

**Draft Strawman Regulatory Impact Analysis for  
Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits  
RIN 2060–AT79**

**Revised: May 15, 2018<sup>1</sup>**

**I. INTRODUCTION**

On October 25, 2016, the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) published a joint final rule establishing greenhouse gas and fuel efficiency standards for medium and heavy-duty engines and vehicles (“Phase 2 Final Rule”).<sup>2</sup> In this rule, EPA reversed its longstanding interpretation of the Clean Air Act to permit it to regulate gliders as new vehicles. Rebuilt engines remained regulated based on date of manufacture, but not if they were rebuilt for installation into a glider vehicle. The obvious practical effect of this change was to render, by regulation, the glider market illegal.

After receiving a petition from three glider assemblers identifying several legal, technical, and economic concerns,<sup>3</sup> EPA provisionally agreed that the Agency lacked statutory authority to define glider kits as motor vehicles and gliders as new motor vehicles. The Agency published a notice of proposed rulemaking (“Glider Repeal NPRM”) that, if finalized, would repeal the glider provisions in the Phase 2 Final Rule.<sup>4</sup>

Pursuant to Executive Order 12866, Regulatory Impact Analyses (RIAs) must accompany economically significant rulemakings, which Section 3(f)(1) defines as regulatory actions that are likely to

[h]ave an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities[.]

In the Fall 2017 Unified Agenda, EPA designated the Phase 2 Glider Repeal NPRM as significant and did not prepare an RIA.<sup>5</sup> During EO 12866 review of the draft proposed rule, multiple representatives from the new truck industry and environmental groups met with OMB

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<sup>1</sup> This work product was prepared on behalf of Fitzgerald Glider Kits LLC from April 29 – May 10, 2018 (with minor editing since then) based on publicly available information except where explicitly noted. Fitzgerald has been given an opportunity to correct technical errors and provide comments, but the author is solely responsible for all content. Any remaining errors will be corrected on request.

<sup>2</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c).

<sup>3</sup> Fitzgerald Glider Kits LLC et al. (2017).

<sup>4</sup> U.S. Environmental Protection Agency (2017).

<sup>5</sup> Office of Management and Budget (2017i).

to raise objections.<sup>6</sup> In the Spring 2018 Unified Agenda, the Final Rule was designated economically significant,<sup>7</sup> which normally triggers a requirement for an RIA.

OMB guidance for implementing Executive Order 13,771 directs agencies to follow the cost estimation principles in Circular A-4, but in reverse.<sup>8</sup> Complying with OMB's guidance is impossible in the short term because the Phase 2 Final Rule RIA does not report cost or benefit estimates for the glider provisions.<sup>9</sup> It is unclear whether EPA conducted, but did not disclose, a cost analysis for the glider provisions, or did not conduct a cost analysis at all. OMB's guidance provides limited insight concerning what should be done for a deregulatory action repealing provisions in a final rule that an agency did not properly analyze prior to promulgation. Further, OMB's guidance,<sup>10</sup> if narrowly interpreted, would establish a bias in favor of regulation, reward an agency for failing to conduct a proper analysis of key regulatory provisions, and incentivize that agency to continue to evade generally accepted minimum analytic requirements.<sup>11</sup>

This strawman RIA has been prepared to identify and, where possible describe and provisionally quantify, costs of the glider provisions which EPA did not estimate. A key reason

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<sup>6</sup> Office of Management and Budget (2017d, 2017e, 2017h, 2017g, 2017f). Handouts provided by the American Lung Association, Volvo Group, National Association of Clean Air Agencies, and the Environmental Defense Fund are included in OMB's meeting records.

<sup>7</sup> Office of Management and Budget (2018, p. 9): "Only those impacts that have been traditionally estimated as costs when taking a regulatory action should be counted as cost savings when taking an EO 13771 deregulatory action."

<sup>8</sup> Office of Management and Budget (2017a, p. 9).

<sup>9</sup> EPA summarizes benefit estimates in the preamble to the final rule, but no costs. *See* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, pp. 73942-73943). The RIA, which is 1,115 pages, contains hundreds of references, and was subjected to peer review of certain modeling elements (but not its cost or benefit estimates). *See* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d). Although EPA asserts that its peer review complied with government-wide guidelines set forth in Office of Management and Budget (2005) – *see* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, Section 4.2.4) – the peer review covered only a small subset of analytic issues and did not address the glider provisions at all.

<sup>10</sup> Office of Management and Budget (2017a, pp. 9-10): "For EO 13771 deregulatory actions that revise or repeal recently issued rules, agencies generally should not estimate cost savings that exceed the costs previously projected for the relevant requirements, unless credible new evidence show [*sic*] that costs were previously underestimated."

<sup>11</sup> The proposed and final RIAs for the Phase 2 rule also violate EPA's own guidance on economic analysis. *See* U.S. Environmental Protection Agency (2014, p. 11-2): "An economic analysis of regulatory or policy options should present *all* identifiable costs and benefits that are *incremental to the regulation* or policy under consideration" (emphasis added). A recently published "consumer's guide to regulatory impact analysis," prepared by 19 members of the Society for Benefit-Cost Analysis, warns agency officials to be on the lookout for RIAs that do not report incremental benefits and costs for key regulatory provisions. *See* Dudley et al. (2017, p. 8): "For a rule with multiple components (for example, one that both sets permissible exposure levels and requires technology controls), an RIA that estimates the benefits and costs of the rule as a whole, without presenting the marginal impacts of the key elements, will not reveal the merits of individual requirements. For example, the RIA may suggest that a proposed regulation would yield net benefits, but most of those benefits may derive from one requirement, while most of the costs derive from another. This would be revealed if the estimated benefits and costs of each component were estimated separately. In such a case, this incremental analysis would show that one component had much greater net benefits, and might point to a different preferred policy."

EPA's RIAs do not include a proper analysis of the incremental effects of the glider provisions is that the Agency chose not to obtain the empirical data that were necessary to conduct such an analysis. In addition, several dubious benefits claimed for the Phase 2 Final Rule are discussed. The net benefits of the Phase 2 Final Rule become negative when they are removed, which further supports the Glider Repeal Rule even in the absence of a comprehensive RIA.

Because the glider provisions are partially in place, cost savings from repealing the glider components of the Phase 2 Final Rule are necessarily less than the costs originally imposed. The Repeal Rule cannot recover deadweight losses already borne by the industry and its customers. These deadweight losses will continue to grow until the Repeal Rule is finalized and becomes effective.

## II. NEED FOR THE REGULATION

Executive Order 12866 and OMB's RIA guidelines direct agencies to give thoughtful and rigorous attention to whether a regulation is needed, and if so, why. Section 1 of EO 12866 identifies alternative ways to make a showing of need and puts clear boundaries on the process:

Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people.

Simply asserting regulatory jurisdiction is insufficient and improper. An agency must first demonstrate clear statutory authority for its actions while recognizing that the existence of statutory authority is not unbridled license.

RIAs help ensure that regulations are bounded by statutory authority. The purpose of an RIA is to

provide[] a formal way of organizing the evidence on the key effects – good and bad – of the various alternatives that should be considered in developing regulations. The motivation is to (1) learn if the benefits of an action are likely to justify the costs or (2) discover which of various possible alternatives would be the most cost-effective.

A good regulatory analysis is designed to inform the public and other parts of the Government (as well as the agency conducting the analysis) of the effects of alternative actions. Regulatory analysis sometimes will show that a proposed action is misguided, but it can also demonstrate that well-conceived actions are reasonable and justified.<sup>12</sup>

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<sup>12</sup> Office of Management and Budget (2003, pp. 2-3).

Market failure that can be cost-effectively remedied by government is the usual foundation for regulation, but adherence to a statutory directive that does not involve remedying a market failure may provide a *compelling public need*. Nonetheless, in no case can an agency claim a compelling public need that exceeds its statutory authority.

### **A. Concerns about EPA’s statutory authority**

The Phase 2 Rule included gliders within its regulatory domain contrary to EPA’s statutory authority. The domain of that authority is clearly set forth in 42 U.S.C. § 7521(a)(1):

The Administrator shall by regulation prescribe (and from time to time revise) in accordance with the provisions of this section, standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare. Such standards shall be applicable to such vehicles and engines for their useful life (as determined under subsection (d), relating to useful life of vehicles for purposes of certification), whether such vehicles and engines are designed as complete systems or incorporate devices to prevent or control such pollution.

The key terms governing EPA’s statutory authority are *new motor vehicles* and *new motor vehicle engines*. These terms are defined in 42 USC § 7550(3) as motor vehicles or motor vehicle engines “the equitable or legal title to which has never been transferred to an ultimate purchaser.” Gliders include used and rebuilt motor vehicle engines for which equitable or legal title was transferred to an ultimate purchaser, typically many years prior to salvage, repair and installation into a glider. Similarly, glider kits are not motor vehicles because they do not have motors. Thus, EPA lacks statutory authority to regulate used, rebuilt engines as “new,” or to regulate glider kits as motor vehicles. Gliders do not escape EPA regulatory authority, of course, because the Agency regulated emissions from these engines when they were first built and sold. By regulating them again as if they were new, EPA imposes a form of regulatory double jeopardy that has no limiting principle.<sup>13</sup>

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<sup>13</sup> At least one commenter on the Phase 2 NPRM described the logical perils of the Agency’s effort to regulate motor vehicle *parts* as if they are motor vehicles, and *old* engines as if they are *new* engines:

The EPA-proposed definitions are confusing because they conflate [glider kit and glider vehicle], which are typically sold by separate businesses. DTNA manufactures and sells glider kits, while most glider assemblers sell glider vehicles but do not manufacture glider kits. The third part of the proposed “glider kit” definition is simply too broad and vague to be workable: “Any other new equipment that is intended to become a motor vehicle with a previously used engine (including a rebuilt or remanufactured engine)” could potentially encompass any number of vehicle parts. *Any other assemblages of parts that EPA considers to be “new equipment that is intended to become a motor vehicle” could potentially be regulated as a glider kit, down to the wiring that constitutes a single headlight, or the glass and metal parts that together comprise a side mirror* (emphasis added).

EPA's assertion of statutory authority raises other concerns related to its regulation of glider kits as motor vehicles despite the absence of a requisite motor, and its regulation of *vehicle* rebuilding as if it were the same as *engine* rebuilding. Whereas the stated purpose of the glider provisions is to reduce GHG emissions, the Agency's actual objective appears to be to reduce NOx and PM emissions from older engines with remaining service life. But regulations on NOx and PM are required to include a 4-year lead time, which the glider provisions in the Phase 2 Final Rule lack.<sup>14</sup> Finally, EPA does not have statutory authority to regulate *vehicle* rebuilding (i.e., glider kits and glider assembly) under its statutory authority to regulate *engine* rebuilding (despite the absence of any provisions in the Phase 2 Final Rule related to rebuilt engines).<sup>15</sup>

Section 1037.150(c) of the Phase 2 Final Rule established a cap equal to the maximum number of units produced during the period 2010-14, not to exceed 300, on incumbent small business-eligible glider manufacturers through calendar year 2020; units beyond the 300<sup>th</sup> must comply with the Phase 2 Final Rule, and § 1037.150(t) terminates the provisional exemption in 2021. The basis for the cap was not disclosed, and cap alternatives were not analyzed in the RIA.<sup>16</sup> Note that new entrants are not permitted into the glider industry, a feature necessary to ensure that the industry is effectively destroyed.

These provisions closely track the recommendations made by a Small Business Advocacy Review ("SBAR") Panel convened pursuant to the Small Business Regulatory Enforcement and Fairness Act of 1996.<sup>17</sup> Of the 13 members recruited by EPA and the Small

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*See* Daimler Trucks North America LLC et al. (2015, p. 122). Daimler suggested that EPA needed to define "glider vehicle" as a separate and distinct entity to describe them logically and reflect longstanding industry terminology and practice, but also noted that the Clean Air Act does not give EPA the authority to create and regulate new classes of vehicles that are not "new motor vehicles," or to regulate motor vehicle components (e.g., glider kits) or vehicle rebuilding (e.g., glider vehicles).

<sup>14</sup> Daimler Trucks North America LLC et al. (2015, p. 122-123): "It is not enough for EPA to opine that the January 1, 2018 implementation date for the glider provisions allows 'sufficient time to "permit the development and application of the requisite control measure"' under 42 U.S.C. § 7521(a)(3)(D). The four-year lead-time and three-year stability requirements of (3)(C) provide an absolute minimum, even for engine rebuilding regulations, and then EPA must determine whether additional time is required above and beyond that based on its determination under the standard contained in (3)(D)."

<sup>15</sup> Daimler Trucks North America LLC et al. (2015, p. 123): "For its proposed glider provisions, EPA purports to rely on its authority to regulate the 'practice of rebuilding heavy-duty engines.' 42 U.S.C. § 7521(a)(3)(D). However, EPA is not regulating engine rebuilding practices, as evidenced by the lack of relevant proposed amendments to its engine rebuilding regulations (40 C.F.R. §§ 86.004-40, 1068.120). Instead, EPA is attempting to regulate vehicle rebuilding, which it clearly does not have the authority to do under the CAA."

<sup>16</sup> For the Agency's sparse analysis of the effects of the interim provision allowing 300 exempt units, *see* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 12-17): "We would expect many customers [otherwise purchasing a glider beyond the 300 unit cap] to purchase a freshly manufactured vehicle instead of opting for a glider vehicle with compliant engines, so it is possible that they may see a drop in sales." EPA purports not to be able to estimate the decline in output beyond 2018, and in any case appears to be unconcerned about economic effects (*see* pp. 12-17, 12-18).

