Does the Energy Paradox Apply to Heavy Trucks?

Are Heavy Truck Buyers “Econs” or “Humans”?

David L. Greene
Oak Ridge National Laboratory
Howard H. Baker, Jr. Center for Public Policy
The University of Tennessee

Energy Use and Policy in the US Trucking Sector
Resources for the Future
October 10, 2012
Washington, DC
The usual prima facie evidence for an energy paradox (under-investment in energy efficiency) can be found in the NRC’s 2010 study. (EPA standards call for 9% to 23% reductions in fuel consumption.)
Two modes of thinking:

- **System 1:**
  - Operates automatically and quickly, with little or no effort and no sense of voluntary control.
  - Has vast resources of learned associations and skills.
  - Continuously generates suggestions for system 2: impressions, intuitions, intentions, and feelings.

- **System 2:**
  - Associated with the subjective experience of agency, choice, and concentration.
  - When we think of ourselves, we identify with system 2.
  - Allocates attention to the effortful mental activities that demand it, including complex computations.
  - Is lazy and not particularly alert; normally in low-effort mode.
  - Most of the time adopts suggestions of system 1 with little or no modification.

“In summary, most of what you (your system 2) think and do originates in your system 1, but system 2 takes over when things get difficult, and it normally has the last word.” (Kahneman, 2011, p. 25)
In-depth interviews with 59 California households about fuel economy and car choices found none who engaged system 2. NONE. (Turrentine and Kurani, 2007, Energy Policy)

- Few households mentioned fuel economy when discussing vehicle purchases.
- At least 14 households included one or more financial services professionals or individuals with high quantitative skills.
- Asked about willingness to pay for a 50% increase in fuel economy:
  - Many “…were not telling us what they were willing to pay…but were rather guessing how much it would cost.”
  - Nine admitted guessing or not understanding the question.
  - Six based their answers on the cost of options or comparing types of vehicles.
  - Some used the price premium for hybrids.
  - A few offered large round numbers without explanation.
- Asked about payback periods:
  - Almost two-thirds could not offer a payback period. “I would never have thought about it that way.”
- System 1 often answers a related question when presented with a question for which it has no answer.
System 1 is loss averse.

• “When directly compared or weighted against each other, losses loom larger than gains. This asymmetry between the power of positive and negative expectations or experiences has an evolutionary history. Organisms than treat threats as more urgent than opportunities have a better chance to survive and reproduce.”

• (Kahneman, 2011. *Thinking Fast and Slow*, p. 282)
Choice of optimal fuel economy for a vehicle is a complex problem with an important structure:
Net benefit = Future Benefit - Upfront Cost.
In general Net Benefit << Future Benefit or Upfront Cost.

Assumes cars driven 15,600 miles/year when new, decreasing at 4.5%/year, 12% discount rate, 14 year vehicle life, $2.00/gallon gasoline, 15% shortfall between EPA test and on-road fuel economy.

NRC, 2002, Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards
Your mileage may vary.
Future energy prices are also uncertain. Econometrically speaking, oil prices have been a random walk. Hamilton, *The Energy Journal*, 2009, v. 20, no. 2, pp. 179-206.
Quantifying uncertainties about fuel prices, realized fuel economy, vehicle use and vehicle life reveals paying up front for fuel economy to be a *risky bet*.

![Distribution of Net Present Value to Consumer of a Passenger Car Fuel Economy Increase from 28 to 35 MPG]

“We concluded from many such observations that ‘losses loom larger than gains’ and that people are loss averse.”
“The ‘loss aversion ratio’ has been estimated in several experiments and is usually in the range of 1.5 to 2.5.” (Kahneman, 2011, p. 284)
“A bird in the hand is worth two in the bush.”
Integrating the loss aversion function with the probability distribution of NPV causes the expected benefit to disappear. 
There’s no “there”, there.
Independent owner operators behave like “Humans” but corporations might behave like “Econs”.

- “Organizations are better than individuals when it comes to avoiding errors because they naturally think more slowly and have the power to impose orderly procedures.
- “Whatever else it produces, an organization is a factory that manufactures judgments and decisions.”
  (Kahneman, 2011. Thinking Fast and Slow, pp. 417-418)
- Or are corporate decision makers just people, after all?
We don’t know.

• Maybe trucking firms base their decisions on numerical calculations of optimal fuel economy, based on expected net benefits but:
  • There has been no standard fuel economy test and their mileage will still vary.
  • Fuel prices are still a random walk.
  • Fuel economy is still a risky bet.
  • And at least some truck buyers are “Humans”.
Thank you.
Uncertainty/loss aversion bias is also consistent with manufacturers’ belief that consumers will pay for only 2-4 years of future fuel savings.