Light-Duty Vehicle Greenhouse Gas Program -- Midterm Evaluation

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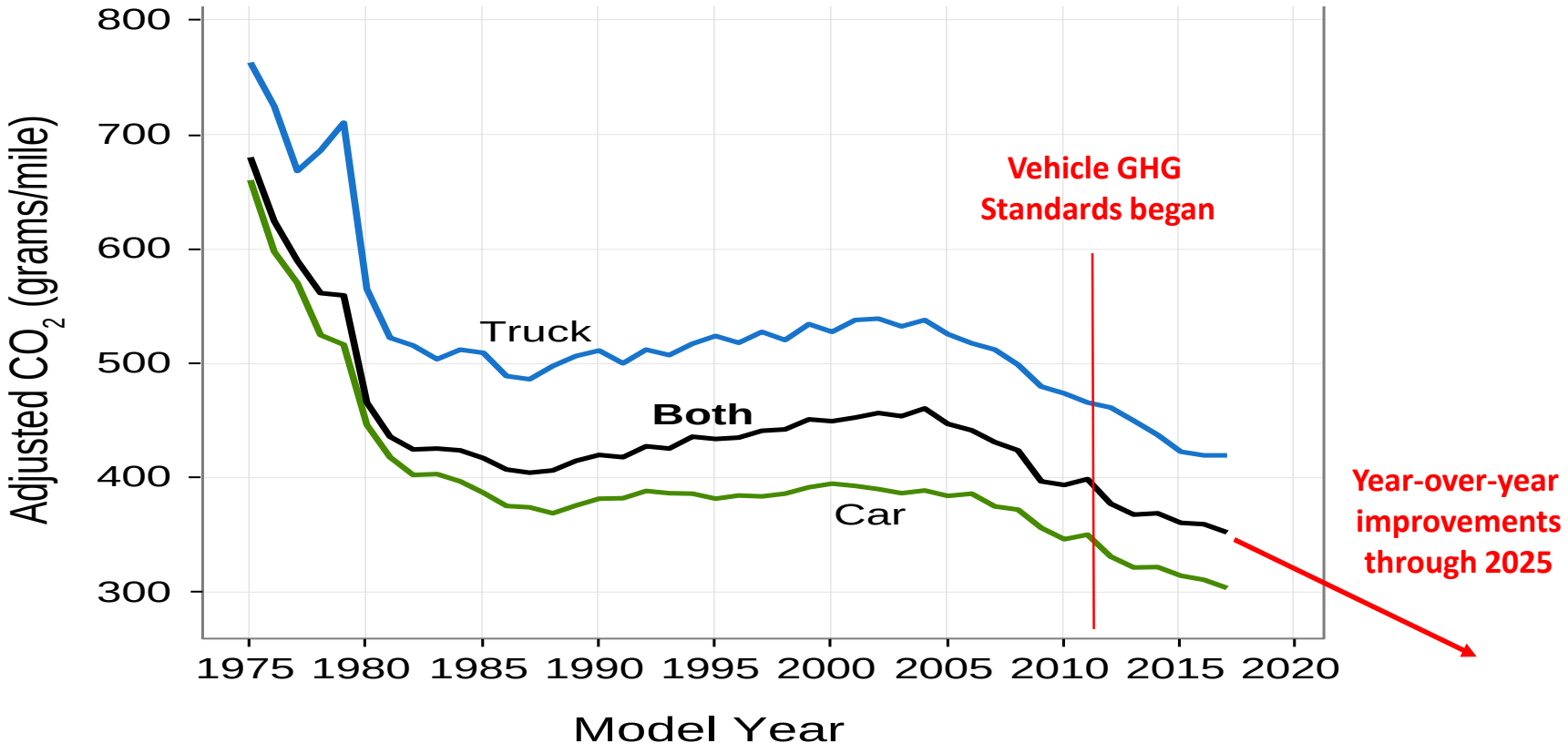
Overview

- GHG standards & how they work
- Midterm Evaluation of the 2022-2025 standards
- EPA's technical work to assess key issues