<sup>17</sup> *Cf.* Small Business Advocacy Review Panel on EPA's Planned Proposed Rule 'Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: Phase 2' (2015, pp. 42-43) and U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, pp. 73946 and Section 1037.150(c) and (t)). Given the absence of representatives from the glider industry on the Panel, the origin of this provision is unclear.

Business Administration Office of Advocacy to serve on the Panel, eight were representatives of the trailer industry; none represented the glider industry.<sup>18</sup> Their absence likely explains the limited relief provided by the interim provisions, and the panel’s recommendation is remarkably similar to what EPA proposed. The draconian nature of the glider provisions reflects EPA’s clearly expressed animus toward the glider industry.<sup>19</sup>

EPA recognized that its proposed assertion of statutory authority to regulate gliders and glider kits was controversial. Subsequent to the NPRM, the Agency published for public comment a draft memorandum setting forth its legal arguments.<sup>20</sup> This memorandum described its proposed requirement that rebuilt engines installed in gliders comply with new engine standards as a backup provision in case its claim of statutory authority to regulate gliders as new motor vehicles was overturned in court.<sup>21</sup>

Issues concerning EPA’s statutory authority affect the estimation of benefits, costs, and other effects likely to result from the Phase 2 rulemaking. If it is determined that EPA lacks statutory authority, or that its authority is not as expansive as the Agency asserted in the Phase 2 Final Rule, then the glider cannot be justified as a “compelling public need.” However, the repeal of the glider provisions could be justified as a compelling public need if it is determined that the agency lacks statutory authority to promulgate them.

## **B. The Phase 2 Final Rule RIA includes no incremental cost estimates for the glider provisions**

Executive Order 12866 and OMB’s RIA guidelines require agencies to estimate the benefits, costs, and other effects of readily separable components of economically significant rules and to conduct similar analysis of a range of reasonable alternatives.<sup>22</sup> Despite the enormous resources obviously devoted to the preparation of the 1,100-page RIA and many

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<sup>18</sup> Small Business Advocacy Review Panel on EPA’s Planned Proposed Rule ‘Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: Phase 2’ (2015, pp. 17-18).

<sup>19</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, p. 73941): “Some of the [public] comments helped EPA target flexibility *for glider vehicles that serve arguably legitimate purposes* (such as reclaiming relatively new powertrains from vehicles chassis that fail prematurely), without causing substantial adverse environmental impacts” (emphasis added). *See also* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 12-9): “We are finalizing the proposed glider-related provisions but have made several revisions in recognition of the *differences between gliders produced to circumvent the 2010 criteria pollutant emission standards and those manufactured for other more legitimate purposes*” (emphasis added).

<sup>20</sup> U.S. Environmental Protection Agency (2016), cited in U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016b).

<sup>21</sup> U.S. Environmental Protection Agency (2016, p. 7).

<sup>22</sup> Clinton (1993, Section 6(a)(3)(B)(iii)), and Office of Management and Budget (2003, pp. 2): “A good regulatory analysis is designed to inform the public and other parts of the Government (as well as the agency conducting the analysis) of *the effects of alternative actions*” (emphasis added). *See also* EPA’s unambiguous requirement for incremental analysis in U.S. Environmental Protection Agency (2014, p. 11-2) (“An economic analysis of regulatory or policy options should present all identifiable costs and benefits that are incremental to the regulation or policy under consideration”).

supporting documents, it includes no analysis of the glider provisions.<sup>23</sup> If the RIA is EPA's complete work product, then it follows that EPA did not actually perform any analysis of the costs of the glider components and decided to promulgate them without regard for (and irrespective of) their net benefits.<sup>24</sup>

In the preamble to the Phase 2 NPRM, EPA said it was "concerned about adverse economic impacts on small businesses that assemble glider kits and glider vehicles." This apparently led the Agency to propose interim provisions that would "grandfather existing small businesses, but cap annual production based on their recent sales limited glider production."<sup>25</sup> However, the proposed production caps were very low for firms primarily engaged in glider assembly, and they were short-lived. The NPRM would have destroyed the glider industry, with obviously very large economic effects, but the Phase 2 NPRM RIA includes no cost analysis consistent with EPA's expression of concern.<sup>26</sup> A summary of purported benefits of the glider provisions is included in the preamble to the Phase 2 Final Rule,<sup>27</sup> but the RIA includes no analysis of incremental costs *or* benefits.<sup>28</sup> Similarly, the interim provisions in § 1037.150(c) and (t) are described, but their costs and benefits are not estimated.<sup>29</sup>

OMB guidance on the implementation of Executive Order 13771 directs agencies not to claim cost savings from deregulatory actions that exceed costs previously projected "unless credible new evidence show that costs were previously underestimated."<sup>30</sup> Given that EPA's implied estimate of the cost of the glider provisions in the Phase 2 Final Rule is zero, it is indisputable that "costs were previously underestimated." The Glider Repeal Rule provides a

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<sup>23</sup> The preamble summarizes a benefit assessment that is not found in the RIA. *See* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c). Problems with the benefit assessment are discussed in Section VI.A.

<sup>24</sup> The glider provisions also do not appear to have been addressed during EO 12866 review of the Phase 2 NPRM. *See* Office of Management and Budget (2015), U.S. Department of Transportation (2015), U.S. Environmental Protection Agency (2015a), U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2015a). The EO 12866 review of the Final Rule was similarly bereft of attention to gliders. *See* Office of Management and Budget (2016). A few edits to the RIA regarding gliders are evident in at least one redline version, but their authorship is not disclosed, and they do not concern cost. *See* U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016a, PDF pp. 1066-1067). Given the existential effects of the glider provisions on the industry and its customers, this lack of interagency interest in them seems peculiar.

<sup>25</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2015b, p. 40215).

<sup>26</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2015c). The Draft RIA includes no incremental analysis of costs *or* benefits.

<sup>27</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, pp. 73942-73943). The preamble includes an expression of concern about small business impacts but it does not include any discussion or estimates of these impacts.

<sup>28</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, Section 12.7.3.2).

<sup>29</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, Section 12.7.3).

<sup>30</sup> Office of Management and Budget (2017a, pp. 9-10).

rare opportunity to correct the record, both retrospectively and prospectively. In the immediate term, that correction can only be partial and mostly qualitative. OMB should permit EPA to count the Glider Repeal Rule as a deregulatory action, with cognizable reductions in regulatory cost, and provide the Agency adequate time to objectively estimate these costs for the purposes of EO 13771 regulatory budget accounting.

EPA reports industry output prior to the Phase 2 Final Rule RIA at about 10,000 units per year<sup>31</sup> (a figure that industry believes is high by a factor of 2<sup>32</sup>), or 2–4% of the annual volume of new Class 8 heavy-duty diesel engine trucks.<sup>33</sup> The Final Rule reduces glider output to perhaps several hundred units through 2020, and to zero thereafter. The costs of these output reductions are not reported by EPA and appear never to have been estimated. These costs include lost producers' and consumers' surplus generated by gliders and the forced retirement of industry capital invested in glider production. Both are substantial for an industry producing more than 10,000 units at an average price of about \$125,000 (\$1.25 billion sales volume).<sup>34</sup>

The Phase 2 Final Rule also can be expected to have significant non-transient unemployment effects. Whether (and if, so, how) to count unemployment is an unsettled question in benefit-cost analysis.<sup>35</sup> The quantification task is technically challenging; employment reductions that appear in partial equilibrium analyses will tend to overstate actual job losses because unemployed workers may change industries or relocate to find work. Meanwhile, general equilibrium analyses are not capable of estimating employment losses because GE models typically assume full employment.<sup>36</sup> Quantification aside, a key problem with counting job losses as costs is that jobs themselves are costs.<sup>37</sup>

A better approach is to quantify non-transient job losses and report them separately as a regulatory effect of legitimate public policy concern. Non-transient employment losses are highly plausible results of the Phase 2 Final Rule because the Rule destroys the glider industry rather than exerting on it an effect at the margin.

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<sup>31</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, p. 73942), Moulis (2017).

<sup>32</sup> Personal communication with Joe Depew, General Counsel for Fitzgerald Glider Kits LLC.

<sup>33</sup> Average annual new truck sales from 2007–2016 were about 250,000 units (derived from Statista (2018)).

<sup>34</sup> Lost producers' surplus is an unknown fraction of the \$1.3 billion annual sales volume. Lost consumers' surplus and the value of forced capital retirement must be added, along with lost producers' and consumers' surplus in the glider kit market and various other markets that supply inputs to the glider market, most obviously engine rebuilding.

<sup>35</sup> Coglianesse et al. (2014).

<sup>36</sup> U.S. EPA Science Advisory Board (2017, pp. 88-89).

<sup>37</sup> Executive Order 13563 (Obama 2011) amended EO 12866 to direct agencies to “consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributive impacts.” The permanent loss of employment in a small community may qualify as a key distributive impact with adverse effects on human dignity.



### C. Previously reported errors in the Phase 2 RIA

Public comments on the Phase 2 NPRM show that EPA’s RIA included controversial benefit claims. These alleged benefits were contested in public comments but retained in the Phase 2 Final Rule RIA. Why they should not be counted is discussed in Section VI.A, beginning on page 12.

The correction of material analytic error is in the public interest, and a useful way to effect such correction is through an RIA for a regulatory action that repeals components of a prior regulation affected by these errors. If the Phase 2 NPRM RIA had been subjected to independent and external peer review with respect to its benefit and cost estimates, these errors might have been identified and corrected. However, OMB’s government-wide peer review guidelines exempt RIAs from independent and external peer review.<sup>38</sup>

## III. REGULATORY BASELINE

Two regulatory baselines are relevant: (1) the Phase 2 Final Rule baseline, consisting of outputs of the glider industry net of the retirement of “donor” trucks; and (2) the Glider Repeal Final Rule, in which the glider industry output is severely constrained through 2020 and eliminated thereafter. OMB guidance recommends the use of multiple baselines when a single baseline is not sufficient.<sup>39</sup>

### A. Phase 2 Final Rule Baseline

For the Phase 2 Final Rule, EPA reported a production volume of about 10,000 gliders.<sup>40</sup> This is a useful starting point for ascertaining the baseline, but it does not take account of reasonably expected future production volumes. Recent glider output is the product of expensive regulatory burdens on the new truck market combined with substantial evidence of significantly diminished reliability, operating costs, and fuel economy. Glider buyers may be indifferent with respect to relative pollutant emission levels, but they are likely to be highly responsive to differences in purchase price, reliability, and fuel economy. If EPA had decided to conduct a proper incremental analysis of benefits and costs, it may have given more consideration to these effects when setting Phase 2 GHG emission standards.

Baseline emissions for gliders should represent a best unbiased estimate of the actual emissions expected to be emitted by gliders produced during the applicable analytic horizon, less emissions from the engines they replace. Where a glider substitutes for a new truck, pollutant emissions (but not necessarily GHG emissions) are likely to increase. However, where a glider substitutes for a used truck, or an old truck retained in service, pollutant and GHG emissions are likely to decrease.

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<sup>38</sup> Office of Management and Budget (2005, p. 2674).

<sup>39</sup> Office of Management and Budget (2003, p. 4).

<sup>40</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, p. 73943).

In EPA's description of glider emissions that the Phase 2 Final Rule would prevent, the agency made two key errors. First, EPA assumed that those who otherwise would have purchased gliders will purchase new trucks instead. This assumption can only be valid if gliders and new trucks are perfect substitutes. There is no evidence supporting this assumption and convincing evidence that it is false. For example, if gliders and new trucks were perfect substitutes, their prices would be identical.

Second, EPA assumed that glider emissions were equal to pre-2002 emission *standards*. This assumption ignores the emission reductions resulting from subsequent Agency regulations, most notably its 2001 ultra-low sulfur diesel (ULSD) standard.<sup>41</sup> In that rulemaking, EPA estimated substantial pollutant emission reductions in pre-2007 model year trucks resulting from the reduction in sulfur from about 340 ppm to about 7 ppm. According to EPA, ULSD was expected to reduce direct sulfate emissions from pre-2007 heavy-duty diesel engines by 95%, and sulfur dioxide emissions from the remaining sulfur by 98%.<sup>42</sup>

The first assumption unambiguously overstates total emission reductions by exaggerating the substitution of new trucks for gliders once gliders are banned. The second assumption is very likely to overstate the difference between new truck and glider emissions. EPA is entitled to claim only the actual difference, and only for the subset of gliders replaced by new trucks, and it must reduce these emission reduction estimates to the extent that gliders substitute for used trucks or existing old trucks retained in service.

## **B. Glider Repeal Rule Baseline**

For the Glider Repeal Rule, the regulatory baseline is the portfolio of new, used and retained old existing trucks that substitute for gliders, both during the period in which the interim provisions apply and after they expire. It cannot be determined *a priori* whether this baseline is higher or lower than the Phase 2 Final Rule emission baseline. Emissions in the Repeal Rule baseline likely would be lower to the extent that new trucks substitute for gliders, but higher to the extent that those who otherwise would have purchased gliders choose instead to acquire used trucks or retain existing old trucks in service.

This is not a mere theoretical concern. There is substantial evidence that fleet age increased as a result of the 2004 emission standards because prospective truck buyers pre-bought purchased used trucks, retained old existing trucks in service, or both.<sup>43</sup> A similar outcome can be expected with respect to Phase 2-compliant trucks and the elimination of the glider market.<sup>44</sup>

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<sup>41</sup> U.S. Environmental Protection Agency (2001).

