Grove locations (27% of overall fuel use). Focusing on these two fleet segments, and particularly the E-350-450 gasoline powered vehicle models, will have the biggest impact on the fleet. Finally, it is important to note that BuxMont is the only partner that has a fuel station for gas and diesel at their location. CNG is off site. All other partners travel to off-site fueling locations. Tri County, Main Line and Valley vehicles use Sunoco and Universal fuel stations. Norristown and Mid county use WEX cards so they fuel at closest fueling station. These fueling considerations will be important to consider when examining alternative fuel options that require infrastructure.

4.0: Alternative Fuel Options – Summary Comparisons & Conclusions:

This report is designed to provide a full range alternative fuel and vehicle options analysis for your fleet operations. This section is designed to provide basic foundation information for high level comparison of five commercially available alternative fuel types: Biodiesel (B20), Ethanol (E85), Compressed Natural Gas (CNG), Propane (LPG), and Electric vehicles (EV). The following sections of this report will provide a more detailed explanation and analysis of each fuel type, as well as chart out prospective vehicle and capital cost return on investment scenarios based on each fleet partner's real-world vehicle and usage data. The following table is designed to provide a high-level summary of each fuel option.

High Level Alternative Fuel Comparisons					
	Biodiesel (B20)	**Ethanol (E85)**	**CNG**	**Propane**	**EV**
Basics	Biodiesel is a renewable fuel that can be manufactured from organic oils, fats, or recycled grease for use in diesel vehicles.	Ethanol is a widely used renewable fuel made from corn and other plant materials. It is blended with gasoline.	Natural gas is a domestically abundant gaseous fuel that can have significant fuel cost savings over gasoline and diesel fuel.	Propane is a readily available gaseous fuel that has been widely used in vehicles throughout the world for decades.	Electricity can be used to power plug-in electric vehicles, which are increasingly available. Hybrids use electricity to boost efficiency.
Retail Availability	Widely available	Widely available	Purchased through utility pipeline.	Regional / Local distributors.	Widely available but charger required
Retail Cost	Moderate	Moderate	Low	Moderate to low.	Low if charger is available
Pollution-Tailpipe	Low, except for CO2	Low, except for CO2	Low—25 percent lower CO2 than diesel and gas.	Moderate	None
Major Pros	Universal availability and moderate cost. Environmental benefit	Universal availability and moderate cost savings.	Low fuel cost. Low Emissions & Noise. Extensive distribution.	Simpler station than CNG. Fuel savings vs. gasoline likely in fleets.	Limited range and not well suited to heavy vehicles because of range and battery weight.
Major Cons	No major cost savings. Cold flow issues if not properly treated	Lower energy per gallon. Limited environmental benefit	High cost / complexity of stations.	Seasonal price spikes if not under contract. No heavy vehicle options.	A charge take hours and applications are limited based on vehicle drive cycle.
Conclusion	Use **biodiesel** only when fuel cost is same or lower than diesel fuel.	Do not use **ethanol** until it's 20-27% lower $ than gasoline.	**CNG** vehicles are cost-effective but station costs too high for your fleet.	**Propane vehicles & stations are the most cost-effective for your fleet type.**	**EVs** cost-effective but no models for priority fleet segments above.

4.1: Detailed Propane Autogas Options Analysis:

Propane is produced as a by-product of natural gas processing and crude oil refining. It accounts for about 2% of the energy used in the United States. The interest in propane as an alternative transportation fuel stems mainly from its domestic availability, high energy density, and clean-burning qualities. Propane is the world's third most common engine fuel and is considered an alternative fuel under the Energy Policy Act of 1992. Older propane vehicle models injected the fuel as gas vapor for combustion. However, modern propane vehicles now almost entirely operate with Liquid Propane Injection engine systems and offer higher fuel efficiency, performance, and reliability compared to older propane vehicles. Additional information about propane also can be found here: https://www.afdc.energy.gov/uploads/publication/propane_basics.pdf