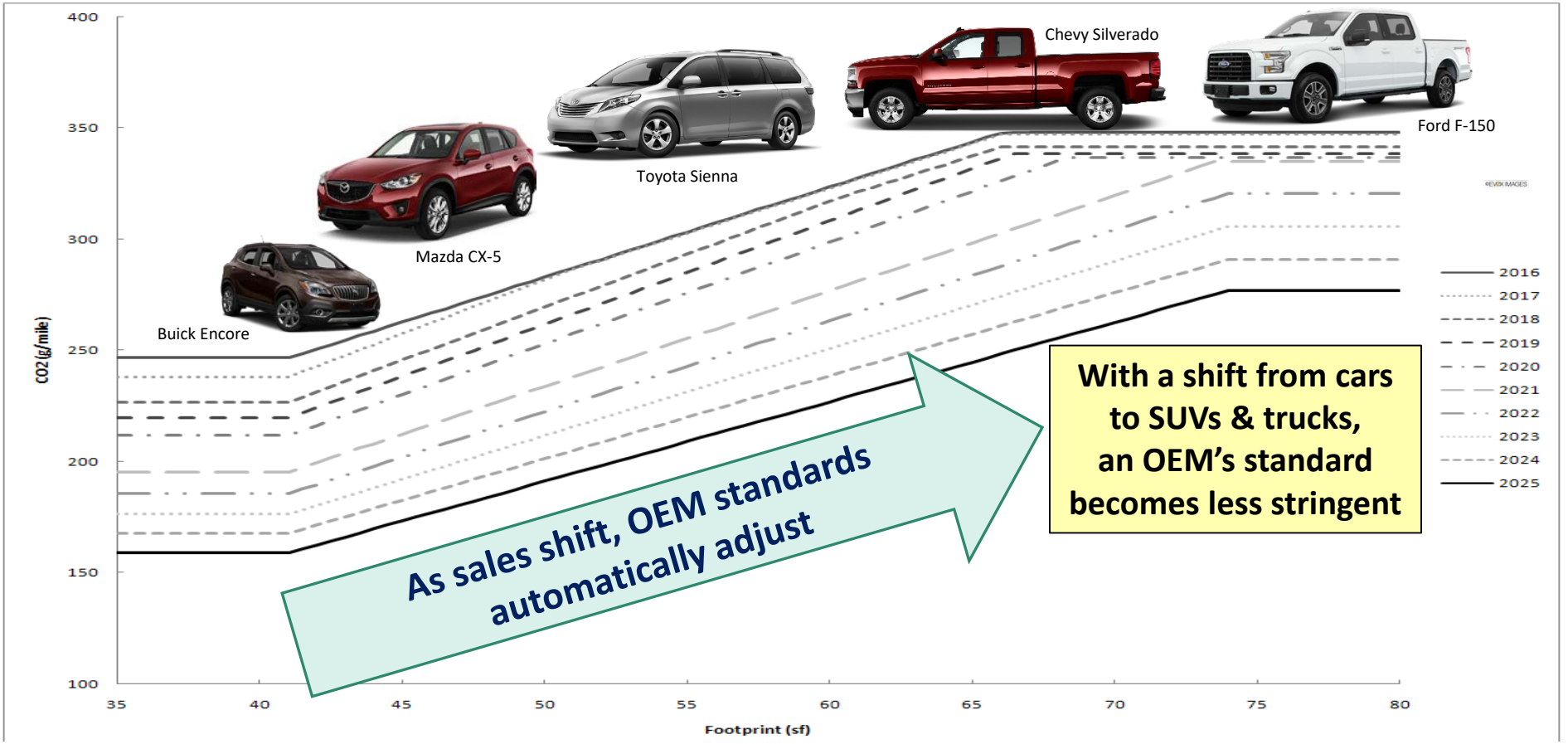
Vehicle CO_2 emissions at record low



Standards based on Vehicle Size – "Footprint"

CO_2 Footprint Target Curves for Trucks

(Separate footprint curve for Cars)



2025 Projection: ~50 mpg compliance = ~36 mpg real-world

Midterm Evaluation -- Process

- When EPA first set the MY2017-2025 standards in the 2012 rulemaking, EPA committed to a midterm evaluation of MY2022-2025 standards
  - EPA must determine whether the 2022-2025 standards remain appropriate
  - Data-driven, holistic, transparent
- Steps Thus Far:
  - **January 2017**: EPA Administrator McCarthy determined that the MY2022-2025 standards were appropriate and should not change
    - Following public comment on a Draft Technical Assessment Report issued jointly by EPA, NHTSA, and CARB in July 2016, and an EPA Proposed Determination in November 2016
  - **March 2017**: EPA Administrator Pruitt announced he would reconsider the prior determination
  - **August – October 2017**: Public comment & public hearing
    - EPA Administrator also took comment on appropriateness of MY2021 standards, separate from MTE
  - No later than **April 1, 2018**: EPA Administrator has said he will make a new Final Determination (per the EPA regs)

Factors to Consider in Determination

	2012 Rulemaking – Factors	August 2017 FR Notice – Additional Factors
Technology	• Powertrain improvements • Light-weighting/safety • Costs • Feasibility • Availability • Market penetration	• Advanced fuels • Approaches to technology projections
Consumers	• Consumer acceptance • Payback • Fuel costs	• Valuation of fuel savings • Distributional effects • Consumer purchasing & usage behavior (e.g., rebound)
Fleet	• Sales & mix	• Reference fleet
Others	• Employment • Infrastructure	• Air quality standards
Any other relevant information …		

How is EPA assessing these factors?