<sup>42</sup> U.S. Environmental Protection Agency (2000b, pp. II-122 and II-128). How much reduction can be expected in pre-2001 engines using ULSD is not readily apparent from the RIA for the ULSD rule.

<sup>43</sup> Calpin and Plaza-Jennings (2012, pp. 4-5 [effects on MY 2007 purchases]), citing Harrison Jr. and LeBel (2008 [effects on MY 2004 purchases]).

<sup>44</sup> EPA did not estimate pre-buy effects for the Phase 2 Final Rule, thus overstating expected emission reductions and benefits. See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 5-5). This error, while potentially significant, does not affect the analysis of the glider provisions. It is briefly discussed in Section VI.A.

#### IV. REGULATORY TIME HORIZON

The regulatory time horizon must be the same as the one used in the Phase 2 Final Rule RIA. That horizon was about 35 years. EPA may well be uncertain about the level of future glider production that would have occurred had the Phase 2 Final Rule not eliminate the industry. To the extent there is uncertainty, however, EPA is required to analyze multiple future output scenarios that span the reasonable range of future market conditions, then calculate benefits, costs, and other effects from each alternative glider output baseline.

#### V. REGULATORY ALTERNATIVES

The RIA for the Phase 2 Final Rule identified no regulatory alternatives relevant to the glider components.

##### A. Reasonable alternatives

At least the following regulatory alternatives should have been analyzed:

- Requiring gliders to meet or exceed the emission standards applicable to the year of original engine and drivetrain manufacture. This alternative would ensure that gliders produced a net reduction in emissions. Older engines and drivetrains would be regulated only once, and the rule would not treat the assembly of a glider from rebuilt engines and drivetrains as the creation of a new motor vehicle.
- Requiring gliders to meet or improve upon the actual emissions of donor engines. This alternative would ensure that gliders produced no net increase in emissions compared to the donor engines they replace. This alternative also would regulate once the rebuilt engines installed gliders, and the rule would not treat the assembly of a glider from rebuilt engines and drivetrains as the creation of a new motor vehicle.
- Requiring gliders to produce net benefits in combined emissions, fuel savings, and vehicle safety compared to the performance of the trucks they replace. This alternative recognizes that emissions are but one of several key attributes of a heavy-duty truck, and benefits from improvements in fuel efficiency and/or highway safety may exceed the value of incremental increases in emissions. This alternative is the only one that incentivizes socially valuable innovations in glider technology, some of which could have value if adopted by the new truck industry.
- Regulating emissions from rebuilt engines irrespective of circumstances. EPA has statutory authority to regulate engine rebuilding and could exercise that authority to regulate emissions from rebuilt engines. The Agency cannot, however, treat otherwise identical engine rebuilds differently depending on how they will be used.

Each of these alternatives was a plausible path forward, with substantially diminished adverse effects on the glider industry.

## B. Transitional provisions

The transitional provisions for small firms in the Phase 2 Final Rule provide only limited and temporary relief. They are not faithful to the directive in Executive Order 12866 § 1(b)(11) to give serious attention to standards that vary based on firm size.<sup>45</sup> They also are unfaithful to OMB guidance that imposes greater analytic burdens on regulations resulting in a product ban.<sup>46</sup>

## VI. IDENTIFICATION OF BENEFITS, COSTS, AND OTHER EFFECTS

Executive Order 12866, OMB's RIA guidance, and EPA's guidance on economic analysis all require every significant category of benefit and cost be analyzed incrementally for distinct components of a regulation. This section identifies the significant benefits and costs associated with the glider provisions of the Phase 2 Final Rule and the Glider Repeal Rule.

Especially where emission standards are technology-forcing and apply to model years over a decade away, EPA should adopt a posture of analytic humility. However, for the Phase 2 Final Rule, EPA estimated CO<sub>2</sub> emissions in grams per ton-mile with as many as four significant figures, fuel consumption in gallons per 100 ton-miles with as many as seven significant figures, and incremental cost per vehicle to the nearest \$0.50.<sup>47</sup> This level of precision conveys far more confidence than is warranted given just known unknowns. Excess precision is a form of information quality error because it misleads decision-makers and the public to misconstrue precision for accuracy.<sup>48</sup>

### A. Benefits and costs of the glider provisions in the Phase 2 Final Rule

The RIA for the Phase 2 Final Rule does not include an incremental analysis of the benefits and costs of the glider provisions, as required by OMB guidance.<sup>49</sup> It is not even clear whether gliders are included in EPA's aggregate analysis. The preamble to the Final Rule summarizes an analysis of purported benefits from the glider provisions (but not the costs); the source for this analysis is not disclosed and it does not come from the RIA.

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<sup>45</sup> Clinton (1993, p. 51736): "Each agency shall tailor its regulations to impose the least burden on society, including individuals, businesses of differing sizes, and other entities (including small communities and governmental entities), consistent with obtaining the regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations."

<sup>46</sup> Office of Management and Budget (2003, p. 5). OMB's first government-wide guidance on regulatory impact analysis expressed this view more strongly. See Office of Management and Budget (1990).

<sup>47</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. ES-15).

<sup>48</sup> Government-wide and EPA information quality guidelines require the Agency to disseminate information that is both substantively and presentationally objective. See Office of Management and Budget (2002), U.S. Environmental Protection Agency (2002). Presentational objectivity means "presented in an accurate, clear, complete, and unbiased manner ... within a proper context." Excess precision is inherently misleading, and thus never provides a proper context.

<sup>49</sup> Office of Management and Budget (2003, pp. 5-6).

To the extent that EPA’s analysis of gliders can be discerned, the Agency appears to assume that gliders are perfect substitutes for new trucks, so that when gliders are banned those who would have bought them purchase new trucks instead. There is no empirical evidence supporting this assumption, and it is inconsistent with reasonable predictions from economic theory. Gliders are fundamentally different from new trucks because they have rebuilt engines and powertrains. If gliders and new trucks were perfect substitutes, the cross-price elasticity of demand for gliders with respect to changes in the price of new trucks would be infinite.<sup>50</sup> But if that were true, there also would be no difference in price between gliders and new trucks; glider assemblers could charge the same price as new truck manufacturers. If EPA made this assumption, it appears to have done so based on a strained interpretation of promotional materials rather than economic theory or empirical evidence.<sup>51</sup> Figure 1 illustrates why this assumption is counterfactual. Nothing in the Phase 2 Final Rule prevents prospective glider purchasers from substituting used trucks or retaining old trucks in service.

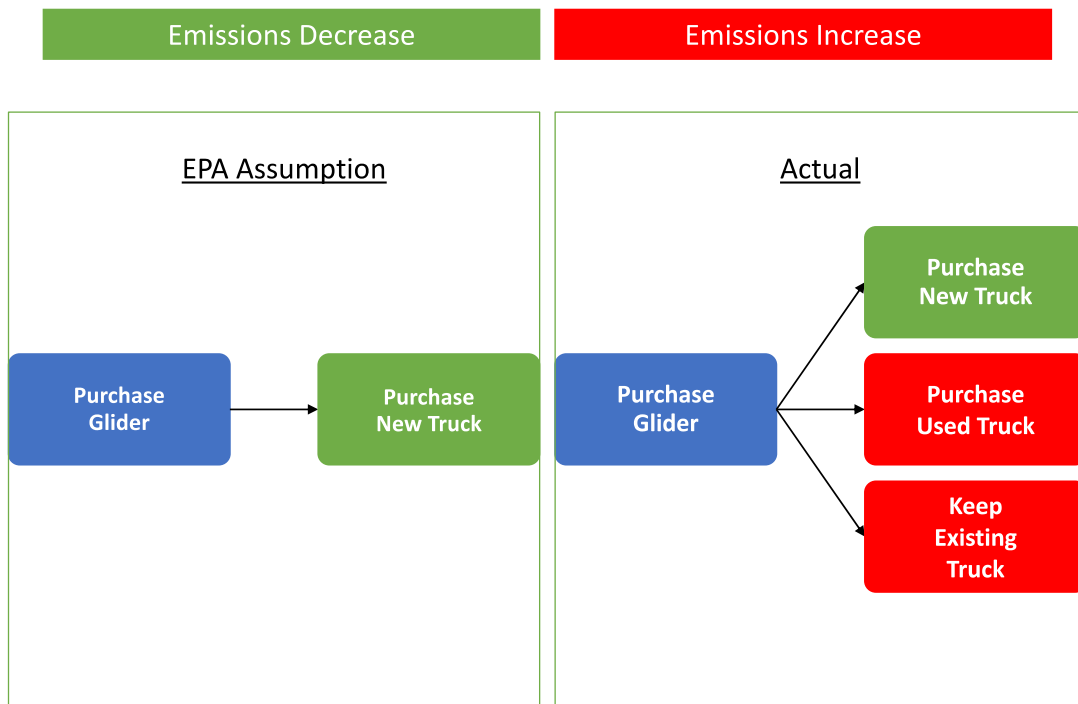
This error has serious practical effects on the analysis of the glider provisions in the Phase 2 Final Rule, as each of the subsections below makes clear. A proper accounting of benefits and costs requires allocating the sales of now-banned gliders to new trucks, used trucks, and existing old trucks retained in service. Assuming that new trucks are perfect substitutes avoids accounting for increases in GHG and pollutant emissions that occur when used trucks and existing old trucks retained in service supplant gliders because gliders are no longer available.

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<sup>50</sup> Elasticities are estimates of demand responsiveness resulting from small changes in price. The elimination of the glider market is an infinitely large change in price. Conventional methods are inappropriate for estimating demand effects resulting from the elimination of a product from the market.

<sup>51</sup> EPA relies on *marketing* materials to make the *legal* argument that gliders are “new motor vehicles” within the meaning of Clean Air Act § 202(a)(1). *See* U.S. Environmental Protection Agency (2016, p. 2), U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, footnote 82).

Fig. 1: Buyer Behavior if Glider Market is Prohibited



The following subsections discuss dubious benefit claims and other systematic analysis errors that drive the aggregate results of the RIA, and benefits and costs of the glider provisions that EPA did not properly estimate.<sup>52</sup> These dubious benefit claims are broader than to the glider provisions, but they undoubtedly color inferences about the effects of these provisions. The absence of analysis of the benefits and costs of the glider provisions misleads decision-makers and the public to believe that the glider provisions have only minor effects.

1. *Dubious benefit claims and other systematic errors*

(a) *Fuel savings*

As it has done in several previous rulemakings, in the Phase 2 Final RIA EPA counts private benefits from improved fuel efficiency as if they are social benefits that market actors cannot capture without regulation. EPA presumes the existence of an “energy paradox” because “many readily available technologies that appear to offer cost-effective increases in [heavy-duty vehicle] fuel efficiency (when evaluated over their expected lifetimes using conventional

<sup>52</sup> EPA’s estimates of the cost of certain technologies, R&D, new truck maintenance, and compliance generally were criticized as unreasonably low (see, e.g., Daimler Trucks North America LLC et al. 2015, p. 127-131), as was the rule’s reliance on proprietary technology (Mannix 2015). This strawman RIA does not revisit these issues.

discount rates) have not been widely adopted, despite their potential to repay buyers' initial investments rapidly," and "a significant number of fuel efficiency improving technologies will remain far less widely adopted in the absence of these standards."<sup>53</sup>

Approximately 75% of the net social benefits claimed by EPA consist of fuel savings obtained by overcoming this "energy paradox" through regulatory mandates. Normally, so important a phenomenon would be subjected to extraordinarily rigorous examination and a high standard of proof, especially when it conflicts with economic theory. In the Phase 2 Final Rule RIA, however, EPA ultimately relies on wishful speculation. The Agency persists in counting these private benefits as social benefits from regulation despite "very little empirical evidence on behaviors that might lead to" an energy paradox.<sup>54</sup>

The "energy paradox" implies that consumers, even if fully informed, make irrational decisions involving the energy-use attributes of goods and services (but apparently *only* their energy-use attributes).<sup>55</sup> In the case of medium- and heavy-duty trucks purchased by firms as key inputs in their production functions, private benefits are even less likely to result from regulation because firms have extraordinarily strong incentives to minimize major costs such as fuel.

Clear and convincing evidence, obtained over many studies using different data sets and analytic methods, must be marshaled before abandoning the bedrock principle of consumer rationality. Moreover, the full ramifications of the energy-paradox hypothesis must be critically examined. If consumers are systematically irrational with respect to energy, why is systematic irrationality limited to decisions involving energy? If consumers are systematically irrational, what enables regulators to avoid it? How can regulators analyze the issue objectively when it is in their institutional interest to confirm it?

There are several explanations for the apparent "energy paradox" that are much more plausible than systematic consumer irrationality. First, the trucking industry is highly diverse. Decisions that make financial sense for large fleets may not be appropriate for small firms and independent owner-operators. Modeling must correctly account for this diversity.

Second, consumers (and firms) are reasonably uncertain about future energy prices, and all decisions involving energy must be made under uncertainty. This uncertainty is irreducible, and EPA is not better positioned than private market actors to manage or minimize it. Large

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<sup>53</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, pp. 8-3, 8-4). EPA notes that its economic analysis is dependent on an *engineering* analysis, which may explain why the putative energy paradox is observed.

<sup>54</sup> When fuel savings benefits are eliminated, the Agency's estimate of annualized net social benefits declines from \$11.7 billion to \$3.1 billion using a 3% discount rate, and from \$9.4 billion to \$2.4 billion using a 7% discount rate (all figures in \$2013). See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. ES-12). The peer review organized by EPA (U.S. Environmental Protection Agency 2015b) reviewed only the GHG emissions model; the panel did not review other key issues, such as the "energy paradox."

