

Checking Dust to Dust's Assumptions about the Prius and the Hummer: Fact-checking using the GREET life cycle model underlines the deep divide between the Dust to Dust study and all previous scientific work.

Heidi Hauenstein and Laura Schewel, Rocky Mountain Institute

Rocky Mountain Institute (RMI), an environmental consulting firm that has decades of experience with automobile design, received several inquiries about a report that CNW¹ Research/Marketing posted on its website in March 2007.² CNW's *Dust to Dust* report purports to be a lifecycle analysis (LCA) of the environmental impact of the most popular consumer vehicles. One of CNW's findings, strongly emphasized in the introduction, was that the *Prius* has a greater impact on the environment than the H3 SUV Hummer. Probably because the CNW report had such unexpected conclusions, the media covered it extensively, and word of the findings spread widely. Needless to say, the report and the associated media coverage have resulted in widespread confusion about the environmental impacts of the two vehicles.

The *Dust to Dust* report, and requests for our response to it, encouraged Rocky Mountain Institute to conduct our own check of the lifecycle environmental impacts of the Prius and the H3. We used the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model to complete our check.³ The GREET Model is a highly rigorous quantitative model developed by Argonne National Laboratories that calculates the energy intensity and air pollution emissions of traditional and advanced vehicles based on the material composition, assembly energy, weight, and lifespan of the vehicle. RMI is satisfied with the quality of research and development that was employed to make the GREET Model, and we are confident in the default inputs. Papers using GREET have been published by Argonne Labs.

Our check found that, even when we manipulate the GREET model to favor the Hummer as much as possible, using some of CNW's most controversial assumptions that we could ascertain from their published documents, the Prius still has a lower impact on the environment. This indicates that the unpublished assumptions and inputs used by CNW must continue the trend of favoring the Hummer, or disfavoring the Prius. Since the researchers at Argonne Labs performed a careful survey of all recent life cycle analyses of cars, especially hybrids, our research underlines the deep divide between CNW's study and all scientifically reviewed and accepted work on the same topic.

In order to test certain assertions made in *Dust to Dust*, we manipulated the GREET model in the following ways:

We ran the GREET model multiple times so we could evaluate what would happen under various scenarios. As mentioned above, we were most interested in how vehicle lifespan

¹ CNW is not an acronym and does not stand for anything.

² Available at <http://cnwmr.com/nss-folder/automotiveenergy/>. Last Access: 8 May 2007.

³ Available at no cost to the public at www.transportation.anl.gov/software/GREET.

influenced the overall environmental impact of the Prius and the Hummer. We also investigated how the energy required for vehicle assembly impacted the overall LCA since CNW argued that because the Hummer shares design, development, and manufacturing energy with other models, its assembly was less energy-intensive than assembly of the Prius. For our LCA, we used greenhouse-gas emissions and energy consumption as an indication of environmental impact.

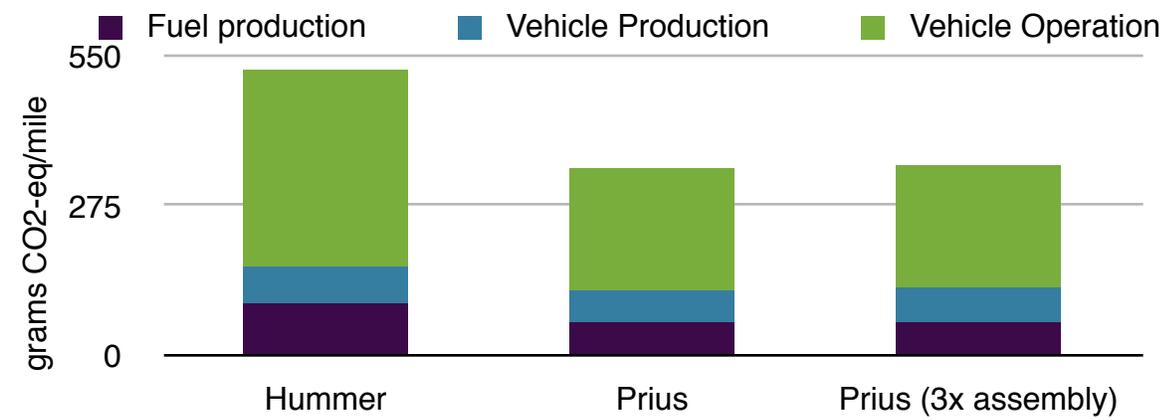
We ran our model four times. The constraints for each run were as follows:

- Run 1: both vehicles have a “lifespan” of 160,000 miles and the same per-pound energy requirements for vehicle assembly.
- Run 2: both vehicles have a lifespan of 160,000 miles, but the Prius’s per-pound energy requirement for assembly is three times that of the Hummer.
- Run 3: the Hummer has a lifespan of 207,000 miles and the Prius has a lifespan of 109,000 miles (CNW’s numbers). Both have the same per-pound energy requirement for assembly.
- Run 4: the Hummer has a lifespan of 207,000 miles and the Prius has a lifespan of 109,000 miles (CNW’s numbers), and the Prius per-pound energy requirement for assembly is three times that of the Hummer.

