Economic Impact of the Propane Green Autogas Solutions Act of 2011 (Propane GAS Act) (H.R. 2014/S. 1120)

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1. Introduction and Overview

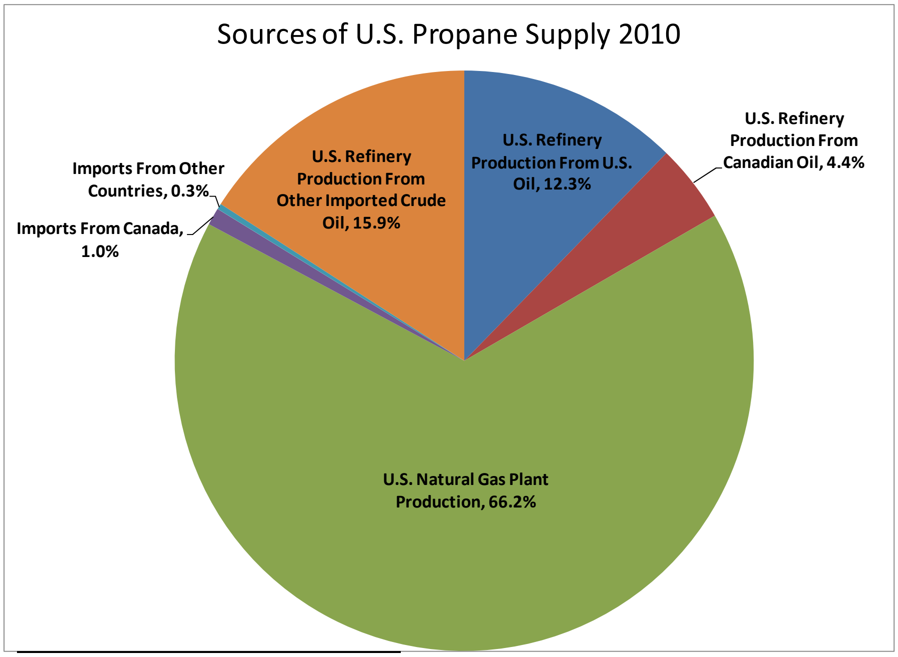
1.1 Introduction

In many ways, propane[1] is an ideal alternative vehicle fuel. The fuel is widely available, and sufficient fuel supply, transportation, and distribution infrastructure exists in the market today to meet foreseeable demand. There are no major technological challenges associated with developing propane fueled vehicles or expanding the fueling infrastructure. The current generation of vehicles powered with propane have nearly the same operational and performance characteristics as conventionally powered vehicles.

In addition, the use of propane as a vehicle fuel is consistent with national environmental and energy security objectives. Propane is cleaner than gasoline and diesel with respect to most major pollutants, including carbon monoxide (CO), non-methane hydrocarbon (NMHC), and exhaust course particulate matter (PM_{10}), and provides from 18 to 20 percent reduction in total carbon dioxide emissions relative to gasoline.

Propane is also primarily a North American energy source (Figure 1). In 2010, more than 99 percent of propane used in the U.S. was produced in North America, and more than 66 percent was produced from natural gas liquids.

Figure 1: Sources of U.S. Propane Supply 2010



[1] Propane used as a vehicle fuel is often referred to as LPG (Liquefied Petroleum Gas) and as propane autogas. In the U.S., the terms propane and LPG are functionally equivalent, although in other parts of the world, LPG may contain a higher proportion of other petroleum gases, including butane than would be allowed in propane. For this report, we use the terms LPG, propane and propane autogas interchangeably.

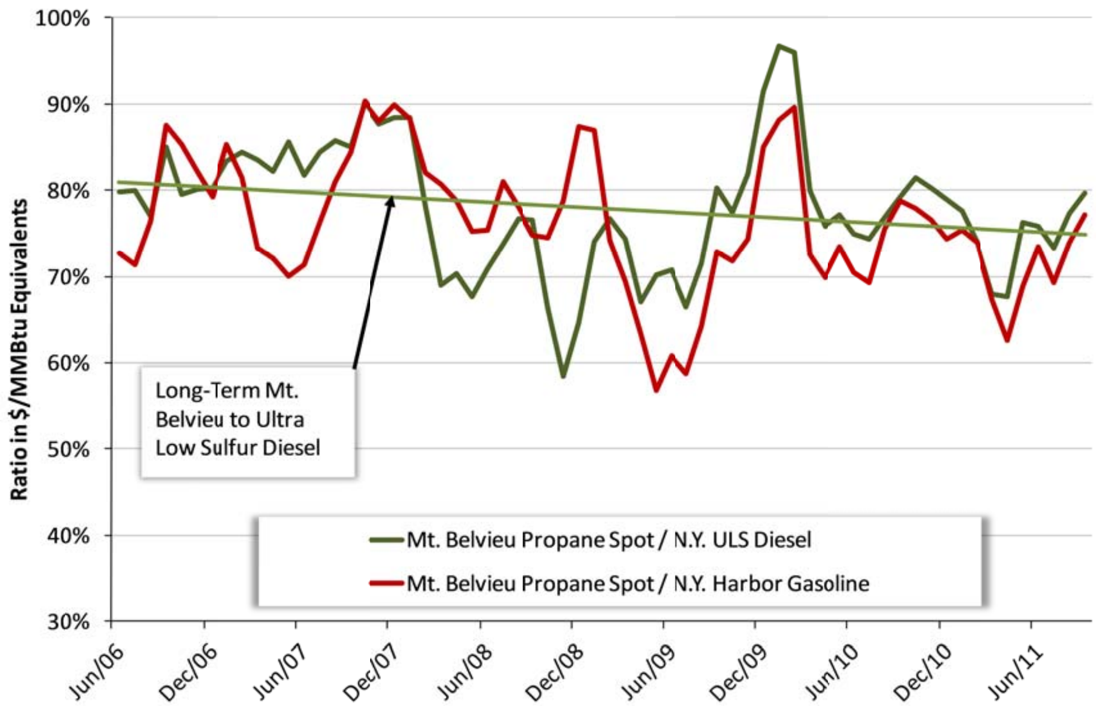
In early 2011, the U.S. became a net exporter of propane. ICF is projecting domestic propane supply to grow rapidly over the next 10 to 20 years in conjunction with the growth in shale gas production. ICF is also projecting consumer propane demand in traditional markets to be stable or declining. Unless domestic demand for propane increases, the growth in propane supply will lead to a significant growth in propane exports. As a result, displacement of gasoline and diesel fuel by propane will directly reduce reliance on imported crude oil and petroleum products, while also reducing propane exports, and increasing domestic energy security.

Despite the potential benefits, propane vehicle sales currently represent a very small share of the total vehicle market. Total propane vehicle sales in 2011 are projected by ICF to be only about 5,200 units. The lack of market interest in propane vehicles is largely a cost and availability issue. Between 2000 and 2007 there were almost no propane fueled vehicles available in the market capable of meeting EPA or CARB emissions certification criteria. Meeting the tighter emissions criteria required significant investment in engine technology development, testing and certification. When spread out over a relatively small number of vehicle sales, these costs substantially increased the cost of propane vehicles relative to conventionally fueled vehicles. Today, bi-fuel conversions of conventional vehicles to propane typically cost $5,000 to $6,000 per vehicle in addition to the initial cost of the vehicle. The new generation of dedicated propane vehicles typically cost from $10,000 to $15,000 more than the equivalent gasoline vehicle. During most of the last 15 years, delivered propane prices did not provide sufficient cost advantage relative to gasoline to offset the first cost differential and stimulate market interest in propane vehicles.

The outlook for propane vehicles has changed substantially in the last few years. The increase in crude oil prices, combined with growth in domestic propane supply associated with the growth of shale gas has reduced the wholesale price of propane relative to gasoline and diesel fuel (Figure 2), and changes in propane fleet fueling business practices have changed the relationship between propane and gasoline prices for fleet customers. Current delivered propane prices are typically well below gasoline prices for fleet vehicles after adjusting for differences in fuel efficiency. Given the current energy price outlook, propane prices are expected to remain well below gasoline prices for the foreseeable future.

In addition, federal government tax policy has promoted the development of new propane vehicles by offering significant tax credits for new vehicles and refueling infrastructure, as well as excise tax credits on fuel. These incentives have encouraged development of a number of new propane vehicles that have recently reached the market, or are expected to reach the market in the next two years. However, the new vehicle tax credit expired at the end of 2010, and the infrastructure and fuel excise tax credit are scheduled to expire on December 31, 2011.

Figure 2: Change in Propane Resource Prices Relative to Gasoline and Diesel Fuel



Congress is currently considering a bill to extend the propane vehicle incentives through 2016. H.R. 2014, the "Propane Green Autogas Solutions Act of 2011" includes three provisions intended to facilitate market penetration of vehicles fueled by Liquefied Petroleum Gas (LPG).[2] These include:

1) Modification and extension of the alternative fuel credits for liquefied petroleum gas used in vehicles for five years, from December 31, 2011 through December 31, 2016. This provision would allow a $0.50 per gallon tax credit for the use of LPG in a qualified vehicle application.
2) Modification and extension of the new qualified alternative fueled motor vehicle credit through December 31, 2016. This provision would allow a tax credit of from 50 percent to 80 percent of the incremental cost of a dedicated LPG fueled vehicle, depending on vehicle efficiency.

[2] The provisions in H.R. 2014 are limited to the use of propane. Hence the analysis assumes that no new tax credits are passed for other alternative fueled vehicles.

3) Extension of the alternative fuel vehicle refueling property credit through December 31, 2016. This provision would allow a tax credit of 30 percent of the incremental cost of refueling infrastructure, not to exceed $30,000 per installation.

ICF International was retained by the National Propane Gas Association to evaluate the potential economic benefits and costs of this legislation. This report documents the results of our analysis.

1.2 Overview of Approach

The ICF analysis was conducted using standard economic modeling and analysis techniques. The analysis was conducted in two phases, using two widely used and respected economic models. In the first phase, ICF projected the number of propane vehicles that would be sold to the fleet market with and without the proposed tax credit. The analysis used a vehicle market share model called the Alternative Fuel and Vehicle Choice (AFVC) model. Key inputs to the analysis, including propane vehicle efficiency, fuel prices, incremental vehicle costs refueling infrastructure costs and other inputs were developed based on input from the propane vehicle industry, as well as research published by the U.S. Department of Energy, the national laboratories and other public sources.

In the second phase, ICF evaluated the impacts of the change in propane vehicle sales on the U.S. economy. The vehicle sales and usage estimates were used to develop the direct economic impacts of the proposed tax credits, including incremental investment in new vehicles and refueling infrastructure for both propane and conventional fuel vehicles, impacts on operating costs associated with the use of propane instead of conventional fuels, benefits to the economy of reducing oil imports, and costs of the tax credit proposal to taxpayers.

ICF used the regional economic model IMPLAN to estimate the economic impacts of the proposed propane tax credit policy on the U.S. economy based on these inputs. IMPLAN is one of the most commonly used input-output models that can be used to estimate the direct, indirect, and induced employment and industry activities, as well as the local, state and federal tax revenues generated by increased expenditures associated with any policy changes - in this case the proposed extension of the propane tax credit policy.

