Creating a Green Baloney Detection Kit for Green Claims made in the CNW report Dust to Dust - The Energy Cost of New Vehicles From Concept to Disposal

by

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2-A ABSTRACT

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From Concept to Disposal

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ABSTRACT

In order to assess the veracity of a green claim made by CNW marketing research Inc., I created a green baloney detection kit. It will serve as a guiding post by which anyone can assess the potential environmental impact of any action taken on the basis of the claims made by CNW in their dust to dust report. In their report they state that after doing an extensive life cycle analysis of several cars sold in the United States in 2005, they found that high fuel economy did not necessarily correlate to a smaller environmental impact, but rather the biggest contribution to the environmental impact of automobiles is in their end-of-life disposal. My green baloney detection kit will be an adaptation of Carl Sagan's original baloney detection kit, which is a series of probes which serve as a pillar for detecting fallacious arguments or claims. My enquiries show that the Dust to Dust report does not pass the green baloney detection kit and with it non-technical environmentally conscious automotive consumers can determine that the claims made by CNW are not scientifically sound and so their decisions should be based on those claims.

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1. Introduction

1.1. Green Baloney Detection Kit

I will design a green baloney detection kit for claims made by CNW detailed in their Dust to Dust report, about the environmental impact of cars and trucks based on life-cycle analysis. My green baloney detection kit will be based on Carl Sagan's original Baloney detection kit, but applied specifically to CNW's green claim. Furthermore, it will provide a framework under which anyone can assess a green claim in order to determine its authenticity. More importantly it will enable people to make informed decisions about how their actions might affect the environment. In recent times, consumers are concerned about the environmental impact of consumption decisions that they make because of a wider national and global green movement. However with a plethora of claims and counter-claims about which choices are greener, and with disputing parties making claims seemingly based on scientific analysis and heavy laden with scientific jargon, it makes it difficult for the lay consumer who wants to be green to know who is right. It is a good idea for non-technical people to be able to have tools to decipher for themselves, which actions on their part would really make a difference and depart from business as usual. Just as Carl Sagan developed the baloney detection kit for claims in general it is my aim with some adaptation from his work as well as adaptation from accounting models used for environmental impact analysis, to design a green baloney detection kit. It will provide a framework for assessing green claims in a simple manner, and will be easy to use by different parties regardless of background or prior knowledge.

1.2. CNW Research Paper

In recent years fuel economy has been one of the most important considerations for reducing the environmental footprint of cars. This is because the belief is that the vehicles have their biggest impact on the environment during the use phase. The reason being that internal combustion engines take in large amounts of fossil-based fuels which result in high levels of emissions. CNW Marketing Research Inc. did an in depth dust to dust analysis of thousands of cars sold to Americans in 2005 and concluded that fuel economy should not be the priority when looking at the environmental impact of cars. This is because looking at the life cycle of automobiles from a dust to dust point of view, cars with the highest fuel efficiency do not necessarily have the smallest environmental impact. The cars were ranked using an environmental/societal cost per mile driven (2005 dollars/mile) as the metric. The highest ranked car was the scion xB costing the environment only $0.478/mile driven with a total lifetime miles of $189,000, and the worst ranked car was the Maybach by Mercedes Benz costing the environment $11.582/mile driven with a lifetime mileage of 257,000 miles. Hybrid cars such as the Toyota Prius and the Honda Accord hybrid were ranked more environmentally harmful than premium sport utility vehicles like the Hummer H2 and H3. The Toyota Prius costs $3.249/mile with lifetime miles of 109,000 miles and the Honda accord costs $3.295/ mile with a lifetime mileage of

117,000. The hummer H2 costs $3.027/mile and has a lifetime mileage of 197,000 and the Hummer H3 costs $1.949/mile with a lifetime mileage of 207,000 miles.

To calculate the cost per mile, the total cost of planning, designing, producing, marketing, selling, operating and disposing of the car was found and this was divided by the total lifetime mileage which as you can tell differs for different cars. The data was obtained through the Society of Automotive Engineers papers, manufacturer and supplier records, CNW's own previous research as well as through interviews of plant workers, car users etc. It is important to note that some of the pieces of information that went into the calculations included things like transportation at all levels of distribution, dealer and employee driving distances to work, electricity usage per pound of material used in each vehicle, supplier as well as brand manufacturer energy consumption, use of materials (steel, plastic, light weight steel, aluminum, etc.). The reason why the hybrid cost so much more than comparable non-hybrid models is the manufacture, replacement and disposal of such items as batteries, electric motors (in addition to the conventional engine), lighter weight materials and the complex power package is very expensive and energy intensive[1]. The different categories of costs that were added together to obtain the total energy cost of a vehicle are as follows, design and development, manufacturing, transportation to retail, dealership expenses, administrative support, recylables, reusables, and non-recyclables, lifetime repair and maintenance, and fuel use/economy. According to the CNW paper, the largest contribution to societal energy costs of a vehicle, are in its end of life disposal, be it recycling, re-use, or other form of disposal.