The notable facts from our LCA analysis are:

1. The Prius emits less in greenhouse gases than the Hummer in all stages of the life-cycle if the assembly energy requirements are equal. If the Prius’s assembly energy is tripled the results remain essentially the same—that is, the Prius emits less in greenhouse gases than the Hummer in all stages of the lifecycle. Indeed, if we triple the entire vehicle cycle (which includes the mining and manufacture of all materials, plus painting and assembly), the Hummer still has a greater impact per mile. Because of the Hummer’s fuel economy, the vehicle produces far more greenhouse gas emissions when being driven than at any other time in the vehicle’s life. The breakdown presented below is consistent with published academic studies.⁴

Figure 1: Breakdown of Prius and Hummer Greenhouse-gas Emissions by Phase Shows that Vehicle Operation Dominates Emissions (Runs 1 + 2)

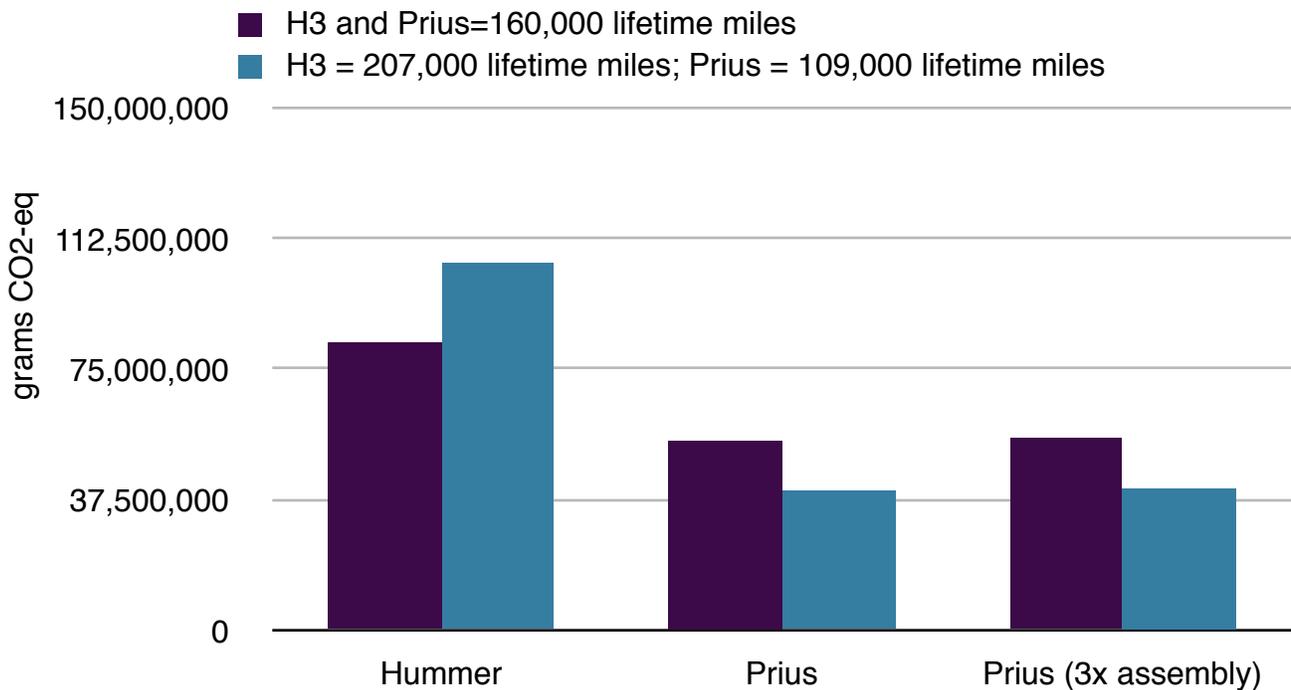


⁴ For a discussion of major related academic studies, see Dr. Peter H. Gleick’s related paper at www.integrityofscience.org and www.pacinst.org.

