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16. Abstract

Increased emphasis on energy efficiency and air quality has resulted in a number of state and federal initiatives examining the use of alternative fuels for motor vehicles. Texas instituted an alternative fuels — primarily compressed natural gas (CNG) — program for public fleet operations beginning in the 1991-92 fiscal year. A life-cycle cost/benefit model for evaluating the economic implications of this action was developed by The University of Texas at Austin Center for Transportation Research. This report documents the various input data, calculations, and assumptions inherent in the CNG Net Present Value (NPV) model.

Input data with constant values are discussed first and include basic parameters for fuel tank pressures, on-board storage capacity, vehicle conversion costs, number of tanks, etc. Variable input data include the number and types of vehicles, fuel consumption, etc. The next section presents the formulas for the internal model calculations. The final section discusses the basic assumptions inherent in the model.

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DOCUMENTATION FOR CNG FLEET CONVERSION COST-EFFECTIVENESS MODEL

by

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Research Report Number 983-1

Research Project 3-4-90/1-983

Conversion of the TxDOT Vehicle Fleet to Alternative Fuels

conducted for

Texas Department of Transportation

by the

CENTER FOR TRANSPORTATION RESEARCH

Bureau of Engineering Research
THE UNIVERSITY OF TEXAS AT AUSTIN

December 1991

Summary

The purpose of this report is to document input data, calculations, and assumptions inherent in the CNG Net Present Value (NPV) model. The model, developed at The University of Texas Center for Transportation Research for the Texas Department of Transportation (TxDOT), analyzes the cost-effectiveness of compressed natural gas (CNG) as an alternative fuel for fleet operations by examining the benefits and costs of a CNG-fueled operation over the life cycle of a CNG fast-fill station.

Abstract

Increased emphasis on energy efficiency and air quality has resulted in a number of state and federal initiatives examining the use of alternative fuels for motor vehicles. Texas instituted an alternative fuels — primarily compressed natural gas (CNG) — program for public fleet operations beginning in the 1991-92 fiscal year. A life-cycle cost/benefit model for evaluating the economic implications of this action was developed by The University of Texas at Austin Center for Transportation Research. This report documents the various input data, calculations, and assumptions inherent in the CNG Net Present Value (NPV) model.

Input data with constant values are discussed first and include basic parameters for fuel tank pressures, on-board storage capacity, vehicle conversion costs, number of tanks, etc. Variable input data include the number and types of vehicles, fuel consumption, etc. The next section presents the formulas for the internal model calculations. The final section discusses the basic assumptions inherent in the model.

Implementation Statement

The purpose of this project is to evaluate the economic feasibility of alternative fuels for the Texas Department of Transportation (TxDOT). The life-cycle cost/benefit analysis model is the basic framework for this evaluation. The model will assist TxDOT in fulfilling the legal requirements of Senate Bill 740, whether through implementation of an alternative fuels program or through the processing of waivers where appropriate. This report provides the support documentation for use of the model.

Disclaimer

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented within. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation. This report does not constitute a standard, a specification, or regulation.

NOT INTENDED FOR CONSTRUCTION,
PERMIT, OR BIDDING PURPOSES

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Documentation for CNG Fleet Conversion Cost-Effectiveness Model

INTRODUCTION

Texas, a state rich in natural gas, adopted alternative fuels legislation influencing the whole state as well as non-attainment areas. Texas Senate Bill 740, which took effect September 1, 1991, requires all school districts with more than 50 buses, state agencies with more than 15 vehicles excluding law enforcement and other emergency vehicles, and metropolitan transit authorities to purchase new vehicles that are capable of operating on natural gas or a fuel with similar emissions characteristics.[1] Affected agencies can receive a waiver of this act if they can demonstrate either that (1) the effort for operating a natural-gas-powered fleet is more expensive than that for a gasoline or diesel fleet over its useful life or that (2) alternate fuels are not available in sufficient supply. The model documented herein analyzes the first area for natural gas, the fuel of choice in the legislation. Another version of the model addresses propane (LPG).

The model, developed at The University of Texas Center for Transportation Research for the Texas Department of Transportation (TxDOT), analyzes the cost-effectiveness of compressed natural gas (CNG) as an alternative fuel for fleet operations. Basically, the model examines the benefits and costs of a CNG-fueled operation over the life cycle of a CNG fast-fill station.

The purpose of this report is to document input data, calculations, and assumptions inherent in the CNG Net Present Value (NPV) model. Presented first are input data that will not change for different TxDOT fleet locations, followed by input data that do change. Next, formulas for calculations are presented and explained where necessary. Finally, the major embedded model assumptions are laid out and explained. Throughout the report, variable names are used directly from the spreadsheet model. A mapping of these names to spreadsheet locations and a sample spreadsheet are provided in the Appendix.

INPUT DATA (Constant)

This section presents input data that will be kept constant for all TxDOT locations analyzed. It is recognized that some data may be slightly different for some locations, but it is believed that these small differences will not significantly alter the final result.

[1]The Texas Air Control Board subsequently ruled that LPG and electricity also qualify as alternative fuels.

Other Factors

This section contains miscellaneous input data. They are as follows:

Work.days.year - number of days the fleet is operational per year. It is assumed that TxDOT fleets are operational 5 days per week for 52 weeks a year.

Fast.fill.on-board.storage - of the possible amount of natural gas, it is assumed that 92.5 percent is stored while fast-filling.[2] A lower mass of natural gas is stored at a certain pressure as temperature increases. Since temperatures increase during fast-fill and fueling cut-off occurs at 3,000 psig, lower mass (and therefore volume in standard cubic feet [scf]) is stored while fast-filling than if the tank were allowed to equalize to ambient temperature (as in slow-fill).

Tank.fill.factor.3000psi - 259.67 scf of natural gas is stored in 1 cubic foot of tank volume at 3,000 psig at standard temperature.[3]

Tank.fill.factor.100psi - 7.92 scf of natural gas is stored in 1 cubic foot of tank volume at 100 psig at standard temperature.[4] It is assumed that a CNG vehicle is filled when its tank pressure drops to 100 psig.

Fuel.in.empty.tank.gal - it is assumed that 2 gallons of liquid fuel (gasoline or diesel) remain in the tank when the vehicle is filled.

NG.Gasoline.Factor - the amount of natural gas (scf) with an equivalent amount of energy as a gallon of gasoline. This is calculated by dividing the net (or lower) heating value of a gallon of gasoline by the net (or lower) heating value of a standard cubic foot of natural gas. This factor is taken to be 114,132 / 930 = 122.7 scf/gallon gasoline.[5,6]

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[2]International Association for Natural Gas Vehicles, Natural Gas Vehicles 1990, January 1990.
[3]Christy Park, Inc., Seamless Pressure Vessels (brochure), McKeesport, Pennsylvania.
[4]Ibid.
[5]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. I, Passenger Cars and Light Trucks, April 1990.
[6]Personal communication with Larry Osgoode, Phillips 66, Bartlesville, Oklahoma.

NG.Diesel.Factor - the amount of natural gas (scf) with an equivalent amount of energy as a gallon of diesel. This is calculated by dividing the net (or lower) heating value of a gallon of diesel by the net (or lower) heating value of a standard cubic foot of natural gas. This factor is taken to be 129,400/930 = 139.1 scf/gallon diesel.[7,8]

Station.Maint.cost.gallon.gale - station maintenance is often reported as a function of the number of gasoline gallon equivalents compressed. Values for this factor range from 2 to 10 cents per gallon equivalent.[9,10,11,12,13,14] Here we assume a value of 4.5 cents, based on DeLuchi's assumptions.[15] Note that compressor maintenance is also very sensitive to the number of times the compressor is toggled on and off, which this factor does not consider.[16] The way in which compressor size is estimated in this model does minimize toggling.

Electricity.cost.kwh - cost of electricity to the fleet. Assumed to be 6.3 cents per kilowatt-hour (kWh).

Days.off.tank.recert - for on-board tank recertification, it is assumed that it will take 5 days to take the tanks off the vehicle, deliver them to a testing facility, have them tested, return them to the TxDOT location, and reinstall them on the vehicle.

Discount.Rate - a discount rate of 10 percent is assumed to be applicable to TxDOT.[17]

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[7]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. I, Passenger Cars and Light Trucks, April 1990.

[8]Personal communication with Larry Osgoode, Phillips 66, Bartlesville, Oklahoma.

[9]Gaseous Fuels for Transport

[10]American Gas Association, An Analysis of the Economic and Environmental Effects of Natural Gas as an Alternative Fuel, EA 1989-10, December 15, 1989.

[11]Mark A. DeLuchi, Robert A. Johnston, and Daniel Sperling, "Methanol vs. Natural Gas Vehicles: A Comparison of Resource Supply, Performance, Emissions, Fuel Storage, Safety, Costs, and Transitions," SAE Paper 881656, 1988.

[12]International Association for Natural Gas Vehicles, Natural Gas Vehicles 1990, January 1990.

[13]Environmental Protection Agency, Technical Report: Emissions, Fuel Economy, and Performance of Light-Duty CNG and Dual-Fuel Vehicles, EPA-AA-CTAB-88-05, June 1988.

[14]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. I, Passenger Cars and Light Trucks, April 1990.

[15]Mark A. DeLuchi, Robert A. Johnston, and Daniel Sperling, "Methanol vs. Natural Gas Vehicles: A Comparison of Resource Supply, Performance, Emissions, Fuel Storage, Safety, Costs, and Transitions," SAE Paper 881656, 1988.

[16]Personal communication with Gordon Slack, Henderson, Inc., Garland, Texas.

[17]Recommended by the Texas State Purchasing and General Services Commission, Workbook on the Cost Effectiveness of Alternative Fuels Using Life Cycle Cost Benefit Analysis, June 1, 1991.

Vehicle Data

These sections contain input data for each vehicle type. The sections for automobiles, light trucks, and heavy-duty gasoline vehicles are conceptually identical; only the variable names differ. The variable names are identical except for the vehicle type identifier prefix of Auto, LT, or HDG. These three sections will be discussed in general with the variable name prefix of VehType used instead. Since the diesel section accommodates both dual-fuel and dedicated conversions, it is slightly different conceptually and will be discussed separately. The input data for the automobiles, light trucks, and heavy-duty gasoline vehicles are as follows:

VehType.CNG.MPG.Adj.Factor - it is assumed that converted CNG vehicles will achieve fuel efficiencies of 95 percent of those of the original gasoline vehicle, while operating on natural gas. This assumes that the conversion does not optimize the engine for natural gas usage. The major reason for the decrease is the added weight of the CNG cylinders. Note that this factor changes to 115 percent somewhere after year 10. It is assumed that OEM vehicles are available in year 11. They are assumed to be optimized and dedicated and will therefore achieve greater fuel efficiencies than gasoline vehicles.[18,19]

VehType.Dual.fuel.MPG.Adjust.Factor - it is assumed that converted CNG vehicles will achieve fuel efficiencies of 95 percent of the original gasoline vehicle, while running on gasoline. This assumes that the conversion does not optimize the engine for natural gas usage. The major reason for the decrease is the added weight of the CNG cylinders.