2. Background

2.1. Baloney Detection Kit

The Baloney Detection kit designed by Carl Sagan, is a tool for testing arguments and claims made by a party and can be used for detecting fallacious and fraudulent arguments. This kit was designed for general scientific claims made by any party. General tenets of the kit include these set of questions[2] that can be explored to see whether a claim is true

- How reliable are the sources of this claim? Is there reason to believe that they might have an agenda to pursue in this case?
- Have the claims been verified by other sources? What data are presented in support of this opinion?
- What position does the majority of the scientific community hold in this issue?
- How does this claim fit with what we know about how the world works?
- Is this a reasonable assertion or does it contradict established theories?
- Are the arguments balanced and logical? Have proponents of a particular position considered alternate points of view or only selected supportive evidence for their particular beliefs?
- What do you know about the sources of funding for a particular position?
- Are they financed by groups with partisan goals?

- Where was evidence for competing theories published? Has it undergone impartial peer review or it is only in proprietary publication?

Since Carl Sagan's work is relevant to general scientific arguments, it can be applied to green claims as well to test the scientific robustness of the claim. Further scientific tools used in Life Cycle Analysis can then be also used to explore whether end of life energy requirements are the greatest contribution to the the environmental impact of an automobile as suggested by CNW.

2.2. Life Cycle Analysis

Life Cycle analysis (LCA) of a product or service gives an assessment of the environmental impact of that product. The fact that it is a life-cycle analysis requires that the environmental impacts, through-out the "lifetime" of the product/service are included. These range from material gathering, manufacture, distribution, operation, and disposal. All scientific life cycle analysis must comply with the ISO 14040 to 14044 series of standards which provide process requirements for life cycle assessment studies. The first step in such a study is to determine the goal and scope of the analysis, and thus set-up the boundaries. In theory boundaries start from the earth as the source and return to the earth as the sink. However it is acceptable to set-up narrower system boundaries, as long as they are not shifting and clear equivalent comparisons can be made. Since evaluation is focused on a service or product, a functional unit must be drawn as part of drawing the goal and scope.

In the life cycle inventory (LCI), tracking is done of materials with respect to the functional unit of the product. It is important to note that both inputs such as raw materials, energy, and chemicals as well as outputs such as air emissions, water emissions and solid waste are considered. Furthermore time stands still. The impact analysis involves accounting for the contribution to impact categories such as global warming potential, energy use, acidification among others. Some of the issues that are important to consider are weighting impacts, normalizing and impact aggregation. Weighting impacts allows you to assign relative importance to different impacts. Normalizing allows you to have the same unit for each impact and impact aggregation allows you to add up the different impacts. According to the ISO standards these manipulations are voluntary. Lastly life cycle interpretation identifies relevant issues, evaluates results, draws conclusions and/or makes recommendations from the impact assessment or LCI study.

It is important to note that previous life cycle analysis of automobiles have not considered such a wide variety of cars. CNW's paper is the first to do a comparative study on such a wide variety of vehicles. In the paper "A life cycle inventory of a generic US family sedan"[3], after doing a life cycle inventory of a fictional vehicle which was a combination of the 1995 Intrepid/Lumina/Taurus, Sullivan et al. concluded that the use phase had the largest energy usage at almost 850GJ and end of life had the least energy usage with less than 20GJ[3]. This conclusion is consistent with an Environmental Input Output Life Cycle Analysis (EIO-LCA)[4] on automobiles done by Hendrickson et al, which concludes that the use phase has an energy value of 1,100GJ, and is once again the largest contributing factor to the environmental impact of a car. The general consensus on environmental lifecycle analysis of automobiles is that the use phase provides the highest environmental impact. It is therefore necessary to delve deeper into the CNW report to determine what extraordinary justifications they have, for why their extraordinary conclusions and further to delineate these to a lay consumer who wants to know what to believe.

3. Methodology

3.1. Details of CNW Report

I first picked out samples of the data that is provided by the CNW report to see where the biggest energy contributions could be found. I graphed the data provided, aggregating several groups see if I understood the methodology for their calculation. This graphical representation also gave me an idea of the relative weights of the different contributions to the total lifetime energy cost. Furthermore, I delved into report and produced the material flows diagram and teased out the boundary conditions for their analysis. I additionally delved into the report to see what kinds of accounting explanations and justifications they had for their methodology for gathering data. This allowed me to better understand the intricacies of their methodologies and also gave me insight on what to critique.