ICF identified the potential benefits and costs associated with the tax credit policy, and allocated the incremental expenditures to sectors within a customized version of the IMPLAN model. The potential benefits of the tax credit policy can broadly be described as increased industry activity due to new and/or retrofitted propane vehicles, construction and maintenance of propane refueling infrastructure, increased sale of domestic propane, propane on-road taxes, and increased demand for household goods and services generated by higher consumers' disposable income as a result of the savings associated with using propane vehicles over traditional vehicles (i.e., since propane costs less at the pump than gasoline). The potential negative impacts of the proposed tax credit policy are those associated with the loss of spending in the traditional oil and gas industry and gas stations as well as the tax revenue generated from that spending. Our modeling also accounted for the costs associated with the tax credit policy's subsidy for propane and propane fueling stations.

ICF modeled the economic impacts over a ten-year time horizon, from 2012 – 2021, which allowed us to capture the five years during which the proposed tax credits would be in place, as well as the following five years in which the effects of the policy would continue to impact the economy. The results from this modeling analysis are reported as the total (direct, indirect, and induced) impacts generated by the proposed propane tax credit policy on changes to employment, output, and tax revenue.

ICF conducted the analysis for two different market scenarios reflecting different views of the propane vehicle market potential. For each market scenario, ICF projected propane vehicle market penetration both with and without the proposed tax credit. The two different market scenarios include:

1) The ICF Base Case reflects ICF's assessment of the likely market penetration of propane vehicles based on ICF's assessment of propane vehicle availability and prices, vehicle performance characteristics, and market conditions, including fleet vehicle fuel price, and competition from conventional and other alternative fueled vehicles. Based on industry order backlogs and assessments of market interest in 2011, this is a conservative assessment of propane vehicle market penetration.

2) The ICF Optimistic Case reflects a more positive assessment of the propane vehicle market. The optimistic case was developed based on discussions with propane vehicle manufacturers concerning their market expectations, along with an assessment of the potential reduction in operating costs that could result from a higher volume of propane vehicle sales. The changes in operating costs included modest improvements in vehicle efficiency, and decreases in refueling costs per vehicle and in delivered propane price relative to gasoline.

1.3 Summary of Results and Key Conclusions

1.3.1 Summary of Results

Table 1 below summarizes the results of the economic impact analysis of H.R. 2014 for the Base Case and the Optimistic Case for each year of the modeling timeframe. Both the Base Case and Optimistic Case were analyzed with and without approval of H.R. 2014. The results shown below reflect the difference between the "with H.R. 2014" and "without H.R. 2014" scenarios. The employment, output and tax impacts for both cases follow the same trend with annual increases in the early years as the propane vehicle market continues to develop. The impacts peak in 2016, the final year of the policy, when incremental propane vehicle and infrastructure sales are at their highest levels.

We do not consider incremental vehicle and infrastructure sales after the tax credit proposal expires in 2016. However, positive job impacts, increases in economic output, and increases in tax revenues continue from 2017 through 2021 because of the continued consumer fuel savings resulting from operation of the propane vehicles sold between 2012 and 2016.

Table 1: Economic Impacts of H.R. 2014

Number of Jobs Created by H.R. 2014										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base Case	6,500	12,000	17,600	23,700	30,400	15,100	14,800	14,500	14,100	13,800
Optimistic Case	9,300	17,800	23,800	32,400	42,000	21,300	20,900	20,400	19,900	19,400
Increase in Economic Output Created by H.R. 2014 (2011$ in Millions)										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base Case	$1,032	$1,869	$2,585	$3,320	$4,078	$1,651	$1,578	$1,503	$1,430	$1,362
Optimistic Case	$1,381	$2,560	$3,511	$4,596	$5,735	$2,529	$2,436	$2,337	$2,242	$2,144
Increase in Tax Revenue Resulting from Implementation of H.R. 2014 (2011$ in Millions)										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base Case	$ 134.0	$ 253.6	$ 373.2	$ 505.1	$ 649.0	$ 339.0	$ 330.4	$ 320.6	$ 310.9	$ 301.8
Optimistic Case	$ 188.1	$ 364.3	$ 503.5	$ 962.0	$ 900.0	$ 484.0	$ 473.0	$ 460.1	$ 447.3	$ 433.6

1.3.2 Key Conclusions

Our analysis of the economics of propane use as an alternative to conventional fuels in fleet applications indicates the propane vehicles are economic for many applications at current and projected propane and gasoline prices, however, propane vehicle sales will expand relatively slowly in the absence of the tax credits proposed in H.R. 2014 or other incentives. Our analysis also concludes that H.R. 2014 will have a significant impact on the number of propane vehicles sold, leading to substantial economic, energy security, and environmental benefits. The key conclusions are summarized below, and discussed in more detail in section 3 of this report. The lower and upper values reflect the impact of the tax credits on the ICF Base Case and ICF Optimistic Case scenarios.

Impact on Propane Vehicle Sales

Implementation of the "Propane Green Autogas Solutions Act of 2011" H.R. 2014 will provide a major stimulus to the sale of propane vehicles, leading to much faster market growth.

1) ICF's analysis projects between 17,000 and 34,000 propane vehicles sold in 2016 in the absence of incentives.

2) ICF is projecting between 96,000 and 157,000 propane vehicle sales per year by 2016 if H.R. 2014 is implemented.

Impact on Jobs and the Economy

H.R. 2014 will also provide significant benefits to the U.S. economy:

3) The growth in the propane vehicle sales and use created by the tax credits will generate an increase in economic activity that peaks at between $4 billion and $5.7 billion per year in 2016, and totals between $20 billion and $29 billion over the ten year period from 2012 through 2021.

4) The growth in economic activity created by the tax credits will create between 30,000 and 42,000 new jobs by 2016, including between 14,000 and 19,000 jobs directly related to the production, sale, and utilization of propane vehicles, propane refueling facilities, and propane production and distribution, and between 16,000 and 23,000 indirect and induced jobs in other industries created by the increase in demand for services by the industries directly affected, as well as the impact of reduced expenditures on fuel on demand for other products

5) Over the ten year period from 2012 to 2021, the cost of the proposed tax credits to the federal government will be more than offset by increased tax revenues at the federal, state and local government level.

Impact on Energy Security and the Environment

H.R. 2014 will improve U.S. energy security by increasing sales of domestically produced propane and reducing reliance on oil and petroleum imports.

6) H.R. 2014 will increase consumption of domestically produced propane by between 579 and 759 million gallons of propane per year by 2016, with a cumulative increase of between 4.2 and 5.5 billion gallons between 2012 and 2021.

7) By 2016, the increase in propane consumption will increase propane industry sales by 3.3 percent to 4.3 percent relative to total 2010 sales, and 6.3 to 8.3 percent of total consumer (odorized) propane sales.

8) The increase in propane use will reduce consumption of conventional fuels by the equivalent of between 480 and 683 million gallons of gasoline per year by 2016, with a cumulative reduction of 3.5 to 4.9 billion gallons of gasoline equivalent between 2012 and 2021.

9) The tax credit will reduce crude oil and petroleum product imports by between 11 and 15 million barrels per year by 2016, and between 83 and 117 million barrels over the period from 2012 through 2021.

10) The increase in propane consumption and corresponding reduction in gasoline consumption will directly reduce annual carbon dioxide emissions by between 0.9 to 1.7 million metric tons per year by 2016, and between 6.2 and 11.5 million metric tons over the period from 2012 to 2021.

2. Impact of H.R. 2014 on Propane Vehicle Sales

2.1 Overview

Propane powered vehicles have been sold for decades in the US. Their primary customers have been fleet owners rather than individuals. Unlike other alternative fuels, the lack of penetration of the consumer market has not been due to the lack of a refueling infrastructure as propane is available relatively widely. Rather, the retail price of propane to a consumer for refueling the vehicle has historically been comparable to the price of gasoline on an energy basis providing little incentive for a consumer to pay more for a vehicle converted to operate on propane. Fleet owners realized some net savings as they did not incur the high retail markup on propane fuel, and as a result, several thousand propane vehicles were sold annually to this market during the 1990s.

More recently, new vehicles have faced much more stringent emissions certification requirements. When spread over a small sales base, the fixed cost of meeting the new requirements has increased the cost of propane vehicles by several thousand dollars relative to comparable gasoline counterparts, resulting in both a decline in vehicle sales, and a decline in vehicle availability. The high costs and lack of vehicle availability have caused the propane vehicle market to decline in the last decade. In the last 3 years however, the very high price of gasoline coupled with the relatively low price of propane at the wholesale level has made the economics of propane vehicles attractive once again. In addition, vehicle manufacturers have invested in new engine technologies capable of meeting the emissions certification requirements, and are bringing a variety of new vehicle models to the market. Manufacturers of propane vehicle conversion systems also expect to see a significant sales increase as new vehicle systems become available.

Since 2006, purchasers of propane vehicles have been provided a tax credit of 50% of the incremental cost for dedicated light duty vehicles, and up to 80% of the incremental cost for medium duty vehicles. The vehicle tax credit was not available for bi-fuel vehicles which can use either gasoline or propane. In addition, users of propane vehicle fuel were eligible for a tax credit of 50 cents per gallon, while the costs of installed refueling infrastructure were eligible for a 30% tax credit. The vehicle tax credits expired on December 31, 2010 and the fuel and refueling infrastructure tax credits are currently scheduled to expire on December 31, 2011. The analysis in this section provides an estimate of propane vehicle sales in the 2012 to 2016 time frame without the tax credit. In addition, the analysis also provides an estimate of vehicle sales if the credits are reinstated in accordance with H.R. 2014.

2.2 Forecasting Market Penetration of New Propane Vehicles

This analysis uses a vehicle market share model called the Alternative Fuel and Vehicle Choice (AFVC) model, developed by Dr. David Greene at Oak Ridge National Laboratory with assistance from K.G. Duleep and other ICF staff to project future market penetration of propane fleet vehicles. The AFVC is a static equilibrium model, in that it does not project year by year development of the propane vehicle market. Instead, it predicts the market share for all alternative fuel types when the market has sufficiently matured so that availability of a number of popular makes and model types of vehicles for each fuel type is not an issue.

Use of the AFVC Model to Address Complexities in Forecasting Market Penetration of New Alternative Fueled Vehicles

Forecasting demand for new products for which there is limited history of market experience is always challenging. Existing studies of consumer demand for alternative fuels offer a reasonable consensus about which fuel characteristics are important but permit only a limited quantification of consumers' willingness to pay for fuel attributes. In addition, some key characteristics of future alternative-fuel vehicles are only approximately known at this time. For some alternative fuels, positive and negative characteristics of the fuel may offset each other to a substantial degree, leaving market share to be determined by price and intangible or unpredictable factors, such as consumer perceptions of fuel "quality" or individual willingness to pay for fuels with social rather than private benefits. The price responsiveness of fuel and vehicle demand in the context of a well-developed alternative-fuels market is also not definitively known. Existing econometric studies of conventional-fuel-type choice indicate very high price elasticity (-10 to -40) of demand in a variety of contexts. The price elasticity of vehicle-type choice is also likely to be quite high for most vehicle types. To the extent that alternative fuels are perceived to be nearly equivalent to gasoline, vehicle and fuel choice is likely to be highly sensitive to small price or quality differences.