Propane Overview: Properties, Characteristics, and Considerations	
	Propane Autogas (LPG)
Basic Properties	Gas (C3H8), stored at low pressure (~120 psi) as color and odorless liquid.
Source/Production	Domestic: By-product of conventional oil & gas exploration; non-renewable.
Distribution	Rail and Truck trailer distribution
Availability	Delivered to station storage tanks
Retail Unit	Gasoline or Diesel gallon energy (BTU) equivalent
Fuel Retail Cost	**Regional Avg: ~$1.47 - $1.80 gge** *(*Higher volume contracts result in lower prices)*
Vehicle Cost	Lower cost; ~$5,000-$10,000 per vehicle
Station Costs	Low cost, similar set up to gasoline except with above ground tanks, limited permitting, and environmental concerns.
Facility Modifications	No major facilities modifications; heavier than air fuel similar properties to gasoline and diesel
Engine Noise Level	Low noise level, ~1/10 decibel level
Environmental	No threat to soil, surface water, or groundwater, dissipates in air
Tailpipe Emission	Lower than conventional gas and diesel vehicles

Propane also offers significant emissions benefits as detailed below.

Propane Emissions vs. Typical Diesel Baseline Emissions*					
	PM	**NO_x**	**CO**	**HC**	**$C0_2E$/ GHG**
Propane (new vehicle)	100%	> 60%	>90%	>80%	19%
Propane (conversion)	80%	0%	20-40%	- 10%	21-24%
** These figures, and new studies on which the figures are based, are posted at the U.S. Department of Energy's Alternative Fuels Data Center at http://www.afdc.energy.gov/afdc.*					

TransNet® currently operates a number of vehicles that have immediate opportunities to be converted to or replaced with propane powered technologies – particularly the fleet's E-350 and E-450 vehicles. Propane engine systems exist for most light and medium duty equipment options (particularly for model years 2005 and newer) and a growing number of heavy duty engine technologies are beginning to enter the market, including school buses, shuttles, and class 6-7 truck chassis. The table below is designed to detail broad guidelines for propane vehicle applications for the major market niches.

Propane Overview: Vehicle Market/Application Relevance	
	Propane Autogas (LPG)
Light Duty: Sedans	LPG is well suited to this light duty market, if these vehicles drive higher miles and return to base.
Light Duty: Vans	LPG is well suited to this light duty market, and many vehicle options exist at relatively low cost, including service trucks and vans, and shuttle chassis.
Med-Heavy Duty: Shuttles	Class 5-7 Propane engines available in a number of makes and models with shuttle services providing an excellent application for propane vehicles
Heavy-Duty Bus	LPG is significantly penetrating the yellow school bus and shuttle market nationally. With low additional cost per unit (~$8,000-$12,000/unit), relatively inexpensive fuel stations, and fuel pricing consistently lower than diesel, propane buses and shuttles regularly have an ROI. However, no class 8 propane Transit bus options currently are commercially available.

With the incremental cost of light-medium duty propane vehicles ranging from $5,000-$12,000, propane vehicles deployed in many fleet operations will easily result in a net lifetime savings if fuel usage meets basic minimum thresholds. Though propane fueling stations are an additional required investment, the total capital costs for a propane station is relatively low (~$60,000), and these costs can be amortized into the per gallon fuel price while continuing to maintain low fuel costs.

The following table provides real world cost details for a medium volume capacity (~100,000 gallons per year) propane station as an average price throughout eastern Pennsylvania. The information in the table includes three cost categories (design, equipment, and construction). Though final costs for individual entities will vary, this information is relevant to the size and capacity of a station for your fleet operations. Since propane is delivered by truck, the station capacity is scalable and can be increased at no cost by scheduling more frequent fuel drops as needed or as the number of vehicles increase.

Propane Station Estimate (Station Capacity: 100,000+ Annual GGE/Year)	
Total Design Costs	**$459**
Total Equipment Costs	**$ 46,517**
Total Construction Costs	**$ 12,662**
Total Propane Station Costs:	**$59,639**

Again, costs for an equivalent station located at your specific location will vary. Cost will vary based on factors such as how much site preparations are needed, i.e. permits, concrete padding, electrical, etc. as well as specific design and construction costs. It is also important to note that the costs in the table above include $9,795 in FuelMaster™ fuel use tracking equipment.