VehType.Conv.Kit.Cost - is the cost of the under-hood equipment (e.g., mixer, regulator, piping, etc.). For automobiles, light trucks, and heavy-duty gasoline vehicles, this cost is assumed to be $700.[20]

VehType.Conv.lab.cost - is the cost of labor to perform the conversion. For automobiles this cost is assumed to be $800, and for light trucks and heavy-duty gasoline vehicles, it is

[18]Mark A. DeLuchi, Robert A. Johnston, and Daniel Sperling, "Methanol vs. Natural Gas Vehicles: A Comparison of Resource Supply, Performance, Emissions, Fuel Storage, Safety, Costs, and Transitions," SAE Paper 881656, 1988.
[19]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. I, Passenger Cars and Light Trucks, April 1990.
[20]Ibid.

$600.[21]

VehType.Tank.cost - is the cost of one composite tank. For automobiles and light trucks this cost is assumed to be $450, and for heavy-duty gasoline it is assumed to be $500.[22,23] These costs are directly related to the VehType.Fuel.Capacity.scf input. It is assumed that TxDOT will implement volume buying in order to achieve price reductions.

VehType.Conv.Kit.Salvage.Value - is the price difference in selling a used converted CNG vehicle versus the same vehicle if it were not converted. It is assumed that this value is $200. As defined, this value includes both tank, kit, and labor salvage value.

VehType.Tank.Salvage.Value - this value is currently not used (it is set to $0). The salvage value of tanks is included in VehType.Conv.Kit.Salvage.Value.

VehType.OEM.Cost.Diff - this is the cost difference between an original equipment manufacturer (OEM) dedicated optimized CNG vehicle and a comparable gasoline or diesel vehicle. It is assumed that this difference is $900 for automobiles, light trucks, and heavy-duty gasoline vehicle replacements.[24]

VehType.OEM.Salvage.Value - is the price difference in selling a used OEM CNG vehicle versus a comparable gasoline vehicle. It is assumed that this value is $200 for automobiles, light trucks, and heavy-duty gasoline vehicles.

VehType.Fuel.Capacity.scf - the amount of natural gas that can be stored in the tank at 3,000 psig at standard temperature. For light-duty vehicles (automobiles and trucks) this is assumed to be 600 scf, and for heavy-duty gasoline vehicles, 750 scf.[25]

VehType.tanks.per.veh - automobiles - 1 tank; light trucks - 2 tanks; heavy-duty gasoline vehicles - 4 tanks.[26]

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[21]Ibid.
[22]Ibid.
[23]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. II, Heavy Duty Vehicles, April 1990.
[24]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. I, Passenger Cars and Light Trucks, April 1990.
[25]Based on TxDOT specification on Conversion of State Vehicles to Operate on Compressed Natural Gas (CNG) and Gasoline, Specification No. SDHPT-070-99-20, June 1990.
[26]Ibid.

VehType.Tank.Recert.Cost - cost to recertify one composite tank is assumed to be $40 (if steel, assumption would be $20), plus the cost of one hour of labor to remove the tank, transport it to and from the testing facility, and replace it on the vehicle.[27]

VehType.Prcnt.NG.miles - percentage of miles driven per vehicle on natural gas. Assumed to be 100 percent for dual-fuel vehicles. Must be 100 percent for dedicated OEM vehicles.

VehType.Maint.Cost.Diff - difference in costs for one vehicle's maintenance in one year.

VehType.On.board.gasoline.capacity - assumed to be: automobiles - 16 gallons; light trucks - 18 gallons; heavy-duty gasoline vehicles - 25 gallons; and heavy-duty diesel vehicles - 45 gallons of diesel.[28]

Since the heavy-duty diesel vehicle data section accommodates both dual-fuel and dedicated conversions, it is slightly different conceptually from automobiles, light trucks, and heavy-duty gasoline vehicles. In year 11 when OEM CNG vehicles become available, it is assumed that only dedicated OEM vehicles will be produced (not dual-fuel), because of emissions regulations.[29] The input data for heavy-duty diesel vehicles are as follows:

HDD.Ded.CNG.MPG.Adj.Factor - dedicated CNG vehicles will have reduced fuel efficiencies mainly because compression ratios used must be less than those for diesel. It is assumed that these reductions will be 26 percent for converted diesels and 20 percent for OEMs replacing diesels.[30]

HDD.Dual.MPG.Adjust.Factor - it is assumed that converted dual-fuel CNG vehicles will achieve fuel efficiencies that are 10 percent less than that of the original diesel vehicle on an energy-equivalent basis.[31]

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[27]Personal communication with Paul Funk, Western Sales and Testing of Deer Park, Inc., Deer Park, Texas.
[28]Personal communication with Terry Eulenfeld, TxDOT, Austin, Texas.
[29]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. II, Heavy Duty Vehicles, April 1990.
[30]Ibid.
[31]Information from Compannia Ipiranga de Petroleo, from data collected in its experimental fleet of 2 dual-fuel Mercedes buses from June-October 1990, operating with biogas made from sugar cane in Brazil.

HDD.Ded.Conv.Kit.Cost - this cost is assumed to be $2,000.[32]

HDD.Ded.Conv.Kit.Salvage.Value - this value is assumed to be $500. As defined, this value includes both tank, kit, and labor salvage value.

HDD.Ded.Conv.lab.cost - this cost is assumed to be $2,350.[33]

HDD.Dual.Conv.Kit.Cost - this cost is assumed to be $2,500.[34]

HDD.Dual.Conv.Kit.Salvage.Value - this value is assumed to be $500. As defined, this value includes both tank, kit, and labor salvage value.

HDD.Dual.Conv.lab.cost - this cost is assumed to be $2,000.[35]

HDD.Tank.cost - this cost is assumed to be $500.[36,37] This cost is directly related to the HDD.Fuel.Capacity.scf input. It is assumed that TxDOT will implement volume buying in order to achieve price reductions.

HDD.Tank.Salvage.Value - this value is currently not used (it is set to $0). The salvage value of tanks is included in the conversion kit salvage value.

HDD.OEM.Cost.Diff - it is assumed that this difference is $2,800.[38,39]

HDD.OEM.Salvage.Value - this value is assumed to be $500.

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[32]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. II, Heavy Duty Vehicles, April 1990.
[33]Ibid.
[34]American Gas Association, "Natural Gas Vehicles: The International Experience," Issue Brief 1988-9, May 13, 1988.
[35]Ibid.
[36]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. I, Passenger Cars and Light Trucks, April 1990.
[37]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. II, Heavy Duty Vehicles, April 1990.
[38]Ibid.
[39]American Gas Association, "Natural Gas Vehicles: The International Experience," Issue Brief 1988-9, May 13, 1988.

HDD.Fuel.Capacity.scf - the amount of natural gas that can be stored in the tank at 3,000 psig at standard temperature. It is assumed to be 750 scf.[40]

HDD.tanks.per.Ded.veh - assumed to be 4 tanks.

HDD.tanks.per.Dual.veh - assumed to be 2 tanks.

HDD.Tank.Recert.Cost - same as for automobiles, light trucks, and heavy-duty gasoline vehicles.

HDD.Prcnt.NG.consumed.dual - this factor applies to dual-fuel conversions only. It is the percentage of energy used by the vehicle over its normal driving schedule which is obtained from natural gas. The rest of the energy is obtained from the diesel fuel. This factor is assumed to be 58 percent.[41]

HDD.Maint.Cost.Diff.Ded - difference in costs for one dedicated CNG vehicle's maintenance in one year.

HDD.Maint.Cost.Diff.Dual - difference in costs for one dual-fuel vehicle's maintenance in one year.

HDD.On.board.gasoline.capacity - assumed to be 45 gallons.[42]

Fuel Prices

Natural Gas Price/mcf - price per thousand standard cubic feet (mcf). The break-even case will be the price at which break-even for the fleet occurs, or a cost of $0.00/mcf (free) if break-even is not achieved.

Gasoline Price/gallon - assumed to be $0.89.

Diesel Price/gallon - assumed to be $0.85.

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[40]Based on TxDOT specification on Conversion of State Vehicles to Operate on Compressed Natural Gas (CNG) and Gasoline, Specification No. SDHPT-070-99-20, June 1990.
[41]See footnote on HDD.Dual.MPG.Adjust.Factor.
[42]Personal communication with Terry Eulenfeld, TxDOT, Austin, Texas.

Annual Fuel Price Adjustment - allows all fuel prices to be increased at a certain percentage per year. It is assumed that fuel prices remain constant over time (except for inflation), so this adjustment is set to 0.0 percent.

Station Design

Usable.Storage - the percentage of natural gas that can be drawn from a fully-charged cascade before it is considered depleted. This value is assume to be 40 percent.[43]

Switch.Time.min - time to pull vehicle up to station, get out of vehicle, connect fuel probe, disconnect fill probe, get back into vehicle, and drive away. Includes all time except time that natural gas is actually being transferred to the vehicle. This time is assumed to be 3 minutes.

Flow.Rate.hose.scfm - the average flow rate per hose achievable by the station while continuously fueling vehicles until the storage is depleted. It is assumed to be 500 standard cubic feet per minute (scfm), but values up to 1,000 scfm have been reported.[44,45] This value does not change the cost of the station significantly (station cost will increase slightly for 1,000 scfm), but labor fueling time losses will decrease significantly as this value increases.

Cycle.Time - a cycle is the time for one continuous fueling session and the time to recharge storage before the next session. It is assumed that one continuous fueling session occurs daily and that the rest of the day's time is used to recharge storage. Thus, the cycle time is the number of minutes per day (1,440).

Number.of.Hoses - 2 CNG hoses are assumed. This variable is directly related to the dispenser cost, so they must be changed in tandem.

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[43]Dean Taylor, Hani Mahmassani, and Mark Euritt, "Working Memorandum #3: Fast-Fill CNG Fueling Stations," prepared by the Center for Transportation Research, The University of Texas at Austin, for the Texas Department of Transportation, April 16, 1991.

[44]Personal communications with Stan Pearson and Terry Pearson, Tri-Fuels, Inc.

[45]Personal communication with Chris Blazek, Institute of Gas Technology.

Station.Setup.Cost.Factor - the cost of miscellaneous items such as piping, labor, and construction overhead is approximated by assuming that it is equal to 25 percent of the total cost of the compressor, storage vessels, and dispenser.[46]

Compressor.Salvage.Value - is assumed to be 15 percent of the original cost (after 15 years).

Storage.Vessel.Salv.Val - is assumed to be 50 percent of the original cost (after 30 years).

Dispenser.Salvage.Value - is assumed to be 10 percent of the original cost (after 30 years).

Dryer.Salvage.Value - is assumed to be 10 percent of the original cost (after 30 years).

Labor Time Loss Calculation

Gasoline.fill.rate.gal.min - assumed to be 7 gallons/minute (without topping off tank).[47]

Diesel.fill.rate.gal.min - assumed to be 7 gallons/minute (without topping off tank).[48]

Gasoline.diesel.switch.time - same definition as for natural gas switch time. This time is assumed to be 3 minutes.

Labor.Cost.hour - cost per man-hour for fueling vehicles and recertifying tanks (includes salary, benefits, etc). Assumed to be $15.00.