What is required is a modeling method that recognizes the existence of uncertainties, permits what is known to be used in a rigorous manner, and requires all critical assumptions to be made explicitly. The AFVC model accomplishes these goals by starting with a theoretically rigorous model structure and calculating all of its parameters from data or explicitly stated assumptions. The process of calibration begins with the specification of key assumptions about consumer behavior and fuel and vehicle attributes. These are used to calculate fuel attribute values in dollars per barrel of gasoline equivalent. Dollar values of fuel attributes are first used to estimate coefficients for the *fuel-choice* decisions for multi-fuel vehicles, which are then subsumed, or *nested*, in the *vehicle-choice* model.

Based on assumptions about vehicle use, depreciation rates, fuel economy, length of ownership, and discount rates, which are also entered in the model, price differences among vehicles are converted to price differences per barrel of gasoline equivalent. Price slope coefficients are then calculated from three items of data supplied by the user: (1) a price elasticity at (2) a given market share and (3) initial vehicle price.[1] The price slope is then used to transform the dollar values of attributes into alternative-specific constants for the logit model. As a result, the coefficients of the choice model in the AFVC depend directly and entirely on the assumptions made about vehicle characteristics and related factors.

Use of the AFVC Model to Address Complexities in Forecasting Market Penetration of New Alternative Fueled Vehicles (Continued)

Because the AFVC is a static equilibrium model, solutions represent long-run adjustments of supply and demand to prices. The AFVC does not attempt to represent the dynamic process of new vehicle purchases and the aging and retirement of vehicle stock. Similarly, the expansion of AFV manufacturing capability and alternative-fuel processing and distribution networks is not represented. The stock of AFVs and the choice of fuel by flexible-fuel vehicles (FFVs) and dual-fuel (or bi-fuel) vehicles (DFVs) are determined at the same time and are, by assumption, in long- run accord with fuel prices. It is therefore desirable that the choice of vehicle reflect the consumer's evaluation of the fuels the AFVs can use and that this evaluation is consistent with the modeling of fuel choices. This is accomplished by an explicit linking of the fuel and vehicle choice logit models. Fuel attribute values from the fuel-choice logit model enter into the vehicle choice model in a way that reflects their expected value to the vehicle purchaser. This linkage between the fuel- and vehicle- type choice models ensures consistent parameter values for the two models. It does not, of course, remove the inherent limitations of static equilibrium models.

The long-run market equilibrium assumption has one enormously important implication for the AFVC model. The model treats all alternative fuels and vehicle technologies equally. More specifically, it assumes that every alternative fuel is widely available (like gasoline) and that every AFV technology is available for every make and model of vehicle consumers may desire. This assumption is unrealistic for dynamically evolving real world markets. Even in a long-run equilibrium market, it is likely that economies of scale would limit the availability of the less popular AFV technologies and alternative fuels. In this particular case, we restrict the "universe" of vehicle sales to only commercial truck fleet sales where GM, Ford and (to a lesser extent) Dodge pickup and van models have the vast majority of vehicle sales. Propane powered versions of many popular GM and Ford full size trucks are already available and we anticipate that propane models of Dodge trucks will likely enter the market in the next 2 to 3 years. In the context of centrally fueled fleets, the AFVC results are likely to be applicable as it removes the key barrier of more difficult fuel availability for alternative fuels relative to gasoline and diesel which is a strong barrier in personal vehicle markets. In addition, fleets are much more likely to pay attention to fuel costs as long as vehicle availability and quality are not issues, and the strong economic framework of the AFVC should be a good model of fleet customer behavior.

2.3 Fleet Vehicle Market Size:

Fleet vehicle sales of trucks that operate on propane have been traditionally concentrated in those weight classes where gasoline powered vehicles have had significant market share, which are primarily the lighter end of the truck market, as most large trucks have been diesel powered. In addition, they have been used primarily for short or regional haul service as the typical range per tank of propane is in the order of 200 to 250 miles. The truck classes included are called "light duty" vehicles in the 6,000 to 10,000 lb. gross vehicle weight (GVW) class where the vehicles overlap considerably with personal use trucks, the medium duty segment in the 12,000 to 18,000 lb GVW category and in school buses of about 20,000 to 24,000 lb. GVW. Trucks over 19,000 lb GVW are almost completely dieselized, and propane powered engines for these weight classes of trucks are not currently available.[3]

Detailed data on truck sales to centrally fueled fleets are not available and the only source of data from which the sales can be estimated is from a survey conducted by the U.S. Census called the Vehicle Inventory and Use Survey (VIUS). The last such survey was conducted in 2002, and while the information from this survey is somewhat dated, it can provide reasonable estimates of the magnitude of vehicle populations that define the universe of interest. Sales are estimated by dividing populations by average age, since overall fleet growth has been quite small as evidenced by total truck sales by weight class over the last decade. The VIUS allows estimation of populations by fleet size, and we chose fleets with 5 or more trucks primarily in short haul service to be likely to use central refueling.

Table 2: VIUS Estimation of Fleet Vehicle Population

Type		Total Population	Fleet Population
Private Light Trucks (<10000 lbs)		78,000,000	2,498,000
Private Light-heavy (10 to 18,000 lbs)		1,860,000	329,000
Private Single Axle Medium Heavy		1,487,000	379,000
Private Dual Axle Medium Heavy		608,500	217,500
Private Heavy- Heavy		1,270,000	343,000
Federal Fleet		375,000	?
State & Local fleet		1,710,000	?
School Bus		617,000	617,000
Transit Bus		76,000	76,000

Table 2 shows the entire on-road population of trucks and the number estimated in fleets of 5 or more. As noted, most of the trucks classified as light duty are for personal use and only about 3% of these trucks are used in commercial service in fleets, but the absolute number is still large. The other target markets are the medium duty (10 to 18k lb GVW) and the school bus market. The federal and state fleets could also be significant markets but no detailed breakdown of weight and use type is available, and we have not estimated the government purchases of trucks in this analysis.

The typical light duty class 2 pickup and van (like the Ford F150/250 pickup and E150/250 van) is driven about 18,000 miles per year in its first 4 years of ownership. The mean life of these vehicles according to DOT is 14 years, implying average sales per year of about 180,000 vehicles per year (~ 2,498,000/14) to fleets with over 5 trucks. Medium duty trucks are used somewhat more intensively with annual mileage at 22,500 miles per year but a similar useful life

[3] Freightliner Custom Chassis and Roush are currently developing propane engine and chassis combinations that would compete with diesel engine applications in the medium and heavy duty weight classes.

of 14 years, implying annual sales of 23,500 per year (~ 329,000/14). School buses however, have very low annual miles (only about 9,000 per year) and are, hence very long lived with an average life of 25 years, implying annual sales of 24,700 buses. Of these only 65% are in the class C category which have engines similar to those used in medium duty vehicles, and sales of these buses are estimated at 16,100 per year. Based on the VIUS data, the fuel economy of light and medium duty vehicles is estimated at 14 mpg and 10 mpg respectively for gasoline powered vehicles. Fuel economy of school buses in the slow speed stop-and-go cycle is estimated at 8 mpg. These factors are utilized to derive market shares for alternative fuels using the AFVC.

2.4 Propane Vehicle Characteristics

The fleet market for propane vehicle sales is driven primarily by the economic and operational characteristics of the available propane vehicles relative to other competing vehicles. The key characteristics that drive vehicle sales include:

- Operational characteristics of vehicles, including vehicle range, vehicle storage space, power, reliability, fuel efficiency, and refueling availability.
- Price of propane fuel, including refueling station costs.
- Incremental costs of vehicles relative to the available alternatives.

The key factors influencing the economics of propane vehicles are summarized below.

2.4.1 Vehicle Performance Characteristics

For fleet applications, propane vehicle characteristics are similar to conventionally powered vehicles:

- Propane fuel tank capacity and fuel efficiency are sufficiently close to those available for conventional vehicles to minimize concerns about vehicle range.
- Emergency refueling options are generally available.
- For dedicated propane vehicles, the fuel tank is similar in size to a gasoline fuel tank, and does not significantly reduce available vehicle trunk or storage space.
- Vehicle refueling characteristics are similar to conventional vehicles in terms of refueling infrastructure requirements and refueling time requirements.
- The current generation of liquid injection engines generally have the same power output and performance characteristics as the comparable gasoline engines.

2.4.2 Fuel Costs

One of the challenges in assessing the net benefit of the proposed propane tax credit to American consumers is determining the cost savings associated with propane fuel relative to gasoline and diesel vehicles. Fuel cost savings provide the predominant economic incentive to switch from conventionally fueled vehicles to propane.

Propane fuel costs vary widely by volume. Larger fleets with private refueling facilities are able to purchase propane at significantly lower prices than individuals. As a result, the target market for propane vehicles is predominantly fleet vehicles. This analysis is focused on fleet sales, and the fuel cost used in the analysis is intended to reflect the average fleet purchase price.

None of the publicly reported propane price series accurately reflect the propane prices paid by fleet vehicle owners. The only publicly reported price data on propane vehicle fuel is reported by the DOE Clean Cities program. This price series is based on a survey of retail fueling stations that typically report prices closer to cylinder refill prices than to prices appropriate for a large volume fleet customer. The majority of transactions at public propane refill facilities include refills of 20 pound (roughly four gallon) cylinders used for barbeque grills, and for other portable cylinder applications, while fleet propane purchases typically range from 500 to 2000 gallons per purchase. The small transactions size of the propane cylinder refill market results in a significantly higher cost than is available to most fleet vehicle customers.

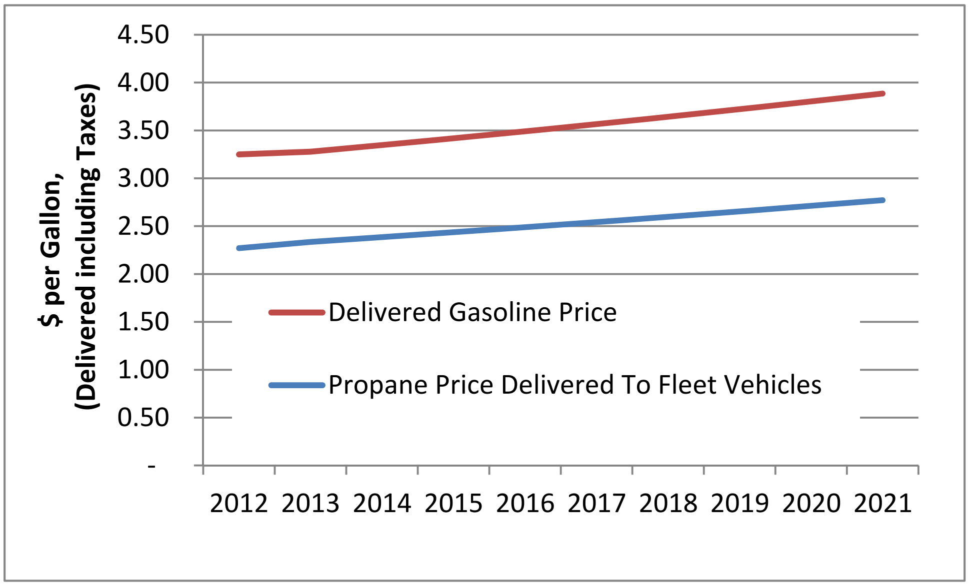
The DOE Clean Cities program does report prices for private fleet operators. However, the reported price data varies widely by region, and is incomplete. For some regions of the country (the Midwest and Gulf Coast), the DOE Clean Cities private fleet propane costs were substantially lower than the reported public refueling station average price, while in other regions (the West Coast) prices were higher or were not reported. The private fleet prices reported by the DOE Clean Cities program were considered, but not relied upon in the development of the fuel price index used in the ICF analysis.