3.2. Other work on Life Cycle Analysis of Cars

As already stated the results and conclusions from the CNW report are very different from other research done on life-cycle analysis of automobiles. Thus I looked at preceding life-cycle analysis studies done on automobiles to see where the discrepancies between the CNW methodology and accepted scientific methodologies lie.

3.3. Green Baloney Detection Kit

After disintegrating the Dust to Dust report and doing my own background research I then put together a list of queries for my green baloney detection kit. These questions when answered show the intrinsic absurdities in CNW's claim. Also I applied Carl Sagan's Baloney detection kit as it currently stands to the CNW report. The information I used for this is found in the appendix of the Dust to Dust report as well as correspondences between Art Spinella, the CNW CEO and other concerned enquirers found on the CNW website. Attempts to contact Mr Spinella haven't as yet resulted in any responses.

4. Results and Discussion

4.1. The CNW Life Cycle data

It is important to note that the only environmental impact measured in the Dust to Dust report is energy use, reported as a cost of energy per mile driven of the car. This method is dissimilar from other research into life cycle analysis as, usually a more holistic view of the environmental impact of a product is obtained by counting a number of different impacts such as Global warming potential, Acidification, Nitrification, Toxic air and water releases, and economic activity. This provides a framework for possibly weighing the different impacts by relative importance and thus having a full picture of environmental impact. However since the Dust to Dust report only counts energy use, all comparisons done in this report would be with other research done on life cycle energy use of automobiles. While it might not be best to generalize the type of cars that made the top ten most energy efficient cars in the Dust to Dust report, it is safe to say that all of them apart from the Jeep Wrangler as shown in Table 1 are economy compact or subcompact cars.

***Table 1**: 10 most energy efficient vehicles from the Dust to Dust report*[1]

Car	Lifetime Energy Cost $/mile	Total Lifetime Miles
1. Scion xB	0.48	189,000
2. Ford Escort	0.57	192,000
3. Jeep Wrangler	0.60	207,000
4. Chevrolet Tracker	0.69	153,000
5. Toyota Echo	0.70	157,000
6. Saturn Ion	0.71	161,000
7. Hyundai Elantra	0.72	162,000
8. Dodge Neon	0.73	148,000
9. Toyota Corolla	0.73	169,000
10. Scion xA	0.74	156,000

The category of cars that made the bottom 10 least energy efficient cars according to CNW are luxury or premium with some of them being sports cars.

***Table 2**: 10 least Energy Efficient vehicles from the Dust to Dust report*[1]

Car	Lifetime Energy Cost $/mile	Total Lifetime Miles
1. Maybach	11.58	257000
2.Volkswagen Phaeton	11.21	241000
3. Rolls-Royce	10.66	273000
4. Bentley	10.56	271000
5. Audi allroad Quattro	5.59	202000
6. Audi A8	4.96	214000
7. Audi A6	4.96	189000
8. Lexus LS430	4.73	223000
9. Porsche Carrera GT	4.53	186000
10. Acura NSX	4.45	192000

Car	Lifetime Energy Cost $/mile	Total Lifetime Miles
1. Accord Hybrid	3.295	117000
2. Prius	3.249	109000
3. Civic Hybrid	3.238	113000
4. Escape Hybrid	3.178	127000
5. Insight	2.939	109000

Table 3: *The relative rankings of hybrid vehicles in the dust to dust report.*[1]

A cursory glance at the data provided in this table shows that the metric for ranking the cars, dollars per mile travelled can easily be manipulated by the value of total lifetime miles. The report provides untenable assumptions for the differences in total lifetime miles given for the different cars. While it is reasonable that different cars have different lifetime number of miles travelled the discrepancies are too large to be justifiable. Some of the assumptions given for differences in lifetime miles include different demographics of buyers of the different kinds of cars, as well as the fact that some car in particular hybrid vehicles are considered secondary vehicles in most households, whereas other cars such as SUV and luxury cars are considered primary vehicles and so are driven more often. All the total lifetime mile allocations are obtained from extensive research and interviews with real users states the report.

The most energy efficient car according to the CNW report is the scion xB. The graph of total energy contributions is show in figure 1. As can easily be observed from the graph, the total energy cost of the xB is very low. While a good number of the energy contributions are negligible the most significant ones are fuel use, recyclables, non-recyclables, reusables.