Though these costs can be directly incurred by the fleet, propane fuel suppliers are also willing to enter into agreements to front the capital investment for such infrastructure in exchange for a long-term fuel contract with a fleet. In these cases, fuel suppliers amortize the cost of the station into the long-term contract price for the fuel (i.e. $1.85/gallon fuel price with amortized contract and no fleet station investment versus $1.65/gallon fuel price with fleet paying for all capital investments).

The upcoming information provides insight into alternative fuel vehicle comparisons related to fuel consumption and maintenance costs. Operation and maintenance costs are derived from average miles per vehicle type, assuming costs per mile found in the referenced. Total costs are calculated by adding operation and maintenance costs with the product of average annual gallons consumed and specific, projected fuel prices for each year, 2018 through 2027. The following table helps visualize the overall difference in fuel costs by providing the ten-year average price for each fuel type in three different projected scenarios:

10 Year Average of Fuel Prices						
	Low Oil Price		**Median Oil Price**		**High Oil Price**	
	Gas	**Propane**	**Gas**	**Propane**	**Gas**	**Propane**
10 Year Average*	$1.69	$1.31	$2.63	$1.58	$4.56	$2.20
Maintenance Costs/Mile**	$0.03	$0.015	$0.03	$0.015	$0.03	$0.015

* There is an individual price applied to each fuel type, which can be seen more completely in the supplied appendix.
**A 50% reduction in maintenance costs by running a vehicle on propane, compared to gasoline, is a factor the Texas Railroad Commission uses in their calculations when considering an alternative fuel conversion study. https://www.roushcleantech.com/saving-calculator/

The following table demonstrates the lifetime cost savings for propane vehicles vs. conventional fuels, using US EIA projected price data. Propane has a lower energy per volumetric unit than gasoline. Therefore, the assumed fuel consumption amount is higher for the propane vehicle.

Gas/Propane Vehicle Comparisons: E 350			
Current Vehicle		**Propane Replacement**	
Base Cost	$30,945	**Incremental Cost**	$11,615
Avg. Fuel/Year	3,942	**Avg. Fuel/Year**	5,440
Annual Mileage	31,535	Annual Mileage	31,535
Maintenance Costs/Mile	$0.03	Maintenance Costs/Mile	$0.015

Gas vs. Propane Operating Costs: E 350						
	Low Oil Price		**Median Oil Price**		**High Oil Price**	
	Gas $1.69/gallon avg.	**Propane** $1.31/gallon avg.	**Gas** $2.63/gallon avg.	**Propane** $1.58/gallon avg.	**Gas** $4.65/gallon avg.	**Propane** $2.20/gallon avg.
O&M	$9,460	$4,730	$9,460	$4,730	$9,460	$4,730
Total	$76,105	$75,977	$113,285	$90,639	$189,123	$124,644
Total Savings	**$127**		**$22,646**		**$64,479**	
Net Savings	**$11,487**		**$11,031**		**$52,864**	

As shown in the table above, based on current fleet fuel use averages, propane powered E-350s are likely to have a positive ROI over the 10-year timeframe in the median and high fuel price scenarios. The calculations above considered a subset of bus units < 30 FT that consume above average fuel use amounts, with an entire fleet average of ~2,700 gallons per year. Multiple units in the TR and BU fleets use 4,000-5,000 gallons per year, offering several vehicles with even higher potential savings. Beyond E-350s, TransNet® also operates numerous E-450s:

Gas/Propane Vehicle Comparisons: E 450			
Current Vehicle		**Propane Replacement**	
Base Cost	$32,035	**Incremental Cost**	$16,215
Avg. Fuel/Year	3,942	**Avg. Fuel/Year**	5,440
Annual Mileage	31,535	Annual Mileage	31,535
Maintenance Costs/Mile	$0.03	Maintenance Costs/Mile	$0.015

Gas vs. Propane Operating Costs: E 450						
	Low Oil Price		**Median Oil Price**		**High Oil Price**	
	Gas $1.69/gallon avg.	**Propane** $1.31/gallon avg.	**Gas** $2.63/gallon avg.	**Propane** $1.58/gallon avg.	**Gas** $4.65/gallon avg.	**Propane** $2.20/gallon avg.
O&M	$9,460	$4,730	$9,460	$4,730	$9,460	$4,730
Total	$76,105	$75,977	$113,285	$90,639	$189,123	$124,644
Total Savings	**$127**		**$22,646**		**$64,479**	
Net Savings	**$16,087**		**$6,431**		**$48,264**	

Much like the E-350s, the TransNet® E-450s are likely to have a positive ROI over the 10-year timeframe in the median and high fuel price scenarios. The calculations above considered a subset of bus units < 30 FT that consume above average fuel use amounts, with an entire fleet average of ~2,700 gallons per year. Again, multiple units in the TRI and BUX fleets use 4,000-5,000 gallons per year, offering several vehicles with even higher potential savings.