In order to create the fuel price index used in this analysis, ICF reviewed confidential transactions level pricing data for propane vehicle fleet purchases of propane provided by propane retailers. Five major propane retailers provided confidential transactions level pricing data. Two additional propane retailers provided publicly posted prices. Transactions records for more than 30 million gallons in propane sales were reviewed as part of the analysis. The data provided included transaction date, location (state), volume, and price (delivered price, including all taxes, prior to subtracting the $0.50 per gallon fuel tax credit). Where possible, ICF adjusted the data to account for differences in taxation between public and private parties, as well as accounting for differences in ownership of the refueling stations.

The data on delivered transactions and posted prices was averaged across all of the companies to create a single national price series. The averaging process gave equal weight to each participating company in order to avoid potential disclosure of pricing data for the largest companies in the sample. As a result, the propane price used in the base case analysis is higher than the average volume weighted transaction price, resulting in understating the economic benefits estimated by the analysis.

We have projected delivered gasoline and propane fuel prices based on a projection of wholesale prices for the two fuels, plus transportation and distribution costs and fuel taxes. The wholesale price of gasoline and propane were projected based on the relationship between the historic fuel prices and the U.S. Refiner Acquisition Cost of Crude for the twelve month period from July 2010 through June 2011. The U.S. Refiner Acquisition Cost of Crude is projected to decline to an average of $90 per barrel in 2012, and remain constant in real terms, leading to an annual increase in nominal oil prices of 2.5 percent per year after 2012.   The projected propane and gasoline prices used in the analysis are shown in Figure 3.

Figure 3: Projected Fuel Prices Used in Analysis Before Consideration of Excise Fuel Tax Credit



2.4.3 Vehicle Efficiency

Propane has a lower energy content per gallon of fuel than gasoline or diesel fuel, and propane vehicles typically have lower miles per gallon than equivalent conventional vehicles. On a BTU basis, one gallon of propane contains 73 percent of the energy content of gasoline, and 66 percent of the energy content of diesel fuel. In practice, engine fuel efficiency differs from the fuel BTU content based on the operational characteristics of the engines. The engines must meet specific emissions criteria to be certified for sale, and tuning the engine to meet the emissions criteria can have a significant impact on fuel efficiency. In addition, there are tradeoffs between power, efficiency, reliability, engine life and other operational characteristics.

The efficiency of the older propane vehicle conversions currently on the road typically has been similar to the BTU content of the fuel, or slightly lower. However, according to industry sources, the new generation of propane direct injection engines has achieved significantly higher levels of efficiency than would be indicated by the Btu content of the fuel, while maintaining power and performance equal to or exceeding the gasoline engine equivalents. These sources indicate that the improvements in efficiency have come from retuning of the engine to take advantage of the higher octane characteristics of propane.

ICF has reviewed some limited fleet fuel consumption data provided by the vehicle manufacturers that indicates that at least some propane vehicle fleets are achieving more than 90 percent of the MPG achieved by similar gasoline fleets in actual operation. However, as of the date of this analysis, no comprehensive testing of propane vehicle efficiency has been conducted. The propane vehicle manufacturers recommend that fuel efficiency comparisons between 83% and 90% should be used for evaluating the economics of their propane vehicles relative to similar gasoline vehicles.

- Roush uses 85% of the gasoline MPG for evaluation purposes.
- Clean Fuel USA uses 83% of the gasoline MPG for evaluation purposes.
- Alliance Autogas uses 90% of the gasoline MPG for evaluation purposes

For this study, all of the vehicles assessed are assumed to be based on the newer liquid injection systems. For our Base Case analysis, we are using the low end of available estimates of new vehicle efficiency, resulting in an estimated MPG for these vehicles at 83 percent of the MPG for equivalent gasoline powered vehicles. In the Optimistic Case, we have used the high end of industry estimates, and the miles per gallon of the propane vehicles is set at 90 percent of the miles per gallon for gasoline vehicles.

2.4.4 Propane Vehicle Refueling Infrastructure

Refueling a propane vehicle is similar to refilling a gasoline or diesel vehicle. Propane is stored and handled as a liquid at the fuel dispenser. Propane is pumped from the dispenser storage tank into the vehicle tank. The cost of building propane fueling stations is similar to comparable-sized gasoline dispensing systems, and existing service station infrastructure used for conventional fuels can be modified to dispense propane. Based on published cost estimates[4] a typical fleet fueling facility capable of serving 10 to 15 vehicles would cost from $25,000 for a 500- gallon tank with a non-electronic turnkey dispenser skid system to $60,000 for a fully integrated electronic fuel dispenser system with a 2,000 gallon tank. For the Base Case analysis, we have assumed that each new fleet would require a new propane fueling station, at a cost of about $3,000 per vehicle, corresponding to a $35,000 refueling station for a 12 vehicle fleet. The Optimistic Case assumes that a larger average fleet size and partial access to existing refueling stations would reduce the incremental refueling infrastructure cost to $1,750 per vehicle.

2.4.5 Incremental Costs of Propane Vehicles

Vehicle costs were based on current market prices (flex-fuel vehicles were assumed to be a $100 option) for gasoline and diesel vehicles, and based on converted vehicle costs quoted for compressed natural gas (CNG) and propane vehicles. In this context, current propane vehicle prices for bi-fuel conversions of light duty vehicles are $5,500 to $6,000 increment to gasoline vehicles while the dedicated propane light truck is quoted at $11,600. The prices are assumed to remain unchanged and no economies of scale are assumed under either of the tax credit scenarios.

2.5 Propane Vehicle Sales Forecast:

ICF used the AFVC model to evaluate the impact of the proposed propane vehicle tax credit on vehicle sales for two alternative scenarios:

1) The ICF Base Case reflects ICF's best assessment of the likely market penetration of propane vehicles without the tax credits. This is based on ICF's assessment of propane

[4] M. Rood Werpy, A. Burnham, and K. Bertram, "Propane Vehicles: Status Challenges, and Opportunities", Argonne National Laboratory, May 2010.

vehicle availability and prices, vehicle performance characteristics, and market conditions, including fleet vehicle fuel price, and competition from conventional and other alternative fueled vehicles. Based on industry order backlogs and assessments of market interest in 2011, this is a conservative assessment of propane vehicle market penetration.

2) The ICF Optimistic Case reflects a more positive assessment of the propane vehicle market. The optimistic case was developed based on discussions with propane vehicle manufacturers concerning their market expectations, along with an assessment of the potential reduction in operating costs that could result from a higher volume of propane vehicle sales. The changes in operating costs included modest improvements in vehicle efficiency, and decreases in refueling costs per vehicle and in delivered propane price relative to gasoline.

For each scenario, ICF prepared two forecasts of propane vehicle sales; one where there are no tax credits for the purchase of alternative fuel vehicles and the second where H.R. 2014 is approved.[5] The difference between the two forecasts reflects the impact of the H.R. 2014 tax credit proposal.

No analysis is provided for the 19,500lb+ GVW truck segment as the propane engine is still under development and we have no data on its price and performance relative to a diesel engine which is standard in the larger trucks. Industry projects a volume of about 2000 units per year in this segment for propane engines even without a tax credit. In addition, we have not included an estimate of private vehicle sales resulting from the tax credits due to lack of data availability and concerns over refueling facility costs and availability. These exclusions result in conservative estimates of the impact of H.R. 2014.

2.5.1 Base Case Forecast of Propane Vehicle Sales

The AFVC solves for market shares of all alternative fuel vehicles simultaneously and inputs are needed not only for the sales, annual use, and baseline fuel economy numbers as listed above, but also the costs of all competing fuels, the relative engine efficiency of all fuels and the costs of all alternative fuel vehicles. The analysis considers gasoline, flex-fuel gasoline, diesel, dedicated alcohol, compressed natural gas and propane powered vehicles. In each case, the fuels are expected to be available to centrally fueled fleets; in all cases, there is at least limited infrastructure to provide emergency refueling off-site if required.

For the Base Case, the assumed pump price for each fuel delivered to the site with the cost of the refueling infrastructure added is as follows for the 2012-2016 period (average):

- Diesel at $3.60/ gallon
- Gasoline at $3.53/gallon
- Ethanol (E85) at $3.08/ gallon

[5] It should be noted that the analysis assumes that propane is the only alternative fuel to receive a tax credit; if other fuels are also provided a tax credit, inter-fuel competition will reduce sales and reduce the impact of the tax credit on propane vehicle sales.

- Propane at $ 2.41/gallon
- Natural Gas (compressed to 3600 psi) at $2/ gasoline gallon eq.

The model projects that, in the absence of H.R. 2014, propane vehicle sales will grow to almost 17,000 units annually by 2016 (Figure 4), compared to an estimated sales of about 5200 units in 2011. The AFVC forecast appears quite reasonable given the significant fuel cost differential but is contingent on two variables: fuel price differentials remaining at these levels for the next 5 years, and continuing growth in propane vehicle model availability.

Under the tax credit scenario, fuel costs for propane decline by 50 cents per gallon and infrastructure costs decline by an additional 8 cents per gallon. Vehicle incremental prices for dedicated light duty vehicles decline by 50% while incremental costs of dedicated medium duty vehicles and school buses decline by 80%. Under these conditions, propane vehicle sales increase by almost 80,000 vehicles per year in 2016, from 16,783 in the base case without the tax credit to 96,458 in the base case with the tax credit. The impact by type of vehicle is shown in Table 3. Most of the increase comes from dedicated propane vehicle sales that are eligible for the large tax credit offsetting much of the incremental cost of the vehicle.

2.5.2 Optimistic Case Forecast of Propane Vehicle Sales

The ICF Base Case is based on a relatively conservative market outlook, and is lower than current industry expectations. In order to evaluate the impact of H.R. 2014 under market conditions more in line with current industry expectations, we have developed an Optimistic Case forecast of propane vehicle sales. The Optimistic Case reflects lower operations and fuel costs that would be consistent with higher market penetration of propane vehicles.

The change in the Optimistic Case forecast of propane fuel price reflects the impact of the following changes in market conditions:

1) An increase in the average fleet size from 12 vehicles per fleet to 15 vehicles per fleet. The increased fleet size reduces annualized refueling infrastructure costs, and increases annual propane purchases per fleet which lowers delivered propane prices

2) 25 percent of new fleet vehicles sold into existing fleets with sufficient refueling infrastructure to meet refueling requirements without new investment.

3) An increase in the average fuel efficiency of propane vehicles from the low range of manufacturers estimates (83% of the MPG of the equivalent gasoline vehicle) to the high range of manufacturers estimates (90% of the MPG of the equivalent gasoline vehicle).

Overall, the Optimistic Case reduces the effective propane price by $0.36 per gallon relative to the base case forecast estimate of $2.41/ gallon. The prices for all other fuels remained unchanged relative to the Base Case.

1) The tax credits for fuel, infrastructure and vehicles were then applied starting from this baseline. In the optimistic scenario, total propane vehicle sales in 2016 were projected to increase by more than 123,000 units due to the tax credit, from almost 34,000 without the

tax credit, to more than 157,000 units with the tax credit (Figure 5). The results are shown by type of vehicle in Table 4.