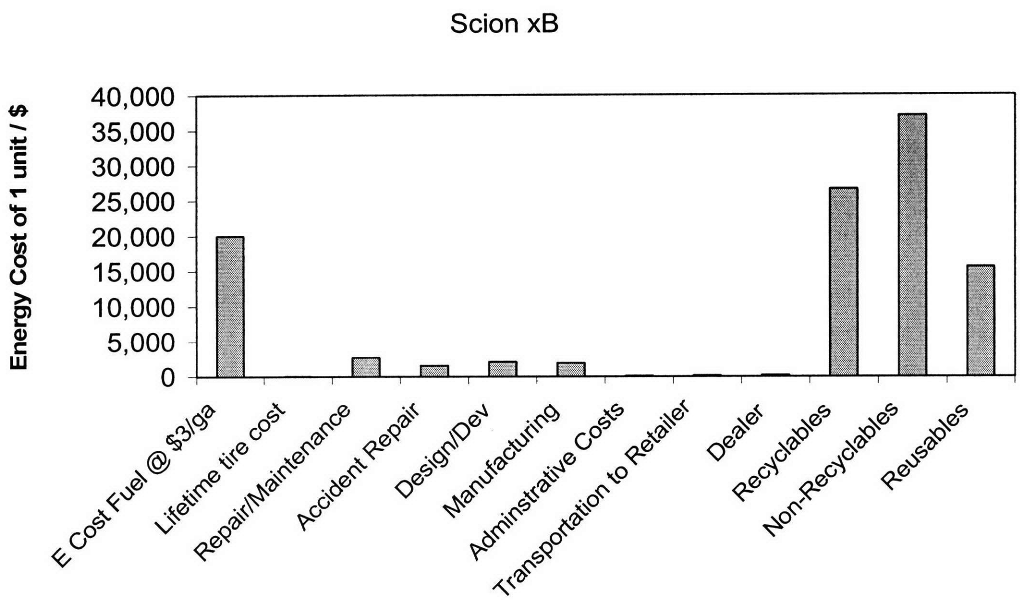

***Figure 1**: Graph showing different contributions to energy cost for Scion xB, CNW's most energy efficient car*

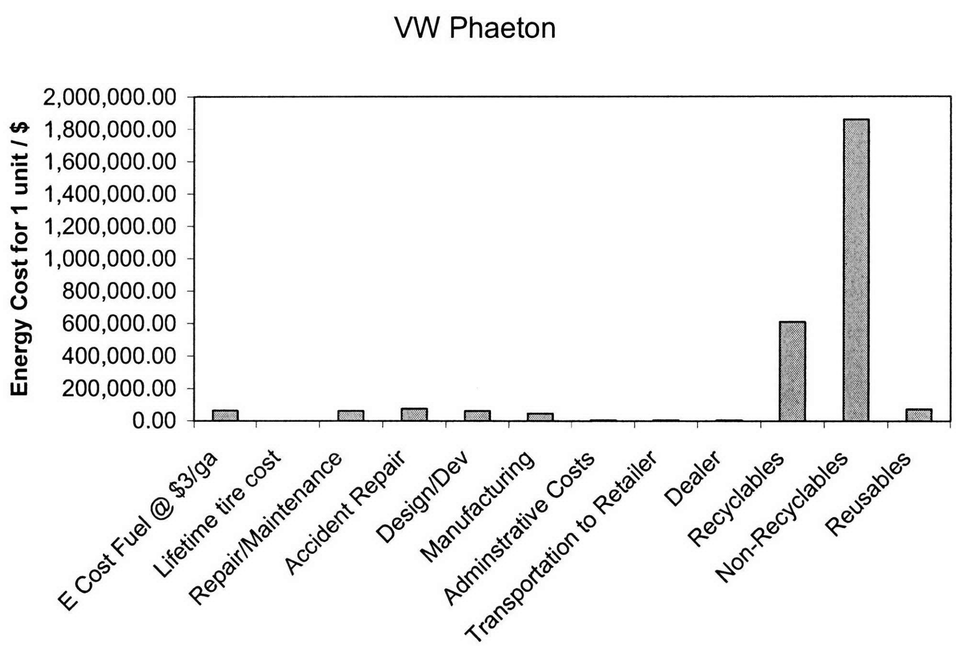

***Figure 2**: Graph showing the different contributions to energy cost for VW Phaeton, one of the least energy efficient cars in the report*

Comparing the graphs in figures 1 & 2, we can tell that the there are great differences in total energy cost between the two cars. While the Scion xb costs a total of about $100,000 in energy use over its lifetime the phaeton costs astronomical close to $3,000,000. It is difficult to image that the energy cost of one car would be 30 times that of another. Also the fuel costs in the Phaeton have become very insignificant compared to its disposal cost, as the disposal cost dominate the total energy cost of the phaeton. The graph shows that the cost of non-recyclables in the phaeton is approximately $1.8million whereas that in the xB is approximately $37,000.