<sup>55</sup> On a related assumption concerning firm rationality, *see* Daimler Trucks North America LLC et al. (2015, p. 129): "[T]he agencies are pushing technologies that do not have the return on investment demanded by fleets; if the technologies did have such return on investment, then manufacturers would already be selling the technologies in high numbers."

firms may be able to hedge against future energy price uncertainty using financial instruments. Small firms are less likely to be able to do so. One way they can hedge is to assemble a diversified portfolio of trucks having different attributes. Further, to the extent that EPA regulations targeting the purported energy paradox have the practical effect of restricting consumer choice, thus forcing second-best decision-making, the Agency is more likely to exacerbate than reduce the effects of uncertainty.

Third, consumers (and firms) generally have higher rates of time preference than the discount rates used by EPA. No firm in the private market can borrow at the government's risk-free interest rate. When market interest rates that reflect credit risk are used, the purported energy paradox may disappear.

Fourth, the principal-agent problem hypothesized in the Phase 2 Final RIA as a possible explanation for the energy paradox appears more likely to apply to EPA than to truck buyers in the private market. Firms practice regularized, cost-minimizing decision-making processes, and they are disciplined by the market for all error, including principal-agent distortions. In contrast, EPA is not a participant in the truck market and is *never* disciplined by the market for *any* error. The Agency is highly susceptible to principal-agent distortions because, as self-appointed agent, it has no contractual relationship with, or accountability to, the principals it presumes to represent. EPA's capacity as an agent is further handicapped by its fundamentally different objective function, which poses a much greater conflict of interest than anything observable among principal-agent distortions in private markets. In short, the purported energy paradox is grounded on "a consistent, self-defeating 'bias' in consumers' (but not regulators') decisionmaking." Proponents of the energy paradox "assume there are no rational consumers, somehow giving the government a monopoly on rationality."<sup>56</sup>

Fifth, evidence supporting the hypothesis that information about energy efficiency available to buyers is significantly imperfect (or asymmetric) is limited and unpersuasive.<sup>57</sup> Even if it were true, it would indict EPA's and NHTSA's decades-long effort to provide informational remedies through regulation. If significant information gaps and asymmetries remain after all this time, past regulation must be judged a failure.

Finally, EPA's inferences of irrational buyer behavior implicitly assume that the Agency's data, modeling, and analysis are correct. This assumption is particularly problematic given EPA's historically substantial cost underestimation. For example, EPA's *ex ante* estimates of the costs of its MY 2004-2010 emission standards, which were reported to the nearest dollar per vehicle, have been credibly calculated as having underestimated up-front cost by a factor ranging from 2 to 5 compared to *ex post* invoice data.<sup>58</sup> Similarly, EPA's estimated reduction in

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<sup>56</sup> Mannix and Dudley (2015, p. 716): "[T]he most plausible explanation for the astonishing private benefits ... is that the regulatory analysis is wrong, rather than that consumers are."

<sup>57</sup> Even EPA describes the evidence as "mixed." See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 8-4).

<sup>58</sup> Calpin and Plaza-Jennings (2012, p. 2). The authors provide persuasive evidence of rational behavior on the part of prospective buyers to avoid buying new trucks covered by these emission standards if possible, including massive pre-buys before the effective date. Moreover, they assert that while "EPA acknowledged the market disruptions caused by the new regulations," the Agency "waved them off as business cycle activity not necessarily



fuel economy resulting from new NOx standards (1.5%) is substantially below what truck purchasers are reported to have actually experienced (5% to 9%).<sup>59</sup>

For all these reasons, a first-order approximation of the actual benefits from improved fuel economy from the purported “energy paradox” is zero. Substantial and consistent evidence is required of actual behavior by heavy-duty truck buyers inconsistent with profit maximization with respect to (only) energy inputs in transportation before accepting significant estimates of fuel savings benefits. This is especially important when the historical record demonstrates theoretically expected rational cost-minimizing behavior with respect to aggregate regulatory costs in prior rounds of heavy-duty truck emissions regulation.<sup>60</sup>

(b) GHG emissions

The Phase 2 Final Rule RIA relies on previously published syntheses of social cost of carbon (“SCC”) estimates.<sup>61</sup> These estimates are controversial for both procedural and substantive reasons. Procedurally, they were not subject to normal rulemaking procedures, nor were they subjected to independent and external peer review prior to their adoption, as required by OMB peer review guidance.<sup>62</sup> Substantively, they violate a fundamental principle in benefit-cost analysis, which requires the same domain be used for estimating benefits and costs.<sup>63</sup> For a domestic regulation, it is inappropriate to count domestic costs but both domestic and international benefits. The use of inconsistent domains is therefore a source of frank bias. Climate change benefits must be limited by the domestic SCC, which has been estimated at 7–

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related to the new emissions standards” See p. 5. The Phase 2 Final Rule RIA assumed no pre-buys. See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 5-5): “[T]he impacts of any delayed fleet turnover [due to pre-buys] are not estimated.”

<sup>59</sup> Calpin and Plaza-Jennings (2012, p. 13). A similar gap between forecast and actual fuel economy for Phase 2-compliant trucks would mean that EPA overstated reductions in GHG emissions.

<sup>60</sup> Calpin and Plaza-Jennings (2012, p. 4): “Many informed prospective new truck purchasers rushed to “pre-buy” trucks with pre-compliant technologies to avoid the effects of EPA’s mandates... [A] surge of orders came in for pre-MY 2004 equipment, after which orders slumped significantly. Also, in 2006, orders surged for pre-MY 2007 equipment, and then fell off precipitously. Lastly, in the 2009 time-frame, orders poured in for pre-MY 2010 equipped trucks. In each instance, the marketplace anticipated and sought to avoid the higher prices and poorer performance of compliant technologies” (internal footnotes omitted).

<sup>61</sup> Interagency Working Group on Social Cost of Carbon (2010, 2016).

<sup>62</sup> Office of Management and Budget (2005).

<sup>63</sup> Clinton (1993, p. 51735): “Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being *of the American people*” (emphasis added); Office of Management and Budget (2003, p. 5): “The analysis should focus on benefits and costs *that accrue to citizens and residents of the United States* (emphasis added). Where the agency chooses to evaluate a regulation that is likely to have effects beyond the borders of the United States, these effects should be reported separately”; and Gayer and Viscusi (2014, p. 5): “[I]n most instances the pertinent populations that are attributed standing in a benefit-cost analysis should correspond to the political jurisdiction that is bearing the cost, either directly through providing the good or indirectly through matching grants or other subsidies for provision of the good.”

10% of the global SCC.<sup>64</sup> Benefits to non-U.S. residents, if any, are properly characterized as transfers from U.S. residents to foreigners and reported separately.<sup>65</sup>

The glider provisions in the Phase 2 Final Rule may yield net reductions in GHG emission reductions irrespective of whether new, used, or existing trucks substitute for them when gliders are banned.<sup>66</sup> GHG emissions are reduced only if new trucks that substitute for gliders actually have better fuel economy. Glider buyers have reported better fuel economy than contemporaneously manufactured new trucks. Thus, the glider provisions could yield higher GHG emissions, at least in the near term.

To the extent that prospective truck buyers rationally avoid purchasing trucks covered by the new GHG emission standards, whether by purchasing gliders or used trucks, or retaining old trucks in service, EPA's estimates will overstate actual GHG emission reductions. Purchase delays cause the fleet to age, with predictably deleterious effects on emissions, fuel economy, and reliability.<sup>67</sup>

There is little or no uncertainty concerning net GHG emissions for the proportion of gliders supplanted by used trucks or old existing trucks. Both used and old existing trucks retained in service have lower fuel economy than gliders, and hence higher CO<sub>2</sub> emissions. Only if GHG reductions from the (probably small) fraction of gliders supplanted by new trucks exceed the GHG increases from the (probably large) fraction of gliders supplanted by used trucks and old trucks retained in service is it possible for the glider provisions to result in a net reduction in GHG emissions.<sup>68</sup>

Prior EPA estimates of fuel economy reductions have not been accurate, so GHG emission estimates in the Phase 2 Final Rule should be interpreted with caution. For MYs 2004 and 2007 emission standards, for example, EPA had estimated a net 1.5% decline in fuel economy resulting from the combined effect exhaust gas recirculation and variable geometry turbo-chargers.<sup>69</sup> However, actual fuel economy losses were reported by Kenworth to be 5–9%.<sup>70</sup>

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<sup>64</sup> Interagency Working Group on Social Cost of Carbon (2010, p. 11 [assuming 2.5-3% discount rate]).

<sup>65</sup> Gayer and Viscusi (2014, p. 5), Fraas et al. (2016).

<sup>66</sup> See Daimler Trucks North America LLC et al. (2015, p. 123): “Glider sales actually create the potential to reduce GHG emissions by incorporating used and rebuilt engines in newer, more aerodynamic vehicles. Rebuilt engines used in glider vehicles emit fewer GHGs, and new cabs and low rolling resistance tires are more efficient than what they replace.”

<sup>67</sup> Calpin and Plaza-Jennings (2012, p. 4). Pre-buys and purchase delays would not occur if truck buyers behaved irrationally, as EPA believes they do with respect to fuel economy.

<sup>68</sup> Net GHG increases in the near-term may be offset by GHG decreases in the long-term, as ever more stringent standards for new trucks kick in. Of course, GHG emissions from gliders also would decline as progressively newer engines are rebuilt and installed in glider kits. Net changes in GHG emissions must be modeled dynamically, taking account of GHG emission reductions in both new trucks and gliders.

<sup>69</sup> U.S. Environmental Protection Agency (2000a, p. 85).

<sup>70</sup> Kilcarr (2010).

(c) Pollutant emissions

It is not clear that pollutant emissions should be counted because prior EPA regulations appear to have counted them at least once, for example in the National Ambient Air Quality Standards (NAAQS) for PM and NOx.<sup>71</sup> If the association between a pollutant is not causal, as alleged by Cox Jr. et al. (2013), then counting them even once is once too much.

Assuming *arguendo* that pollutant emissions should be counted and that the emissions from gliders have not yet been counted, EPA's estimates (summarized in the preamble the Phase 2 Final Rule but not included in the RIA) are too high. Emission reductions can only be realized for the fraction of gliders supplanted by new trucks once gliders are unavailable. Banning gliders likely causes pollutant emissions to increase for the remaining fraction supplanted by used trucks or existing old trucks retained in service. Whether pollutant emission reductions exceed pollutant emission increases depends on emission differences for each of the three substitution scenarios and the proportions of new, used and retained old trucks that substitute for gliders.

The net change in pollutant emissions attributable to the Phase 2 Final Rule is correctly calculated by subtracting the emissions of the glider substitute (new, used, or existing) from the emissions of the glider. Thus, whether the glider provisions yield net reductions in pollutant emissions depends on the relative fractions of new, used, and existing old trucks that substitute for gliders, and the relative emissions of each. Net changes in pollutant emissions also must account for emission reductions resulting from the adoption of regulations (e.g., ULSD) promulgated subsequent to the issuance of emission standards for older engines that would be rebuilt before installation into gliders.<sup>72</sup>

2. *Benefits and costs of the glider provisions that EPA did not properly estimate*

(a) Reliability

Reliability is a key attribute that makes gliders appealing. Gliders incorporate proven technologies that make repairs less likely and less expensive. There is substantial evidence that previous rounds of heavy-truck emission regulations reduced truck reliability, increased downtime and repair costs, and made even routine maintenance more expensive.<sup>73</sup> The RIA does not account for the opportunity cost of diminished reliability. Indeed, instead of acknowledging reduced reliability as a systematic cost of the Final Rule, the RIA misinterprets concerns about reliability as evidence of irrational decision-making that the Final Rule would prevent.<sup>74</sup>

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<sup>71</sup> Smith (2016) estimates that 70% of the benefits for the most recent PM<sub>2.5</sub> standard (12 µg/m<sup>3</sup>) were due to reductions from baseline levels that were already attaining the standard, which was set to protect public health with an adequate margin of safety. Emissions and risks are fully counted once if they are obtained by extrapolation using a liner no-threshold model.

<sup>72</sup> U.S. Environmental Protection Agency (2001).

<sup>73</sup> Calpin and Plaza-Jennings (2012).

<sup>74</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 8-6): "Questions related to uncertainty about future costs for fuel and maintenance, as well as about the reliability of new

Published reports and public comments submitted on the Phase 2 NPRM and Glider Repeal NPRM also suggest that some of the appeal of gliders is the result of adverse performance of recently manufactured new trucks. Industry benchmarking firm J.D. Power regularly conducts customer surveys, and in 2012 reported that newly-mandated emission controls “are causing an increase in heavy-duty truck engine problems and a decrease in overall satisfaction with the powertrain.”<sup>75</sup>

(b) Highway safety

Gliders rely on rebuilt engines and drivetrains, but they incorporate many modern safety features. If prospective glider buyers switch to new trucks after the Phase 2 Final Rule makes gliders unavailable, there would be an improvement in highway safety only if new trucks are demonstrably safer than gliders. However, if prospective glider buyers purchase used trucks or retain existing old trucks in service, the glider provisions forego the realization of highway safety benefits provided by gliders. These benefits include reduced property damage, injury, and death from fewer crashes, reduced social costs of responding to crashes, and reduced delays to third parties resulting from traffic congestion caused by crashes.