Figure 4: Impact of Tax Credits on Propane Vehicle Sales by Year for the ICF Base Case

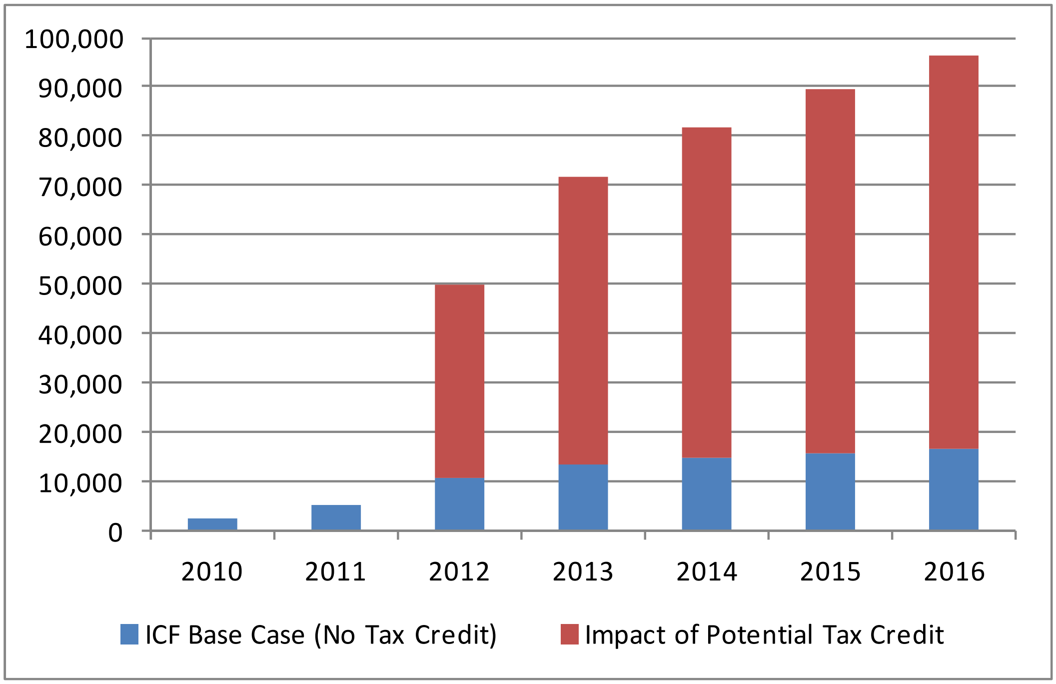


Table 3: Impact of Tax Credits on Propane Vehicle Sales in 2016 for the ICF Base Case

	No Tax Credit	Tax Credit	Impact of Tax Credit on Vehicle Sales
Light Duty Vehicles			
Bifuel	10,210	14,226	*4,016*
Dedicated	2,254	58,145	*55,892*
Medium Duty Vehicles			
Bifuel	1,346	1,011	*-335*
Dedicated	603	15,716	*15,113*
School Buses			
Bifuel	1,776	1,593	*-183*
Dedicated	595	5,766	*5,172*
Total	**16,783**	**96,458**	***79,675***

Figure 5: Impact of Tax Credits on Propane Vehicle Sales by Year for the Optimistic

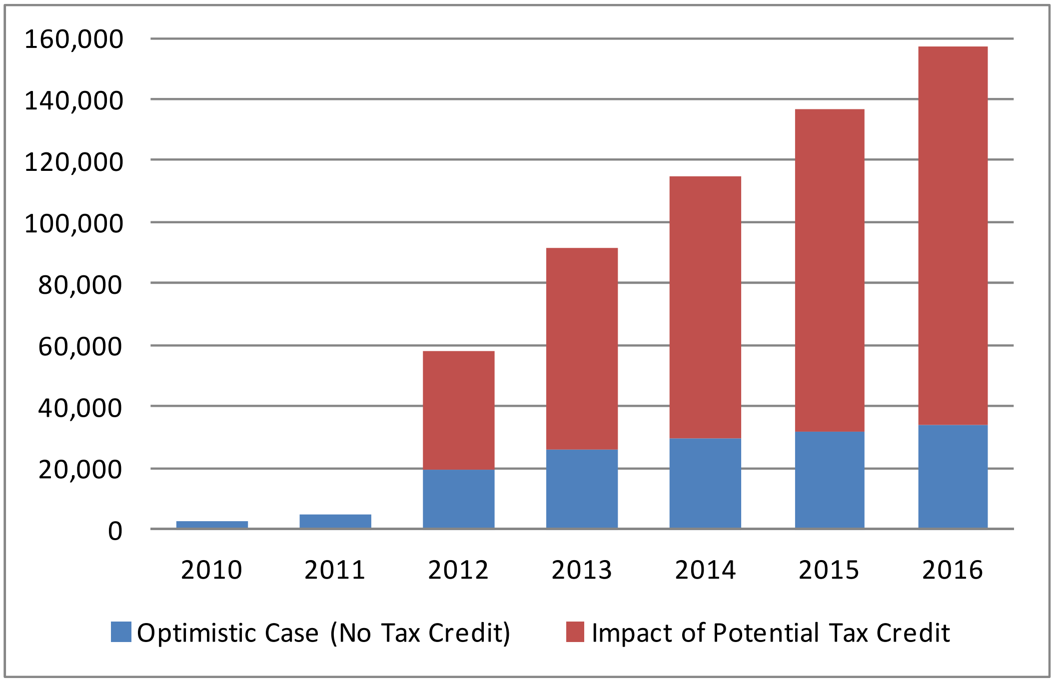


Table 4: Impact of Tax Credits on Propane Vehicle Sales in 2016 for the ICF Optimistic Scenario

	No Tax Credit	Tax Credit	Impact of Tax Credit on Vehicle Sales
Light Duty Vehicles			
Bifuel	11,422	45,688	*34,266*
Dedicated	11,322	67,214	*55,892*
Medium Duty Vehicles			
Bifuel	4,320	17,280	*12,960*
Dedicated	4,320	19,433	*15,113*
School Buses			
Bifuel	1,850	1,667	*-183*
Dedicated	700	5,872	*5,172*
Total	**33,934**	**157,154**	***123,220***

3. Economic Impacts of Incremental Propane Vehicle Sales

3.1 Approach

In the second phase of this study, ICF evaluated the impacts of the change in propane vehicle sales on the U.S. economy. The vehicle sales and usage estimates were used to develop the direct economic impacts of the proposed tax credits, including incremental investment in new vehicles and refueling infrastructure for both propane and conventional fuel vehicles, impacts on operating costs associated with the use of propane instead of conventional fuels, benefits to the economy of reducing oil imports, and costs of the tax credit proposal to taxpayers.

ICF used the regional economic model IMPLAN to estimate the economic impacts of the proposed propane tax credit policy on the U.S. economy based on these inputs. IMPLAN is one of the most commonly used input-output models that can be used to estimate the direct, indirect, and induced employment and industry activities, as well as the local, state and federal tax revenues generated by increased expenditures associated with any policy changes - in this case the proposed extension of the propane tax credit policy.

ICF modeled the impact over a ten year time horizon, from 2012 – 2021. This modeling timeframe captures the five years when the proposed policy would be in place, as well as the following five years in which the effects of the policy would continue to impact the economy via differences in fuel demand. To capture the impact over the modeling timeframe, ICF ran the model for each scenario in each year. The results from this modeling analysis are reported as the total (direct, indirect, and induced) impacts generated by the proposed propane tax credit policy on changes to employment, output, and tax revenue. These are further explained below:

- Employment – represents the jobs created by industry, based on the output per worker and output impacts for each industry.
- Output – represents the increase in the value of an industry's total output (economic growth) due to the modeled scenario (in millions of constant dollars).
- Tax Impact – breakdown of taxes collected by the federal, state and local government institutions from different economic agents. Includes corporate taxes, household income taxes, and other indirect business taxes.[6]

ICF conducted the vehicle market and economic impact analysis for two different scenarios reflecting different views of the propane vehicle market potential. For each scenario, ICF evaluated the impact of the tax credit relative to a "no tax credit" case. The ICF Base Case reflects a conservative assessment of propane vehicle market potential, leading to a conservative assessment of the likely impacts of the proposed tax credit on propane vehicle sales and economic impacts. The Optimistic Case analysis reflects a more positive assessment of the propane vehicle market based on inputs from the propane vehicle industry and other sources, and leads to a larger projection of tax credit impacts.

[6] The tax impacts are not part of the GDP accounting framework used for the other impacts. These are calculated in IMPLAN using standard assumptions about tax rates.

3.2 Introduction to the IMPLAN Model

The IMPLAN model is created and maintained by the Minnesota IMPLAN Group (MIG). IMPLAN is one of the most commonly used static input-output models used to analyze the effects of an economic stimulus on a pre-specified economic region, in this case, the U.S. economy. The model is considered static because the impacts calculated by IMPLAN represent the impacts for one discrete period (typically a year). The modeling framework in IMPLAN consists of two components – the descriptive model and the predictive model. The descriptive model defines the local economy in the specified modeling region, and includes accounting tables that trace the “flow of dollars from purchasers to producers within the region”.[7] It also includes the trade flows that describe the movement of goods and services, both within, and outside of the modeling region (i.e., regional exports and imports with the outside world). In addition, it includes the Social Accounting Matrices (SAM) that trace the flow of money between institutions, such as transfer payments from governments to businesses and households, and taxes paid by households and businesses to governments. The predictive model consists of a set of “local-level multipliers” that can then be used to analyze the changes in final demand and their ripple effects throughout the local economy. These multipliers are thus coefficients that “describe the response of the [local] economy to a stimulus (a change in demand or production).”[8]

The IMPLAN model is based on the input-output data from the U.S. National Income and Product Accounts (NIPA) from the Bureau of Economic Analysis. The model includes 440 sectors based on the North American Industry Classification System (NAICS). The model uses region-specific multipliers to trace and calculate the flow of dollars from the industries that originate the impact to supplier industries. These multipliers are thus coefficients that “describe the response of the economy to a stimulus (a change in demand or production).”[9] Three types of multipliers are used in IMPLAN:

- Direct – represents the jobs created due to the investments that result in final demand changes, such as spending in the construction sector to build new propane fueling stations.
- Indirect – represents the jobs created due to the industry inter-linkages caused by the iteration of industries purchasing from industries, brought about by the changes in final demands.
- Induced – represents the jobs created in all local industries due to consumers’ consumption expenditures arising from the new household incomes that are generated by the direct and indirect effects of the final demand changes.

To illustrate these concepts consider the following simplified example. A $10 million investment required to construct new fueling stations leads to 100 jobs (for example) in the

[7] IMPLAN Pro Version 2.0 User Guide.
[8] Ibid.
[9] Ibid.

construction industry, due to the workers needed to construct the stations. These jobs are the result of the direct investment and are hence termed as direct jobs in IMPLAN terminology. Because the construction industry is connected to other industries through its inter-industry linkages, the 100 direct jobs create an additional 40 jobs (for example) in industries such as wholesale trade, motor vehicle parts and dealers, architectural and engineering services, etc. In the regional economic parlance (and in IMPLAN), these additional jobs are termed indirect jobs. Finally, because the direct and indirect jobs create income for the workers involved, which are then spent on various consumption activities, these expenditures lead to further economic activity and employment in the economy. In IMPLAN, these jobs, (for example an additional 30 jobs), are termed as induced employment and are created in sectors such as food and beverage stores (restaurants and bars), retail outlets, general merchandise stores, hospitals and physician offices, etc. Thus the total number of jobs created by the $10 million investment in this example is 170, out of which 70 jobs are created in "support" industries due to the input-output relationships between economic sectors. These 70 jobs are also referred to as the "multiplier" effects by regional economists.