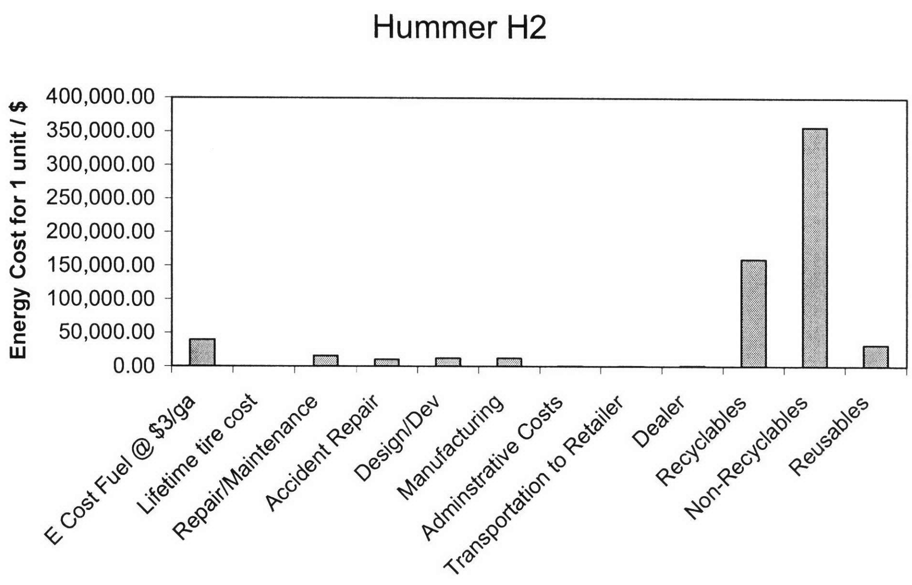

***Figure 3**: Graph showing the different contributions to energy cost for Hummer H2*

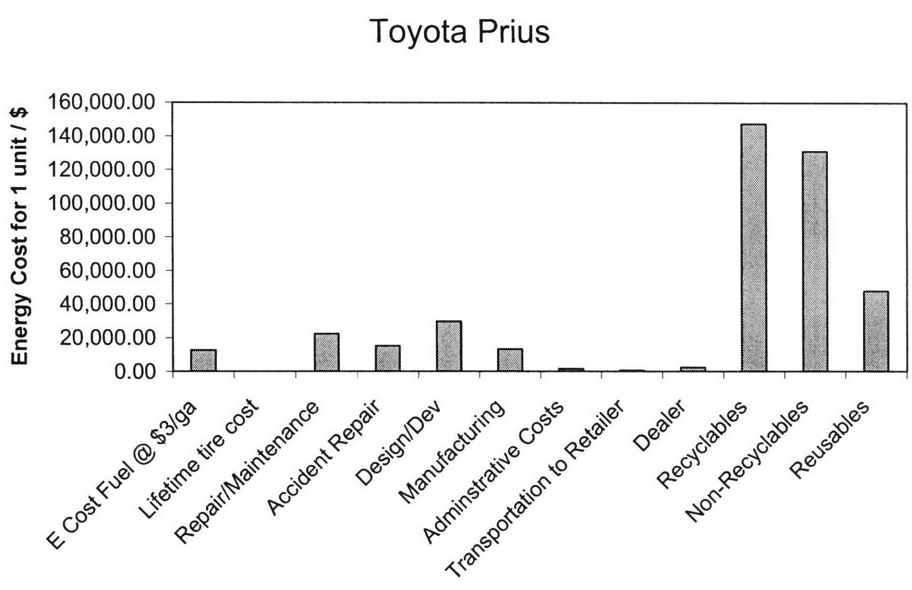

***Figure 4**: Graph showing the different contributions to energy cost for Toyota Prius*

Comparing the graphs in figures 3&4 we see surprisingly that the Hummer H2 even with a much bigger size and less fuel economy is still more energy efficient than the Prius. The key to this puzzle is in the energy use at disposal. The noticeable thing about these graphs as well as all the energy and automobile data that I plotted from the Dust to Dust report is that the energy cost for end of life disposal was significantly greater than the energy cost at other stages in the life cycle of the car. According to CNW the energy use at end of life dominates the total energy use for automobiles. However other research has shown that the use phase contributes the most to energy. Figure 5 below from Sullivan et al shows that the use phase dominates the total energy use of a generic automobile and the end of life energy contribution is almost insignificant.

