



ALTERNATIVE FUEL VEHICLE TAX CREDIT EXTENSION WOULD DRIVE BILLIONS IN ECONOMIC GROWTH AND PRIVATE INVESTMENT, CREATE THOUSANDS OF JOBS, AND IMPROVE AIR QUALITY ACROSS THE COUNTRY

NGVamerica prepared the following white paper to evaluate the economic costs and benefits of extending the alternative fuel tax credit (AFTC) for compressed natural gas (CNG) and liquefied natural gas (LNG) that is sold or used to power motor vehicles. NGVamerica thanks ampCNG for providing the quantitative model and thought partnership that shaped the analysis and conclusions of this paper.

Executive Summary

Renewing and extending the AFTC for CNG and LNG will spur \$9.9 billion in economic growth, the creation of 62,000 new middle-class jobs, better air quality and improved public health at a net cost to the government of \$2.4 billion. These benefits are achieved by encouraging the use of America's abundant, clean, cost-effective natural gas resources as a transportation fuel and accelerating the development of the natural gas vehicle (NGV) industry.

Until the provision expired December 31, 2016, the U.S. tax code provided a credit of \$0.50 per gasoline gallon equivalent (GGE) of compressed natural gas and \$0.50 per diesel gallon equivalent (DGE) of liquefied natural gas sold or used as a motor vehicle fuel (see 26 USC 6426 and 6427). The fuel credit also included other alternative fuels such as propane and liquefied hydrogen.

The fuel credit was effective at providing a real alternative to dirty diesel vehicles by reducing the cost of CNG and LNG used in transportation applications and encouraging operators to add more natural gas vehicles to their fleet. As Congress considers significant reform to the U.S. Tax Code, they should renew the AFTC to extend the proven benefits of this incentive. This paper demonstrates that a 5-year extension of the AFTC will provide benefits many years after the credit is no longer active. It will provide businesses with the certainty they need to make significant, long-term investments in trucks, fueling infrastructure, maintenance capabilities, and manufacturing. Additionally, a multi-year extension of the program will spur enough research and investment in advancing NGV technology and reducing equipment / manufacturing costs that the adoption of this clean technology will continue without the need for further public investment beyond the five-year extension.

For example, over the next 10 years, the private sector will add 58,000 NGVs and America will benefit from:

- **\$9.9 billion of economic growth**
- **\$5.8 billion** in additional **private sector investment** in infrastructure and equipment
- **62,000** new **middle-class jobs**
- 200.6 million metric ton reduction of greenhouse gas emissions
- 82,300 metric ton reduction of NOx emissions
- \$1.0 billion in avoided public health costs

Renewing and extending the AFTC will increase energy independence by decreasing consumption of petroleum-based fuels, stimulating US manufacturing, promoting meaningful job growth, igniting sustained economic output, improving our nation's air quality, and reducing public health costs in disadvantaged communities for years to come.

I. Introduction

Since the discovery of significant natural gas reserves in the United States in the mid-1990s and the development of revolutionary technology such as horizontal drilling, the United States has become the world's largest producer of clean-burning natural gas. By some estimates, the US has enough natural gas supply to last the next eighty-six years. While natural gas consumption has been increasing, the US still imports about 5 million barrels of crude oil a day. The transportation sector is particularly dependent on petroleum-based diesel fuels exacerbating America's reliance on foreign oil. While natural gas currently accounts for 30% of total energy consumption, it represents just 0.30% of energy consumed in the transportation sector¹. With over 1,600 natural gas fueling stations across the country² and clean natural gas vehicle (NGV) options for almost every application, now is the time to:

- Spur job creation, infrastructure investment, and incremental economic output by using more natural gas as a transportation fuel
- Decrease America's reliance on foreign oil / displace petroleum-based transportation fuels and forge a path toward energy independence
- Address environmental and health concerns like smog and greenhouse gas emissions
- Develop more sustainable sources of transportation fuel

Jobs Creation, Infrastructure Investment, and Economic Growth

Most of the components in the manufacturing and supply chain for natural gas transportation fuels are sourced in America. Using more natural gas results in more domestic job opportunities. These jobs range from the manufacture of parts that go into natural gas vehicles and infrastructure projects to the development and operation of natural gas fueling stations and renewable natural gas (RNG) projects. With an average salary of \$52,000 per year, these are jobs that strengthen America's middle class and expand the tax base.