3.3 Costs and Impacts of H.R. 2014

As discussed in Section Two of this report, ICF is projecting that H.R. 2014 would result in a significant increase in propane vehicle sales and propane use, and a corresponding decline in conventional vehicle sales and use. The economic impact analysis conducted for this study translated the expenditure impacts due to the proposed tax credit to corresponding economic sectors. Some sectors, such as the propane vehicle manufacturing sectors received a positive boost and thus will need new employment to handle the increased demand, while other sectors, such as the traditional oil and gas industry, will be negatively affected. The potential positive benefits of this tax credit include:

- Investment in new and retrofit propane systems, vehicle parts and equipment like fuel tanks and gas metering systems.
- Construction and maintenance of propane refueling infrastructure.
- Reduced fuel costs to consumers.
- Increased sale of domestic propane that displaces imported oil.
- Propane on-road taxes, and
- Increased demand for household goods and services generated by higher consumers' disposable incomes as a result of the savings associated with using propane vehicles over traditional vehicles.

The potential negative impacts of the proposed tax credit policy are those associated with the loss of spending in the traditional oil and gas industry and gas stations as well as the decline in associated tax revenue generated as a consequence. Our modeling also accounted for the costs associated with the subsidy effect on the propane industry and propane fueling stations. The detailed inputs to the economic analysis are shown in Appendix A.

After identifying all of the potential benefits and costs of the proposed tax credit, ICF identified the relevant IMPLAN sectors to allocate the incremental expenditures associated with the tax credit policy.

3.3.1 Incremental Capital Expenditures

Incremental capital expenditures include the additional investment in new propane vehicles and refueling infrastructure created by the tax credits. The additional capital expenditures on propane vehicles are determined based on the incremental number of new propane vehicles stimulated by the tax credits, hence reflects the difference in vehicle sales between the "no tax credit" case and the "tax credit" case. Since all of the available propane vehicles are based on conversions or upgrades of existing conventional fueled vehicles, the incremental capital cost is based only on the incremental cost of the vehicle conversions, rather than the full vehicle cost. In addition, since the investment costs reflect the cost of converting conventional vehicles to use propane and are incremental to the cost of the conventional vehicles, the tax credits do not result in a reduction in expenditures on conventionally fueled vehicles. Incremental vehicle capital expenditures peak in 2016 at about $930 million per year in the Base Case and $1.16 billion in the Optimistic Case.

The incremental expenditures on refueling infrastructure reflect the cost of new refueling infrastructure per vehicle as discussed earlier in this document, times the number of incremental propane vehicles stimulated by the tax credits. The incremental vehicle refueling capital expenditures peak in 2016 at about $280 million per year in the Base Case and $430 million in the Optimistic Case.

Since the tax credit proposal expires in 2016, we have not included any incremental vehicle sales after 2016, hence there are no incremental capital expenditures, and no incremental employment related to the capital expenditures after the tax credits expire in 2016.

3.3.2 Impact on Fuel Expenditures

For the ICF Base Case, H.R. 2014 is projected to increase consumption of domestically produced propane by 579 million gallons of propane per year by 2016, with cumulative increase of 4.8 billion gallons between 2012 and 2021. The increase in propane use would reduce consumption of conventional fuels (gasoline and diesel fuel) by the equivalent of 480 million gallons of gasoline per year by 2016, with cumulative reduction of 3.5 billion gallons of gasoline equivalent between 2012 and 2021.

Based on the difference between projected gasoline and propane fuel prices delivered to fleet customers, the increase in propane vehicles will result in significant savings in fuel expenditures. The reduction in gasoline and diesel consumption will have a direct economic benefit to consumers by reducing net expenditures on fuel by more than $750 million per year in 2016, with cumulative savings of more than $5.6 billion between 2012 and 2021.

The impact on fuel expenditures increases in the Optimistic Case. Consumption of domestically produced propane increases by 760 million gallons of propane per year by 2016, with a cumulative increase of 5.5 billion gallons between 2012 and 2021. The increase in propane use would reduce consumption of gasoline and diesel fuel by the equivalent of 680 million gallons of gasoline per year by 2016, with cumulative reduction of five billion gallons of gasoline equivalent between 2012 and 2021.

Based on the difference between projected gasoline and propane fuel prices delivered to fleet customers, the increase in propane vehicles will result in significant savings in fuel expenditures. The reduction in gasoline and diesel consumption will have a direct economic benefit to consumers by reducing net expenditures on fuel. In the Base Case, expenditures on fuel decline by more than $750 million per year in 2016, with cumulative savings of more than $3.0 billion between 2012 and 2021. In the Optimistic Case, expenditures on fuel decline by more than $1.1 billion per year in 2016, with cumulative savings of more than $5.6 billion between 2012 and 2021.

3.3.3 Additional Energy Security Benefits of Reduced Oil Imports

The projected reduction in gasoline and diesel consumption will also have an indirect economic impact due to improved domestic energy security. In research conducted at the Oakridge National Laboratory, Paul Leiby[10] estimated the energy security benefits of reduced oil imports to be $13.58 per barrel based on 2006 oil price forecasts. This figure includes a benefit of $8.90 per barrel, reflecting the overall benefit to the economy of lower world oil prices resulting from the decline in U.S. oil imports, as well as $4.68 per barrel benefit due to a reduction in the risk to the U.S. economy of a major oil price event. We have used the Leiby estimate of $13.58 per barrel in the Base Case analysis, despite the increase in oil prices since the Leiby analysis was conducted. In the Optimistic Case, we have increased the Leiby values from $13.58 per barrel to $20.37 per barrel to reflect current oil price expectations.

The additional security benefits of reduced oil imports account for about 8.3 percent of the total increase in economic activity in the Base Case, and 13.5 percent of the total increase in economic activity in the Optimistic Case.

3.3.4 H.R. 2014 Tax Credits to Consumers

Over the five year period from 2012 through 2016, the Propane Green Autogas Solutions Act of 2011 (H.R. 2014) proposed tax credit is expected to result in tax credits to consumers of about $3.4 billion in the Base Case, and $4.7 billion in the Optimistic Case.

- The tax credit incentives to offset the incremental cost of purchasing new vehicles account for about 55 percent of the total cost of implementing H.R. 2014.
- The fuel excise tax credits account for about 35 percent of the total cost of implementing H.R. 2014. Fuel used in new vehicles accounts for 27 percent of the total cost, while fuel used in vehicles existing prior to approval of H.R. 2014 accounts for seven percent of the total cost.
- The refueling infrastructure investment credit accounts for 11 percent of the total cost of H.R. 2014.

[10] Paul N. Leiby, Estimating the Energy Security Benefits of Reduced U.S. Oil Imports, Oak Ridge National Laboratory, February 2007.

There are two important assumptions in the calculation of the costs of the fuel excise tax credit to taxpayers:

1) The costs are estimated based on the assumption that the tax credits authorized by H.R. 2014 will be fully utilized. We anticipate that this assumption likely overstates the cost of the fuel excise tax credit, as we understand that the complexity involved with collecting the $0.50 per gallon fuel excise tax credit has resulted in less than 100 percent uptake in the past. However, there are no reliable estimates for the amount of excise tax credits that may have been foregone.

2) The propane fuel excise tax credit will apply to all propane consumed by existing propane vehicles as well as by new vehicles. As a result, the users of these vehicles will receive a direct incentive to use propane without increasing the number of propane vehicles on the road. The ICF analysis focused on the impact of the tax credit on new propane vehicle sales and utilization, and did not independently assess tax credit costs for existing vehicles. The Joint Committee on Taxation has recently scored H.R. 2014 based on an assessment of the historical costs of each tax credit component. ICF has used the CBO scoring analysis to estimate that existing vehicles, including on-road vehicles and forklifts, would consume about 100 million gallons of propane per year that would be eligible to receive the $0.50 per gallon federal excise tax credit. A copy of the CBO scoring memo is included in Appendix B. Hence the tax credit would reduce fuel costs by $50 million per year for users of existing propane vehicles. This cost savings results in an economic benefit to the owners of existing propane vehicles, as well as contributing to the cost of the proposal to taxpayers.

3.4 Economic Impacts of H.R. 2014

Table 5 summarizes the results of the economic impact analysis of H.R. 2014 for the Base Case and the Optimistic case for each year of the modeling timeframe. The employment, output and tax impacts for both cases follow the same trend with annual increases in the early years as program expenditures accumulate and then a decline and leveling off starting in 2017. The impacts peak in 2016, the final year of the policy. In this year the incremental capital expenditures on propane vehicles and infrastructure are at their highest levels, as are the consumer savings on fuel expenditures. These two factors drive the significant employment impacts in 2016. After the program ends, the positive job impacts are sustained from 2017 through 2021 because of the continued consumer fuel savings.

The employment, economic output, and tax impacts are discussed in more detail below.

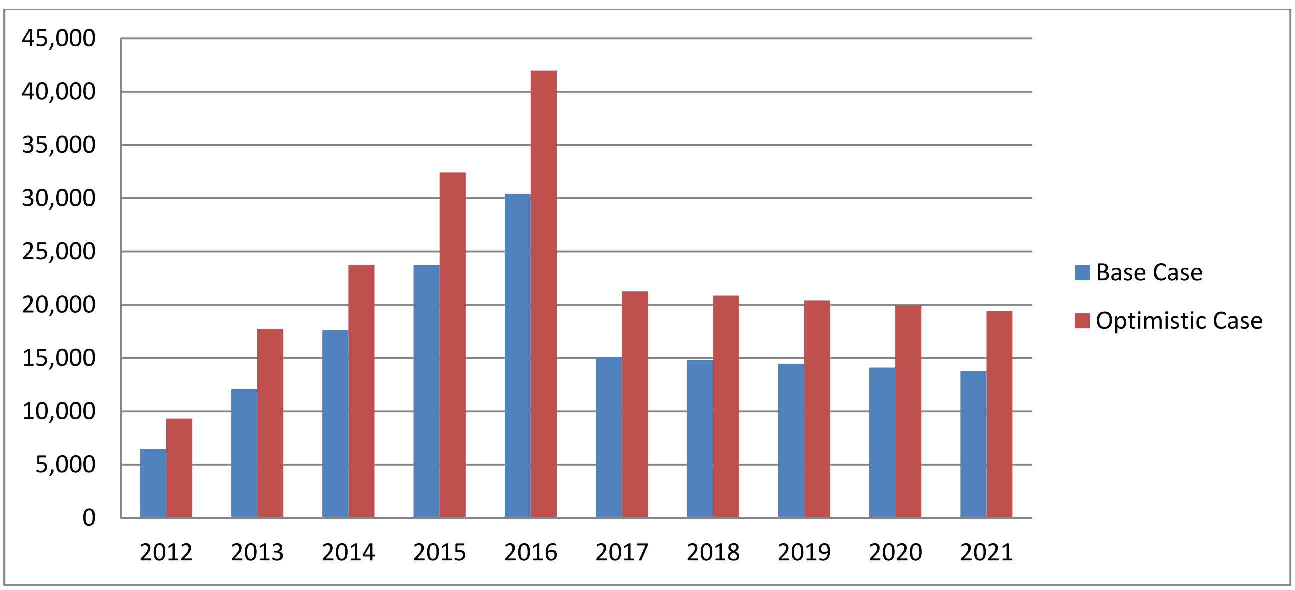
Table 5: Economic Impacts of H.R. 2014

Number of Jobs Created by H.R. 2014										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base Case	6,500	12,000	17,600	23,700	30,400	15,100	14,800	14,500	14,100	13,800
Optimistic Case	9,300	17,800	23,800	32,400	42,000	21,300	20,900	20,400	19,900	19,400
Increase in Economic Output Created by H.R. 2014 (2011$ in Millions)										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base Case	$1,032	$1,869	$2,585	$3,320	$4,078	$1,651	$1,578	$1,503	$1,430	$1,362
Optimistic Case	$1,381	$2,560	$3,511	$4,596	$5,735	$2,529	$2,436	$2,337	$2,242	$2,144
Increase in Tax Revenue Resulting from Implementation of H.R. 2014 (2011$ in Millions)										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base Case	$ 134.0	$ 253.6	$ 373.2	$ 505.1	$ 649.0	$ 339.0	$ 330.4	$ 320.6	$ 310.9	$ 301.8
Optimistic Case	$ 188.1	$ 364.3	$ 503.5	$ 962.0	$ 900.0	$ 484.0	$ 473.0	$ 460.1	$ 447.3	$ 433.6

3.4.1 Employment

Figure 6 shows the annual impact of H.R. 2014 on employment for the Base Case and Optimistic scenarios from 2012 through 2021.