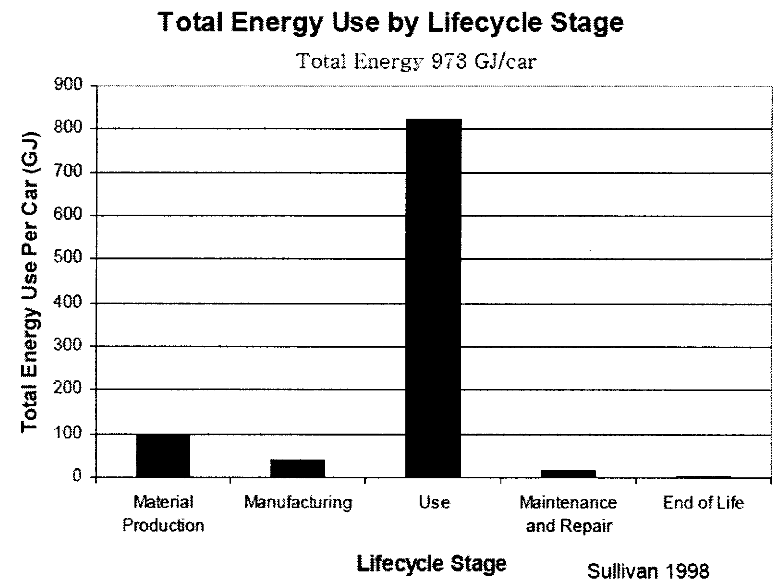

***Figure 5**: Total Energy by Life Cycle Stage*[1]

4.2. Materials Flow Chart

I drew up a materials flow chart using what I gathered from explanations in the report about how they drew boundaries for energy accounting. Some of the boundary conditions I found unusual. For example there was no energy accounting for raw material extraction and production. Their energy accounting began from the design and development of the vehicle.

The total cost of design and development of all the vehicles was amortized over the number of cars produced to date. Thus newer cars with newer technologies, and fewer cars produced to date, had a much higher product development cost than older cars with much higher production rates to date.

Also there are design and development costs assigned to the end of life portion of the lifecycle of the vehicles. This is newer more complex vehicles require more extensive research into methods of recycling. These technologies are still being developed and so all the energy that goes into tinkering with different methods of recycling were also accounted for. It is difficult to determine the appropriate way to do this, as collecting data from all people playing around with ways to recycle a specific kind of material used in cars seems impossible to me. By broadening out the boundaries in such a manner CNW, should be careful as data collection becomes more difficult and also unreliable.

Another interesting point noted from the materials flow diagram is that part of the energy contribution to design and development, manufacturing, and dealership energy comes from the transportation to work of employees at these different life-cycle stages of the vehicle. This is an unconventional method of determining the goal and scope definition for LCA. It is also different from goal and scope definition requirements of ISO 14040:1997[4] which state that the LCA should be done on the functional unit defined. Usually the choice of house location, mode of transportation to work as well as type of car driven is the responsibility of the person and would be accounted for in a lifestyle analysis of that person. Thus it is unconventional to charge the factory where the person works for how the lifestyle choices of that person affect the environment. The energy use charge to the factory should simply be all energy uses at the plant, in particular electricity, and fuel, also all energy uses by employees while they working on manufacturing the car. The energy use and life-style analysis of employees cannot be a contributing factor to the energy costs of a car. Thus CNW neglected to separate the impact of the lifestyles of employees designing developing manufacturing and selling the cars from the energy impact of the car itself.