Path to Energy Independence

Extending the AFTC will also give a much-needed boost to NGV deployment in Class 7 and Class 8 trucks by encouraging both infrastructure investment and truck conversions. This, in turn, will accelerate the achievement of technology advancements and manufacturing economies of scale which become self-reinforcing as costs come down. Importantly, a spike in natural gas usage in vehicle applications will have little or no impact on prices in other applications. Ultimately, economics rather than policy will provide the most sustainable path to energy independence.

Environmental and Health Benefits

Two of the most pressing environmental issues are ozone pollution/smog from nitrogen oxide (NOx) emissions in urban areas and greenhouse gas (GHG) emissions. While diesel-burning Class 7 and Class 8 trucks account for only 1% of the vehicles on the road, they are responsible for more than 50% of NOx emissions and more than 20% of GHG emissions³. In stark contrast, NOx emissions from conventional natural gas vehicles are 50% - 90% below federal standards and GHG emissions are at least 20% lower. Using certain sources of Renewable Natural Gas (RNG), the GHG emissions can be reduced by more than 100%. These air quality improvements drive public health benefits.

Sustainability

Recent technological developments have also allowed for sources of renewable natural gas (RNG) to be used as a transportation fuel. RNG is produced by capturing methane wherever organic materials are present, including landfills, dairy farms, wastewater treatment facilities, and other animal and crop waste systems. RNG currently accounts for roughly 35% of the natural gas used in the transportation sector. When using RNG in transportation, "well-to-wheel" GHG emissions can be reduced by more than 100%. In addition, many of the highest potential RNG development sites are dairy and swine farms, so renewal of the AFTC will support the continued development of rural communities².

Implicit in the above analysis, two foundational elements of the case for natural gas are that (a) it is America's most plentiful clean / renewable energy resource and (b) the technology to utilize it effectively as a transportation fuel across all vehicle applications is commercially viable today. These two issues are particularly relevant in heavy duty

trucking where many legislators and other decision-makers have mistakenly assumed the inevitability of electric vehicles (EVs). The road to electrifying heavy duty applications will be long and difficult. In particular, the size and weight of the batteries that would be required to pull Class 8 loads using current technologies would be prohibitive⁴. While a comprehensive analysis of the future capabilities and vehicle specifications of EVs is outside the scope of this work, as of this writing, there are no plans for a commercially available heavy duty EV truck in the next two years. In the near-term, NGVs are the only real choice for displacing petroleum's dominance in heavy duty applications.

II. Methodology

To assess the potential impact of extending the AFTC, this analysis considered a high oil price, low oil price, and reference oil price scenario based on the Energy Information Administration's Annual Energy Outlook (AEO)⁵. In each scenario, the model projected an annual number of NGV truck conversions, the economic and environmental impact of those new trucks, and the associated "net" government investment in our future.

The key driver of truck conversion is economics. A diesel truck will be replaced by natural gas if the ongoing operating cost savings provide a sufficient return on the investment to upgrade the engine. There are many commercial factors that impact this calculation including conversion costs, fuel price, fuel efficiency, taxes and target payback timeline (years). The model accounts for variability in these factors by vehicle application, by state, and by year. This methodology is applied both with and without the AFTC to calculate the incremental effect of the AFTC on truck conversions.

The economic impact of truck conversions, including infrastructure spending, station builds, indirect and direct job creation, and economic output were calculated using ratios from Argonne National Labs JOBS model⁶ and published research from ICF⁷ and Nevada Governor's Office of Economic Development⁸. The public health benefit of NOx emissions reductions was calculated using ratios from an Environmental Research Letter on the VW emissions scandal jointly authored by MIT and Harvard researchers⁹. Environmental benefits of NGV truck conversion were calculated using California Air Resources Board (ARB) Carbon Intensity (CI) scores¹⁰ and NOx emissions benchmarks¹¹.

The cost of extending the AFTC is calculated based on the cumulative volume of fuel consumed by NGVs on the road today as well as those added over the 5-year period. This investment is offset by incremental tax revenues from two sources:

- Increased excise tax receipts due to the conversion cost of new NGVs
- Increased income tax receipts associated with job creation

Importantly, these sources of incremental tax revenue will persist long after the expiration of the AFTC.