Beyond the vehicles examined previously, the fleet would also have opportunities to replace sedans and vans in each of the different locations with propane powered options:

Gas/Propane Vehicle Comparisons: Sedan/SW			
Current Vehicle		**Propane Replacement**	
Base Cost	$20,000	**Incremental Cost**	$7,500
Avg. Fuel/Year	2,229	**Avg. Fuel/Year**	3,076
Annual Mileage	31,211	Annual Mileage	31,211
Maintenance Costs/Mile	$0.03	Maintenance Costs/Mile	$0.015

Gas vs. Propane Operating Costs: Sedan/ Station Wagon						
	Low Oil Price		**Median Oil Price**		**High Oil Price**	
	Gas $1.69/gallon avg.	**Propane** $1.31/gallon avg.	**Gas** $2.63/gallon avg.	**Propane** $1.58/gallon avg.	**Gas** $4.65/gallon avg.	**Propane** $2.20/gallon avg.
O&M	$9,363	$4,681	$9,363	$4,681	$9,363	$4,681
Total	$47,047	$44,968	$68,071	$53,258	$110,953	$72,486
Total Savings	**$2,078**		**$14,812**		**$38,467**	
Net Savings	**$5,421**		**$7,312**		**$30,967**	

Gas/Propane Vehicle Comparisons: Van			
Current Vehicle		**Propane Replacement**	
Base Cost	$23,995	**Incremental Cost**	$8,195
Avg. Fuel/Year	3,107	**Avg. Fuel/Year**	4,288
Annual Mileage	37,285	Annual Mileage	37,285
Maintenance Costs/Mile	$0.03	Maintenance Costs/Mile	$0.015

Gas vs. Propane Operating Costs: Van						
	Low Oil Price		**Median Oil Price**		**High Oil Price**	
	Gas $1.69/gallon avg.	**Propane** $1.31/gallon avg.	**Gas** $2.63/gallon avg.	**Propane** $1.58/gallon avg.	**Gas** $4.65/gallon avg.	**Propane** $2.20/gallon avg.
O&M	$11,185	$5,592	$11,185	$5,592	$11,185	$5,592
Total	$63,713	$61,748	$93,018	$73,304	$152,792	$100,106
Total Savings	**$1,964**		**$19,713**		**$52,686**	
Net Savings	**$6,230**		**$11,518**		**$44,491**	

As described in the tables above, this analysis has examined four TransNet® vehicle types: E-350s, E-450s, Sedans/Wagons, and Vans. While propane does not require maintenance facility modifications or costly training for mechanics, it would require the fleet to install a propane autogas refueling station at relevant depot locations. As described above, the highest the fleet would reasonably expect to pay for such a station is $59,639 – but likely could realize a station for lower costs by gathering bids for the project. The table below is designed to detail the total investment in propane vehicles, vehicle 10 year operational costs (including maintenance), and investments in station infrastructure to fuel vehicles – calculating the total cost or net savings based on utilizing these vehicles for 10 years at EIA project fuel prices. The two tables that follow detail scenarios for stations based at the TRI and BUX fleet locations.

TRI Fleet: 10 Year Total Investment ROI Scenarios			
	Low Oil Price	Median Oil Price	High Oil Price
(4) E 350 (MY 2006-2009)	($45,951)	$44,126	$211,459
(4) E 450 (MY 2006-2009)	($64,351)	$25,725	$193,059
(4) Sedan/SW (MY 2006-2008)	($21,685)	$29,249	$123,868
(4) Van (MY 2009)	($24,921)	$46,075	$177,964
Station Cost	($59,639)	($59,639)	($59,639)
Ten Year ROI	$216,547	$85,537	$646,712

The tables above and below detail fairly conservative scenarios (erring on the high-cost) side of vehicle incremental price, and infrastructure costs. Prices for fuel are based on best estimates over 10 years from the US Energy Information Administration. We recommend converting the oldest vehicles in each category to replace, since there are eligible vehicles in each class.

