US truck fuel efficiency standards: costs and benefits compared

Before and after standards there was a similar level of price rise, but after standards, fuel efficiency increased dramatically

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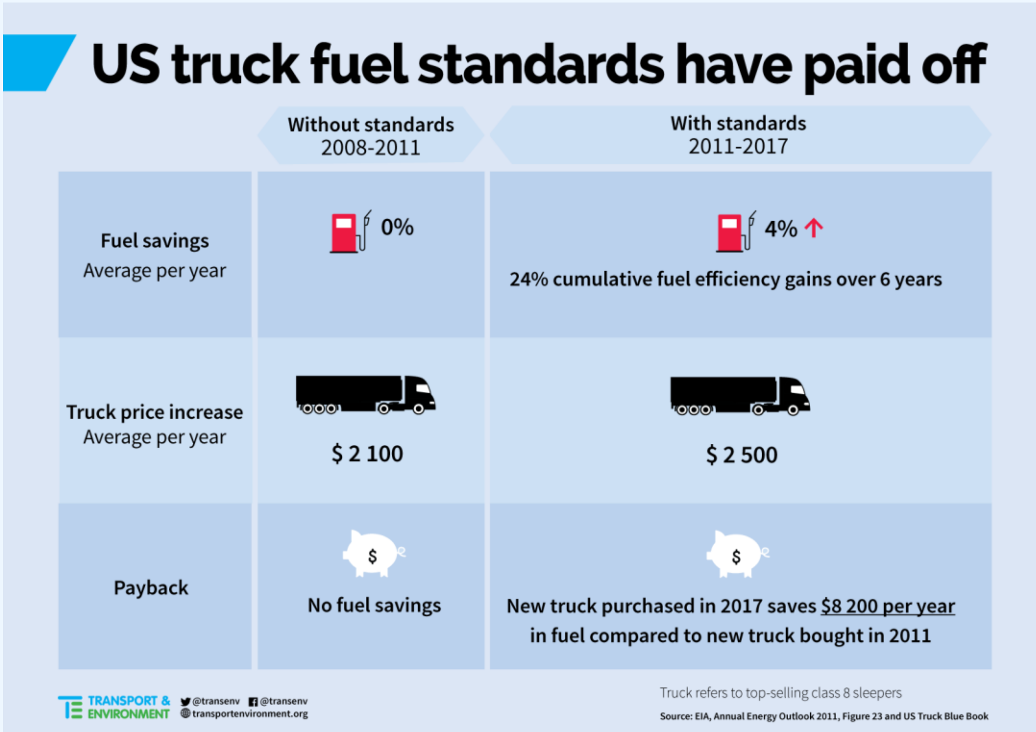
Summary

In 2011 the US introduced heavy-duty truck standards which ensured major fuel economy improvements and lowered CO_2 emissions. This regulatory push improved both vehicles and engines, harnessed new fuel-saving technology, and delivered major financial savings for trucking operators.

This study shows that, in the period 2008 to 2011, a time before standards came into effect, truck prices increased but fuel efficiency remained broadly static. Coming into force in 2011, standards ensured the deployment of fuel saving technologies and brought about a 24% fuel efficiency gain from 2011 to 2017.

From 2008 to 2011, i.e. pre-standards, annual price increases averaged $2100 a year, while after standards, prices rose by $2500 a year on average from 2011 to 2017. What jumps out post-standards is the dramatic fuel savings.

The purchaser of a top-selling new Class 8 sleeper in 2017 secured annual fuel savings in the order of $8200 compared to the buyer of a similar truck six years previously.



Taking a year-to-year context, the annual price rise after standards has been $400 higher than before standards but, for this, purchasers got an average additional fuel efficiency gain of $1400 every year. (In detail: new truck sold in 2017 was $8200 more fuel efficient than a 2011 model,

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which averaged across the six years gives \$1366, or to \$1400 rounding). In short, standards have significantly reduced the total cost of ownership of trucks.

Because of their extensive usage and high annual mileage, this study focuses on Class 8 high roof sleeper trucks. Their fuel consumption accounts for around two thirds of all fuel consumed in the US freight sector.

The picture in Europe is similar. Trucks represent 3% of all EU vehicles but emit almost 25% of CO_2 road transport emissions. European long-haul tractor-trailers account for almost 75% of total truck emissions.