The full opportunity cost of foregone highway safety benefits requires a comprehensive comparison of the relative safety attributes of new trucks, gliders, used trucks, and existing old trucks retained in service. Estimates are available for the highway safety benefits of one safety feature — antilock brakes (ABS). To the extent that gliders are supplanted by used trucks and old trucks retained in service, the glider provisions forego the benefits of ABS. In the seven states

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technology that could result in costly downtime, *illustrate the problem of uncertain or unreliable information about the actual performance of fuel efficiency technology...*” (emphasis added).

<sup>75</sup> J.D. Power (2012b): “The most problematic engine and fuel problems are driven by technology that is designed to reduce emissions from heavy-duty truck engines.” *See also* J.D. Power (2012a):

Technology designed to reduce emissions and make heavy-duty truck engines compliant with the 2010 EPA regulations is resulting in more heavy-duty truck owners experiencing problems with the engine. The study finds that 46 percent of owners of heavy-duty trucks that are one model-year old report experiencing some type of engine-related problem, up from 42 percent in 2011. The most commonly reported problems are issues with the electronic control module calibration (cited by 23 percent of owners), exhaust gas recirculation (EGR) valve (20 percent), and electronic engine sensors (16 percent).

In addition, the average number of engine- and fuel-related problems has increased to 81 problems per 100 vehicles (PP100) from 71 PP100 in 2011. The rise in problems has impacted overall engine satisfaction, which declines to 719 index points on a 1,000-point scale in 2012, compared with 739 in 2011.

Other reports give additional examples of regulatory failure. *See, e.g.,* Daimler Trucks North America LLC et al. (2015, p. 130): “[Having undergone earlier experiences with downtime and increased maintenance due to similar emissions regulations in 2004 and 2007, customers were on ‘high alert’ with regards to new technology likely contributing to their ‘slow’ process to assess technologies and adopt them. In addition, during this time truckers were experiencing poor profitability, weak freight, and limited access to credit made worse by the recent end of a major recession, limiting their ability to spend more on fuel efficiency technologies given the three year [REDACTED] % increase in the price of criteria emission technologies required to meet emission standards. EPA2010 emissions standards, which essentially forced the use of SCR, resulted in recovering some of the fuel efficiency gains lost due to earlier EPA NOx rules. So SCR could be viewed as one of the most expensive fuel efficiency technologies adopted by customers.”

where NHTSA was able to obtain comprehensive crash data, heavy-duty trucks equipped with ABS were a statistically significant 7% less likely to be involved in a crash than controls without ABS, and a non-statistically significant 2% less likely to be involved in fatal crashes. NHTSA acknowledges that this may understate the true effectiveness because some older trucks may have been equipped with antilock brakes before they were required, and some newer trucks may have had non-functioning antilock brakes.<sup>76</sup>

(c) *Producers' and consumers' surplus*

By eliminating the glider market, the Phase 2 Final Rule sacrifices all producers' and consumers' surpluses that the glider market produces. The Phase 2 Final Rule RIA does not include these costs.

A rough approximation of lost producers' surplus can be obtained by multiplying the glider output reported by EPA (10,000) by an average glider price (about \$125,000) and illustrative percentages for net profit (10% of average price) and buyers' willingness to pay (10% above average price). These assumptions yield lost producers' and consumers' surplus of about \$250 million. These figures are scalable for different unit estimates of producers' and consumers' surplus. A doubling of their magnitudes doubles the deadweight loss.

(d) *Forced retirement of capital assets*

The Phase 2 Final Rule severely restricts glider production through 2020 and terminates it thereafter. Substantial capital investments by glider assemblers, glider kit manufacturers, and firms engaged in various supply businesses (e.g., engine rebuilding) will be forcibly retired. By forbidding the use of rebuilt engines and drivetrains as donors, the glider provisions also force their premature economic retirement. Engine and drivetrain rebuilding still would be permitted, but only in circumstances where an unspecified and arbitrary threshold quantity of other vehicle upgrades does not occur.

A first-order approximation of the value of forcibly retired assets is the pre-regulation asset value of firms primarily engaged in the business of assembling gliders, a portion of pre-regulation asset value of firms engaged in the manufacture of glider kits, a portion of pre-regulation asset value of secondary industries such as engine rebuilding, plus the economic value of older engines and drivetrains that now must be scrapped. No estimates of this cost are currently available but could be developed later by EPA.

(e) *Competition*

The Phase 2 Final Rule eliminates a key alternative product from the heavy-duty truck market. As they have grown in popularity – a tenfold increase since MY 2007, according to EPA<sup>77</sup> – gliders almost certainly have exerted downward price pressure on new trucks, thereby reducing manufacturers' monopoly rents and intensifying their pecuniary reasons for opposing gliders. This price pressure is severely attenuated under the interim provisions and will go away

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<sup>76</sup> Allen (2010).

<sup>77</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, p. 73943).

entirely when the ban on gliders becomes complete in 2021. As substitutes for new trucks disappear, prices and monopoly rents will rise, to the detriment of buyers and the advantage of new truck manufacturers.

The glider provisions also make used trucks and existing old trucks more valuable as new-truck substitutes. Prices will rise in the used truck market and the imputer opportunity cost of retiring an existing old truck will increase. In the used truck market, there will be lost consumers' surplus, increased producers' surplus, and a deadweight loss from gliders' disappearance. Used and existing old trucks will be operated for longer periods, resulting in greater GHG and pollutant emissions. Finally, to the extent that the Phase 2 Final Rule requires the widespread use of proprietary technologies, the rule produces additional monopoly rents to the owners of such technologies.<sup>78</sup>

## **B. Benefits and costs of repealing the glider provisions in the Phase 2 Final Rule**

New trucks are expected generally to have lower emissions than gliders, but gliders are expected to have lower emissions than used or old retained trucks.<sup>79</sup> Emissions would decline for the fraction of gliders supplanted by new trucks but increase for the fraction supplanted by used or existing old trucks. Whether a net reduction in emissions occurs depends on the relative emissions of each group and the proportion of gliders supplanted by each group. For this reason, it cannot be determined *a priori* even whether the glider provisions in the Phase 2 Final Rule produce net environmental benefits.<sup>80</sup>

### *1. Dubious benefit claims and other systematic errors*

#### *(a) Fuel savings*

Absent clear and convincing evidence that profit maximizing glider buyers behave irrationally with respect to (only) energy inputs in their production functions, the Glider Repeal Rule should be assumed to produce no fuel savings from overcoming a putative “energy paradox” in the private market.

However, there is an energy paradox *caused* by the Phase 2 Final Rule. To the extent that gliders offer a rational choice, the glider provisions deny this option and force buyers to make second-best decisions. Only by repealing the glider provisions can buyers capture these private benefits.

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<sup>78</sup> Mannix (2015).

<sup>79</sup> Phase 2-compliant trucks likely have lower GHG emissions than gliders, but the glider ban becomes effective well before Phase 2-compliant trucks are produced. Therefore, the discounted present value of GHG emission reductions from the Phase 2 Final Rule are not unambiguously positive.

<sup>80</sup> Section VII shows that the net emissions from the glider provisions of the Phase 2 Final Rule is positive under fairly robust market conditions.

*(b) GHG emissions*

As indicated in Section VI.A.1(b) above, the Glider Repeal Rule reduces CO<sub>2</sub> emissions only to the extent that gliders that substitute for new trucks have lower GHG emissions. This may occur in the short term but likely does not in the long term. Still, it cannot be determined *a priori* whether the glider provisions result in a net reduction in GHG emissions. The Repeal Rule reverses whatever is determined empirically to be the expected change in GHG reductions from the glider provisions.

As in the case of the Phase 2 Final Rule, the magnitude of climate change benefits (if any) may be provisionally approximated by multiplying by the domestic (not global) SCC.

*(c) Pollutant emissions*

The analysis is analogous for pollutant emissions. First, it is unclear whether any reductions have not already been counted. Second, assuming that they have not been counted, the sign on the net change in pollutant emissions cannot be determined *a priori*. Unless new trucks supplant a large fraction of gliders, the Glider Repeal Rule is likely to result in a net reduction in pollutant emissions.<sup>81</sup>

2. *Reversed benefits and costs of the glider provisions that EPA did not properly estimate*

*(a) Reliability costs avoided*

Based on past experience, more complex and technologically uncertain emission control systems can be expected to result in additional reliability problems, with their own suite of costs. The Glider Repeal Rule avoids these costs, first for the fraction of new trucks supplanted by gliders, and second for the used trucks and existing old trucks retained in service.

*(b) Highway safety risks avoided*

Glider represents a small fraction of the truck market, so the Glider Repeal Rule cannot eliminate a large absolute number of highway safety risks. Nonetheless, the Glider Repeal Rule can be expected to reduce highway safety risks, and the magnitude of this reduction could be disproportionately large if the used and existing old trucks replaced by gliders are disproportionately risky.

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<sup>81</sup> See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, pp. 73942-73943) (“For the final rule, EPA has updated its analysis of the environmental impacts of gliders. The updated analysis used the same emissions modeling tool used to estimate the other emissions impacts of the rule, described in Section VII of the Preamble. *The modeling of gliders assumed annual glider sales of 10,000 for 2015 and later*, consistent with the comments received on the proposal” [emphasis added]). These emissions are at best co-benefits (i.e., incidental to the purpose of the rule, which is reducing GHG emission), and they may have been previously counted in RIAs for National Ambient Air Quality Standards.

(c) *Producers' and consumers' surplus losses avoided*

The Glider Repeal Rule avoids the consumers' and producers' surpluses that the Phase 2 Final Rule mandates. Therefore, when the Phase 2 Final Rule is used as the baseline, these costs – not counted in the Phase 2 Final Rule RIA – become benefits of the Glider Repeal Rule.<sup>82</sup>

(d) *Forced retirement of capital assets avoided*

The Phase 2 Final Rule causes the premature retirement of a substantial share of the glider industry's capital assets, and forces early retirement of older engines and drivetrains that otherwise would be rebuilt and repurposed in gliders. Capital assets likely would be sold at liquidation values, and forcibly retired engines and drivetrains would be scrapped. The Glider Repeal Rule avoids these premature capital retirements. The cost of capital assets and older engines forcibly retired under the Phase 2 Final Rule (missing from the RIA) becomes a benefit of the Glider Repeal Rule.

(e) *Competition*

The Glider Repeal Rule restores gliders as an alternative in the truck market. New truck manufacturers' capacity to collect monopoly rents, which the Phase 2 Final Rule exacerbates, go away.

### C. Other analytic issues

The RIA for the Phase 2 Final Rule relies on certain assumptions that have the effect of undercounting costs and overcounting benefits.

1. *No emission reductions from pre-buys*

The Phase 2 Final Rule will induce prospective truck buyers to pre-buy trucks prior to the effective dates of the new emission standards. This has been documented to have occurred after the promulgation of MY 2004 and 2007 emission standards.<sup>83</sup> There is anecdotal evidence that the Phase 1 Final Rule led to a surge in glider sales, much like pre-buys of new trucks.<sup>84</sup> EPA did not estimate pre-buy effects for the Phase 2 Final Rule, thus overstating the rule's expected emission reductions and benefits.

Glider pre-buys are analytically similar to new truck pre-buys because purchasers of both are motivated by the same cost-minimizing considerations. They want to avoid the higher up-front cost of Phase 2-compliant trucks, their higher expected maintenance, and their expected diminished reliability. Even though new-truck and glider buyers' intentions are indistinguishable, for some reason EPA characterizes glider pre-buys as illegitimate (and sharply restricts it

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<sup>82</sup> Producers' and consumers' surplus losses resulting from the interim provisions can be reduced, but not eliminated, by prompt promulgation of the Glider Repeal Rule.

<sup>83</sup> Harrison Jr. and LeBel (2008 [effects on MY 2004 purchases]) and Calpin and Plaza-Jennings (2012, pp. 4-5 [effects on MY 2007 purchases]).

<sup>84</sup> See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 5-5).



through the interim provisions) but acknowledges new truck pre-buys without voicing moral opprobrium (and does not regulate it).<sup>85</sup>

There is substantial evidence that when EPA has promulgated expensive new emission standards for heavy-duty trucks, the net effect of pre-buys has been an increase in average fleet age.<sup>86</sup> Gliders provided an intermediate substitution alternative that increased fleet *engine* age while decreasing fleet *chassis and cab* age. Whereas rising fleet age due to expensive new emission standards has generally reduced reliability and increased highway safety risks, gliders mitigate these opportunity costs by providing the market with more reliable and safer alternatives. These countervailing benefits go away as a result of the glider provisions in the Phase 2 Final Rule.

A surge of pre-buys prior to the effective date of Phase 2 emission standards, followed by significant declines in Phase 2-compliant truck purchases, should be expected from the Phase 2 Final Rule. Substantial pre-buys occurred prior to the effective date of the MY 2004 and MY 2007 heavy-duty truck emission standards.<sup>87</sup> In the RIA, EPA acknowledged that pre-buys reduce emission reductions but did not estimate these effects.<sup>88</sup> Thus, EPA's estimates of GHG and pollutant emission reductions from the Phase 2 Final Rule knowingly overstate what is reasonably expected. At the same time, the glider provisions in the Phase 2 Final Rule account for *glider* pre-buys by severely constraining pre-buy opportunities.

A objective analysis of regulatory impacts must take account of pre-buys. EPA's failure to do so does not have a significant effect on the glider provisions because the Agency used regulatory tools against gliders that it did not attempt to use with respect to new trucks. However,

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<sup>85</sup> See, e.g., U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, p. 73943): "While the few hundred glider vehicles produced annually in the 2004–2006 timeframe may have been produced for arguably legitimate purposes, such as salvaging powertrains from vehicles otherwise destroyed in crashes, EPA believes (as did many commenters) that the more than tenfold increase in glider kit production since the MY 2007 criteria pollutant emission standards took effect reflects an attempt to avoid these more stringent standards and (ultimately) the Clean Air Act." EPA does not characterize pre-buys as attempts to avoid more stringent standards.