Figure 6: Increase in Annual Employment 2012 – 2021



The employment impacts for both scenarios increase annually in the early years as propane vehicle production and sales increase. Employment impacts peak in 2016, with the policy supporting more than 30,000 jobs in the Base Case, and more than 41,000 jobs in the Optimistic Case. The impact on jobs includes between 14,000 and 19,000 jobs directly related to the production, sale, and utilization of propane vehicles, propane refueling facilities, and propane production and distribution, as well as between 6,000 and 9,000 indirect jobs created to meet the growth in requirements of the industries directly affected by the increase in propane vehicle sales. The increase in jobs also includes between 10,000 and 14,000 induced jobs in other industries created by expenditures resulting from the increase in income for the direct and indirect jobs, as well as the increase in demand for services created by the reduced expenditures on fuel. In 2016 year the incremental capital expenditures on propane vehicles and infrastructure are at their highest levels, and this positive boost to the propane vehicle industry and fuel stations is seen in the employment impacts

For this analysis, we are not considering incremental propane vehicle sales after the proposed propane policy ends in 2016. As a result, the jobs associated with new propane vehicle production are not counted after 2016. After the policy ends, the positive job impacts are sustained from 2017 through 2021 because of the continued consumer fuel savings by the propane vehicles added between 2012 and 2016. The fuel cost savings drive retail spending across the economy as consumers spend the money that they would have used to purchase fuel on other goods and services. Job gains are concentrated in the general retail sector because the significant consumer fuel savings is allowing consumers to spend throughout the economy. Other key sectors for employment gains in the early years are motor vehicle parts manufacturing, extraction of oil and natural gas and non-residential construction, as well as the sectors that correspond to capital expenditures on propane vehicles, propane and fueling stations.

Table 6: Employment Impacts by Industry Section, 2016

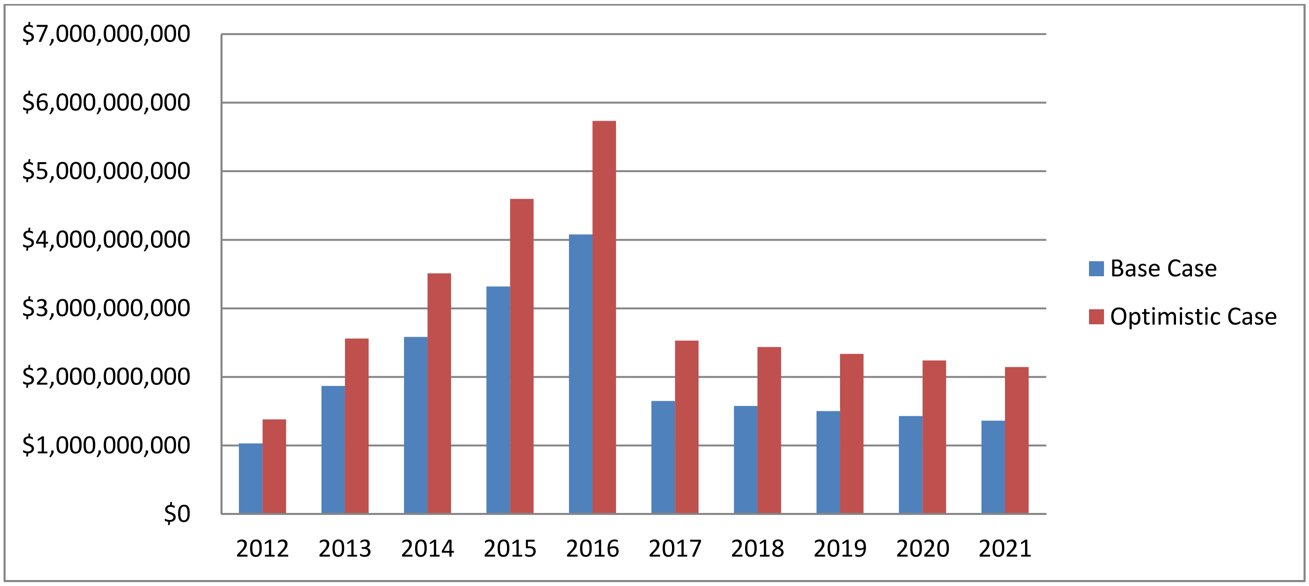
Industry Description	2016 Employment	
	Base Case	**Optimistic Case**
General consumer spending	13,841	20,159
Motor vehicle parts manufacturing	1,914	2,415
Construct other new nonresidential structures	1,755	2,714
Vehicle refueling stations	1,708	1,043
Extraction of oil and natural gas	1,138	1,538
Food services and drinking places	1,019	1,419
Real estate establishments	780	1,054
Wholesale trade businesses	765	1,088
Support activities for oil and gas operations	498	673
Total Other Industries	6,994	9,876
Total	**30,412**	**41,979**

3.4.2 Industry Output

Figure 7 presents a summary of the industry output results in the Base Case and Optimistic scenarios over the study timeframe. The trends in output are consistent with the employment trends over the same timeframe, with a peak in 2016 and a decline and leveling-off after the policy ends from 2017 through 2021. In the peak year (2016), industry output impacts would be more than $5.7 billion in the Optimistic Case and almost $4.1 billion in the Base Case. The

Optimistic Case results are between 34% and 57% larger than the Base Case results, with the greatest variation in the latter years of the policy.

Figure 7: Growth in Industry Output per Year (2011$) 2012 – 2021



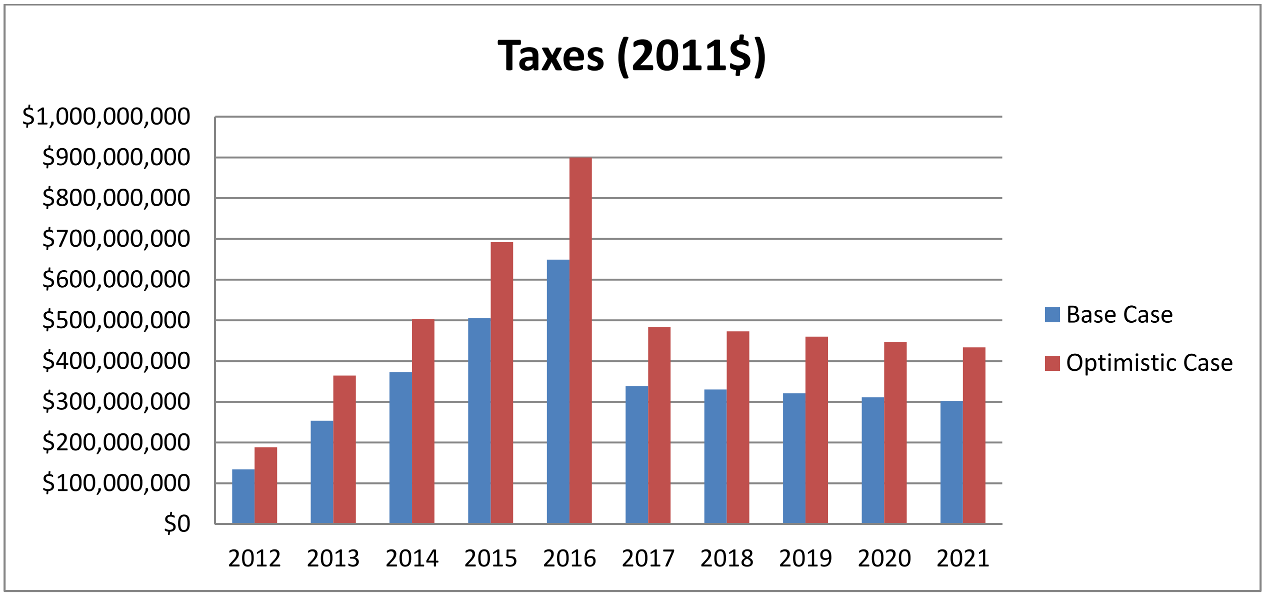
3.4.3 Tax Impacts

Figure 8 presents the trends in incremental tax revenue collected during the study timeframe. Tax impacts include the incremental state, local and federal revenue generated by income and spending that occurs as a result of the proposed propane auto gas tax credit policy. The trends in tax revenue for each case mirror those of employment and industry output, with annual increases until 2016 and then a decline with leveling off after the policy ends, from 2017 – 2021. It is estimated that in the peak year (2016), more than $900 million in tax revenue would be generated in the Optimistic Case and almost $650 million in the Base Case.

3.4.4 Net Revenue Impact of the Proposed Tax Credits to the U.S. Treasury

Over the five year period from 2012 through 2016, the Propane Green Autogas Solutions Act of 2011 (H.R. 2014) proposed tax credit is expected to result in a cost to taxpayers of about $3.4 billion in the Base Case, and $4.7 billion in the Optimistic Case. Federal tax revenues are expected to increase by $1.6 billion in the Base Case and $2.3 billion in the Optimistic Case, offsetting much of this cost. The tax credit proposal will also generate sufficient incremental economic activity to increase state and local tax revenues by more than $1.8 billion over the ten year period from 2012 through 2021 in the Base Case, and by more than $2.5 billion in the Optimistic Case. Hence, the shortfall in federal tax revenue will be more than offset by increases in state and local tax revenues, and the Propane Green Autogas Solutions Act will be revenue positive, when federal, state, and local revenues are considered.