The European Commission is expected to publish a proposal to regulate heavy-duty vehicle CO_2 emissions in early May 2018. This study shows that robust, ambitious standards deliver significant fuel consumption reductions that benefit fleet operators, consumers and the environment. All EU institutions must act quickly and decisively during the time remaining in the current European legislative cycle (i.e. to mid-2019) to make sure proposed standards are ambitious, effective – and adopted.

1. Introduction

The first US trucks standards were adopted in 2011 in the form of a Heavy Duty National Program. [i] Jointly established by the US Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA), this legislation creates separate standards for vehicles and engines.

In the first step MY2014 trucks had to decrease their emissions and fuel consumption between 10% and 21% from a MY2010 baseline. During the second step, trucks had to improve their efficiency by an additional 3% for their 2017 models, resulting in approximately 24% fuel efficiency improvement for Class 8 high roof sleeper cabins. On top of these phase one standards, a second phase covering MYs 2018-2027 was agreed in 2016 and would result in 2027 models becoming up to 30% more fuel efficient compared to 2017 trucks.[ii]

Europe also plans to introduce truck CO_2 emission standards, scheduled for the first half of 2018[iii] to tackle growing transport emissions and in the context of the EU climate targets (30% reduction by 2030 compared to 2005 emissions for non-ETS sectors). The European Commission projects that emissions from heavy duty vehicles will increase by 10% between 2010 and 2030, and by 17% from 2010 to 2050 – unless action is taken. Therefore, transport urgently needs to do its share to meet its 2030 climate targets. The current lack of truck fuel efficiency measures threatens Europe's leadership on efficiency and undermines the overall competitiveness of the European truck industry.

The US EPA and the European Commission both note that introducing fuel efficiency standards will benefit the transport sector, and **deliver cleaner trucks at a lower total cost of ownership**. In practical terms, fuel efficiency standards would force manufacturers (hereafter OEMs) to introduce innovations as part of their standard vehicles. While the American Truck Dealers association objected to standards[iv], other stakeholders, such as American Trucking Associations have been supportive[v].

In this report, we analyse the **real net costs of introducing standards in the US**, based on developments of US truck retail prices. We do this by analysing prices before and after standards were announced and introduced.

2. Vehicle selection

This study focuses on US Class 8 long-haul tractor-trailer sleeper trucks as they are one of the major emitters of CO_2 in the freight sector.[1] For comparative purposes, the most common configuration in the US market is examined. This baseline reference has a 6x4 drivetrain and a sleeper cabin. The selected trucks are essentially comparable, based on their usage and purpose, to their 4x2 axle alternatives in Europe. These long-haul tractor-trailers are responsible for approximately 75% of the CO2 emissions of the heavy-duty truck fleet[vi] and this is also the main category that will be regulated during the EU phase I standard.

US (left) and EU (right) configurations

[1] The analysis looks at five of the top-sold Class 8 sleeper trucks, manufactured by the top 4 manufacturers in the class. Current legislation divides Class 8 trucks into 9 categories according to their weight, cab type and roof height.

Our research looks at five tractor-trailers[2] with biggest market penetration in the period 2008-2017 using the Truck Blue Book database[vii] on heavy-duty commercial trucks in the US to track price developments. All five best-sold trucks assessed are high-roof sleepers, and as such relate to the typical profile in Europe. At the same time, this analysis takes into account price inflation throughout the years. The Manufacturer's Suggested Retail Price (MSRP) is used as a reference, as it serves to provide for a standardised price across different locations. The figures are adjusted to their real values, as of November 2017.[viii]

3. How did standards affect US truck prices?

3.1.The estimates

In their impact assessment, EPA and NHTSA estimated the range of the payback period and the net costs of the HDV program. MY2014 Class 8 high-roof sleeper trucks have to decrease both fuel consumption and CO_2 emissions of the vehicle by about 21%, compared to a MY2010 baseline. A smaller decrease is expected for MY2017 trucks where Class 8 high-roof sleepers are to decrease CO_2 emissions and fuel consumption by about 3% compared to MY2014 levels, totaling up to almost 24% fuel consumption reductions for sleeper cabs between 2010 and 2017 models.[ix]

The two US agencies estimated that complete phasing in for the MY2014 to MY2017 of an average Class 8 truck would lead to an average program compliance cost increase of $6,638 yearly.[x] By default, Class 8 trucks average a high number of annual miles. This is why their payback period is shorter and projected to **occur within the second year of ownership** after the implementation of the phase one standards.[xi] But what was the price increase of top sold trucks in reality?