EPA also attributes the view that gliders are generally illegitimate to a SBAR panel. See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016c, p. 73966), referencing Small Business Advocacy Review Panel on EPA's Planned Proposed Rule 'Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: Phase 2' (2015). The SBAR panel did not include representatives from the glider industry, and the source of the information about gliders on which the panel relied is not disclosed in the report.

<sup>86</sup> Harrison Jr. and LeBel (2008), Calpin and Plaza-Jennings (2012).

<sup>87</sup> Ibid.

<sup>88</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 5-5): "The effect of the regulations on the timing of fleet turnover and total VMT can have an impact on downstream GHG and other emissions... *If the regulations spur firms to increase their purchase of new vehicles before efficiency standards are in place ("pre-buy") or to delay their purchases once the standards are in place then there will be a delay in achieving the full GHG and other emission reductions from improved fuel economy across the fleet.* If the lower per-mile costs associated with higher fuel economy lead to an increase in VMT (the "rebound effect"), then the total emission reductions will also be reduced. Chapter 8 of the RIA provides more detail on how the rebound effect was calculated in the agencies' analysis. The analysis discussed in this chapter incorporates the rebound effect into the estimates. However, *the impacts of any delayed fleet turnover are not estimated*" (emphasis added).

the absence of any analysis of pre-buys may have had a significant effect on Agency estimates of regulatory effects on the new truck market. Had EPA conducted the proper analysis of pre-buys, the consequences of its immediate restriction on glider output, followed by destruction of the industry, would have been more clearly visible.

## 2. *Discount rates*

EPA uses default discount rates (3% and 7%) that appear to understate interest rates in private markets where glider purchasers obtain financing. The correct discount rate for the Phase 2 regulation is the rate of time preference of those whose choices are subject to regulatory control. Buyers in the glider market typically finance their purchases. The pre-tax interest rates they pay vary according to credit risk from about 7% to 11%.<sup>89</sup> Assuming a marginal tax rate of 20%, the after-tax interest rate ranges from about 6% to 9%.

Higher discount rates give less weight to benefits from GHG and pollutant reductions (which are substantially delayed) and greater weight to financial costs and highway safety benefits foregone (which are realized immediately). The net effect of higher discount rates is to reduce the net benefits of the Phase 2 Final Rule and increase the net benefits of the Glider Repeal Rule.

## 3. *Regulatory failure*

EPA appears to view the demand for gliders as inherently illegitimate except if it involves a recently manufactured engine and drivetrain, though how recently the Agency doesn't say.<sup>90</sup> The Agency appears to believe that glider production *ought* to be illegal except in cases where EPA approves. In any case, the demand for gliders is clearly associated with the costs of EPA's new truck emission standards. This is especially noticeable when the Agency adopts technology-forcing standards the costs of which are unknown.

Further recognizing that most of the benefits claimed for the Phase 2 Final Rule are unrelated to GHG emission control, and that even the benefits from GHG emission control are exaggerated by mischaracterizing transfers as benefits, it is plausible that the Phase 2 emission standards are overly stringent given the magnitude of marginal damages. If so, then the Phase 2 emission standards attempt to remedy a market failure by creating a governmental failure.<sup>91</sup>

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<sup>89</sup> Personal communication with Joe Depew, General Counsel for Fitzgerald Glider Kits LLC.

<sup>90</sup> U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. 12-9): "We are finalizing the proposed glider-related provisions but have made several revisions in recognition of the differences between gliders produced to circumvent the 2010 criteria pollutant emission standards and *those manufactured for other more legitimate purposes* (emphasis added)." EPA does not explain how it distinguishes between legitimate and illegitimate motives, nor does it provide a statutory basis for using such distinctions as the basis for regulation.

<sup>91</sup> Viscusi and Zeckhauser (1979) have shown that the economically optimal standard is less stringent if a regulation cannot be perfectly enforced. Even if it can ban gliders, EPA has no authority to compel the purchase of Phase 2-compliant trucks. Thus, the optimal Phase 2 emission standard must be less stringent than it would be if its costs could not be avoided.

A more neutral analysis explains growing market demand for gliders as a rational response to the high fixed cost of Phase 2-compliant trucks, and secondarily because of the higher costs of diminished performance, reduced reliability, and regular maintenance.<sup>92</sup> As new-truck regulatory costs rise, the price gap between new trucks and gliders inevitably increases. This price gap is likely to significantly rise as a result of the technology-forcing provisions of the Phase 2 Final Rule. Indeed, rising demand for gliders is evidence of rational decision-making by profit maximizing firms.

Departures from the competitive equilibrium that occur in unregulated markets are examples of *market* failure.<sup>93</sup> When departures occur because of regulation, however, they are evidence of *government* failure.<sup>94</sup> Which failure is more severe depends on the circumstances, but a longstanding principle of regulation has been to intervene only when a market failure will not self-correct and is greater in magnitude than government failure that inevitably accompanies regulation. Further, federal policy and OMB guidelines direct agencies encountering government failure to revisit and revise existing rules, not promulgate additional layers of regulation.<sup>95</sup>

## VII. QUANTIFICATION OF BENEFITS, COSTS, AND OTHER EFFECTS

Benefits, costs, and other effects must be calculated from the appropriate baseline, and there are two baselines to consider: (A) the glider market prior to the promulgation of the Phase 2 Final Rule, which allows for estimates of expected effects from the Phase 2 Final Rule; and (B) the glider market after the Final Rule's implementation. In the first baseline, the glider market operates essentially unimpeded; in the second baseline, it is severely constrained through 2020 and terminates in 2021.<sup>96</sup>

Quantification of benefits and costs is hamstrung by limited public data access and the urgent need for action to repeal the glider provisions of the Phase 2 Final Rule before the industry suffers irreparable harm. Further, it is important to note that EPA apparently did not collect sufficient data that could be used estimate the impacts of the glider provisions on the glider industry and its customers.

It is inappropriate to impose a substantial analytic burden on action that repeals regulatory provisions that an agency failed to properly analyze prior to imposing them. To impose such a burden establishes a bias favoring regulation and rewards an agency for analytical neglect, both of which are inconsistent with Executive Orders 12866 and 13771. Therefore, this section focuses on *how* to properly quantify the benefits, costs, and other effects of the glider provisions in the Phase 2 Final Rule and the Glider Repeal Rule, with the understanding that

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<sup>92</sup> In 2008, the additional up-front cost of a Class 8 truck meeting the MY 2010 NOx standard was forecast to be \$7,000 to \$10,000. *See* Harrison Jr. and LeBel (2008). Ex post up-front cost exceeded \$21,000. *See* Calpin and Plaza-Jennings (2012, p. 12).

<sup>93</sup> Bator (1958).

<sup>94</sup> Wolf Jr. (1997).

<sup>95</sup> *See* Clinton (1993), Office of Management and Budget (2003), and Office of Management and Budget (2017c, 2017a, 2017b), Trump (2017a, 2017b).

<sup>96</sup> *See* the interim provisions in the Phase 2 Final Rule, § 1037.150(c) and (t).

EPA can do this later and initiate new regulatory action if objective analysis shows that the benefits of regulating gliders justify the costs.

## A. Benefits and costs of the glider provisions in the Phase 2 Final Rule

### 1. *Dubious benefit claims and other systematic errors*

#### (a) Fuel savings

The Phase 2 Final Rule is highly unlikely to produce private benefits from an “energy paradox” in the private market. Therefore, repealing the glider provisions also should not cause the loss of such benefits.

#### (b) GHG emissions

As indicated in Section VI.A.1(b) above, the quantification of climate change benefits must be based on the domestic SCC. The global SCC, used in the Phase 2 Final Rule RIA, overstates social benefits by including transfers from U.S. residents to foreigners, in contravention of longstanding practice in benefit-cost analysis. After this correction is made, there remains the analytic task of estimating changes in GHG emissions from the glider provisions in the Phase 2 Final Rule.

The net change in GHG emissions depends on whether gliders are supplanted by new trucks, used trucks, or old trucks retained in service, and the relative GHG emissions of each. In the long run, new trucks are expected to have better fuel economy than gliders (and hence lower GHG emissions), but gliders achieve better fuel economy than used trucks and old trucks retained in service (and hence lower GHG emissions). Moreover, there is substantial anecdotal evidence (some reported in public comments on the Glider Repeal NPRM) that gliders may achieve better fuel economy than current new truck models. If future new trucks unambiguously achieve better fuel economy than gliders in actual use, there would be a tradeoff between GHG reductions from one substitution (new trucks) and GHG increases from the others (used trucks and old trucks retained in service).

A model can be devised that is agnostic with respect to this empirical question. For simplicity of exposition, it is assumed that used trucks and old trucks retained in service have identical GHG emissions. Let:

$G_n =$  GHG emissions from new trucks.

$G_g =$  GHG emissions from gliders.

$G_u =$  GHG emissions from used trucks.

$p_n =$  % of gliders supplanted by new trucks.

Therefore:

$1 - p_n =$  % of gliders supplanted by used/old trucks.

There is no net change in GHG emissions from the Phase 2 Final Rule if:

$$G_g = p_n G_n + (1 - p_n) G_u .$$

Expanding terms yields:

$$G_g = p_n G_n + G_u - p_n G_u .$$

Rearranging terms yields:

$$G_g - G_u = p_n G_n - p_n G_u .$$

This can be simplified and expressed in terms of  $p_n$ :

$$G_g - G_u = p_n (G_n - G_u) .$$

$$p_n = \frac{G_g - G_u}{G_n - G_u} .$$

The right side is the difference in GHG emission between gliders and used/old trucks divided by the difference in GHG emissions between new trucks and used/old trucks. Both differences are expected to be negative, resulting in an appropriately positive value for  $p_n$ . As the difference in emissions between gliders and used/old trucks rises,  $p_n$  also must rise for net GHG emissions to decline.

## 2. *Pollutant emissions*

Pollutant emissions can be modeled in a similar manner. Let:

$E_n$  = *pollutant emissions from new trucks.*

$E_g$  = *pollutant emissions from gliders.*

$E_u$  = *pollutant emissions from used trucks.*

$p_n$  = *% of gliders supplanted by new trucks.*

As before,

$1 - p_n$  = *% of gliders supplanted by used or old trucks.*

The proportion of gliders that must be supplanted by new trucks to produce a net reduction in pollutant emissions is:

$$p_n = \frac{E_g - E_u}{E_n - E_u} .$$

As the difference in pollutant emissions between gliders and used trucks rises,  $p_n$  also must rise for net pollutant emissions to decline.

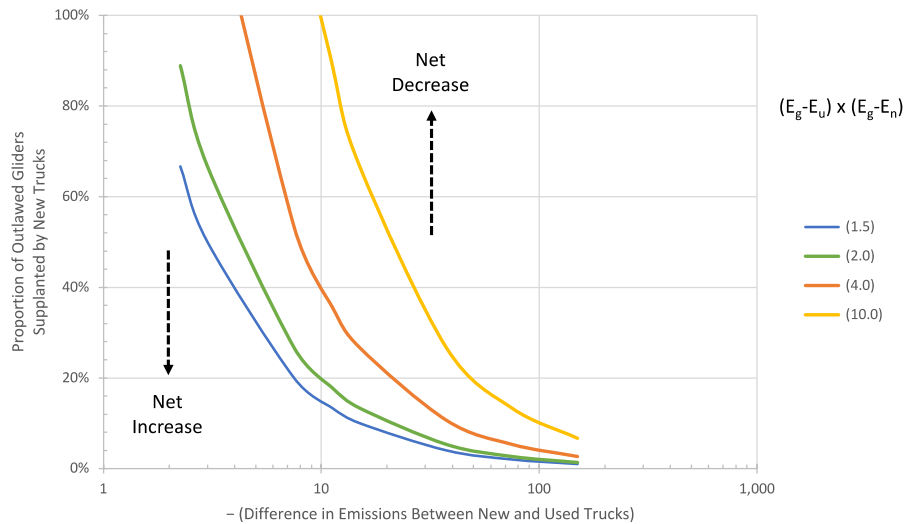
The fraction of gliders replaced by new trucks,  $p_n$ , is likely to be small because new trucks are about 40% more expensive (a gap that Phase 2 is likely to increase). But low values for  $p_n$  require large differences in pollutant emissions between new and used trucks, small differences in pollutant emissions between gliders and used trucks, or both.

EPA appears not to have collected sufficient data to derive empirical estimates of the minimum value of  $p_n$  necessary to produce net emission reductions. Separate estimates are required for GHG and pollutant emissions, and the minimum  $p_n$  necessary to produce net GHG emission reductions may well be different than the minimum  $p_n$  necessary to produce net pollutant reductions. The composite minimum  $p_n$  is obtained by weighting the two by the relative magnitude of monetized unit benefits.

Modeling hypothetical differences in emissions provides insight about the conditions under which the glider provisions of the Phase 2 Final Rule produce a net increase in GHG or pollutant emissions. Figure 2 shows graphically the results of such a comparison. Four alternative values for the difference in emissions between gliders and used trucks (ranging from 1.5 to 10), and eight alternative values for the difference in emissions between new and used trucks (ranging from 1.5 to 100). The horizontal axis is the difference in emissions between new and used trucks (expressed as a negative to utilize the upper right quadrant of the plot). The minimum proportion of gliders that must be supplanted by new trucks is shown on the vertical axis.