III. Findings

Assuming the reference oil price outlook from AEO, a renewal of the AFTC for 5 years will result in more than 18,000 incremental CNG and LNG trucks by 2022, and America will benefit from:

- \$3.8 billion of economic growth
- \$2.2 billion in private sector investment in infrastructure, equipment, and project development
- ~26,000 new jobs
- 62.6 metric ton reduction in greenhouse gas emissions
- 25,030 metric ton reduction in NOx emissions
- \$300 million in avoided public health costs

Over a 10-year horizon, assuming no further public investment after the AFTC expires, there will be nearly 58,000 incremental NGVs with a commensurate increase in economic and environmental benefits:

- \$9.9 billion of economic growth
- \$5.8 billion in private sector investment
- ~62,000 new jobs
- 200.6 million metric ton reduction in greenhouse gas emissions
- 82,327 metric ton reduction in NOx emissions
- \$1.0 billion in avoided public health costs

Table 1. Benefits of AFTC by year (Reference Oil Price Scenario)

	Units	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	5-Year Total	10-Year Total
Diesel-fueled Trucks Replaced by NGVs	# trucks	3,193	3,649	3,741	3,795	3,829	3,679	5,444	7,453	9,969	12,950	18,207	57,702
Additional Private Sector Investment	million \$	355	453	486	491	446	403	516	698	831	1,146	2,232	5,825
American Jobs Created	# jobs	4,046	5,397	5,876	5,716	4,937	4,595	5,189	7,308	7,781	11,027	25,972	61,872
Average Salary	\$/job	45,546	46,961	48,397	49,666	50,840	51,708	52,781	53,921	55,187	56,695	48,398	51,996
Incremental Economic Output	million \$	569	769	874	859	762	722	845	1,210	1,335	1,923	3,832	9,868
Greenhouse Gas Reduction	million MT CO2e	10,140	12,747	13,069	13,257	13,376	12,852	19,018	26,036	34,825	45,239	62,589	200,558
NOx Reduction	MTs	4,420	5,041	5,020	5,139	5,410	5,224	7,817	10,789	14,513	18,954	25,030	82,327
Public Health Costs Avoided	million \$	49	57	58	61	65	65	99	140	193	258	289	1,044

These incremental benefits are a direct result of the government investment in our future. As modeled, the cumulative “net” investment is approximately \$2.3 billion by year 10 due to the continued growth in the tax base long after the AFTC expires. In addition, America will have made great progress towards our goal of energy independence.

Table 2. Cost of AFTC to Government and Economy (Reference Oil Price Scenario)

	Units	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	5-Year Total	10-Year Total
Eligible CNG + LNG Fuel Consumption	million DGE	742	902	1,073	1,275	1,518	1,783	2,117	2,534	3,054	3,725	5,510	18,722
Blended Tax Credit per Gallon	\$/DGE	0.56	0.56	0.56	0.57	0.57	0.00	0.00	0.00	0.00	0.00	0.56	0.17
Total Tax Credit	million \$	418	509	606	721	858	0	0	0	0	0	3,112	3,112
Less: Increase in Tax Receipts	million \$	52	66	69	67	59	54	65	90	101	137	313	761
Net Government Investment in Our Future	million \$	366	443	536	654	800	-54	-65	-90	-101	-137	2,799	2,351
Memo:													
Less: Public Health Costs Avoided	million \$	49	57	58	61	65	65	99	140	193	258	289	1,044
Net Cost to Economy	million \$	317	386	479	593	734	-119	-164	-230	-293	-395	2,510	1,308

As expected, the impact of the AFTC is sensitive to the oil price assumption. In the short-term, the modeled impact of AFTC in the “High Oil” scenario is smaller but the total number of NGVs on the road is higher because diesel prices drive greater demand for NGVs. Ultimately, the economic and environmental benefits of NGVs grow as they become a larger fraction of the transportation fleet mix. The AFTC is an important catalyst for this in all three scenarios.

Table 3. Incremental Economic and Environmental Benefits in All Scenarios

	Units	5-Year Totals			10-Year Totals		
		Reference	High Oil	Low Oil	Reference	High Oil	Low Oil
Trucks Added	# trucks	18,207	17,706	20,642	57,702	77,147	57,042
Truck Stock	# trucks	104,880	127,875	106,878	235,732	389,632	230,818

IV. Conclusion

Extending the AFTC for natural gas provides clearly demonstrable economic and social benefits at a nominal cost to the government over the long-term. Over the next 5 years, Americans will see an increase in the number of well-paying jobs available in both urban and rural communities, greater economic growth, improved air quality, and significant investment in renewable/sustainable sources of transportation fuel. Importantly, because NGVs will still only account for ~1% of forecasted natural gas energy consumption by 2027¹², securing these benefits will have no meaningful impact on the price of natural gas in other applications. Finally, the momentum that is created around NGV technology advancements, manufacturing efficiencies, and industry-wide economies of scale will help put America on a self-reinforcing path to energy independence.

Advocating the increasing use of NGVs where they benefit most.
For the economy. For the environment. For health. For security. **For America.**

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