Figures 2 and 3 demonstrates the following points:

1. The CNW lifespan assumptions change the way environmental impacts are interpreted in the following ways:
 - a. The per-mile energy and greenhouse-gas emissions of the Hummer and the Prius start to converge, but the Prius still comes out ahead.
 - b. The total lifetime energy and greenhouse-gas emissions start to diverge and the Hummer looks even worse than it did when both vehicles had the same lifespan.
2. The Prius has a smaller lifetime environmental impact than the Hummer regardless of lifespan or assembly energy assumptions.

Figure 2: Manipulating lifetime mileage disfavors the Hummer for total lifetime impact. First graph shows total greenhouse-gas emissions. Second shows lifetime energy use.



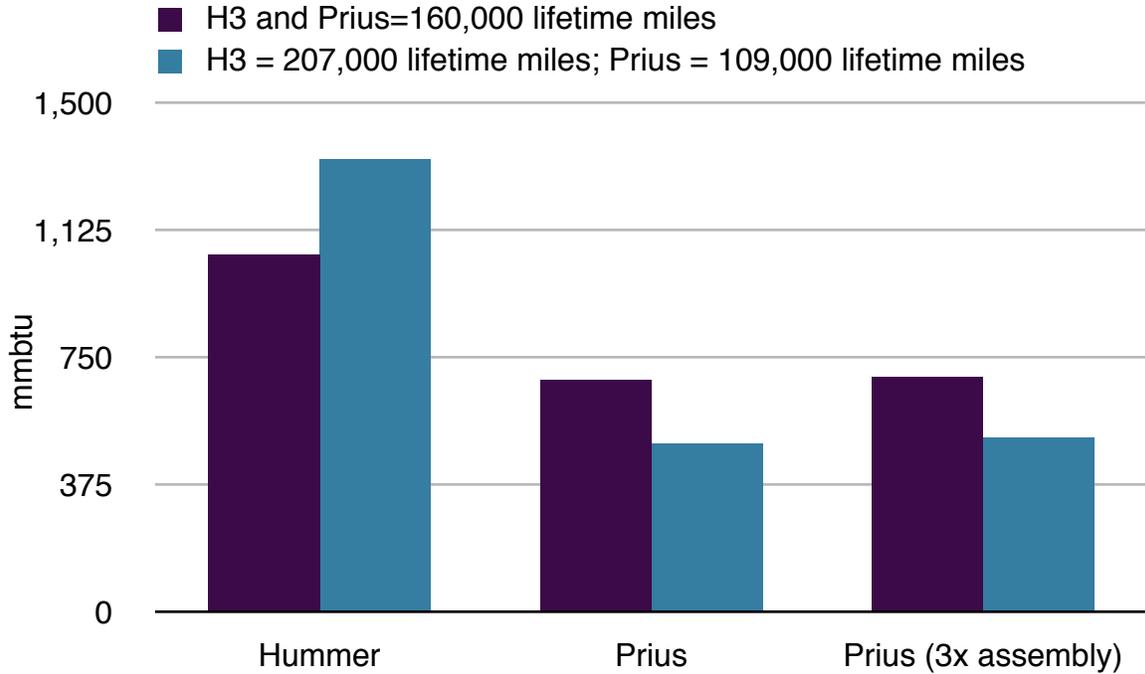
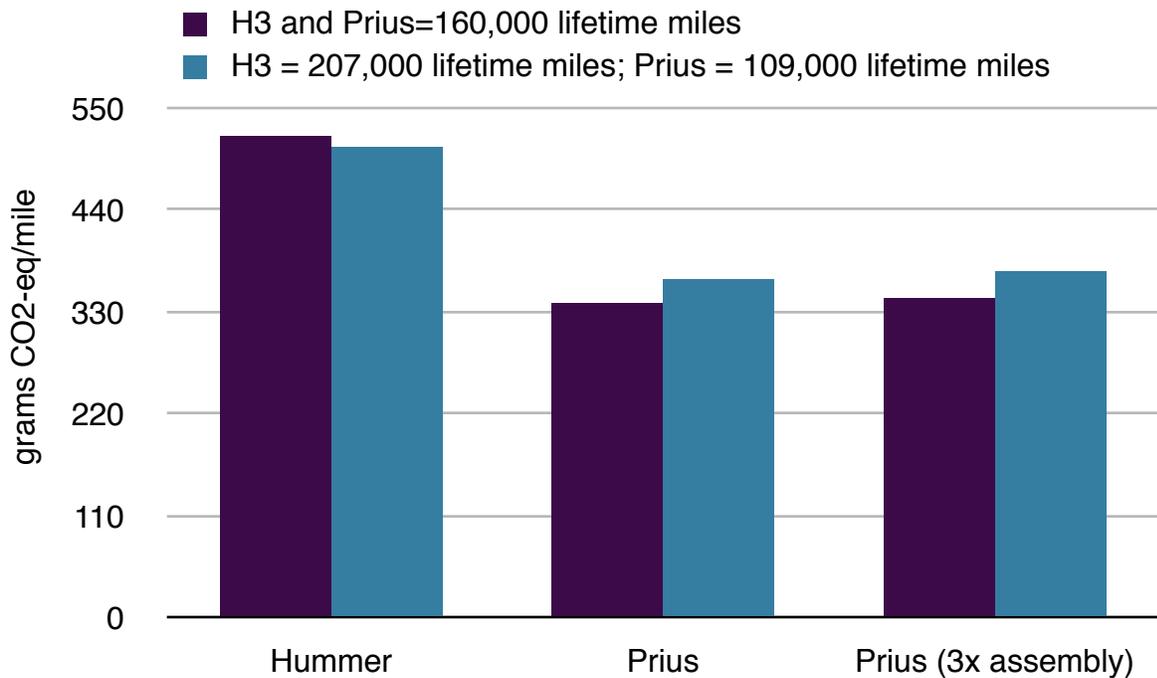
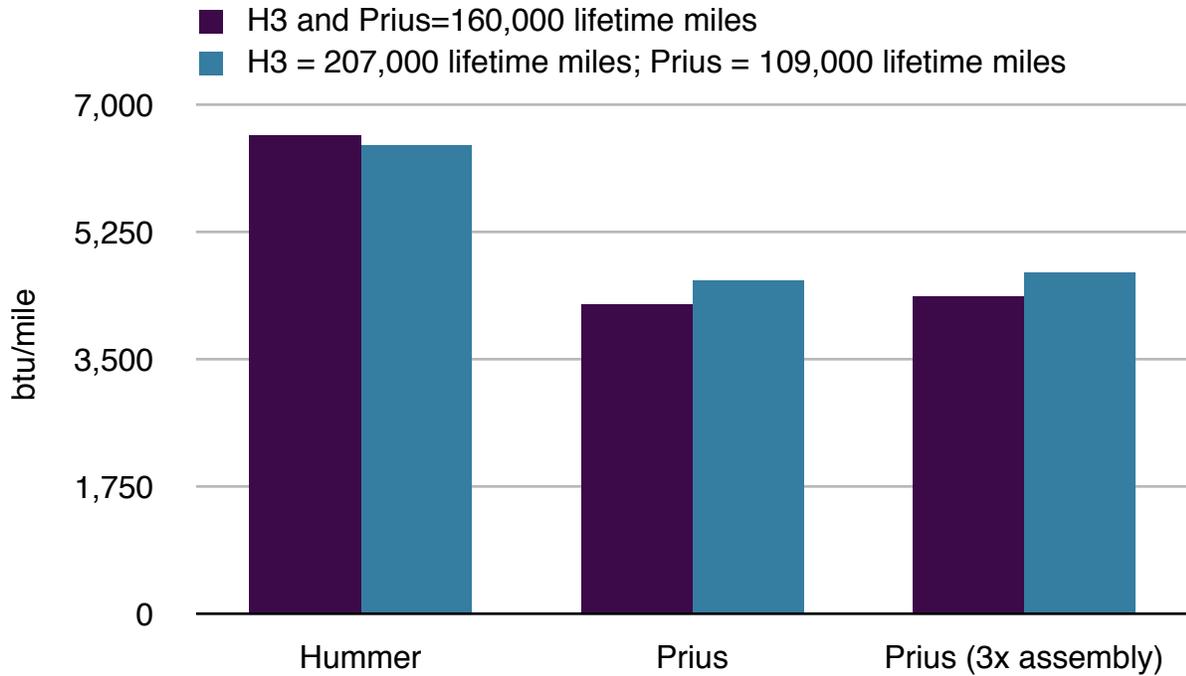


Figure 3: When calculating impact per mile, CNW’s assumptions push the Prius and Hummer closer together, but the model, using the most widely scientifically accepted inputs, still calculates that the Prius has less impact than the Hummer per mile.





We recognize that the GREET model does not include the transportation of the materials used to make the car, which could be a significant contribution. RMI plans on continuing to develop our capacity for vehicle lifecycle analysis, including the greenhouse gas and energy ramifications of transporting materials, in the near future. However, since the components of the Prius, except for the NiMH battery and Hybrid drivetrain, are approximately the same as the Hummer, and since the Hummer contains many more pounds of metal than the Prius, we do not believe the difference between the vehicles' materials transportation will be a more significant issue than that of fuel economy.

All questions, comments, or contributions to this report and RMI's lifecycle analysis capacity are welcomed by the authors: hhauenstein@rmi.org and lschewel@rmi.org.