BUX Fleet: 10 Year Total Investment ROI Scenarios			
	Low Oil Price	Median Oil Price	High Oil Price
(4) E 350 (MY 2002-2007)	($45,951)	$44,126	$211,459
(4) E 450 (MY 2002-2007)	($64,351)	$25,725	$193,059
(4) Sedan/SW (MY 2003-2004)	($21,685)	$29,249	$123,868
(3) Van (MY 2002-2007)	($18,691)	$34,557	$133,473
Station Cost	($59,639)	($59,639)	($59,639)
Ten Year ROI	$210,317	$74,018	$602,221

Based on TransNet's® relatively high vehicle utilization and commercially available, cost-effective propane vehicles and infrastructure, transitioning to propane autogas is likely to result in significant cost savings for the fleet. The key consideration for TransNet® is the fleet's ability to site propane fueling stations on the TRI and BUX fleet depots based on arrangement with local partners. As discussed above, propane stations are easy to install, with minimum cost and footprint on local sites, requiring limited permitting and construction time. If TransNet® can arrange for propane fueling sites at the TRI and BUX locations, the fleet would stand to make significant potential returns. In addition, we believe that a combination of competitive local vehicle dealers, station packagers, and State of Pennsylvania incentive programs could further improve the return for such propane vehicles – making propane yield relatively high savings for select fleet vehicles.

Maximize Incentives – Pursue Federal, State, and Local Subsidies:

Securing funding is often critical to the success of efforts to reduce petroleum use and vehicle emissions in fleet operations. The Pennsylvania Department of Environmental Protection (DEP) has and will continue to offer grant funding for clean, alternative fuel projects in Pennsylvania and investment in Pennsylvania's energy sector through the Alternative Fuels Incentive Grant Program (AFIG). The AFIG program is designed to reimburse up to 50% of the incremental cost to purchase alternative fuel fleet vehicles or convert vehicles to utilize alternative fuels up to a maximum of $20,000 for each vehicle and $300,000 per application. Station Cost can be applied for in a separate application provided you have 10 or more vehicles in your fleet that are less than 26,000lbs. Gross Vehicle Weight (GVW). TransNet can apply for an Infrastructure project, which will pay 50% of the cost of the station. The Pennsylvania DEP has opened the program, details of the program and the RFP can be found here at: http://www.dep.pa.gov/citizens/grantsloansrebates/alternative-fuels-incentive-grant/pages/default.aspx

TRI Fleet: 10 Year Total Investment ROI Scenarios w/ AFIG				
	AFIG $/Unit	Low Oil Price	Median Oil Price	High Oil Price
(4) E 350 (MY 2006-2009)	$5,808	($22,720)	$67,356	$234,692
(4) E 450 (MY 2006-2009)	$8,108	($31,920)	$58,156	$225,492
(4) Sedan/SW (MY 2006-2008)	$3,750	($6,684)	$44,248	$138,868
(4) Van (MY 2009)	$4,098	($8,528)	$62,468	$194,356
Station Cost (if >10 Units)	$29,820	$29,820	$29,820	$29,820
Ten Year ROI		$99,672	$202,408	$763,588