Number.Gasoline.hoses - assumed to be 2.

Number.Diesel.hoses - assumed to be 1.

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[46]Department of Energy, Assessment of Costs and Benefits of Flexible and Alternative Fuel Use in the U.S. Transportation Sector, Technical Report Four: Vehicle and Fuel Distribution Requirements, August 1990.
[47]Based on only one gasoline data point.
[48]Based on gasoline data only (not diesel).

Costs

Dispenser costs are assumed to be $25,000 for two metered hoses or $20,000 for 1 metered hose.

Dryer costs are approximately $25,000 for a regenerative unit, similar to those required for public stations by new standards. This can be considered a maximum cost for TxDOT applications. Some cost savings are obtainable by using non-regenerative units, where chemicals must be changed periodically.[49] A cost of $10,000 is used.

INPUT DATA (Variable)

This section of input data is data that will be different for all TxDOT locations analyzed. This is where fleet-specific variables are input.

Vehicle Data

These sections contain input data for each vehicle type. It is assumed that the number of vehicles in each TxDOT location will remain constant over time (though the model can accommodate changes over time). The sections for automobiles, light trucks, and heavy-duty gasoline vehicles are conceptually identical; only the variable names differ. The variable names are identical except for the vehicle type identifier prefix of Auto, LT, or HDG. These three sections will be discussed in general with the variable name prefix of VehType used instead. Since the diesel section accommodates both dual-fuel and dedicated conversions, it is slightly different conceptually and will be discussed separately. The input data for the automobiles, light trucks, and heavy-duty gasoline vehicles are as follows:

VehType.Num.CNG.Converted - this is the number of vehicles converted to dual-fuel CNG operation in a certain year. It is assumed that conversions must be performed for the first 10 years, since OEM vehicles are not available.

VehType.Num.CNG.Trans - when converted vehicles reach the end of their TxDOT life at the beginning of a specific year, their kits and tanks are assumed to be transferred to the

[49] Personal communication with Robert Petsinger of CNG Services of Pittsburgh, Inc., Pittsburgh, Pennsylvania.

new replacement vehicles, unless OEM vehicles are available. In that case, the kit is salvaged.

VehType.Num.CNG.Retired - number of converted vehicles reaching the end of their TxDOT life at the beginning of this year.

VehType.Num.OEM - number of OEM CNG vehicles purchased at the beginning of this year.

VehType.Num.OEM.Retired - number of OEM CNG vehicles reaching the end of their TxDOT life at the beginning of this year.

VehType.Num.Need.Recert - number of converted CNG vehicles needing tank recertification in this year (composite tanks must be recertified every 3 years and steel tanks every 5 years; there are new tanks available that last 15 years).[50]

VehType.Gasoline.MPG - average fuel efficiency for this vehicle type at this location while operating on gasoline. Fiscal year 1991 averages will be used for all TxDOT locations analyzed.

VehType.miles - annual miles traveled for this vehicle type at this location. Fiscal year 1991 averages will be used for all TxDOT locations analyzed.

Since the diesel vehicle data section accommodates both dual-fuel and dedicated conversions, it is slightly different conceptually from automobiles, light trucks, and heavy-duty gasoline vehicles. It is assumed that only dedicated OEM vehicles will be produced (i.e., no dual-fuel vehicles).[51] The input data for heavy-duty diesel vehicles are as follows:

HDD.Num.New.Ded.Converted - this is the number of vehicles converted to dedicated CNG operation in a certain year. It is assumed that conversions must be performed in years 6 through 10, since OEM vehicles are not available. It is also assumed that dedicated CNG conversions are not available until year 6.

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[50]Personal communication with Robert Petsinger of CNG Services of Pittsburgh, Inc., Pittsburgh, Pennsylvania.

[51]Environmental Protection Agency, Analysis of the Economic and Environmental Effects of Compressed Natural Gas as a Vehicle Fuel, Vol. II, Heavy Duty Vehicles, April 1990.

HDD.Num.Ded.Kits.Trans - when dedicated converted vehicles reach the end of their TxDOT life at the beginning of a specific year, their kits and tanks are assumed to be transferred to the new replacement vehicles, unless OEM vehicles are available. In that case, the kit is salvaged.

HDD.Num.Ded.Conv.Retired - number of dedicated converted vehicles reaching the end of their TxDOT life at the beginning of this year.

HDD.Num.New.Dual.Converted - this is the number of vehicles converted to dual-fuel operation in a certain year. It is assumed conversions must be performed in years 6 through 10, since OEM vehicles are not available. It is also assumed that dual-fuel conversions are not available until year 6.

HDD.Num.Dual.Kits.Trans - when dual-fuel converted vehicles reach the end of their TxDOT life at the beginning of a specific year, their kits and tanks are assumed to be transferred to the new replacement vehicles, unless OEM vehicles are available. In that case, the kit is salvaged.

HDD.Num.Dual.Conv.Retired - number of dual-fuel converted vehicles reaching the end of their TxDOT life at the beginning of this year.

HDD.Num.Ded.OEM - number of dedicated OEM CNG vehicles purchased at the beginning of this year.

HDD.Num.Ded.OEM.Retired - number of dedicated OEM CNG vehicles reaching the end of their TxDOT life at the beginning of this year.

HDD.Num.Ded.Need.Recert - number of dedicated CNG vehicles needing tank recertification in this year (composite tanks must be recertified every 3 years and steel tanks every 5 years; there are new tanks available that last 15 years).[52]

HDD.Num.Dual.Need.Recert - number of dual-fuel vehicles needing tank recertification in this year (composite tanks must be recertified every 3 years and steel tanks every 5 years;

[52]Personal communication with Robert Petsinger of CNG Services of Pittsburgh, Inc., Pittsburgh, Pennsylvania.

there are new tanks available that last 15 years).[53]

HDD.Diesel.MPG - average fuel efficiency for this vehicle type at this location while operating on diesel. Fiscal year 1991 averages will be used for all TxDOT locations analyzed.

HDD.miles - annual miles traveled for this vehicle type at this location. Fiscal year 1991 averages will be used for all TxDOT locations analyzed.

Note that the yearly data entered for the number of new conversions, conversions retired, kits transferred, OEMs purchased, and OEMs retired are based on the TxDOT life of that vehicle type. The criteria used for determining the TxDOT life of a vehicle type are based strictly on mileage. An automobile, light truck, or heavy-duty gasoline vehicle's life is considered over when it exceeds 90,000 miles; for a heavy-duty diesel vehicle, the figure is 150,000 miles.

CALCULATIONS

A list of all the variable names (and their spreadsheet cell references) used in these calculations is shown in the Appendix. This section gives the equations used in all calculations, with an explanation of the assumptions inherent in them where required.

Vehicle Data

Conceptually, the formulas are the same for automobile, light truck, and heavy-duty gasoline vehicle types. As before, the actual reference to Auto, LT, or HDG in each formula is replaced by VehType, and the diesel formulas are presented separately.

VehType.Num.Vehicles =
(VehType.Num.CNG.Converted + VehType.Num.OEM + VehType.Num.CNG.Trans)-
(VehType.Num.CNG.Retired + VehType.Num.OEM.Retired)

VehType.CNG.mpg =
VehType.Gasoline.MPG * VehType.CNG.MPG.Adj.Factor

VehType.Dual.Fuel.Gasoline.MPG =
VehType.Gasoline.MPG * VehType.Dual.fuel.MPG.Adjust.Factor

[53]Ibid.

VehType.Annual.NG.consump.scf =
(((VehType.Num.Vehicles - VehType.Num.Need.Recert) * VehType.miles *
VehType.Prcnt.NG.miles) / (VehType.CNG.mpg) * NG.Gasoline.Factor) +
((VehType.Num.Need.Recert * ((Work.days.year - Days.off.tank.recert) /
Work.days.year) * Auto.miles * Auto.Prcnt.NG.miles) / (Auto.CNG.mpg) *
NG.Gasoline.Factor)

VehType.Annual.gasoline.consumption.gal =
((VehType.Num.Vehicles - VehType.Num.Need.Recert) *
VehType.miles * (1 - VehType.Prcnt.NG.miles) / VehType.Dual.Fuel.Gasoline.MPG) +

((VehType.Num.Need.Recert *
((Work.days.year - Days.off.tank.recert) / Work.days.year) *
VehType.miles * (1 - VehType.Prcnt.NG.miles) / VehType.Dual.Fuel.Gasoline.MPG)) +

((VehType.Num.Need.Recert * (Days.off.tank.recert / Work.days.year) * VehType.miles)
/ VehType.Dual.Fuel.Gasoline.MPG)

An annual fuel tax is required by Texas law. The amount charged is based on weight and annual mileage of the vehicle. Vehicle weights are assumed to be: automobiles - less than 4,000 lbs; light trucks - less than 4,000 lbs; and heavy-duty gasoline vehicles - between 10,001 and 15,000 lbs.[54]

Auto (or LT).Annual.NG.Fuel.Tax =
IF(0<HDD.miles<5000,$30)
IF(5001<HDD.miles<10000,$60)
IF(10001<HDD.miles<15000,$90)
ELSE($120)

HDG.Annual.NG.Fuel.Tax =
IF(0 < HDG.miles < 5000, $48)
IF(5001 < HDG.miles 10000, $96)
IF(10001 < HDG.miles < 15000, $144)
ELSE($192)

The diesel equations are as follows:

HDD.Num.Ded.Vehicles =
(HDD.Num.New.Ded.Converted + HDD.Num.Ded.OEM +
HDD.Num.Ded.Kits.Trans) - (HDD.Num.Ded.Conv.Retired +
HDD.Num.Ded.OEM.Retired)

[54]Personal communication with Terry Eulenfeld, TxDOT, Austin, Texas.

HDD.Num.Dual.Vehicles =
(HDD.Num.New.Dual.Converted + HDD.Num.Dual.Kits.Trans) -
HDD.Num.Dual.Conv.Retired

HDD.Ded.CNG.mpg =
HDD.Diesel.MPG * HDD.Ded.CNG.MPG.Adj.Factor

HDD.Dual.MPG =
HDD.Diesel.MPG * HDD.Dual.MPG.Adjust.Factor

HDD.Annual.NG.consump.scf =
(((HDD.Num.Ded.Vehicles - HDD.Num.Ded.Need.Recert) * HDD.miles) /
(HDD.Ded.CNG.mpg) * NG.Diesel.Factor) +

((HDD.Num.Ded.Need.Recert * ((Work.days.year - Days.off.tank.recert) /
Work.days.year) * HDD.miles) / (HDD.Ded.CNG.mpg) * NG.Diesel.Factor) +

((HDD.Num.Dual.Vehicles - HDD.Num.Dual.Need.Recert) * HDD.miles /
HDD.Dual.MPG) * HDD.Prcnt.NG.consumed.dual * NG.Diesel.Factor +

((HDD.Num.Dual.Need.Recert * ((Work.days.year - Days.off.tank.recert) /
Work.days.year) * HDD.miles / HDD.Dual.MPG)) * HDD.Prcnt.NG.consumed.dual *
NG.Diesel.Factor

HDD.Annual.diesel.consumption.gal =
((HDD.Num.Dual.Vehicles - HDD.Num.Dual.Need.Recert) * HDD.miles /
HDD.Dual.MPG) * (1 - HDD.Prcnt.NG.consumed.dual) +

((HDD.Num.Dual.Need.Recert *
((Work.days.year - Days.off.tank.recert) / Work.days.year) *
HDD.miles / HDD.Dual.MPG)) * (1 - HDD.Prcnt.NG.consumed.dual) +

((HDD.Num.Dual.Need.Recert * (Days.off.tank.recert/Work.days.year) * HDD.miles) /
HDD.Dual.MPG)

The annual fuel tax for diesel-converted CNG vehicles is identical to gasoline-converted vehicles. Heavy-duty diesel vehicle weights are assumed to be between 10,001 and 15,000 lbs.[55]

[55]Personal communication with Terry Eulenfeld, TxDOT, Austin, Texas.