EPA continues to evaluate a wide range of information:

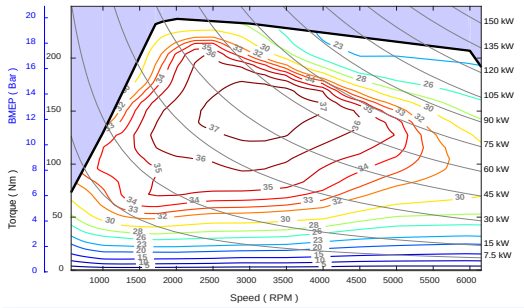
- **Public comments**
  - More than **280,000 comments** received, mostly from citizens; about 100 comments from organizations
- **Extensive reviews of the literature**
  - **Hundreds of reports/papers** published in the literature since 2012, including major studies such as the 2015 National Academies of Science (NAS) report
- **Stakeholder outreach & collaboration**
  - **Hundreds of meetings** with automakers, suppliers, NGOs, consumer groups, labor, states/local governments, others
  - **Collaboration** with DOE, CARB, Canada

EPA Research: Technology & Modeling

- EPA's **National Vehicle and Fuel Emissions Laboratory** has been performing state-of-the-art fuel economy and emissions testing since the 1970's
- In-house **benchmarking testing of 30 vehicles** across wide range of powertrains & segments
  - Provides critical up-to-date engine and transmissions inputs for vehicle simulation modeling
  - All data is publicly available
- In-house **vehicle simulation modeling** (ALPHA)
  - Industry best practice recommended by NAS
- Commissioned **cost teardown studies** of key technologies
  - NAS-recommended best practice
- In-house **technology/cost optimization modeling** (OMEGA)
- Published over **30 peer-reviewed technical papers/reports**
  - Provides transparency and sparks technical feedback

EPA National Vehicle and Fuel Emissions Laboratory, Ann Arbor, MI

Engine Testing via Tethered Vehicle



Fuel Map for Vehicle Simulation Modeling

EPA Research: Consumer Issues

- Role of fuel economy in purchase decisions
- **Consumer satisfaction** with fuel efficient technologies
- Consumer **willingness to pay** (WTP) for vehicle attributes
- **Potential tradeoffs**
- Affordability
- Energy paradox (or “energy efficiency gap”)

Consumer Satisfaction

EPA researching in two ways:

1) Professional auto reviews

- RTI coded >1000 auto reviews for each of MY 2014 & 2015 vehicles
  - 21 technologies, 22 operational characteristics (acceleration, handling, braking, etc.)
  - Is any mention of technology or operational characteristic positive, negative or neutral?
- Overall, **69%** of mentions of technologies were **positive**
- Each technology had **majority positive** ratings
- Few correlations between existence of technology and problems with operational characteristics

2) Survey data of new car owners

- Research underway to conduct similar analyses using actual **consumer data** (Strategic Vision) for MY2014-2016 vehicles