3.2. Standards in action

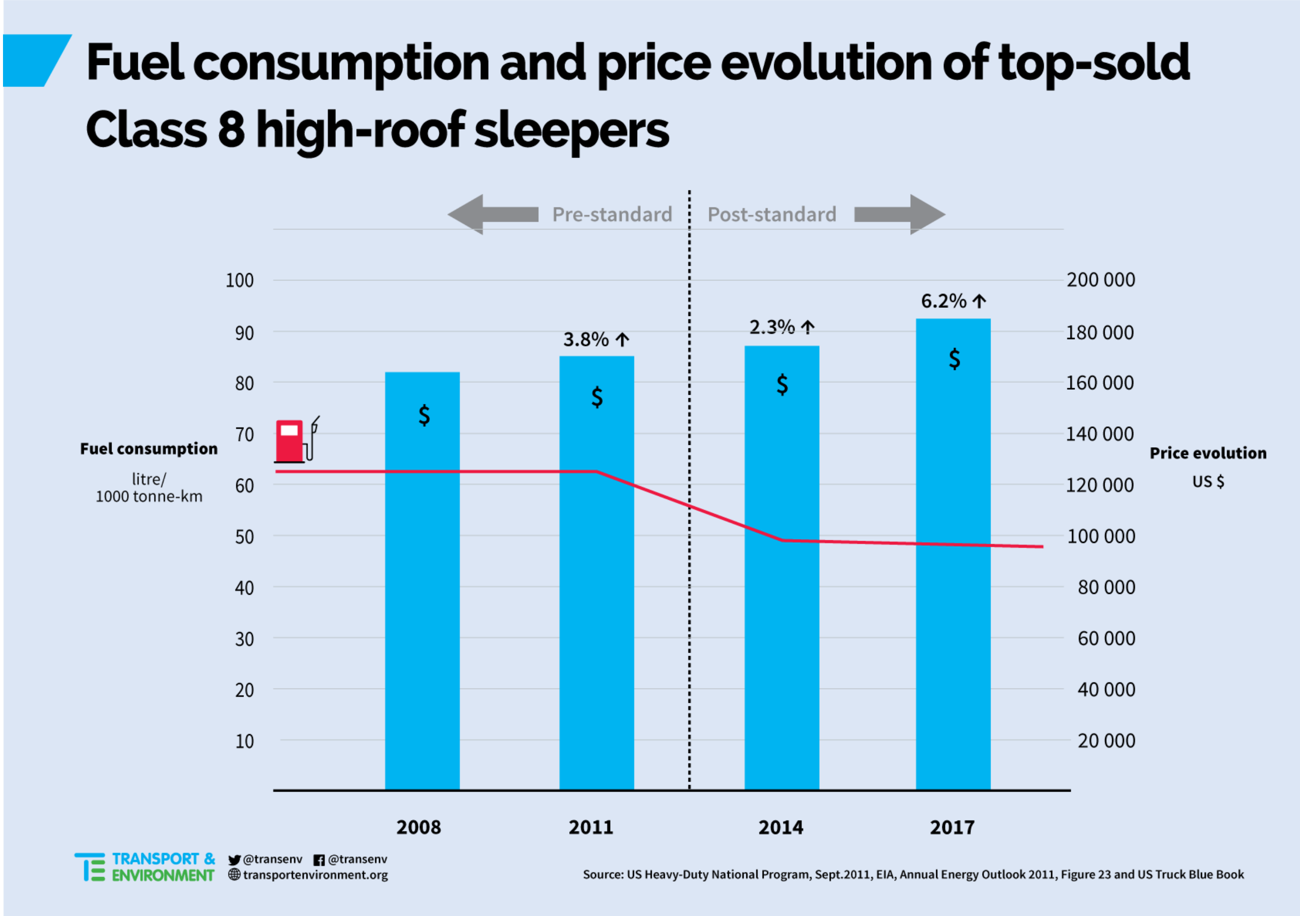
Based on the analysis of the Truck Blue Book, the cost evolution before and after the announcement, as well as throughout the implementation of standards, provides us with better insight of the price developments on the market.