HDD.Annual.NG.Fuel.Tax =
IF(0<HDD.miles<5000,$48)
IF(5001<HDD.miles<10000,$96)
IF(10001<HDD.miles<15000,$144)
ELSE($192)

Fuel Prices

NG.price.gallon.gasoline.equivalent =
(Natural.Gas.Price.mcf/1,000) * NG.Gasoline.Factor

NG.price.gallon.diesel.equivalent =
(Natural.Gas.Price.mcf/1,000) * NG.Diesel.Factor

Total.NG.consumption.scf =
Auto.Annual.NG.consump.scf + LT.Annual.NG.consump.scf +
HDG.Annual.NG.consump.scf + HDD.Annual.NG.consump.scf

Station Design

NG.Session.Time.min =
((Autos.per.day / Number.of.Hoses) * (Switch.Time.min +
(Auto.NG.per.fill.scf / Flow.Rate.hose.scfm))) +
((Light.Trucks.per.day / Number.of.Hoses) * (Switch.Time.min +
(LT.NG.per.fill.scf / Flow.Rate.hose.scfm))) +
((Heavy.Gasoline.per.day / Number.of.Hoses) * (Switch.Time.min +
(HDG.NG.per.fill.scf / Flow.Rate.hose.scfm))) +
((Heavy.Ded.Diesel.per.day / Number.of.Hoses) * (Switch.Time.min +
(HDD.Ded.NG.per.fill.scf / Flow.Rate.hose.scfm))) +
((Heavy.Dual.Diesel.per.day / Number.of.Hoses) * (Switch.Time.min +
(HDD.Dual.NG.per.fill.scf / Flow.Rate.hose.scfm)))

Design.Daily.NG.demand.scf =
((Auto.Num.Vehicles * Auto.miles * Auto.Prcnt.NG.miles / Auto.CNG.mpg *
NG.Gasoline.Factor) +
(LT.Num.Vehicles * LT.miles * LT.Prcnt.NG.miles / LT.CNG.mpg *
NG.Gasoline.Factor) +
(HDG.Num.Vehicles * HDG.miles * HDG.Prcnt.NG.miles / HDG.CNG.mpg *
NG.Gasoline.Factor) +
(HDD.Num.Ded.Vehicles * HDD.miles / HDD.Ded.CNG.mpg *
NG.Diesel.Factor) +
(HDD.Num.Dual.Vehicles * HDD.miles / HDD.Dual.MPG *
HDD.Prcnt.NG.consumed.dual * NG.Diesel.Factor)) / Work.days.year

The inherent assumption in the following equation is that the cheapest station design is to minimize compressor size by allowing it to run 24 hours/day and maximize storage. This may not always be the case; but even if not, the assumption yields costs that are reasonable for the purpose of this analysis, given the uncertainty in all costs and savings.

Min.Comp.Size.scfm =
Design.Daily.NG.demand.scf / Cycle.Time

An assumption inherent in the following equation is that the station is designed to fill all the required vehicles continuously in one session per cycle (per day in TxDOT's case). Less storage is required if more sessions are allowed per cycle (such as morning and evening sessions or vehicles fueling uniformly throughout the day), which can result in somewhat significant costs savings.[56]

Max.Storage.scf =
Design.Daily.NG.demand.scf / (Useable.Storage * (1 + (NG.Session.Time.min / (Cycle.Time - NG.Session.Time.min))))

The following equation was derived by a curve-fit to actual size/HP data.

Min.Comp.HP =
2.6588 + (0.54898 * Min.Comp.Size.scfm)

The assumption inherent in the following three equations is that vehicles fuel when they are almost empty.

Autos.(or Light.Trucks. or Heavy.Gasoline.)per.day =
(VehType.Num.Vehicles * VehType.miles * VehType.Prcnt.NG.miles / VehType.CNG.mpg * NG.Gasoline.Factor) / ((VehType.NG.per.fill.scf) * Work.days.year)

Heavy.Ded.Diesel.per.day =
(HDD.Num.Ded.Vehicles * HDD.miles / HDD.Ded.CNG.mpg * NG.Diesel.Factor) / ((HDD.Ded.NG.per.fill.scf) * Work.days.year)

[56]Dean B. Taylor, Mark A. Euritt, and Hani S. Mahmassani, "Economic Evaluation of CNG Fleet Conversion and Operation," a paper prepared for presentation at the 71st Annual Meeting of the Transportation Research Board, January 1992.

Heavy.Dual.Diesel.per.day =
(HDD.Num.Dual.Vehicles * HDD.miles * HDD.Prcnt.NG.consumed.dual / HDD.Dual.MPG*NG.Diesel.Factor) / ((HDD.Dual.NG.per.fill.scf) * Work.days.year)

VehType.NG.per.fill.scf =
(VehType.Fuel.Capacity.scf * VehType.tanks.per.veh. * Fast.fill.onboard.storage) - (((VehType.Fuel.Capacity.scf * VehType.tanks.per.veh.) / Tank.fill.factor.3,000psi) * Tank.fill.factor.100psi)

Labor Time Loss Calculations

The assumption inherent in the following two equations is that vehicles fuel when they are almost empty. These are the number of dedicated gasoline/diesel vehicles requiring fueling daily to offset the natural gas usage of their replacement CNG vehicles. These values can then be used to calculate dedicated gasoline and diesel fueling session times which are directly comparable with the natural gas fueling session time, in order to compute labor losses due to fueling. Thus, the computation of labor losses assumes that the fueling of converted dual-fuel vehicles with gasoline or diesel would take the same amount of time as fueling the original gasoline or diesel vehicle, for the miles a dual-fuel vehicle utilizes gasoline or diesel. In actuality this is not the case, since gasoline/diesel fuel efficiency drops when the vehicle is converted. However, this error is small and is therefore ignored in order to make computations simpler. In fact, there is no error for gasoline vehicles if 100 percent of the mileage driven is on CNG.

Number.(Autos or LT.Trucks or Heavy.Gas).day =
((VehType.Num.Vehicles * (VehType.miles * VehType.Prcnt.NG.miles / VehType.Gasoline.MPG)) / Work.days.year) /
(VehType.On.board.gasoline.capacity - Fuel.in.empty.tank.gal)

Number.Diesel.day =
((HDD.Num.Ded.Vehicles * (HDD.miles / HDD.Diesel.MPG)) / Work.days.year) /
(HDD.On.board.diesel.capacity - Fuel.in.empty.tank.gal) +

((HDD.Num.Dual.Vehicles * (HDD.miles * HDD.Prcnt.NG.consumed.dual / HDD.Diesel.MPG)) / Work.days.year) /
(HDD.On.board.diesel.capacity - Fuel.in.empty.tank.gal)

The following two equations give the continuous fueling session times necessary if dedicated gasoline and diesel vehicles are retained.

Ded.Gasoline.Session.Time =
((Number.Autos.day / Number.Gasoline.hoses) *
(Gasoline.diesel.switch.time + ((Auto.On.board.gasoline.capacity -
Fuel.in.empty.tank.gal) / Gasoline.fill.rate.gal.min))) +
((Number.LT.Trucks.day / Number.Gasoline.hoses) *
(Gasoline.diesel.switch.time + ((LT.On.board.gasoline.capacity - Fuel.in.empty.tank.gal) /
Gasoline.fill.rate.gal.min))) +
((Number.Heavy.Gas.day / Number.Gasoline.hoses) *
(Gasoline.diesel.switch.time + ((HDG.On.board.gasoline.capacity -
Fuel.in.empty.tank.gal) / Gasoline.fill.rate.gal.min)))

Ded.Diesel.Session.Time =
((Number.Diesel.day / Number.Diesel.hoses) *
(Gasoline.diesel.switch.time + ((HDD.On.board.diesel.capacity - Fuel.in.empty.tank.gal) /
Diesel.fill.rate.gal.min)))

Savings

Gasoline Savings (Auto or LT or HDG) =
((((VehType.miles * VehType.Num.Vehicles) /
VehType.Gasoline.MPG) * Gasoline.Price.gallon) -
(VehType.Annual.NG.consump.scf * (Natural.Gas.Price.mcf/1,000)) -
(VehType.Annual.gasoline.consump.gal * Gasoline.Price.gallon))

Diesel Savings =
((((HDD.miles * (HDD.Num.Ded.Vehicles + HDD.Num.Dual.Vehicles)) /
HDD.Diesel.MPG) * Diesel.Price.gallon) -
(HDD.Annual.NG.consump.scf * (Natural.Gas.Price.mcf/1,000)) -
(HDD.Annual.diesel.consump.gal * Diesel.Price.gallon))

Maintenance savings =
(Auto.Num.Vehicles * Auto.Maint.Cost.Diff) +
(LT.Num.Vehicles * LT.Maint.Cost.Diff) +
(HDG.Num.Vehicles * HDG.Maint.Cost.Diff) +
(HDD.Num.Ded.Vehicles * HDD.Maint.Cost.Diff.Ded) +
(HDD.Num.Dual.Vehicles * HDD.Maint.Cost.Diff.Dual)

Costs

Infrastructure

Land costs are assumed to be negligible for TxDOT.

Station Setup =
Station.Setup.Cost.Factor * (Compressor.costs + Storage.Vessels.costs + Dispenser.costs)

The following two equations were derived by curve-fitting to actual size/cost data. For the compressor, 5 psig inlet pressure was assumed.