The four curves show alternative multiples of the relative difference in emissions, ranging from 1.5 to 10. High multiples would apply if emissions from gliders are closer to old trucks than new trucks. Net emissions increase if the actual value of  $p_n$  is below the relevant curve and decrease if the actual value of  $p_n$  is above the curve. For all curves, there is a zone in which  $p_n$  is too low to produce net emission reductions. Only if gliders emit more than used or old trucks will net emissions from the glider provisions always be positive.

Fig 2: Conditions Resulting in Net Decrease or Increase in Emissions from Phase 2 Final Rule



Objective and reliable data on actual emissions from gliders, new trucks, and used trucks are needed to ascertain which curve in Figure 2 most accurately describes the case at hand. Nonetheless, because  $p_n$  is likely to be small independent of relative emissions because of the substantial price difference between new trucks and gliders, net increases in emissions from the glider provisions in the Phase 2 Final Rule are plausible over a fairly wide range of scenarios. Indeed, if relatively few gliders are supplanted by new trucks, net emission increases become likely across the entire range of scenarios illustrated. Estimating  $p_n$  may be extremely difficult and fraught with uncertainty, so decision-makers mostly need to know if  $p_n$  must be implausibly large for restrictions on glider output potentially to have benefits that justify costs. If potential net benefits are feasible, then an array of reasonable regulatory alternatives must be considered to ascertain the least burdensome regulatory stringency that achieves the purposes of the Clean Air Act.

## **B. Benefits and costs of repealing the glider provisions in the Phase 2 Final Rule**

### *1. Fuel savings*

Discarding the putative “energy paradox” for the Phase 2 Final Rule requires discarding it for the Glider Repeal Rule as well.

However, the Phase 2 Final Rule created a glider-specific “energy paradox” as a regulatory effect. It forces prospective glider purchasers to make second-best decisions with respect to energy inputs in their production functions. The Glider Repeal Rule will remove the constraint that impedes optimal decision-making with respect to energy use. Therefore, the Repeal Rule will produce private fuel savings that cannot be captured without deregulatory action. Only if gliders are *never* optimal choices, for any truck buyer under any circumstances, will the Repeal Rule fail to produce fuel savings from overcoming this regulation-induced “energy paradox.”

### *2. GHG emissions*

Changing the baseline to the Glider Repeal Rule reverses the sign on effects estimated for the Phase 2 Final Rule. If the Phase 2 Final Rule yields net GHG emission reductions, these reductions are lost in the Repeal Rule, resulting in a regulatory cost. On the other hand, if the Phase 2 Final Rule yields GHG emission increases, then these increases are prevented and the Repeal Rule results in a regulatory benefit.<sup>97</sup>

### *3. Pollutant emissions*

A similar analysis applies to pollutant emissions. Benefits (costs) from net emission reductions (increases) obtained via the Phase 2 Final Rule become costs (benefits) from net emission increases (decreases) via the Glider Repeal Rule.

Getting the Phase 2 Final Rule analysis right is a prerequisite for objectively estimating the effects of the Repeal Rule.

## **VIII. ADDITIONAL ALTERNATIVES**

The RIA for the Phase 2 Final Rule identifies no regulatory alternatives to the glider components. As noted previously, this violates Executive Order 12866 and OMB’s implementing guidance on Regulatory Impact Analysis. Three obvious alternatives were identified in Section V:

- Requiring gliders to meet or exceed the emission standards applicable to the year of original engine and drivetrain manufacture.

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<sup>97</sup> As indicated above, some social costs of the Phase 2 Final Rule cannot be recovered by repeal.



- Requiring gliders to meet or exceed the emission performance of donor engines and drivetrains.
- Requiring gliders to produce net benefits in emissions, fuel savings, and vehicle safety compared to the performance of the trucks they replace.
- Regulating emissions from rebuilt engines irrespective of circumstances.

What distinguishes each of these alternatives from the glider provisions in the Phase 2 Final Rule is that each would further the goals of the Clean Air Act but do so without making impossible the survival of the glider industry. Further, because the glider industry is such a small fraction of the Class 8 heavy-duty diesel engine industry, its regulatory destruction cannot further the goals of the Clean Air Act very much even if the glider provisions are shown to yield net emission reductions.

As previously noted, quantification of the benefits, costs, and other effects of the Glider Repeal Rule is limited by the absence of any analysis of the benefits, costs, and other effects of the glider provisions as promulgated. This also is true for the analysis of reasonable alternatives. EPA did not consider any alternative regulatory approaches to gliders except banning them after a short wind down period.

The Agency apparently decided to ban gliders based on reasons unrelated to the benefits, costs, and other effects that would result. EPA may have been motivated by a belief that glider production is generally but not always illegitimate. But EPA did not articulate any principle by which legitimate and illegitimate gliders could be clearly distinguished. Moral arguments require clarity so that market actors can understand what actions they may take and why other actions are forbidden. Regulators cannot deem some actions legitimate and others not based on intuition, subjective judgment, or mere opinion. EPA certainly cannot base regulatory decisions on animus toward an industry.

## IX. UNCERTAINTY AND VARIABILITY

The theoretical analysis in Section VII provides insight concerning the effects of uncertainty. It shows the critical importance of collecting data on relative emissions and developing a more accurate understanding of the glider market and the effects of eliminating it through regulation. More importantly, the theoretical analysis reveals the peril of promulgating regulations designed to terminate an industry based on mere assumption or whims.

This theoretical analysis does not account for variability, however; for expository simplicity, all differences in emissions are assumed to be fixed. This is a serious oversimplification of the real world. Engine performance declines over time<sup>98</sup> and can display substantial variability, particularly for older engines under real-world operating conditions. Collecting data from a small number of test engines is likely to be insufficient to characterize even the mean emission characteristics of the relevant engine population, and sure to be

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<sup>98</sup> Jääskeläinen (2007).

inadequate for extrapolation if the sample is not representative. Multiple tests across the same engine are likely to yield different results, and using central tendency values without regard for inter-test variability will lead to erroneous inferences. Any comparison between glider engines and new and used alternatives must account for variability – both within engines and among engine groups – before drawing inferences about whether differences in emissions are statistically significant. Failing to account for variability is equivalent to discarding data; failing to collect necessary data is indistinguishable from deciding that variability is unimportant.

## X. CONCLUSIONS

This strawman RIA shows that the Phase 2 Final Rule does not provide a proper accounting of the benefits and costs of its glider provisions. To the extent that aggregate estimates in the RIA include glider provisions, it appears to rely on counterfactual assumptions about the glider market and how its future customers would respond if the glider industry were regulatorily terminated. This overstates GHG and pollutant emission reductions, which a more careful analysis may show to exhibit a net increase.

Important non-emission costs of the glider provisions also were not accounted for in the Phase 2 Final Rule RIA. These include reduced competition in the heavy-duty truck market, lost producers' and consumers' surpluses, the forced retirement of the glider industry's capital and older engines that have remaining service life if rebuilt, and foregone highway safety benefits.

Separate and distinct from the glider provisions, the Phase 2 Final Rule RIA generally does not provide a proper accounting of non-emission benefits and costs. It incorrectly counts private fuel savings based on the dubious assumption that firms behave irrationally with respect to energy inputs in their production functions. It overstates GHG reduction benefits tenfold by mischaracterizing as benefits transfers from U.S. residents to foreigners. The importance of these errors is clear because net benefits *for the entire Phase 2 Final Rule* are negative when fuel savings (\$169 billion) and transfers to foreigners (90% of \$88 billion) are removed.<sup>99</sup>

The Glider Repeal Rule would reverse most of the costs of the glider provisions of the Phase 2 Final Rule, including costs the Phase 2 Final Rule RIA did not take into account. To the extent that gliders generate net emission reductions, by replacing old trucks that have lower fuel economy and higher emissions, the Glider Repeal Rule would recapture these emission reductions as benefits.

The Glider Repeal Rule would have no effect on the remainder of the Phase 2 Final Rule. Its negative net benefits (after putative fuel savings and transfers from U.S. residents to foreigners are removed) would remain unchanged.

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<sup>99</sup> See U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (2016d, p. ES-12 [Table 2, lifetime present value at 3%]).

## XI. REFERENCES

- Allen, Kirk. 2010. "The Effectiveness of ABS in Heavy Truck Tractors and Trailers". DOT HS 811 339. Washington DC: DOT/NHTSA. (July). <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811339>.
- Bator, Francis M. 1958. "The Anatomy of Market Failure." *Quarterly Journal of Economics* 72:351-379. (August). <http://opim.wharton.upenn.edu/~sok/papers/b/Bator-market-failure.pdf>.
- Calpin, Patrick, and Esteban Plaza-Jennings. 2012. "A Look Back at EPA's Cost and Other Impact Projections for My 2004-2010 Heavy-Duty Truck Emissions Standards". Torrance CA: National Automobile Dealers Association. <https://www.nada.org/WorkArea/DownloadAsset.aspx?id=21474839308>.
- Clinton, William J. 1993. "Executive Order 12866--Regulatory Planning and Review." *Federal Register* 58 (190):51735-51744. (October 4). <http://www.gpo.gov:80/fdsys/pkg/WCPD-1993-10-04/pdf/WCPD-1993-10-04-Pg1925.pdf>.
- Coglianesse, Cary, et al., eds. 2014. *Does Regulation Kill Jobs?* Philadelphia PA: University of Pennsylvania Press.
- Cox Jr., Tony, et al. 2013. "Temperature, Not Fine Particulate Matter (PM<sub>2.5</sub>), Is Causally Associated with Short-Term Acute Daily Mortality Rates: Results from One Hundred United States Cities." *Dose-Response* 11 (3). <http://journals.sagepub.com/doi/full/10.2203/dose-response.12-034.Cox>.
- Daimler Trucks North America LLC, et al. 2015. "Comments of Daimler Trucks North America LLC, Detroit Diesel Corporation, and Mercedes-Benz USA on 'Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Phase 2; Proposed Rule'". EPA-HQ-OAR-2014-0827-1164; Daimler. (September 29). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-1164>.
- Dudley, Susan, et al. 2017. "Consumer's Guide to Regulatory Impact Analysis: Ten Tips for Being an Informed Policymaker." *Journal of Benefit-Cost Analysis*:1-18. doi: 10.1017/bca.2017.11. <https://www.cambridge.org/core/journals/journal-of-benefit-cost-analysis/article/consumers-guide-to-regulatory-impact-analysis-ten-tips-for-being-an-informed-policymaker/FAF984595B822A70495621AEA7EF7DEB>.
- Fitzgerald Glider Kits LLC, et al. 2017. "Petition for Reconsideration of Application of the Final Rule Entitled 'Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2 Final Rule' to Gliders". Crossville TN: FGK. (July 10).
- Fraas, Art, et al. 2016. "Should the Federal Regulatory Agencies Report Benefits to Americans from Mandated Reductions in Greenhouse Gas Emissions?". Resources for the Future, Last Modified February 8, accessed May 1, 2018. <http://www.rff.org/blog/2016/should-federal-regulatory-agencies-report-benefits-americans-mandated-reductions>.
- Gayer, Ted, and W Kip Viscusi. 2014. "Determining the Proper Scope of Climate Change Benefits." Washington, DC: The Brookings Institution. [https://regulatorystudies.columbian.gwu.edu/sites/g/files/zaxdzs1866f/downloads/Gayer-Viscusi\\_Determining%20the%20Proper%20Scope%20of%20Climate%20Change%20Benefits.pdf](https://regulatorystudies.columbian.gwu.edu/sites/g/files/zaxdzs1866f/downloads/Gayer-Viscusi_Determining%20the%20Proper%20Scope%20of%20Climate%20Change%20Benefits.pdf).
- Harrison Jr., David, and Mark LeBel. 2008. "Customer Behavior in Response to the 2007 Heavy-Duty Engine Emission Standards: Implications for the 2010 Nox Standard": NERA Economic Consulting. [https://www.ooida.com/Documents/NERA\\_2010\\_NOx\\_Standard\\_Report.pdf](https://www.ooida.com/Documents/NERA_2010_NOx_Standard_Report.pdf).