The analysis begins in 2008 in order to illustrate the trend prior to the announcement of standards in 2011. The graph here provides a closer look at the price evolution of the five top-selling Class 8 high-roof sleepers between 2008 and 2017.

A detailed breakdown of price movements in the context of fuel consumption savings gives a more complete picture (please see graph below).

Note: Trucks are top selling models chosen from high-roof sleeper category
Source: T&E analysis of truckbluebook.com data.

[2] Models taken into consideration are:
Freightliner CASCADIA, 6x4 125" BBC "Cascadia" Conv. 72" Raised Roof Sleeper Tractor w/Air Brakes
International PROSTAR, 6x4 ProStar Series 122" BBC Steel Conventional Tractor w/ 73" Hi-Rise Sleeper, Air Brakes, Power Steering & Disc Wheels
Peterbilt 386, 6x4 126" BBC Alum Conv (FG Hood and Fenders) SBA Tractor w/ 70" High Rise Sleeper, Air Brakes
Peterbilt 388, 6x4 123" BBC Alum Conventional Tractor w/ 70" High Rise Sleeper Cab, Air Brakes & Power Steering
Volvo VNL64T, 6x4 174'' BBC ``VNL 670 Series'' Galvanized HSS (SMC Tilt Hood w/Integral Fenders) Conv 61'' FULL INTEGRAL TALL SLEEPER Tractor w/Air Brakes & Power Steering



Between 2008 and the announcement of standards in 2011, prices for sleepers increased from an average of $164,086 to $170,293, or $6,200 rounded to the nearest hundred. Over this time (2008 to 2011) there was no discernable increase in fuel economy.[3]

Standards applied from 2011 and by 2014 truck prices had increased but slightly less compared to the previous three-year period. The MY2011 average retail price for the selected models stood at $170,293 whereas the average retail price of these trucks for MY2014 was $174,289, a change of approx. $4,000. During this time, however, a 21% improvement in fuel economy was delivered for new Class 8 trucks with high-roof sleeper cabs. In the final three year period studied, 2014 and 2017, average prices went from $174,289 to $185,037 (MY2017), an increase of $10,748. Again, a fuel economy saving was delivered over this period (approx. 3%).

Calculating the average-per-year increase gives us a yearly rise of approx. $2,100 in the period before standards (2008 to 2011) and $2,500 a year in the six period of standards (2011 to 2017).

In short, before the application of standards the prices of new trucks were rising but fuel savings weren't being delivered. Standards brought changes. Buyers began paying around $400 more per new vehicle but - and this is the key point - they got an average of $1,400 of additional fuel savings every year in return. Framed in terms of the six year period, a new truck sold in 2017 delivers $8,200 more in fuel savings a year than a new truck sold in 2011.[4] To obtain this saving, prices have risen around $2,400 more than business-as-usual ($400 x 6 years).

[3] Real Prospects for Energy Efficiency in the United States (2010). The National Academies Press (URL: https://www.nap.edu/read/12621/chapter/5#165)

[4] The savings figure of $8,200 is calculated by taking a conservative average national annual mileage for Class 8 trucks overall of around 68,000 miles, a pre-standard fuel consumption of 5.8 miles per gallon and an average diesel price of $3. This yields a

4. Next steps

As showed earlier, pricing did not go significantly above the trend line, while very substantial fuel efficiency improvements were delivered. In addition, it provides for a competitive advantage in the global truck manufacturing market.

The US EPA/NHTSA legislation provides for an increasing level of ambition from 2017 to 2027 and may also include trailers (trailers are currently subject to some uncertainty). Milestones are set for 2021 and 2024, based on higher levels of technological uptake.[xii] Overall, the second of phase of standards projects requires CO_2 reductions of up to 30% for tractor trailers compared to 2017 levels.[xiii] The state of California has taken a step further and plans to develop its own phase two program (which may include the regulation of trailers) to meet its higher emissions reduction goal.[xiv]

In Europe attention now turns to the European Commission which is due to propose the EU's first truck standards in early May 2018. Regulatory efforts are being strengthened generally by increased innovation levels and a range of truck and pilot project launches on both sides of the Atlantic.