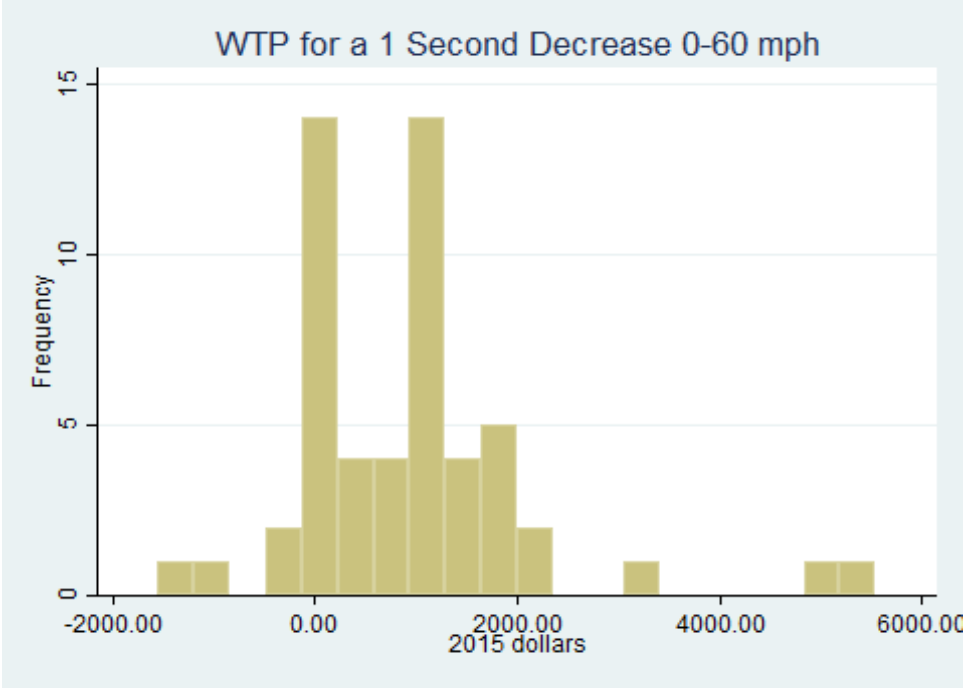
Professional Auto Reviewers' Evaluations of Fuel Efficient Technologies

Technology	% Positive	Technology	% Positive
Active Air Dam	100%	Electric Vehicle	74%
Active Grill Shutters	88%	Fuel Cell	100%
Active Ride Height	67%	Stop-Start	55%
Low Resistance Tires	53%	High Speed Auto. Transmission	65%
Electric Power Steering	65%	CVT	55%
Turbocharged	79%	DCT	69%
GDI	83%	Electric Assist/ Low Drag Brakes	56%
Cylinder Deactivation	80%	LED Lights	91%
Diesel	71%	Mass Reduction	89%
Hybrid	65%	Passive Aerodynamics	78%
Plug-In Hybrid Electric	63%		
Technology Totals			**69%**

More detail on preliminary MY2014-2015 analysis: https://www.epa.gov/sites/production/files/2017-03/documents/sbca-mtg-hidden-costs-2017-03-16.pdf
MY2014 analysis: Helfand et al. (2016), "Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles," Energy Policy 98: 590-606

Consumer Willingness to Pay (WTP)

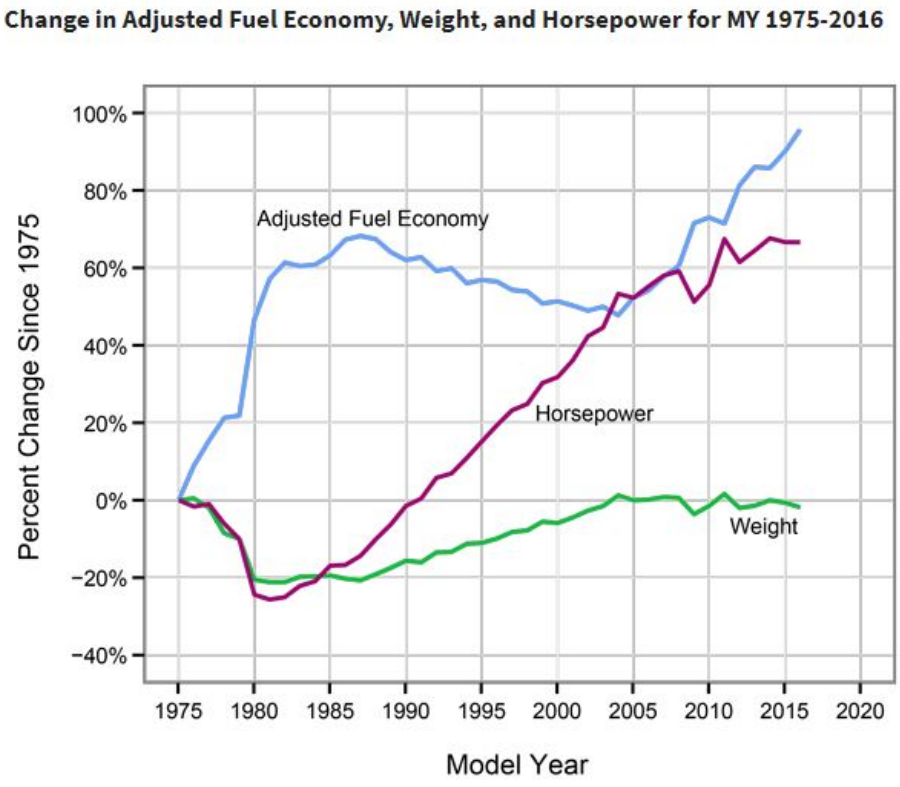
- EPA commissioned RTI (with subject matter expert, Dr. David Greene) to study consumer WTP for vehicle attributes from academic papers from 1995-2015
- Estimated WTP values for many attributes: fuel economy, performance, range, comfort, size, reliability, etc.
- WTP estimates for all vehicle attributes varied tremendously
  - Wide span of negative to positive values
  - Perhaps due to model specification – how well are researchers capturing the vehicle choice decision?
- Any one estimate is likely to be just that – one estimate from a wide distribution
  - Sensitivity analysis using the range is likely to give very uncertain outcomes – which may be all we can say about policy impacts