Compressor =
(15,791 + (482.38 * Min.Comp.Size.scfm) + (0.16734 * (Min.Comp.Size.scfm ^ 2)) -
(0.001037 * (Min.Comp.Size.scfm ^ 3)))

Storage Vessels =
(-487.55 + (1.0889 * Max.Storage.scf))

Vehicle

Conversion Kit =
((Auto.Num.CNG.Converted * Auto.Conv.Kit.Cost) +
(LT.Num.CNG.Converted * LT.Conv.Kit.Cost) +
(HDG.Num.CNG.Converted * HDG.Conv.Kit.Cost) +
(HDD.Num.New.Ded.Converted * HDD.Ded.Conv.Kit.Cost) +
(HDD.Num.New.Dual.Converted * HDD.Dual.Conv.Kit.Cost)) -

(((Auto.Num.CNG.Retired - Auto.Num.CNG.Trans) * Auto.Conv.Kit.Salvage.Value) +
((LT.Num.CNG.Retired - LT.Num.CNG.Trans) * LT.Conv.Kit.Salvage.Value) +
((HDG.Num.CNG.Retired - HDG.Num.CNG.Trans) * HDG.Conv.Kit.Salvage.Value) +
((HDD.Num.Ded.Conv.Retired - HDD.Num.Ded.Kits.Trans) *
HDD.Ded.Conv.Kit.Salvage.Value) + ((HDD.Num.Dual.Conv.Retired -
HDD.Num.Dual.Kits.Trans) * HDD.Dual.Conv.Kit.Salvage.Value))

Tanks =
(Auto.Num.CNG.Converted * Auto.Tank.cost * Auto.tanks.per.veh.) +
(LT.Num.CNG.Converted * LT.Tank.cost * LT.tanks.per.veh.) +
(HDG.Num.CNG.Converted * HDG.Tank.cost * HDG.tanks.per.veh.) +
(HDD.Num.New.Ded.Converted * HDD.Tank.cost * HDD.tanks.per.Ded.veh.) +
(HDD.Num.New.Dual.Converted * HDD.Tank.cost * HDD.tanks.per.Dual.veh.) -

((Auto.Num.CNG.Retired * Auto.Tank.Salvage.Value * Auto.tanks.per.veh.) +
(LT.Num.CNG.Retired * LT.Tank.Salvage.Value * LT.tanks.per.veh.) +
(HDG.Num.CNG.Retired * HDG.Tank.Salvage.Value * HDG.tanks.per.veh.) +
(HDD.Num.Ded.Conv.Retired * HDD.Tank.Salvage.Value * HDD.tanks.per.Ded.veh.) +
(HDD.Num.Dual.Conv.Retired * HDD.Tank.Salvage.Value * HDD.tanks.per.Dual.veh.))

Labor =
((Auto.Num.CNG.Converted + Auto.Num.CNG.Trans) * Auto.Conv.lab.cost) +
((LT.Num.CNG.Converted + Lt.Num.CNG.Trans) * LT.Conv.lab.cost) +
((HDG.Num.CNG.Converted + HDG.Num.CNG.Trans) * HDG.Conv.lab.cost) +
((HDD.Num.New.Ded.Converted + HDD.Num.Ded.Kits.Trans) *
HDD.Ded.Conv.lab.cost) +
((HDD.Num.New.Dual.Converted + HDD.Num.Dual.Kits.Trans) *
HDD.Dual.Conv.lab.cost)

OEM =
((Auto.Num.OEM * Auto.OEM.Cost.Diff) +
(LT.Num.OEM * LT.OEM.Cost.Diff) +
(HDG.Num.OEM*HDG.OEM.Cost.Diff) +
(HDD.Num.Ded.OEM*HDD.OEM.Cost.Diff)) -

((Auto.Num.OEM.Retired * Auto.OEM.Salvage.Value) +
(LT.Num.OEM.Retired * LT.OEM.Salvage.Value) +
(HDG.Num.OEM.Retired * HDG.OEM.Salvage.Value) +
(HDD.Num.Ded.OEM.Retired*HDD.OEM.Salvage.Value))

Operating

Station Maintenance =
(Total.NG.consump.scf / NG.Gasoline.Factor) * Station.Maint.cost.gale

Cylinder Recertification =
(Auto.Num.Need.Recert * Auto.tanks.per.veh. * Auto.Tank.Recert.Cost) +
(LT.Num.Need.Recert * LT.tanks.per.veh. * LT.Tank.Recert.Cost) +
(HDG.Num.Need.Recert * HDG.tanks.per.veh. * HDG.Tank.Recert.Cost) +
(HDD.Num.Ded.Need.Recert * HDD.tanks.per.Ded.veh. * HDD.Tank.Recert.Cost) +
(HDD.Num.Dual.Need.Recert * HDD.tanks.per.Dual.veh. * HDD.Tank.Recert.Cost)

This power cost estimate is a maximum cost; the actual cost will be somewhat less. This estimate assumes that the compressor motor draws full current at all times. This is the case only if the back-pressure on the compressor is at its maximum (i.e., when compressing into a full storage vessel).

Power =
Min.Comp.HP *
(Auto.Annual.NG.consump.scf + LT.Annual.NG.consump.scf +
HDG.Annual.NG.consump.scf + HDD.Annual.NG.consump.scf) /
Min.Comp.Size.scfm * 0.745712 / 60 * Electric.cost.kwh

Labor Fueling Time Loss =
((Number.of.Hoses * NG.Session.Time.min -
Number.Gasoline.hoses * Ded.Gasoline.Session.Time -
Number.Diesel.hoses * Ded.Diesel.Session.Time) / 60) *
Work.days.year * Labor.Cost.hour

NG Fuel Tax =
Auto.Num.Vehicles * Auto.Annual.NG.Fuel.Tax +
LT.Num.Vehicles * LT.Annual.NG.Fuel.Tax +
HDG.Num.Vehicles * HDG.Annual.NG.Fuel.Tax +
HDD.Num.Ded.Vehicles * HDD.Annual.NG.Fuel.Tax +
HDD.Num.Dual.Vehicles*HDD.Annual.NG.Fuel.Tax

Additional training can include costs to train mechanics to work on CNG vehicles, costs to train drivers to operate CNG vehicles, costs to train maintenance workers to perform fueling station maintenance, etc. There is no cost added for this item.

Cost Per Vehicle Per Year

This cost allows one to compare conversion of different size fleets or to compute items such as gasoline taxes required to make conversion cost-effective. It is calculated by computing an annuity equivalent to the Cumulative NPV and then dividing this annuity by the number of vehicles in the fleet in Year 30. This value is not valid if the number of vehicles does not remain constant over the whole analysis time period. Also, each vehicle type is given the same weight.

EMBEDDED MODEL ASSUMPTIONS

This section presents the embedded model assumptions that have not been discussed previously.

It is assumed that ASME vessels are used for fueling station storage. Therefore, no recertification is required for these vessels.

No savings are accrued for power cost savings or maintenance savings because of reduced usage of gasoline/diesel fuel dispensers. Nor are any savings given for possible elimination of gasoline/diesel fueling stations.

On-board composite CNG cylinders requiring recertification every 3 years are assumed, although composites are available that do not require recertification for 15 years and there are steel cylinders that require recertification only every 5 years.[57,58]

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[57]Ibid.

[58]Personal communication with Paul Funk, Western Sales and Testing of Deer Park, Inc., Deer Park, Texas.

APPENDIX

Variable Name	Cell Reference
Annual.Fuel.Price.Adjustment	=$B$231
Auto.Annual.gasoline.consump.gal	=$B$72:$AH$72
Auto.Annual.NG.consump.scf	=$B$71:$AH$71
Auto.Annual.NG.Fuel.Tax	=$B$85:AF$85
Auto.CNG.mpg	=$B$66:$AH$66
Auto.CNG.MPG.Adj.Factor	=$B$65:$AH$65
Auto.Conv.Kit.Cost	=$B$73:$AH$73
Auto.Conv.Kit.Salvage.Value	=$B$74:$AH$74
Auto.Conv.lab.cost	=$B$75:$AH$75
Auto.Dual.Fuel.Gasoline.MPG	=$B$68:$AH$68
Auto.Dual.fuel.MPG.Adjust.Factor	=$B$67:$AH$67
Auto.Fuel.Capacity.scf	=$B$80:$AH$80
Auto.Gasoline.MPG	=$B$63:$AH$63
Auto.Maint.Cost.Diff	=$B$84:$AH$84
Auto.miles	=$B$70:$AH$70
Auto.NG.per.fill.scf	=$B$250:$AH$250
Auto.Num.CNG.Converted	=$B$51:$AH$51
Auto.Num.CNG.Retired	=$B$55:$AH$55
Auto.Num.CNG.Trans	=$B$53:$AH$53
Auto.Num.Need.Recert	=$B$61:$AH$61
Auto.Num.OEM	=$B$57:$AH$57
Auto.Num.OEM.Retired	=$B$59:$AH$59
Auto.Num.Vehicles	=$B$49:$AH$49
Auto.OEM.Cost.Diff	=$B$78:$AH$78
Auto.OEM.Salvage.Value	=$B$79:$AH$79
Auto.On.board.gasoline.capacity	=$A$86:$AH$86
Auto.Prcnt.NG.miles	=$B$83:$AH$83
Auto.Tank.cost	=$B$76:$AH$76
Auto.Tank.Recert.Cost	=$B$82:$AH$82
Auto.Tank.Salvage.Value	=$B$77:$AH$77
Auto.tanks.per.veh.	=$B$81:$AH$81
Autos.per.day	=$B$245:$AH$245
Compressor.costs	=$B$16:$AH$16
Compressor.Salvage.Value	=$B$256:$AH$256
Conversion.Kit.costs	=$B$23:$AH$23
Cost.per.veh.per.year	=$B$45
Cumulative.NPV	=$AI$40
Cycle.Time	=$B$243:$AH$243
Days.off.tank.recert	=$B$285
Ded.Diesel.Session.Time	=$B$273:$AH$273
Ded.Gasoline.Session.Time	=$B$272:$AH$272
Design.Daily.NG.demand.scf	=$B$241:$AH$241
Diesel.fill.rate.gal.min	=$B$263:$AH$263
Diesel.Price.gallon	=$B$228:$AH$228
Discount.Rate	=$B$286

Variable Name	Cell Reference
Dispenser.costs	=$B$18:$AH$18
Dispenser.Salvage.Value	=$B$258:$AH$258
Dryer.Salvage.Value	=$B$259:$AH$259
Electric.cost.kwh	=$B$284
Fast.fill.onboard.storage	=$B$277
Flow.Rate.hose.scfm	=$B$238:$AH$238
Fuel.in.empty.tank.gal	=$B$280
Fuel.Price.Diff.	=$B$3
Gasoline.diesel.switch.time	=$B$264:$AH$264
Gasoline.fill.rate.gal.min	=$B$262:$AH$262
Gasoline.Price.gallon	=$B$227:$AH$227
HDD.Annual.diesel.consump.gal	=$B$204:$AH$204
HDD.Annual.NG.consump.scf	=$B$203:$AH$203
HDD.Annual.NG.Fuel.Tax	=$B$222:$AH$222
HDD.Ded.CNG.mpg	=$B$198:$AH$198
HDD.Ded.CNG.MPG.Adj.Factor	=$B$197:$AH$197
HDD.Ded.Conv.Kit.Cost	=$B$205:$AH$205
HDD.Ded.Conv.Kit.Salvage.Value	=$B$206:$AH$206
HDD.Ded.Conv.lab.cost	=$B$207:$AH$207
HDD.Ded.NG.per.fill.scf	=$B$253:$AH$253
HDD.Diesel.MPG	=$B$195:$AH$195
HDD.Dual.Conv.Kit.Cost	=$B$208:$AH$208
HDD.Dual.Conv.Kit.Salvage.Value	=$B$209:$AH$209
HDD.Dual.Conv.lab.cost	=$B$210:$AH$210
HDD.Dual.MPG	=$B$200:$AH$200
HDD.Dual.MPG.Adjust.Factor	=$B$199:$AH$199
HDD.Dual.NG.per.fill.scf	=$B$254:$AH$254
HDD.Fuel.Capacity.scf	=$B$215:$AH$215
HDD.Maint.Cost.Diff.Ded	=$B$220:$AH$220
HDD.Maint.Cost.Diff.Dual	=$B$221:$AH$221
HDD.miles	=$B$202:$AH$202
HDD.Num.Ded.Conv.Retired	=$B$179:$AH$179
HDD.Num.Ded.Kits.Trans	=$B$177:$AH$177
HDD.Num.Ded.Need.Recert	=$B$191:$AH$191
HDD.Num.Ded.OEM	=$B$187:$AH$187
HDD.Num.Ded.OEM.Retired	=$B$189:$AH$189
HDD.Num.Ded.Vehicles	=$B$172:$AH$172
HDD.Num.Dual.Conv.Retired	=$B$185:$AH$185
HDD.Num.Dual.Kits.Trans	=$B$183:$AH$183
HDD.Num.Dual.Need.Recert	=$B$193:$AH$193
HDD.Num.Dual.Vehicles	=$B$173:$AH$173
HDD.Num.New.Ded.Converted	=$B$175:$AH$175
HDD.Num.New.Dual.Converted	=$B$181:$AH$181
HDD.OEM.Cost.Diff	=$B$213:$AH$213
HDD.OEM.Salvage.Value	=$B$214:$AH$214