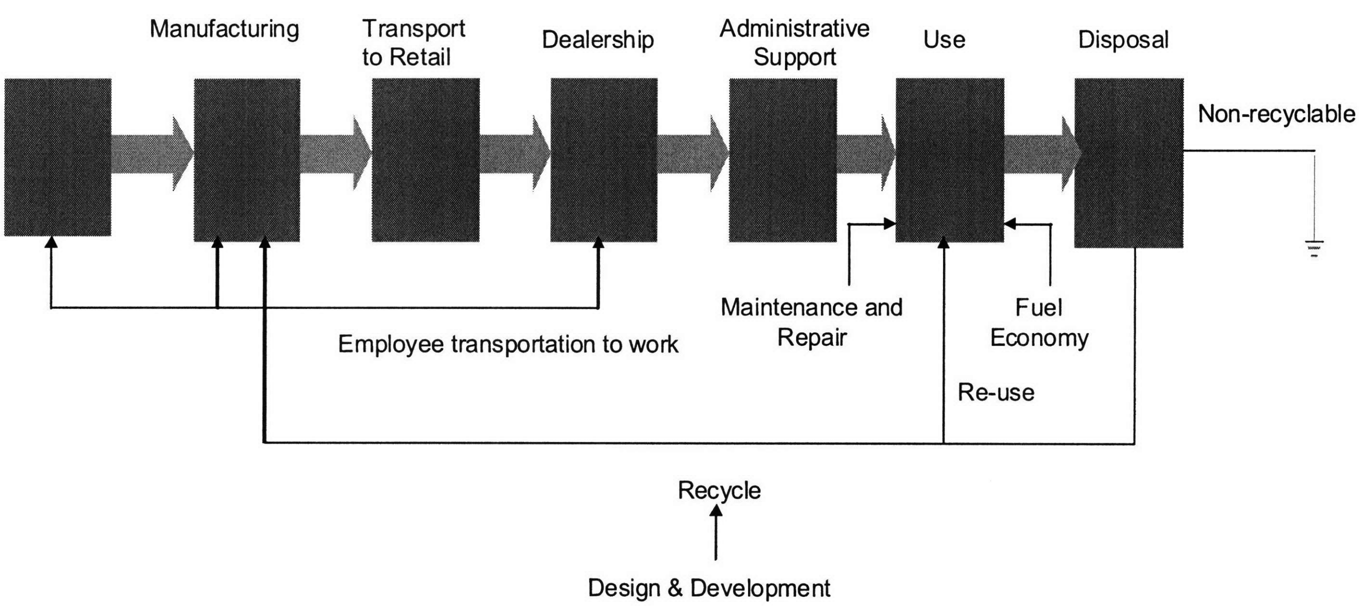

***Figure 6**: Materials Flow Diagram for Dust to Dust Report*

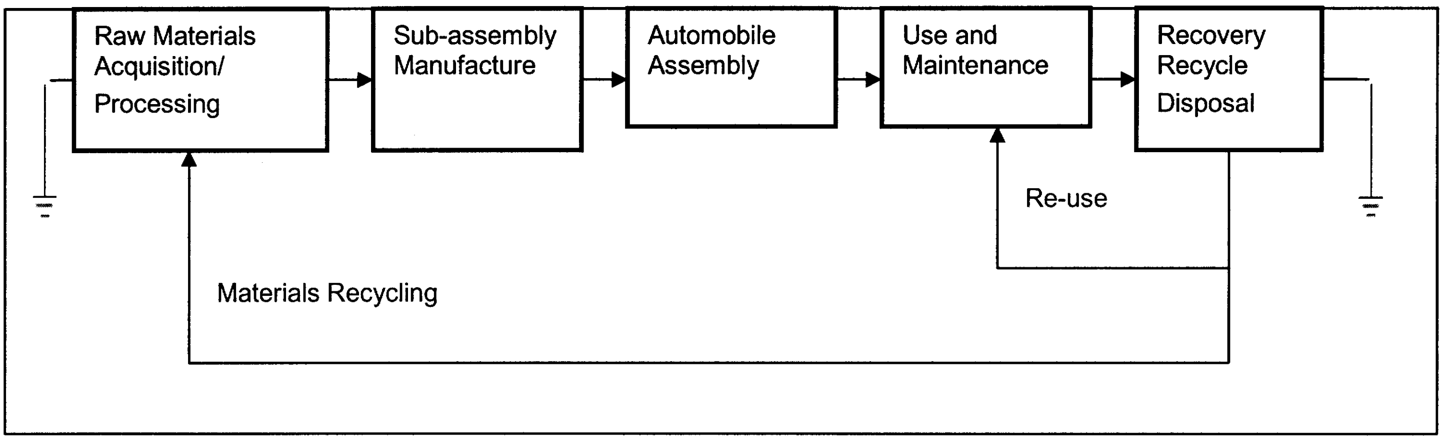

***Figure** 7: Major Life Cycle Stages for the Generic Automobile*[4]

The materials flow diagram shown in figure 7 was obtained from the Sullivan et al paper on life cycle analysis of a generic automobile. We notice here that there are returns to materials production of recycling that would count as a credit in doing energy impact analysis and thus reduce the energy impact of the disposal stage of the life cycle of an automobile. As a result of the huge investment in design and development of recycling technologies considered in the CNW report as well as the fact that it's not clear if they give a credit for materials extracted through recycling, they have very large values for energy cost of recycling.

4.3. Green Baloney Detection Kit

4.3.1. Compliance with ISO Standards

The ISO standards for LCA clearly state the there should be attempts made in any life cycle study to show how they comply with these standards. In the Dust to Dust report, any compliance or non-compliance with the standards would have to be gleaned by the reader. Furthermore the report is not clearly organized by showing boundary conditions, and defining goal and scope, showing data for life-cycle inventory and then showing the methodology for impact analysis. The fact that the report does not comply with these ISO standards means that it is not reliable.