http://te3conference.com/wp-content/uploads/2017/11/TE3WTPVEhicleAttributes17Oct2017.pdf

Potential for tradeoffs with other attributes?

- In the early years of CAFE, vehicles became smaller and less powerful for a while (mid-1970s to early 1980s)
- As fuel efficiency improves, concern often raised that other vehicle attributes might suffer ("tradeoffs")
- Footprint-based standards were intended to mitigate incentives for downsizing
- How will consumers respond … will there be impacts on other vehicle characteristics?



EPA 2016. "Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends Report," p. 7.

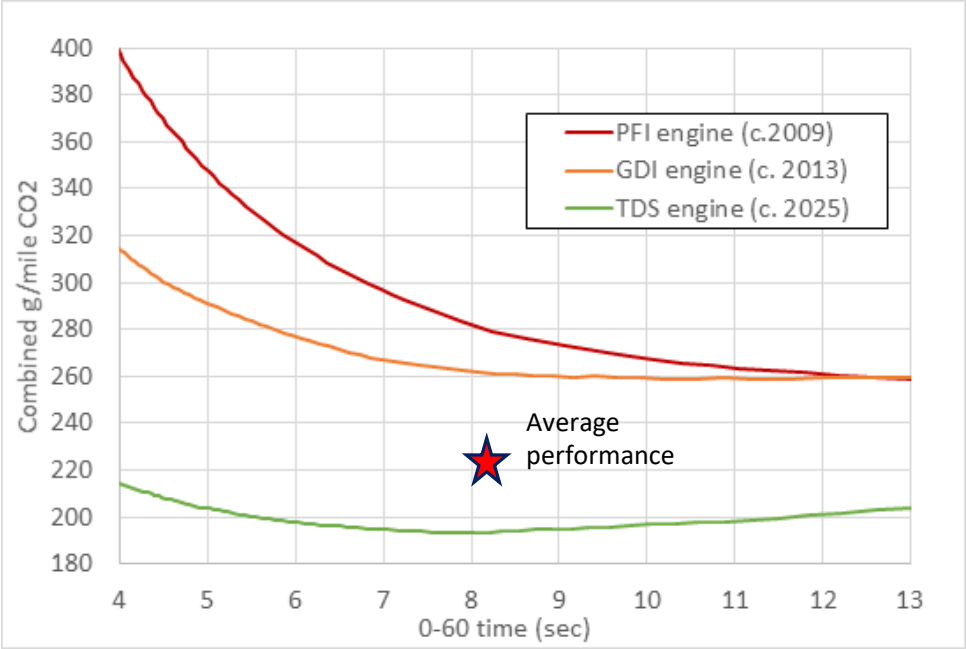
Technical relationship between power and fuel economy

- EPA has investigated the relationship between performance and fuel economy for different engine technologies, using our ALPHA model

- New research indicates that technology innovation is flattening the historic tradeoff between fuel economy and acceleration
  - Win-win: better fuel economy and better performance

- Advanced technology engines have a "sweet spot" of high efficiency that is better matched to vehicle speed/loads found on compliance test cycles
  - Improving performance "costs" less fuel because operation remains close to the sweet spot.

CO_2 as a function of 0-60 time for port fuel injection, gasoline direct injection, and turbo-downsized engines



Based on EPA Proposed Determination Technical Support Document, p. 2-247
https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf

Summary

- EPA technical staff are continuing to conduct research on technologies, modeling, consumer, and other issues
- EPA will continue assessing the many issues surrounding the MY2022-2025 standards using the best available data
- EPA Administrator plans to make a new Final Determination no later than April 1, 2018

Thank You

To find out more about the EPA Midterm Evaluation:

https://www.epa.gov/regulations-emissions-vehicles-and-engines/midterm-evaluation-light-duty-vehicle-greenhouse-gas-ghg