Conclusion

Vehicle- and engine-focused regulations affect manufacturers and hauliers. Looking at the data from the first six years of US truck standards, annual fuel savings outweigh the rise in vehicle cost by a benefit-to-cost ratio of 3.5:1 ($1,400 in additional fuel savings each year while average prices only climbed $400 a year more above price rises in the period before standards).

Large-scale fleet surveys are recording very substantial savings as aging trucks are replaced.[xv]

The implications for Europe are quite strong. With the success of American standards, US trucks are projected to overtake EU trucks as the most fuel efficient in the world by the early 2020s.[xvi] This is a huge threat to the competitiveness of the European truck industry. In Europe today fuel efficient technologies are mainly offered as an expensive 'add-on' option because of the absence of standards. Effective European standards could have positive environmental, monetary and social impacts mirroring developments in the US.

The European Commission will propose truck CO_2 standards for the EU in early May 2018. The initiative is an opportunity to enhance the competitiveness of vehicle manufacturing in Europe, deliver fuel savings and reduce emissions.

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yearly fuel bill for a pre-standards truck of about $35,200, meaning the introduction of standards brought about $8,200 in fuel savings (comparing new trucks purchased in 2011 and 2017).

Endnotes:

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[i] *Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles*, Federal Register, vol. 76, no. 179, p. 57106. (URL: http://www.gpo.gov/fdsys/pkg/FR-2011-09-15/pdf/2011-20740.pdf).
[ii] *Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles — Phase 2*, Federal Register, vol. 81, no. 206, pp. 73502-73505. (URL: https://www.gpo.gov/fdsys/pkg/FR-2016-10-25/pdf/2016-21203.pdf)
[iii] *COM(2017) 675 final, Delivering on low-emission mobility,* European Commission, (URL:http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017DC0675)
[iv] National Automobile Dealers Association & American Truck Dealers, *EPA/NHTSA Emissions Rule for Trucks Will Harm Consumers, Economy, Emissions Goals (*URL: https://www.nada.org/CustomTemplates/DetailPressRelease.aspx?id=21474841991)
[v] Fleetowner, *Trucking industry reactions to GHG Phase II vary,* (URL: http://www.fleetowner.com/regulations/trucking-industry-reactions-ghg-phase-ii-vary)
[vi] *Fuel Efficiency Technology in European Heavy-Duty Vehicles: Baseline and Potential for the 2020-2030 Time Frame,* ICCT (URL: http://www.theicct.org/sites/default/files/publications/EU-HDV-Tech-Potential_ICCT-white-paper_14072017_vF.pdf)
[vii] Truck Blue Book *database*, (URL: http://www.truckbluebook.com/Navigation.do?product=TBB)
[viii] OECD (2017), Inflation (CPI) (indicator). doi: 10.1787/eee82e6e-en (Accessed on 16 November 2017)
[ix] Calculations made by the author, based on data from Table III-2 and Table III-6 from the final heavy-duty program, Phase One
[x] This refers to EPA/NHTSA vehicle standard compliance cost estimates for an average MY2014 truck, Table VIII-1, Phase One Final Rule
[xi] Phase One Final Rule, p. 57127 – 2009 USD values adjusted to 2017 real values
[xii] North American Council for Freight Efficiency (NACFE), Annual Fleet Fuel Study, Final Report, 2016 at p.18. (URL: http://truckingefficiency.org/sites/truckingefficiency.org/files/reports/NACFE%202016%20Annual%20Fleet%20Fuel%20Study%20FINAL%20Report%20082316_0.pdf)
[xiii] Phase Two Final Rule, p. 73504. Table I-6
[xiv] California Phase 2, (URL: https://www.arb.ca.gov/msprog/onroad/caphase2ghg/caphase2ghg.htm)
[xv] Truck fleet owners and testimonies on standards. (URLs: https://www.trucks.com/2017/10/18/navistar-international-usxpress-truck-sale , https://www.trucks.com/2017/09/06/class-8-trucks-industry-rebound/)
[xvi] Explanatory note: Comparing EU and US truck fuel economy, T&E. (URL: https://www.transportenvironment.org/sites/te/files/2015_06_Comparing_US_EU_truck_fuel_economy_explantory_note_Final.pdf