Variable Name	Cell Reference
HDD.On.board.diesel.capacity	=$B$223:$AH$223
HDD.Prcnt.NG.consumed.dual	=$B$219:$AH$219
HDD.Tank.cost	=$B$211:$AH$211
HDD.Tank.Recert.Cost	=$B$218:$AH$218
HDD.Tank.Salvage.Value	=$B$212:$AH$212
HDD.tanks.per.Ded.veh.	=$B$216:$AH$216
HDD.tanks.per.Dual.veh.	=$B$217:$AH$217
HDG.Annual.gasoline.consump.gal	=$B$154:$AH$154
HDG.Annual.NG.consump.scf	=$B$153:$AH$153
HDG.Annual.NG.Fuel.Tax	=$B$167:$AH$167
HDG.CNG.mpg	=$B$148:$AH$148
HDG.CNG.MPG.Adj.Factor	=$B$147:$AH$147
HDG.Conv.Kit.Cost	=$B$155:$AH$155
HDG.Conv.Kit.Salvage.Value	=$B$156:$AH$156
HDG.Conv.lab.cost	=$B$157:$AH$157
HDG.Dual.Fuel.Gasoline.MPG	=$B$150:$AH$150
HDG.Dual.fuel.MPG.Adjust.Factor	=$B$149:$AH$149
HDG.Fuel.Capacity.scf	=$B$162:$AH$162
HDG.Gasoline.MPG	=$B$145:$AH$145
HDG.Maint.Cost.Diff	=$B$166:$AH$166
HDG.miles	=$B$152:$AH$152
HDG.NG.per.fill.scf	=$B$252:$AH$252
HDG.Num.CNG.Converted	=$B$133:$AH$133
HDG.Num.CNG.Retired	=$B$137:$AH$137
HDG.Num.CNG.Trans	=$B$135:$AH$135
HDG.Num.Need.Recert	=$B$143:$AH$143
HDG.Num.OEM	=$B$139:$AH$139
HDG.Num.OEM.Retired	=$B$141:$AH$141
HDG.Num.Vehicles	=$B$131:$AH$131
HDG.OEM.Cost.Diff	=$B$160:$AH$160
HDG.OEM.Salvage.Value	=$B$161:$AH$161
HDG.On.board.gasoline.capacity	=$B$168:$AH$168
HDG.Prcnt.NG.miles	=$B$165:$AH$165
HDG.Tank.cost	=$B$158:$AH$158
HDG.Tank.Recert.Cost	=$B$164:$AH$164
HDG.Tank.Salvage.Value	=$B$159:$AH$159
HDG.tanks.per.veh.	=$B$163:$AH$163
Heavy.Ded.Diesel.per.day	=$B$248:$AH$248
Heavy.Dual.Diesel.per.day	=$B$249:$AH$249
Heavy.Gasoline.per.day	=$B$247:$AH$247
Labor.Cost.hour	=$B$265:$AH$265
Labor.costs	=$B$25:$AH$25
Land.costs	=$B$14:$AH$14
Light.Trucks.per.day	=$B$246:$AH$246
LT.Annual.gasoline.consump.gal	=$B$113:$AH$113

Variable Name	Cell Reference
LT.Annual.NG.consump.scf	=$B$112:$AH$112
LT.Annual.NG.Fuel.Tax	=$B$126:$AH$126
LT.CNG.mpg	=$B$107:$AH$107
LT.CNG.MPG.Adj.Factor	=$B$106:$AH$106
LT.Conv.Kit.Cost	=$B$114:$AH$114
LT.Conv.Kit.Salvage.Value	=$B$115:$AH$115
LT.Conv.lab.cost	=$B$116:$AH$116
LT.Dual.Fuel.Gasoline.MPG	=$B$109:$AH$109
LT.Dual.fuel.MPG.Adjust.Factor	=$B$108:$AH$108
LT.Fuel.Capacity.scf	=$B$121:$AH$121
LT.Gasoline.MPG	=$B$104:$AH$104
LT.Maint.Cost.Diff	=$B$125:$AH$125
LT.miles	=$B$111:$AH$111
LT.NG.per.fill.scf	=$B$251:$AH$251
LT.Num.CNG.Converted	=$B$92:$AH$92
LT.Num.CNG.Retired	=$B$96:$AH$96
Lt.Num.CNG.Trans	=$B$94:$AH$94
LT.Num.Need.Recert	=$B$102:$AH$102
LT.Num.OEM	=$B$98:$AH$98
LT.Num.OEM.Retired	=$B$100:$AH$100
LT.Num.Vehicles	=$B$90:$AH$90
LT.OEM.Cost.Diff	=$B$119:$AH$119
LT.OEM.Salvage.Value	=$B$120:$AH$120
LT.On.board.gasoline.capacity	=$B$127:$AH$127
LT.Prcnt.NG.miles	=$B$124:$AH$124
LT.Tank.cost	=$B$117:$AH$117
LT.Tank.Recert.Cost	=$B$123:$AH$123
LT.Tank.Salvage.Value	=$B$118:$AH$118
LT.tanks.per.veh.	=$B$122:$AH$122
Max.Storage.scf	=$B$240:$AH$240
Min.Comp.HP	=$B$242:$AH$242
Min.Comp.Size.scfm	=$B$239:$AH$239
Natural.Gas.Price.mcf	=$B$226:$AH$226
NG.Diesel.Factor	=$B$282
NG.Gasoline.Factor	=$B$281
NG.price.gallon.diesel.equivalent	=$B$230:$AH$230
NG.price.gallon.gasoline.equivalent	=$B$229:$AH$229
NG.Session.Time.min	=$B$237:$AH$237
Number.Autos.day	=$B$268:$AH$268
Number.Diesel.day	=$B$271:$AH$271
Number.Diesel.hoses	=$B$267:$AH$267
Number.Gasoline.hoses	=$B$266:$AH$266
Number.Heavy.Gas.day	=$B$270:$AH$270
Number.LT.Trucks.day	=$B$269:$AH$269
Number.of.Hoses	=$B$244:$AH$244

Variable Name	Cell Reference
OEM.costs	=$B$26:$AH$26
Station.Maint.cost.gale	=$B$283
Station.Setup.Cost.Factor	=$B$255:$AH$255
Station.setup.costs	=$B$15:$AH$15
Storage.Vessel.Salv.Val	=$B$257:$AH$257
Storage.Vessels.costs	=$B$17:$AH$17
Switch.Time.min	=$B$236:$AH$236
Tank.fill.factor.100psi	=$B$279
Tank.fill.factor.3000psi	=$B$278
Tanks.costs	=$B$24:$AH$24
Total.NG.consump.scf	=$B$232:$AH$232
Useable.Storage	=$B$235:$AH$235
Work.days.year	=$B$276

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Period**	**Begin 1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
2	**SAVINGS**																
3	Gasoline Price Diff.		42,322	42,322	42,322	41,441	42,322	42,322	41,441	42,322	42,322	41,441	44,967	44,967	44,749	45,055	46,515
4	Automobiles		892	892	892	873	892	892	873	892	892	873	892	892	980	980	980
5	Light Trucks		26,699	26,699	26,699	26,143	26,699	26,699	26,143	26,699	26,699	26,143	29,343	29,343	29,343	29,343	29,343
6	Heavy Duty Trucks		14,732	14,732	14,732	14,425	14,732	14,732	14,425	14,732	14,732	14,425	14,732	14,732	14,425	14,732	16,191
7	Diesel Price Diff.		0	0	0	0	0	6,785	6,785	6,785	6,946	6,785	6,785	6,946	6,785	6,785	6,946
8	Maintenance		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9																	
10	**Total Savings**	0	42,322	42,322	42,322	41,441	42,322	49,107	48,226	49,107	49,268	48,226	51,752	51,913	51,533	51,840	53,460
11																	
12	**COSTS**																
13	**Infrastructure**																
14	Land																
15	Station setup	37,055	0	0	0	0	0	8,928	0	0	0	0	0	0	0	0	0
16	Compressor	28,307	0	0	0	0	0	4,391	0	0	0	0	0	0	0	0	0
17	Storage Vessels	94,913	0	0	0	0	0	31,319	0	0	0	0	0	0	0	0	0
18	Dispenser	25,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Dryer	10,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	**Subtotal**	195,274	0	0	0	0	0	44,638	0	0	0	0	0	0	0	0	0
21																	
22	**Vehicle**																
23	Conversion Kit	64,400	0	0	0	0	0	24,000	0	0	0	0	-15,600	0	-800	0	-2,000
24	Tanks	92,000	0	0	0	0	0	24,000	0	0	0	0	0	0	0	0	0
25	Labor	56,000	0	0	0	0	0	28,200	0	6,000	0	0	0	0	0	0	0
26	OEM	0	0	0	0	0	0	0	0	0	0	0	70,200	0	3,600	0	9,000
27	**Subtotal**	212,400	0	0	0	0	0	76,200	0	6,000	0	0	54,600	0	2,800	0	7,000
28																	
29	**Operating**																
30	Station Maint.		3,535	3,535	3,535	3,467	3,535	4,767	4,699	4,767	4,743	4,699	4,379	4,355	4,342	4,366	4,128
31	Cylinder Recert.		0	0	0	11,000	0	0	11,000	0	2,640	11,000	0	2,640	2,200	0	2,640
32	Power		4,924	4,924	4,924	4,829	4,924	6,367	6,276	6,367	6,336	6,276	5,849	5,817	5,800	5,832	5,514
33	Labor - fueling time loss		4,488	4,488	4,488	4,488	4,488	6,156	6,156	6,156	6,156	6,156	4,888	4,888	4,821	4,821	4,366
34	NG Fuel Tax		6,360	6,360	6,360	6,360	6,360	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088
35	Additional Training																
36	**Subtotal**	0	19,308	19,308	19,308	30,145	19,308	25,378	36,219	25,378	27,963	36,219	23,204	25,789	25,252	23,107	24,737
37																	
38	**Total Costs**	407,674	19,308	19,308	19,308	30,145	19,308	146,216	36,219	31,378	27,963	36,219	77,804	25,789	28,052	23,107	31,737
39																	
40	**Savings - Cost**	-407,674	23,015	23,015	23,015	11,296	23,015	-97,109	12,006	17,729	21,305	12,006	-26,053	26,124	23,481	28,733	21,724
41	NPV	-407,674	20,922	19,020	17,291	7,715	14,290	-54,816	6,161	8,271	9,036	4,629	-9,131	8,324	6,802	7,566	5,200
42	NPV-cumulative	-407,674	-386,752	-367,731	-350,440	-342,725	-328,434	-383,250	-377,089	-368,818	-359,782	-355,153	-364,285	-355,961	-349,159	-341,593	-336,392
43	Discount Factor	1.000	1.100	1.210	1.331	1.464	1.611	1.772	1.949	2.144	2.358	2.594	2.853	3.138	3.452	3.797	4.177
44																	
45	**Cost per vehicle per year**	-301.54															