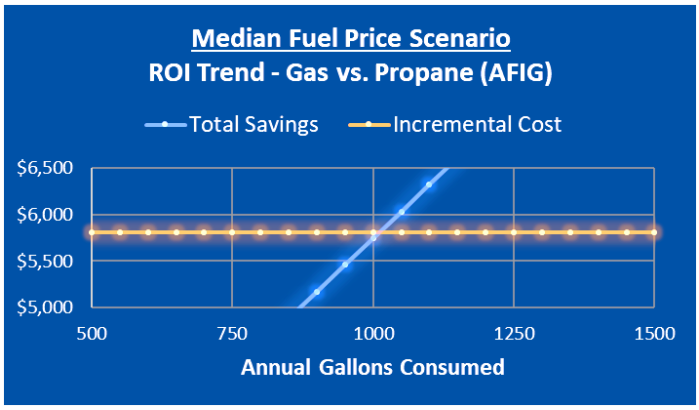
BUX Fleet: 10 Year Total Investment ROI Scenarios				
	AFIG $/Unit	Low Oil Price	Median Oil Price	High Oil Price
(4) E 350 (MY 2002-2007)	$5,808	($17,040)	$50,517	$176,019
(4) E 450 (MY 2002-2007)	$8,108	($23,940)	$43,617	$169,119
(4) Sedan/SW (MY 2003-20084	$3,750	($5,013)	$33,186	$104,151
(3) Van (MY 2002-2007)	$4,098	($6,396)	$46,851	$145,767
Station Cost (if 10> Units)	$29,820	$29,820	$29,820	$29,820
Ten Year ROI		$82,209	$144,351	$565,236

The most cost-effective process for the entire fleet would be to coordinate efforts regarding fueling infrastructure. This would lower investment cost for the entire fleet. The following table combines the previous two ROI tables, and demonstrates figures if a mutual, centralized station were to be constructed:

BUX & TRI Fleet: 10 Year Total Investment ROI Scenarios (Centralized Station)					
		AFIG $/Unit	Low Oil Price	Median Oil Price	High Oil Price
BuxMont / W. Grove	(4) E 350 (MY 2006-2009)	5,808	(17,040)	50,517	176,019
	(4) E 450 (MY 2006-2009)	8,108	(23,940)	43,617	169,119
	(4) Sedan/SW (MY 2006-2008)	3,750	(5,013)	33,186	104,151
	(3) Van (MY 2009)	4,098	(6,396)	46,851	145,767
Tri County and Valley / Sanatoga / Red Hill	(4) E 350 (MY 2006-2009)	5,808	(22,720)	67,356	234,692
	(4) E 450 (MY 2006-2009)	8,108	(31,920)	58,156	225,492
	(4) Sedan/SW (MY 2006-2008)	3,750	(6,684)	44,248	138,868
	(4) Van (MY 2009)	4,098	(8,528)	62,468	194,356
Station Cost (if 10> Units)	-	29,820	(29,820)	(29,820)	(29,820)
Ten Year ROI	-	-	(152,061)	376,579	1,358,644

Based on recent successes with fleet grant awards and the availability of future state grant programs, we recommend that your fleet actively pursue AFIG Funding for propane vehicle replacements, and encourage communication between partners to develop a mutual plan and location for station infrastructure.

The following information demonstrates a vehicle threshold profile for "Bus < 30 FT" that will return a positive ROI based on the same median fuel price scenario used in previous charts and tables. This threshold profile used the fleet average MPG for this vehicle type to generate the figures shown in the following chart:



Using fuel prices presented in the median fuel price scenario, a current fleet vehicle would have to consume 1,011 gallons of gasoline and travel 14,356 miles to show a positive ROI over 10 years when converted to a propane alternative fuel vehicle. The average numbers for the entire Suburban Transit fleet are significantly above and beyond these numbers, making the large majority of "Buses < 30 FT" eligible for reasonable replacement.

5.0: Key Recommended Actions – Conclusion

The following recommendations for further action are based on our review and assessment of data supplied and current fleet Key Performance Indicators. The summary of recommended actions are designed to provide a framework for achieving fleet goals. The Table below summarizes each of the overall recommendations in this report, based on a detailed analysis leading to the specific recommended action.