- Interagency Working Group on Social Cost of Carbon. 2010. "Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866".  
[https://www.epa.gov/sites/production/files/2016-12/documents/scc\\_tsd\\_2010.pdf](https://www.epa.gov/sites/production/files/2016-12/documents/scc_tsd_2010.pdf).
- Interagency Working Group on Social Cost of Carbon. 2016. "Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis -under Executive Order 12866". Washington DC: USEPA. (August). [https://www.epa.gov/sites/production/files/2016-12/documents/sc\\_co2\\_tsd\\_august\\_2016.pdf](https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf).
- J.D. Power. 2012a. "EPA Emission-Compliant Engines Increase Costs, Reduce Satisfaction." J.D. Power, Last Modified August 23, accessed May 3, 2018. <http://www.jdpower.com/press-releases/2012-us-heavy-duty-truck-engine-and-transmission-study>.
- J.D. Power. 2012b. "Introduction of EPA Emission Standard-Compliant Engines Impacts Class 8 Quality and Satisfaction." J.D. Power, Last Modified June 27, accessed May 3, 2018. <http://www.jdpower.com/press-releases/2012-us-heavy-duty-truck-customer-satisfaction-study>.
- Jääskeläinen, Hannu. 2007. "Dieselnet Technology Guide: Emission Effect of Engine Faults and Service": Ecopoint, Inc. [https://www.dieselnet.com/tech/emi\\_fault.php](https://www.dieselnet.com/tech/emi_fault.php).
- Kilcarr, Sean. 2010. "Dealing with Def." Informa USA, Last Modified October 22, accessed May 10, 2018. <http://www.fleetowner.com/blog/dealing-def>.
- Mannix, Brian. 2015. "Public Interest Comment on the Environmental Protection Agency and National Highway Traffic Safety Administration's Proposed Rule: Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles – Phase 2". Washington DC: George Washington University Regulatory Studies Center. (October 1). <https://regulatorystudies.columbian.gwu.edu/public-interest-comment-epa-and-nhtsas-proposed-rule-greenhouse-gas-emissions-and-fuel-efficiency>.
- Mannix, Brian F., and Susan E Dudley. 2015. "Point/Counterpoint: Please Don't Regulate My Internalities." *Journal of Public Policy & Management* 34 (3):715-718.  
<https://onlinelibrary.wiley.com/doi/abs/10.1002/pam.21847?campaign=wolearlyview>.
- Moulis, Charles. 2017. "Summary Memo for Glider Production Data - Redacted Version". EPA-HQ-OAR-2014-0827-2379. Washington DC: USEPA/OAR. (November 15).  
<https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-2379>.
- Obama, Barack. 2011. "Executive Order 13563: Improving Regulation and Regulatory Review." *Federal Register* 76 (14):3821-3823. (January 21, 2011).
- Office of Management and Budget. 1990. "Regulatory Impact Analysis Guidance (Appendix V)." In *Regulatory Program of the United States Government, April 1, 1990 -- March 31, 1991*, pp. 653-666. Washington, DC: Office of Management and Budget.
- Office of Management and Budget. 2002. "Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Notice; Republication." *Federal Register* 67 (36):8452-8460. (February 22). <http://www.whitehouse.gov/omb/fedreg/reproducible2.pdf>.
- Office of Management and Budget. 2003. "Circular A-4: Regulatory Analysis."  
<https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf>

- Office of Management and Budget. 2005. "Final Information Quality Bulletin for Peer Review." *Federal Register* 70 (10):2664-2667. (January 14). [http://www.whitehouse.gov/omb/fedreg/2005/011405\\_peer.pdf](http://www.whitehouse.gov/omb/fedreg/2005/011405_peer.pdf).
- Office of Management and Budget. 2015. "Part of E.O. 12866 Review: From OMB to EPA NHTSA Heavy-Duty Phase 2, Draft NOPR 5/27/2015". EPA-HQ-OAR-2014-0827-0675. Washington DC: regulations.gov. (July 8). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-0675>.
- Office of Management and Budget. 2016. "Summary of Interagency Working Comments on Draft Language under EO 12866 and EO 13563 Interagency Review. Subject to Further Policy Review.". EPA-HQ-OAR-2014-0827-2352. Washington DC: regulations.gov. (August 17). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-2352>.
- Office of Management and Budget. 2017a. "Guidance Implementing Executive Order 13771, Titled 'Reducing Regulation and Controlling Regulatory Costs'". OMB M-17-21. Washington DC: OMB. (April 5.). <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-21-OMB.pdf>.
- Office of Management and Budget. 2017b. "Guidance on Regulatory Reform Accountability under Executive Order 13777, Titled *Enforcing the Regulatory Reform Agenda*". M-17-23. Washington DC: OMB. <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-23.pdf>.
- Office of Management and Budget. 2017c. "Interim Guidance Implementing Section 2 of the Executive Order of January 30, 2017, Titled *Reducing Regulation and Controlling Regulatory Costs*". Washington DC: OMB/OIRA. (February 2). [https://www.whitehouse.gov/sites/whitehouse.gov/files/briefing-room/presidential-actions/related-omb-material/eo\\_interim\\_guidance\\_reducing\\_regulations\\_controlling\\_regulatory\\_costs.pdf](https://www.whitehouse.gov/sites/whitehouse.gov/files/briefing-room/presidential-actions/related-omb-material/eo_interim_guidance_reducing_regulations_controlling_regulatory_costs.pdf).
- Office of Management and Budget. 2017d. "Meeting Record: Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Ruke [Requested by Advanced Engine Systems Institute]." OMB/GSA, Last Modified October 30, accessed May 5, 2018. <https://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=true&rin=2060-AT79&meetingId=2962&acronym=2060-EPA/OAR>.
- Office of Management and Budget. 2017e. "Meeting Record: Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Ruke [Requested by American Lung Association]." OMB/GSA, Last Modified October 30, accessed May 5, 2018. <https://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=true&rin=2060-AT79&meetingId=2948&acronym=2060-EPA/OAR>; <https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3249>; <https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3250>.
- Office of Management and Budget. 2017f. "Meeting Record: Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Ruke [Requested by Environmental Defense Fund]." OMB/GSA, Last Modified October 26, accessed May 5, 2018. <https://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=true&rin=2060-AT79&meetingId=2949&acronym=2060-EPA/OAR>; <https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3248>; <https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3247>.
- Office of Management and Budget. 2017g. "Meeting Record: Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Ruke [Requested by National Association of Clean Air Agencies (NACAA)]." OMB/GSA, Last Modified October 27, accessed May 5, 2018. <https://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=true&rin=2060->

- [AT79&meetingId=2947&acronym=2060-EPA/OAR;](https://www.reginfo.gov/public/do/AT79&meetingId=2947&acronym=2060-EPA/OAR;)  
<https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3243>.
- Office of Management and Budget. 2017h. "Meeting Record: Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Ruke [Requested by Volvo Group]." OMB/GSA, Last Modified October 30, accessed May 5, 2018.  
<https://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=true&rin=2060-AT79&meetingId=2950&acronym=2060-EPA/OAR;>  
<https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3246;>  
<https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3244;>  
<https://www.reginfo.gov/public/do/eoDownloadDocument?pubId=&eodoc=true&documentID=3245>.
- Office of Management and Budget. 2017i. "Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Rule [RIN 2060-At79]." OMB/GSA, Last Modified November 8, accessed May 5, 2018. <https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201710&RIN=2060-AT79>.
- Office of Management and Budget. 2018. "Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Final Rule [RIN 2060-At79]." OMB/GSA, Last Modified November 8, accessed May 5, 2018. <https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201804&RIN=2060-AT79>.
- Office of Management and Budget. 2016. "Summary of Interagency Comments Received on Draft Final Rule under EO 12866 Reviewepa-Hq-Oar-2014-0827-2352". EPA-HQ-OAR-2014-0827-2352. Washington DC: regulations.gov. (July 19). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-2352>.
- Small Business Advocacy Review Panel on EPA's Planned Proposed Rule 'Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: Phase 2'. 2015. Washington DC: USEPA/SBA. (January 15). [https://www.epa.gov/sites/production/files/2015-08/documents/report-sbarpanel\\_heavydutyengines2.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/report-sbarpanel_heavydutyengines2.pdf).
- Smith, Anne E. 2016. "Inconsistencies in Risk Analyses for Ambient Air Pollutant Regulations." *Risk Analysis* 36 (9):1737-1744. <https://www.onlinelibrary.wiley.com/doi/epdf/10.1111/risa.12517>.
- Statista. 2018. "U.S. Class 8 Truck Sales from 2007 to 2016, by Brand (in 1,000s)." Statista: The Statistics Portal, accessed May 6, 2018. <https://www.statista.com/statistics/245369/class-8-truck-sales-by-manufacturer/>.
- Trump, Donald J. 2017a. "Executive Order 13771 of January 30, 2017: Reducing Regulation and Controlling Regulatory Costs." *Federal Register* 82 (22):9339-9341. <https://www.gpo.gov/fdsys/pkg/FR-2017-02-03/pdf/2017-02451.pdf>.
- Trump, Donald J. 2017b. "Executive Order 13777—Enforcing the Regulatory Reform Agenda." *Federal Register* 82 (39):12285-12287. (March 1). <https://www.gpo.gov/fdsys/pkg/DCPD-201700139/pdf/DCPD-201700139.pdf>.
- U.S. Department of Transportation. 2015. "Documents Submitted to Conclude E.O. 12866 Review: Email from T Mullins, Dot, to OMB 6-18-15 127pm; 2 Attachments". EPA-HQ-OAR-2014-0827-0696. Washington DC: regulations.gov. (June 18). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-0696>.
- U.S. Environmental Protection Agency. 2000a. "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines". EPA420-R-00-010. Washington DC: USEPA/OAR. (July). <https://nepis.epa.gov/Exe/ZyNET.exe/P10020UG.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2000+Thru+2005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery>

[=&File=D%3A%5Czyfiles%5CIndex%20Data%5C00thru05%5CTxt%5C0000016%5CP10020UG.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#.](#)

- U.S. Environmental Protection Agency. 2000b. "Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements". EPA-420-R-00-026. Washington DC: USEPA/OAR. (December). <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100K576.PDF?Dockey=P100K576.PDF>.
- U.S. Environmental Protection Agency. 2001. "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule." *Federal Register* 66 (12):5002-5193. (January 18). <https://www.gpo.gov/fdsys/pkg/FR-2001-01-18/pdf/01-2.pdf>.
- U.S. Environmental Protection Agency. 2002. "Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency (EPA/260r-02-008)". <https://www.epa.gov/quality/guidelines-ensuring-and-maximizing-quality-objectivity-utility-and-integrity-information>.
- U.S. Environmental Protection Agency. 2014. "Guidelines for Preparing Economic Analyses". Washington DC: USEPA/NCEE. (May). [https://yosemite.epa.gov/ee/epa/erm.nsf/vwAN/EE-0568-50.pdf/\\$file/EE-0568-50.pdf](https://yosemite.epa.gov/ee/epa/erm.nsf/vwAN/EE-0568-50.pdf/$file/EE-0568-50.pdf).
- U.S. Environmental Protection Agency. 2015a. "Part of E.O. 12866 Review: Email from C. Achanta, OMB, to DOT-EPA, 5-29-15 2:02 pm; Attachment: Summary of Interagency Comments Received on EO 12866 Review of Draft Heavy Duty Vehicles NPRM". EPA-HQ-OAR-2014-0827-0676. Washington DC: regulations.gov. (May 29). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-0676>.
- U.S. Environmental Protection Agency. 2015b. "Peer Review of the Greenhouse Gas Emissions Model (GEM) and Epa's Response to Comments: Phase Ii". EPA-420-R-15-009, edited by Versar Inc. Washington DC. (June). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-0257>.
- U.S. Environmental Protection Agency. 2016. "Legal Memorandum Discussing Issues Pertaining to Trailers, Glider Vehicles, and Glider Kits under the Clean Air Act (Draft)". Washington DC: USEPA. (August). <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-1627>.
- U.S. Environmental Protection Agency. 2017. "Repeal of Emission Requirements for Glider Vehicles, Glider Engines, and Glider Kits; Proposed Rule." *Federal Register* 82 (220):53442-53449. (November 16). <https://www.gpo.gov/fdsys/pkg/FR-2017-11-16/pdf/2017-24884.pdf>.
- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2015a. "Document Submitted to Initiate E.O. 12866 Review - HD P2 NPRM RIA, 03/27/2015; Briefing Slides for OMB". Washington DC: USEPA/NHTSA. <https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-0671>.
- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2015b. "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2; Proposed Rule." *Federal Register* 80 (133):40138-40765. (October 25). <https://www.gpo.gov/fdsys/pkg/FR-2015-07-13/pdf/2015-15500.pdf>.

- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2015c. "Proposed Rulemaking for Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2: Draft Regulatory Impact Analysis". EPA-420-D-15-900. Washington DC: USEPA/NHTSA. (June).  
<https://nepis.epa.gov/Exe/ZyPDF.cgi/P100MKYR.PDF?Dockey=P100MKYR.PDF>.
- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2016a. "0 Complete Ria Compiled Redline" [sic]. EPA-HQ-OAR-2014-0827-2352. Washington DC: regulations.gov.  
<https://www.regulations.gov/document?D=EPA-HQ-OAR-2014-0827-2352>.
- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2016b. "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2—Notice of Data Availability." *Federal Register* 81 (41):10822-10826. (March 2).  
<https://www.gpo.gov/fdsys/pkg/FR-2016-03-02/pdf/2016-04613.pdf>.
- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2016c. "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2; Final Rule." *Federal Register* 81 (206):73478-74274. (October 25). <https://www.gpo.gov/fdsys/pkg/FR-2016-10-25/pdf/2016-21203.pdf>.
- U.S. Environmental Protection Agency, and National Highway Traffic Safety Administration. 2016d. "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Phase 2; Regulatory Impact Analysis". Washington DC: USEPA/NHTSA. (August).  
<https://nepis.epa.gov/Exe/ZyPDF.cgi/P100P7NS.PDF?Dockey=P100P7NS.PDF>.
- U.S. EPA Science Advisory Board. 2017. "SAB Advice on the Use of Economy-Wide Models in Evaluating the Social Costs, Benefits, and Economic Impacts of Air Regulations". Washington DC: EPA/SAB. (September 29).  
[https://yosemite.epa.gov/sab/sabproduct.nsf/WebBOARD/4B3BAF6C9EA6F503852581AA0057D565/\\$File/EPA-SAB-17-012.pdf](https://yosemite.epa.gov/sab/sabproduct.nsf/WebBOARD/4B3BAF6C9EA6F503852581AA0057D565/$File/EPA-SAB-17-012.pdf).
- Viscusi, W. Kip, and Richard J. Zeckhauser. 1979. "Optimal Standards with Incomplete Enforcement." *Public Policy* 27:437-456.
- Wolf Jr., Charles. 1997. *Markets or Governments: Choosing between Imperfect Alternatives*. 2nd ed. Cambridge MA: MIT Press.