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
46	**Period**	**Begin 1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
47	**VEHICLE DATA**																
48	**Automobiles:**																
49	Number of Vehicles	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
51	Number New Conversions	4															
53	Number Kits Transferred																
55	Number Conversions Retired														4		
57	Number OEM														4		
59	Number OEM Retired																
61	Number Vehicle Needing Recert.					4			4			4					
63	Gasoline MPG	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
65	CNG MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	1.15	1.15	1.15
66	CNG MPG	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	23.9	23.9	23.9
67	Dual-fuel MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
68	Dual-Fuel Gasoline MPG	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8
70	Annual miles traveled per vehicle	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176
71	Annual NG consump (scf)		203,113	203,113	203,113	199,207	203,113	203,113	199,207	203,113	203,113	199,207	203,113	203,113	167,789	167,789	167,789
72	Annual gasoline consump (gal)		0	0	0	32	0	0	32	0	0	32	0	0	0	0	0
73	Conversion Kit Cost	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700
74	Conv. Kit Salvage Value	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
75	Conv. labor cost	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800
76	Tank cost	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450
77	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
78	OEM Cost Difference	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900
79	OEM Salvage Value Difference	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
80	Fuel Capacity/tank (scf)	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
81	Number tanks/veh.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
82	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55
83	% NG miles	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
84	Maint. Cost Difference/year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
85	Annual NG Fuel Tax per vehicle	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60
86	On-board gasoline capacity	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
87	Period	Begin 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
88	**VEHICLE DATA**																
89	**Light Trucks:**																
90	Number of Vehicles	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78
92	Number New Conversions	78															
94	Number Kits Transferred																
96	Number Conversions Retired												78				
98	Number OEM												78				
100	Number OEM Retired																
102	Number Vehicle Needing Recert.					78			78			78					
104	Gasoline MPG	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1
106	CNG MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	1.15	1.15	1.15	1.15	1.15
107	CNG MPG	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	17.4	17.4	17.4	17.4	17.4
108	Dual-fuel MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
109	Dual-Fuel Gasoline MPG	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
111	Annual miles traveled per vehicle	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115
112	Annual NG consump (scf)		6,082,403	6,082,403	6,082,403	5,965,434	6,082,403	6,082,403	5,965,434	6,082,403	6,082,403	5,965,434	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594
113	Annual gasoline consump (gal)		0	0	0	953	0	0	953	0	0	953	0	0	0	0	0
114	Conversion Kit Cost	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700
115	Conv. Kit Salvage Value	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
116	Conv. labor cost	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600
117	Tank cost	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450
118	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
119	OEM Cost Difference	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900
120	OEM Salvage Value Difference	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
121	Fuel Capacity/tank (scf)	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
122	Number tanks/veh.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
123	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55
124	% NG miles	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
125	Maint. Cost Difference/year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
126	Annual NG Fuel Tax per vehicle	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60
127	On-board gasoline capacity	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
128	Period	Begin 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
129	VEHICLE DATA																
130	Heavy Duty Gasoline:																
131	Number of Vehicles	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
133	Number New Conversions	10															
135	Number Kits Transferred									10							
137	Number Conversions Retired									10							10
139	Number OEM																10
141	Number OEM Retired																
143	Number Vehicle Needing Recert.					10			10			10			10		
145	Gasoline MPG	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
147	CNG MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	1.15
148	CNG MPG	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	5.9
149	Dual-fuel MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
150	Dual-Fuel Gasoline MPG	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
152	Annual miles traveled per vehicle	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250
153	Annual NG consump (scf)		3,356,190	3,356,190	3,356,190	3,291,648	3,356,190	3,356,190	3,291,648	3,356,190	3,356,190	3,291,648	3,356,190	3,356,190	3,291,648	3,356,190	2,772,505
154	Annual gasoline consump (gal)		0	0	0	526	0	0	526	0	0	526	0	0	526	0	0
155	Conversion Kit Cost	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700
156	Conv. Kit Salvage Value	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
157	Conv. labor cost	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600
158	Tank cost	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
159	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
160	OEM Cost Difference	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900
161	OEM Salvage Value Difference	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
162	Fuel Capacity/tank (scf)	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
163	Number tanks/veh.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
164	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55
165	% NG miles	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
166	Maint. Cost Difference/year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
167	Annual NG Fuel Tax per vehicle	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144
168	On-board gasoline capacity	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
169	Period	Begin 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
170	VEHICLE DATA																
171	Heavy Duty Diesel:																
172	Number of Ded. CNG Vehicles	0	0	0	0	0	0	12	12	12	12	12	12	12	12	12	12
173	Number of Dual-Fuel Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	Number New Ded. Conversions							12									
177	Number Ded. Kits Transferred																
179	Number Ded Conversions Retired																
181	Number New Dual Conversions							0									
183	Number Dual Kits Transferred																
185	Number Dual Conversions Retired																
187	Number OEM (Ded.)																
189	Number OEM Retired (Ded.)																
191	Number Ded. Veh. Needing Recert.										12			12			12
193	Number Dual Veh. Needing Recert.										0			0			0
195	Diesel MPG	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
197	Ded. CNG MPG Adjust. Factor	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
198	Ded. CNG MPG	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
199	Dual-Fuel MPG Adjust. Factor	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
200	Dual-Fuel MPG	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
202	Annual miles traveled per vehicle	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
203	Annual NG consump (scf)		0	0	0	0	0	3,357,620	3,357,620	3,357,620	3,293,051	3,357,620	3,357,620	3,293,051	3,357,620	3,357,620	3,293,051
204	Annual diesel consump (gal)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
205	Ded. Conversion Kit Cost	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
206	Ded. Conv. Kit Salvage Value	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
207	Ded. Conv. labor cost	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350
208	Dual Conversion Kit Cost	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
209	Dual Conv. Kit Salvage Value	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
210	Dual Conv. labor cost	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
211	Tank cost	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
212	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
213	OEM Cost Difference (Ded.)	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800
214	OEM Salvage Value Difference	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
215	Fuel Capacity/tank (scf)	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
216	Number Tanks/Ded. vehicle	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
217	Number Tanks/Dual vehicle	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
218	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55
219	% NG of fuel consumed (dual-fuel)	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%
220	Maint. Cost Difference/year (Ded.)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
221	Maint. Cost Difference/year (Dual)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
222	Annual NG Fuel Tax per vehicle	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144
223	On-board diesel capacity	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
224	Period	Begin 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
225	FUEL PRICES																
226	Natural Gas Price/mcf	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500
227	Gasoline Price/gallon	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890
228	Diesel Price/gallon	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850
229	NG price/gallon gasoline equivalent	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307
230	NG price/gallon diesel equivalent	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348
231	Annual Fuel Price Adjustment	0.0%															
232	Total NG consump (scf)	0	9,641,707	9,641,707	9,641,707	9,456,289	9,641,707	12,999,327	12,813,910	12,999,327	12,934,757	12,813,910	11,941,518	11,876,948	11,841,652	11,906,194	11,257,939
233																	
234	STATION DESIGN																
235	Useable Storage	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
236	Switch Time (min.)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
237	NG Session Time (min.)	79	79	79	79	79	79	99	99	99	99	99	90	90	89	89	86
238	Flow Rate/hose (scfm)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
239	Min. Comp. Size (scfm)	26	26	26	26	26	26	35	35	35	35	35	35	35	35	35	35
240	Max Storage (scf)	87,611	87,611	87,611	87,611	87,611	87,611	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374
241	Design daily NG demand (scf)	37,083	37,083	37,083	37,083	37,083	37,083	49,997	49,997	49,997	49,997	49,997	45,929	45,929	45,793	45,793	43,548
242	Min. Comp. HP	17	17	17	17	17	17	22	22	22	22	22	22	22	22	22	22
243	Cycle Time (min)	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440
244	Number of Hoses	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
245	Autos per day	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.2	1.2	1.2
246	Light Trucks per day	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	18.0	18.0	18.0	18.0	18.0
247	Heavy Gasoline per day	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.0
248	Heavy Diesel per day (Ded.)	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
249	Heavy Diesel per day (Dual)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250	Auto NG per fill (scf)	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537
251	Lt Truck NG per fill (scf)	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073
252	Heavy Gas. NG per fill (scf)	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683
253	Heavy Ded. Dies. NG per fill (scf)	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683
254	Heavy Dual Dies. NG per fill (scf)	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342
255	Station Setup Cost Factor	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
256	Compressor Salvage Value																
257	Storage Vessel Salvage Val.																
258	Dispenser Salvage Value																
259	Dryer Salvage Value																
260																	
261	Labor Time Loss Calculations:																
262	Gasoline fill rate (gal/min)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
263	Diesel fill rate (gal/min)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
264	Gasoline/diesel switch time (min)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
265	Labor Cost ($/hour)	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
266	Number of Gasoline hoses	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
267	Number of Diesel hoses	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
268	Number of Autos/day	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
269	Number of Lt Trucks/day	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32
270	Number of Heavy Gas/day	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
271	Number of Heavy Diesel/day	0.00	0.00	0.00	0.00	0.00	0.00	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
272	Dedicated Gasoline Session Time	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
273	Dedicated Diesel Session Time	0	0	0	0	0	0	15	15	15	15	15	15	15	15	15	15
274																	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
275	**OTHER FACTORS**																
276	Work days/year	260															
277	Fast-fill onboard storage	92.5%															
278	3000 psi comp factor	259.67															
279	100 psi comp factor	7.92															
280	Fuel in an "empty" tank (gal)	2															
281	NG to Gasoline Factor	123															
282	NG to Diesel Factor	139															
283	Station Maint cost/gas. gal. equiv.	$0.045															
284	Electric cost ($/kWh)	$0.063															
285	No. days off for tank recert.	5															
286	Discount Rate	10.0%															