4.3.2. Impact Allocations and boundaries

Since Dust to Dust does not comply with the ISO standards there are unusual boundaries drawn as well as energy allocations as explained previously that resulting in conclusions that are different from those accepted by the scientific community. For example in the case of assigning design and development costs to the recycling portion of the dust to dust analysis results in double counting and thus very large values for recycling energy. Furthermore in counting the cost of transporting employees to work on building automobiles, only a portion of their lifestyles was considered, why not look at the energy from diets of the employees, since they need energy from food to do work? Once again CNW shows absurdities in their choice of boundaries that are not only inconsistent with what is acceptable to the scientific community but also just unjustifiable.

4.3.3. End of Life Accounting

As stated previously one of the biggest discrepancies between CNW report and other research on life cycle analysis is in the end of life values for energy consumption. A more in depth look at end-of-life accounting shows very high energy cost allocation to recycling because of the cost of developing new technology to recycle car components. Broadening the boundary conditions this much as stated earlier definitely causes problems in obtaining reliable data. Therefore is make it more difficult to draw the line as to where to stop. In their case shouldn't they also consider the cost to hospitalize asthma patients, traffic accident victims as well as other people who suffer the effects of having automobiles on our roads.

4.3.4. Unusual Data Manipulation

Delving deeper into the Dust to Dust Report, I notice that there are high design and development as well as manufacturing costs for newer car technologies. The costs of new car technologies are amortized over the short period that they have been in existence. Thus the energy costs of developing the new technology, building and operating a new factory are spread over the current number of cars it has produced. Therefore in a few years when the production increases, the amount of energy cost allocated to each would be less as the total number of cars in existence would be much more. Each car would then carry less weight from design and development costs as well as fixed cost of production. This kind of data manipulation is an example of inappropriate amortization, which unnecessarily heavily penalizes new car technologies.

4.3.5. Inconsistent Data Analysis

The data provided in the Dust to Dust report and as can be gleaned from the graphs in figures 1,2,3 and 4 show that the energy cost at end of life is 4 to 40 times more than the energy cost during vehicle use. However data from the Energy Information Administration (EIA), shows that energy used in the US transportation sector in 2005 was 28,331 trillion Btu, whereas total US energy use for that year was

100,691 trillion Btu[5]. Thus the transportation sector was responsible for approximately 28% of all energy used in the US that year. Assuming trucks rather than cars were responsible for about half of this number. Then cars in their use phase were responsible for 14% of energy use in the US for 2005. For the Toyota Prius for example, if CNW data is accurate, and the disposal phase uses 26 times the amount of energy used in the use phase, this will mean that the end of life phase is responsible for 364% of energy use and in the case of the VW Phaeton, the disposal phase is responsible for 40 times 14% of energy use. This can obviously not be right, as that much energy is not actually being used in the US. This shows that the logic that the CNW researchers are using for the calculation must be flawed.

4.3.6. Lack of Corroboration with other Scientific Research

As I have shown in previous sections of this report, other scientific research in life cycle analysis of vehicles have come up with different conclusions. The mere fact that the rest of the scientific community does not agree with CNW conclusions means that they are required to provide good justifications in order to make these conclusions. However, once again as I have shown earlier their conclusions are not full-proof.

4.3.7. Lack of Transparency on source of funding

While funding information is not provided in the report itself, from correspondences from the CNW CEO with other enquirers about funding, the only response that he gives is that the research is "self-funded". Such vague responses raise doubts about whether the report is financed by partisan groups. Furthermore it raises questions about the agenda the proponents of the claim have. This also makes the reports conclusions less believable.

4.3.8. Lack of Peer Review

It is clear from the dust to Dust report that the CNW did not pull from any other previous research and theories on life-cycle analysis to do their research. Their assumptions and methodology is entirely their own. Furthermore they state clearly that prior to its release to the general public the report had not been seen by anyone. This points to the fact that CNW does not believe in peer reviewing their work. However one of the fundamental aspects of scientific research as reiterated by Carl Sagan is that it must be peer reviewed.

5. Conclusions and Recommendations

While the CNW provides new information by doing extensive analysis of several different cars all together we know, since it looks at only one level of impact even if the results were believable do not provide the full picture of environmental impact of vehicles and so cannot be the only guideline used in deciding the "greenest" car for use. Further more since by the report does not passing the green baloney detection kit the results are doubtful. It is therefore not advisable to make "green" decisions based on the conclusions from the report. In order to make a decision on what cars have the most impact on the environment, other research on life cycle analysis should be considered in order to assess environmental impacts other than energy use as well as have a more accurate picture of the most energy intensive stage of automobiles.

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