Key Recommended Actions:

Fuel Options Assessment:

1. **Deploy propane vehicle replacements for conversion of light-medium duty applications for 16 vehicles in the TRI fleet and 15 vehicles in the BUX fleet based on current analysis above.**
    a. **Begin to convert the remainder of the fleet with propane vehicles as they are being replaced or near end of life cycle occurs.**
2. **Pursue state Alternative Fuels Incentive Grant (AFIG) for both vehicles and infrastructure cost. Use other federal incentives, subsidies, grant programs, and other incentives to help reduce the implementation costs of strategies and technologies outlined in this report.**
3. **The following chart is our recommendation to begin your fleet conversion to propane.**

The following chart is our recommendation of vehicles that currently should be replaced by propane fueled vehicles:

Vehicle #	VIN #	Year	Vehicle Type	Fuel Type
BU002	2B5WB35Z42K116129	2007	Van	Gasoline
BU022	2B5WB35ZX1K541482	2005	Van	Gasoline
BU014	1FMNE1BW4BDB31311	2011	Van	Gasoline
BU108	1FDXE45P85HA88071	2005	Bus < 30 FT	Diesel Fuel
BU256	1FDXE45F32HB70650	2002	Bus < 30 FT	Diesel Fuel
BU260	1FDWE45F12HB76703	2003	Bus < 30 FT	Diesel Fuel
BU262	1FDWE45F22HB76712	2003	Bus < 30 FT	Diesel Fuel
BU268	1FDWE45FO3HB79755	2004	Bus < 30 FT	Diesel Fuel
BU270	1FDXE45P34HA78711	2004	Bus < 30 FT	Diesel Fuel
BU272	1FDXE45PX4HA78723	2004	Bus < 30 FT	Diesel Fuel
BU274	1FDXE45P64HA78721	2004	Bus < 30 FT	Diesel Fuel
BU314	2B4GP44322R749619	2004	Sedan	Gasoline
BU318	2B4GP54L22R668738	2003	Sedan	Gasoline
BU332	1D4GP24383B285780	2004	Sedan	Gasoline
BU334	1D4GP24373B224078	2004	Sedan	Gasoline
TR016	1B3LC56J38N228110	2009	Sedan	Gasoline
TR031	1FAHP34N68W130905	2009	Sedan	Gasoline
TR033	KNAFG528397259086	2010	Sedan	Gasoline
TR034	KNAFG528X97252281	2010	Sedan	Gasoline
TR715	1FBNE31L57DB42448	2008	Van	Gasoline
TR733	1FBSS31L17DB05344	2008	Van	Gasoline
TR742	1FBSS31L16DA76894	2008	Van	Gasoline
TR743	1FBNE31L57DA53866	2008	Van	Gasoline
TR757	1FDEE3FL6ADB02290	2010	Bus < 30 FT	Gasoline
TR777	1FD3E35L18DB45180	2008	Bus < 30 FT	Gasoline
TR779	1FD3E35L98DB51423	2008	Bus < 30 FT	Gasoline
TR781	1FD3E35L28DB51425	2008	Bus < 30 FT	Gasoline
TR783	1FD4E45S08DB56575	2008	Bus < 30 FT	Gasoline
TR795	1FDEE3FL7ADA90053	2010	Bus < 30 FT	Gasoline
TR797	1FDEE3FL9BDA04954	2010	Bus < 30 FT	Gasoline
TR799	1FDFE4FS6BDA43065	2011	Bus < 30 FT	Gasoline

Our recommendation is to discuss the feasibility of finding a central fueling location between Buxmont and Tri-County locations. Contacting local propane suppliers, may help with decisions to location, and

feasibility. While speaking to local propane suppliers, provide them with fleet information, fuel usage and include potential for growth while replacing your fleet. If you cannot find a central fueling location it would be recommended to house all your propane vehicles at the location with the fueling station. This may take some fleet planning, but in the long run will save time and money.

The replacement of older, high mileage vehicles is the recommendation while replacing fleet vehicles, the older the vehicle, the less fuel efficient it is. A good practice is to schedule to replace vehicles older than 5 years old to begin your conversion process. Vehicles that use the most fuel would be the next to replace and then replace newer vehicles or convert the newer vehicles to propane before the end of useful life.
Suburban Transit could reduce cost and Green House Gas (GHG's) by converting its fleet to run on propane. With nearly 300 vehicles within your fleet, Suburban Transit has the ability to move from petroleum based fossil fuels to alternatives fuel vehicles which provide financial and environmental benefits.
More information describing the methodology and full analysis results for each of the alternative fuel options scenarios is available upon request. This report has researched many possible scenarios based on the current fleet profile, as TransNet® shifts its fleet structure to utilizing different types of vehicles and other scenarios not examined here, the recommendations made herein might change as well.