Figure 8: Increase in Annual Tax Revenue (2011$) 2012 – 2021



Appendix A: Expenditures and Costs Associated with H.R. 2014

Table A-1: ICF Base Case

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Incremental Capital Expenditures										
Propane Refueling Infrastructure	90,561,609	151,077,307	196,004,985	238,165,788	278,861,318					
Propane Vehicles	312,322,022	514,027,728	660,159,757	796,552,803	927,813,374					
Total Change in Capital Expenditures	**402,883,631**	**665,105,036**	**856,164,742**	**1,034,718,591**	**1,206,674,692**					
Increase In Propane Fuel Expenditures										
Propane Resource Cost	76,393,181	209,925,016	386,745,349	607,042,021	871,376,243	879,725,191	884,696,503	885,022,569	883,728,796	882,862,145
Propane Distribution Cost	17,267,685	46,853,718	86,318,715	135,487,311	194,484,763	196,348,187	197,457,748	197,530,523	197,241,762	197,048,332
Propane Fueling station costs	15,891,378	43,119,281	79,438,752	124,688,404	178,983,513	180,698,414	181,719,538	181,786,513	181,520,767	181,342,755
Propane On-Road Taxes	19,296,673	51,082,075	91,813,294	140,596,774	196,896,706	193,934,868	190,273,942	185,701,532	180,907,379	176,321,920
Propane Fuel Tax Credits	(87,995,204)	(146,412,642)	(218,845,168)	(303,663,097)	(399,938,470)	-	-	-	-	-
Impact of Propane Infrastructure Tax Credits	(5,152,954)	(13,402,484)	(24,058,239)	(37,047,282)	(52,385,924)	(52,878,474)	(53,164,459)	(53,173,346)	(53,090,339)	(53,051,846)
Total Increase in Propane Fuel Costs	**35,700,758**	**191,164,963**	**401,412,702**	**667,104,132**	**989,416,831**	**1,397,828,187**	**1,400,983,273**	**1,396,867,791**	**1,390,308,366**	**1,384,523,306**
Avoided Gasoline/Diesel Fuel Expenditures										
Crude oil Import Cost	105,329,325	280,742,816	517,213,149	811,826,480	1,165,333,343	1,176,498,794	1,183,147,169	1,183,583,232	1,181,853,007	1,180,693,993
Refining Costs	18,830,857	51,095,193	94,132,793	147,752,419	212,090,668	214,122,780	215,332,785	215,412,148	215,097,247	214,886,307
Fuel Distribution Costs	5,794,110	15,721,598	28,963,936	45,462,283	65,258,667	65,883,932	66,256,241	66,280,661	66,183,768	66,118,864
Fueling Station Costs	5,794,110	15,721,598	28,963,936	45,462,283	65,258,667	65,883,932	66,256,241	66,280,661	66,183,768	66,118,864
Fuel Federal, State, Local Taxes	23,082,226	61,103,176	109,824,901	168,178,553	235,523,207	231,980,326	227,601,213	222,131,803	216,397,150	210,912,132
Total Avoided Gasoline/Diesel Expenditures	**158,830,628**	**424,384,380**	**779,098,716**	**1,218,682,019**	**1,743,464,554**	**1,754,369,765**	**1,758,593,649**	**1,753,688,505**	**1,745,714,941**	**1,738,730,159**
Total Change in Fuel Expenditures	**(123,129,869)**	**(233,219,417)**	**(377,686,014)**	**(551,577,887)**	**(754,047,723)**	**(356,541,578)**	**(357,610,376)**	**(356,820,714)**	**(355,406,575)**	**(354,206,853)**
Change in Other Domestic Oil Import Costs (@$13.58/BBL)	**(14,521,635)**	**(38,441,613)**	**(69,093,730)**	**(105,805,545)**	**(148,173,836)**	**(145,944,917)**	**(143,189,901)**	**(139,748,952)**	**(136,141,131)**	**(132,690,362)**
Cost to Tax Payers of Tax Credit Proposal										
Fuel Tax Credits (New Vehicles)	37,995,204	96,412,642	168,845,168	253,663,097	349,938,470					
Fuel Tax Credits (Existing Vehicles and Forklifts)	50,000,000	50,000,000	50,000,000	50,000,000	50,000,000					
Refueling Infrastructure Tax Credit	38,597,213	59,676,237	74,483,049	88,176,543	101,280,449					
Vehicle Tax Credit	198,852,413	309,590,215	387,146,937	458,876,688	527,533,144					
Total Cost to Tax Payer (100% uptake)	**325,444,830**	**515,679,094**	**680,475,154**	**850,716,328**	**1,028,752,063**					

Table A-2: ICF Optimistic Case

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Incremental Capital Expenditures										
Propane Refueling Infrastructure	134,534,061	227,370,650	298,574,308	365,938,121	431,268,439					
Propane Vehicles	364,271,663	614,102,614	805,132,536	985,763,241	1,160,894,159					
Total Change in Capital Expenditures	**498,805,725**	**841,473,264**	**1,103,706,844**	**1,351,701,362**	**1,592,162,598**					
Increase In Propane Fuel Expenditures										
Propane Resource Cost	96,151,083	267,392,885	498,093,956	789,091,471	1,141,558,524	1,152,594,982	1,159,231,140	1,159,762,645	1,158,137,931	1,151,989,045
Propane Distribution Cost	28,305,601	77,726,373	144,787,086	229,374,907	331,830,833	335,038,936	336,967,949	337,122,448	336,650,173	334,862,801
Propane Fueling station costs	13,429,534	36,877,118	68,693,936	108,826,454	157,436,458	158,958,536	159,873,753	159,947,054	159,722,984	158,874,969
Propane On-Road Taxes	24,287,456	65,066,011	118,247,438	182,761,179	257,947,259	254,088,843	249,318,810	243,349,387	237,081,442	230,070,936
Propane Fuel Tax Credits	(103,406,790)	(187,171,311)	(291,788,349)	(414,867,268)	(555,028,957)	-	-	-	-	-
Impact of Propane Infrastructure Tax Credits	(4,712,372)	(12,405,957)	(22,414,354)	(34,669,664)	(49,187,514)	(49,652,032)	(49,923,516)	(49,934,304)	(49,857,308)	(49,579,862)
Total Increase in Propane Fuel Costs	**54,054,511**	**247,485,120**	**515,619,713**	**860,517,080**	**1,284,556,605**	**1,851,029,265**	**1,855,468,135**	**1,850,247,231**	**1,841,735,224**	**1,826,217,888**
Avoided Gasoline/Diesel Fuel Expenditures										
Crude oil Import Cost	143,751,804	387,756,175	722,304,211	1,144,290,321	1,655,415,649	1,671,420,018	1,681,043,353	1,681,814,108	1,679,458,052	1,670,541,327
Refining Costs	17,792,347	48,857,278	91,010,331	144,180,580	208,582,372	210,598,922	211,811,462	211,908,578	211,611,715	210,488,207
Fuel Distribution Costs	7,907,710	21,714,346	40,449,036	64,080,258	92,703,276	93,599,521	94,138,428	94,181,590	94,049,651	93,550,314
Gasoline Fueling station costs	7,907,710	21,714,346	40,449,036	64,080,258	92,703,276	93,599,521	94,138,428	94,181,590	94,049,651	93,550,314
Fuel Federal, State, Local Taxes	31,502,259	84,394,443	153,373,882	237,052,000	334,572,769	329,568,176	323,381,162	315,638,470	307,508,577	298,415,537
Total Avoided Gasoline/Diesel Expenditures	**208,861,830**	**564,436,588**	**1,047,586,495**	**1,653,683,417**	**2,383,977,342**	**2,398,786,158**	**2,404,512,833**	**2,397,724,335**	**2,386,677,645**	**2,366,545,700**
Total Change in Fuel Expenditures	**(154,807,319)**	**(316,951,468)**	**(531,966,782)**	**(793,166,337)**	**(1,099,420,737)**	**(547,756,893)**	**(549,044,697)**	**(547,477,104)**	**(544,942,421)**	**(540,327,812)**
Change in Other Domestic Oil Import Costs (@$20.37/BBL)	**(29,728,348)**	**(79,642,142)**	**(144,737,307)**	**(223,703,460)**	**(315,732,775)**	**(311,009,994)**	**(305,171,374)**	**(297,864,678)**	**(290,192,584)**	**(281,611,579)**
Cost to Tax Payers of Tax Credit Proposal										
Fuel Tax Credits (New Vehicles)	53,406,790	137,171,311	241,788,349	364,867,268	505,028,957					
Fuel Tax Credits (Existing Vehicles and Forklifts)	50,000,000	50,000,000	50,000,000	50,000,000	50,000,000					
Refueling Infrastructure Tax Credit	60,650,683	95,744,891	120,396,570	143,194,700	165,011,232					
Vehicle Tax Credit	269,327,575	425,815,999	535,674,469	637,275,105	734,506,279					
Total Cost to Tax Payer (100% uptake)	**433,385,049**	**708,732,201**	**947,859,387**	**1,195,337,072**	**1,454,546,468**					

Appendix B:
Joint Committee on Taxation Scoring of H.R. 2014

112TH CONGRESS, 1ST SESSION

HOUSE
DAVE CAMP, MICHIGAN,
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DEPUTY CHIEF OF STAFF

Congress of the United States
JOINT COMMITTEE ON TAXATION
1625 LONGWORTH HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6453
(202) 225-3621
http://www.jct.gov

JUN 21 2011

Honorable John R. Carter
U.S. House of Representatives
409 Cannon HOB
Washington, D.C. 20515

Dear Mr. Carter:

This is in response to your May 27, 2011, request for a revenue estimate of H.R. 2014, the "Propane Green Autogas Solutions Act of 2011." H.R. 2014 consists of three provisions:

1. Modification and extension of the alternative fuel credits,
2. Extension and modification of a new qualified alternative fuel motor vehicle credit, and
3. Extension of the alternative fuel vehicle refueling property credit.

Below is a brief description of each of the three provisions.

1. **Modification and extension of the alternative fuel credits.** The proposal would amend sections 6426(d)(5), 6426(e)(3), and 6427(e)(6) of the Internal Revenue Code (the "Code") to provide that the present law sunset date for the alternative fuel credit, alternative fuel mixture credit, and related payment provisions insofar as they relate to liquefied petroleum gas be extended for five years, from December 31, 2011, to December 31, 2016. The provision would be effective upon date of enactment.

2. **Extension and modification of a new qualified alternative fuel motor vehicle credit.** The proposal would amend the Code section 30B new qualified alternative fuel motor vehicle credit by extending the sunset date through December 31, 2016, but only for vehicles powered by liquefied petroleum gas.

3. **Extension of the alternative fuel vehicle refueling property credit.** The proposal would modify Code section 30C alternative fuel vehicle refueling property credit by extending the sunset date through December 31, 2016, but only for property related to liquefied petroleum gas.

The estimated changes in Federal fiscal year budget receipts for each of the three provisions and for H.R. 2014 as a whole are provided below.

Congress of the United States
JOINT COMMITTEE ON TAXATION
Washington, DC 20515–6453

Honorable John R. Carter
U.S. House of Representatives

Page 2

Fiscal Years
[Millions of Dollars]

Provision	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2011-16	2011-21
Alternative fuel credits	---	-56	-72	-67	-63	-61	-15	---	---	---	---	-319	-334
New qualified alternative fuel motor vehicle credit...	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[2]	-1	-1
Alternative fuel vehicle refueling property credit	---	-2	-4	-5	-6	-7	-4	-2	-1	---	---	-25	-32
Total	[1]	-58	-76	-72	-69	-68	-19	-2	-1	[1]	[2]	-345	-367

NOTE: Details may not add to totals due to rounding.
[1] Loss of less than $500,000.
[2] Gain of less than $500,000.

I hope this information is helpful to you. If we can be of further assistance in this matter, please let us know.

Sincerely,

Thomas A. Barthold

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