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1	Period	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	End 30	NPV
2	**SAVINGS**																	
3	Gasoline Price Diff.	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	46,515	0	409,405
4	Automobiles	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	0	8,606
5	Light Trucks	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343	0	259,489
6	Heavy Duty Trucks	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	16,191	0	141,310
7	Diesel Price Diff.	6,785	6,785	7,414	7,414	7,414	7,414	7,414	7,414	7,414	7,414	7,414	7,414	7,414	7,414	7,414	0	39,282
8	Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9																		
10	**Total Savings**	53,299	53,299	53,929	53,929	53,929	53,929	53,929	53,929	53,929	53,929	53,929	53,929	53,929	53,929	53,929	0	448,687
11																		
12	**COSTS**																	
13	**Infrastructure**																	
14	Land																	0
15	Station setup	7,626	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-43,754
16	Compressor	25,599	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-4,576	-36,094
17	Storage Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-63,116	-108,974
18	Dispenser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2,500	-24,857
19	Dryer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1,000	-9,943
20	**Subtotal**	33,225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-71,191	-223,622
21																		
22	**Vehicle**																	
23	Conversion Kit	0	0	-6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	-70,690
24	Tanks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-105,547
25	Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-74,717
26	OEM	0	0	33,600	0	0	54,600	7,000	0	0	2,800	0	0	0	7,000	27,600	-24,400	-42,966
27	**Subtotal**	0	0	27,600	0	0	54,600	7,000	0	0	2,800	0	0	0	7,000	27,600	-24,400	-293,921
28																		
29	**Operating**																	
30	Station Maint.	4,152	4,152	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059	4,059	0	-38,252
31	Cylinder Recert.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-20,629
32	Power	5,646	5,646	5,521	5,521	5,521	5,521	5,521	5,521	5,521	5,521	5,521	5,521	5,521	5,521	5,521	0	-52,037
33	Labor - fueling time loss	4,366	4,366	4,170	4,170	4,170	4,170	4,170	4,170	4,170	4,170	4,170	4,170	4,170	4,170	4,170	0	-46,163
34	NG Fuel Tax	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	8,088	0	-69,694
35	Additional Training																	
36	**Subtotal**	22,253	22,253	21,838	21,838	21,838	21,838	21,838	21,838	21,838	21,838	21,838	21,838	21,838	21,838	21,838	0	-226,775
37																		
38	**Total Costs**	55,477	22,253	49,438	21,838	21,838	76,438	28,838	21,838	21,838	24,638	21,838	21,838	21,838	28,838	49,438	-95,591	-744,318
39																		
40	**Savings - Cost**	-2,178	31,046	4,490	32,090	32,090	-22,510	25,090	32,090	32,090	29,290	32,090	32,090	32,090	25,090	4,490	95,591	-295,631
41	**NPV**	-474	6,142	808	5,247	4,770	-3,042	3,082	3,584	3,258	2,703	2,693	2,448	2,225	1,582	257	5,478	
42	**NPV-cumulative**	-336,866	-330,724	-329,916	-324,669	-319,899	-322,941	-319,859	-316,275	-313,017	-310,314	-307,621	-305,174	-302,948	-301,367	-301,109	-295,631	
43	Discount Factor	4.595	5.054	5.560	6.116	6.727	7.400	8.140	8.954	9.850	10.835	11.918	13.110	14.421	15.863	17.449	17.449	
44																		
45																		

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
46	Period	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	End 30	
47	VEHICLE DATA																	
48	Automobiles:																	
49	Number of Vehicles	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	
51	Number New Conversions																	
53	Number Kits Transferred																	
55	Number Conversions Retired																	
57	Number OEM										4							
59	Number OEM Retired										4						4	
61	Number Vehicle Needing Recert.																	
63	Gasoline MPG	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	
65	CNG MPG Adjust. Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	
66	CNG MPG	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	
67	Dual-fuel MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
68	Dual-Fuel Gasoline MPG	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	
70	Annual miles traveled per vehicle	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	8,176	
71	Annual NG consump (scf)	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	167,789	0	
72	Annual gasoline consump (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
73	Conversion Kit Cost	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	
74	Conv. Kit Salvage Value	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
75	Conv. labor cost	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800	
76	Tank cost	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	
77	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
78	OEM Cost Difference	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	
79	OEM Salvage Value Difference	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
80	Fuel Capacity/tank (scf)	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	
81	Number tanks/veh.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
82	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	
83	% NG miles	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
84	Maint. Cost Difference/year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
85	Annual NG Fuel Tax per vehicle	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	
86	On-board gasoline capacity	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
87	**Period**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**End 30**	
88	**VEHICLE DATA**																	
89	**Light Trucks:**																	
90	Number of Vehicles	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	0	
92	Number New Conversions																	
94	Number Kits Transferred																	
96	Number Conversions Retired																	
98	Number OEM						78											
100	Number OEM Retired						78										78	
102	Number Vehicle Needing Recert.																	
104	Gasoline MPG	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	
106	CNG MPG Adjust. Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	
107	CNG MPG	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	
108	Dual-fuel MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
109	Dual-Fuel Gasoline MPG	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	
111	Annual miles traveled per vehicle	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	9,115	
112	Annual NG consump (scf)	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	5,024,594	0	
113	Annual gasoline consump (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114	Conversion Kit Cost	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	
115	Conv. Kit Salvage Value	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
116	Conv. labor cost	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	
117	Tank cost	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	
118	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
119	OEM Cost Difference	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	
120	OEM Salvage Value Difference	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
121	Fuel Capacity/tank (scf)	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	
122	Number tanks/veh.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
123	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	
124	% NG miles	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
125	Maint. Cost Difference/year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
126	Annual NG Fuel Tax per vehicle	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60	
127	On-board gasoline capacity	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
128	**Period**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**End 30**	
129	**VEHICLE DATA**																	
130	**Heavy Duty Gasoline:**																	
131	Number of Vehicles	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	0	
133	Number New Conversions																	
135	Number Kits Transferred																	
137	Number Conversions Retired																	
139	Number OEM							10							10			
141	Number OEM Retired							10							10		10	
143	Number Vehicle Needing Recert.																	
145	Gasoline MPG	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	
147	CNG MPG Adjust. Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	
148	CNG MPG	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
149	Dual-fuel MPG Adjust. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
150	Dual-Fuel Gasoline MPG	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	
152	Annual miles traveled per vehicle	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	13,250	
153	Annual NG consump (scf)	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	2,772,505	0	
154	Annual gasoline consump (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
155	Conversion Kit Cost	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	
156	Conv. Kit Salvage Value	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
157	Conv. labor cost	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	
158	Tank cost	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	
159	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
160	OEM Cost Difference	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900	
161	OEM Salvage Value Difference	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
162	Fuel Capacity/tank (scf)	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	
163	Number tanks/veh.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
164	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	
165	% NG miles	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
166	Maint. Cost Difference/year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
167	Annual NG Fuel Tax per vehicle	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	
168	On-board gasoline capacity	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
169	**Period**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**End 30**	
170	**VEHICLE DATA**																	
171	**Heavy Duty Diesel:**																	
172	Number of Ded. CNG Vehicles	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	0	
173	Number of Dual-Fuel Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	Number New Ded. Conversions																	
177	Number Ded. Kits Transferred																	
179	Number Ded Conversions Retired			12														
181	Number New Dual Conversions																	
183	Number Dual Kits Transferred																	
185	Number Dual Conversions Retired			0														
187	Number OEM (Ded.)			12												12		
189	Number OEM Retired (Ded.)															12	12	
191	Number Ded. Veh. Needing Recert.																	
193	Number Dual Veh. Needing Recert.																	
195	Diesel MPG	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	
197	Ded. CNG MPG Adjust. Factor	0.74	0.74	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
198	Ded. CNG MPG	6.2	6.2	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
199	Dual-Fuel MPG Adjust. Factor	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
200	Dual-Fuel MPG	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
202	Annual miles traveled per vehicle	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	
203	Annual NG consump (scf)	3,357,620	3,357,620	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	3,105,799	0	
204	Annual diesel consump (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
205	Ded. Conversion Kit Cost	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	
206	Ded. Conv. Kit Salvage Value	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	
207	Ded. Conv. labor cost	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	$2,350	
208	Dual Conversion Kit Cost	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	
209	Dual Conv. Kit Salvage Value	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	
210	Dual Conv. labor cost	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	
211	Tank cost	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	
212	Tank Salvage Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
213	OEM Cost Difference (Ded.)	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	
214	OEM Salvage Value Difference	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	
215	Fuel Capacity/tank (scf)	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	
216	Number Tanks/Ded. vehicle	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
217	Number Tanks/Dual vehicle	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
218	Tank Recert. Cost/tank	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	
219	% NG of fuel consumed (dual-fuel)	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	
220	Maint. Cost Difference/year (Ded.)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
221	Maint. Cost Difference/year (Dual)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
222	Annual NG Fuel Tax per vehicle	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	$144	
223	On-board diesel capacity	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
224	**Period**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**End 30**	
225	**FUEL PRICES**																	
226	Natural Gas Price/mcf	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	$2.500	
227	Gasoline Price/gallon	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	$0.890	
228	Diesel Price/gallon	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	$0.850	
229	NG price/gallon gasoline equivalent	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	$0.307	
230	NG price/gallon diesel equivalent	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	$0.348	
231																		
232	Total NG consump (scf)	11,322,508	11,322,508	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	11,070,687	0	
233																		
234	**STATION DESIGN**																	
235	Useable Storage	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
236	Switch Time (min.)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
237	NG Session Time (min.)	86	86	84	84	84	84	84	84	84	84	84	84	84	84	84	0	
238	Flow Rate/hose (scfm)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	
239	Min. Comp. Size (scfm)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
240	Max Storage (scf)	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	116,374	
241	Design daily NG demand (scf)	43,548	43,548	42,580	42,580	42,580	42,580	42,580	42,580	42,580	42,580	42,580	42,580	42,580	42,580	42,580	0	
242	Min. Comp. HP	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	
243	Cycle Time (min)	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	
244	Number of Hoses	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
245	Autos per day	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.0	
246	Light Trucks per day	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	0.0	
247	Heavy Gasoline per day	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0	
248	Heavy Diesel per day (Ded.)	4.8	4.8	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.0	
249	Heavy Diesel per day (Dual)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
250	Auto NG per fill (scf)	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	
251	Lt Truck NG per fill (scf)	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073	
252	Heavy Gas. NG per fill (scf)	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	
253	Heavy Ded. Dies. NG per fill (scf)	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	2,683	
254	Heavy Dual Dies. NG per fill (scf)	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	
255	Station Setup Cost Factor	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	
256	Compressor Salvage Value	$4,905															$4,576	
257	Storage Vessel Salvage Val.																$63,116	
258	Dispenser Salvage Value																$2,500	
259	Dryer Salvage Value																$1,000	
260																		
261	**Labor Time Loss Calculations:**																	
262	Gasoline fill rate (gal/min)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
263	Diesel fill rate (gal/min)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
264	Gasoline/diesel switch time (min)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
265	Labor Cost ($/hour)	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	
266	Number of Gasoline hoses	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
267	Number of Diesel hoses	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
268	Number of Autos/day	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.00	
269	Number of Lt Trucks/day	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	0.00	
270	Number of Heavy Gas/day	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	0.00	
271	Number of Heavy Diesel/day	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	0.00	
272	Dedicated Gasoline Session Time	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	0	
273	Dedicated Diesel Session Time	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	0	
274																		