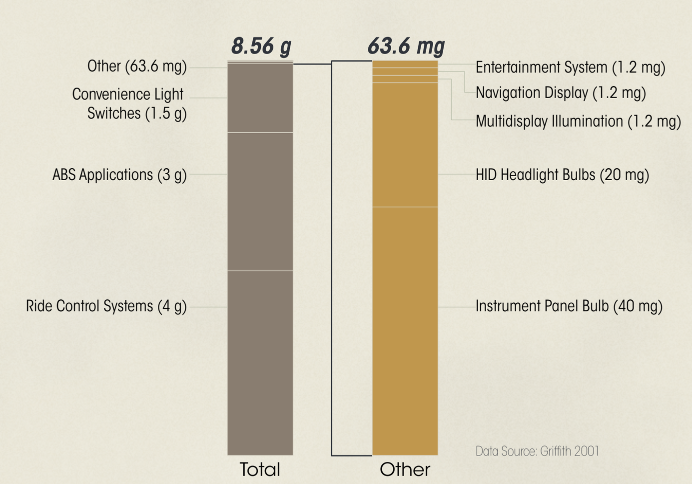
DESIGN FOR RECYCLING UNDER EXTENDED PRODUCER RESPONSIBILITY

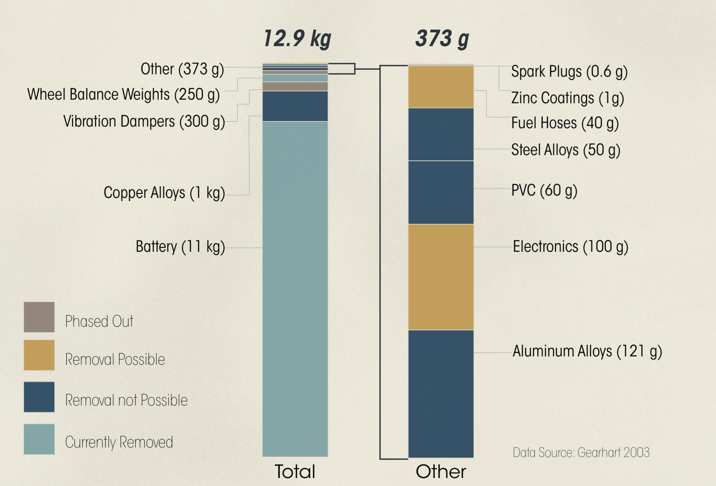
BACKGROUND

Automobiles are manufactured using a variety of environmentally harmful substances including lead and mercury. Extended producer responsibility (EPR) requires auto manufacturers to choose between the redesign of their product vs. the removal of contaminants at End of Life (EOL). In order to make that choice, manufacturers require information about the end of life removal costs.

Historic and Current Automotive Mercury Uses



Historic and Current Automotive Lead Uses



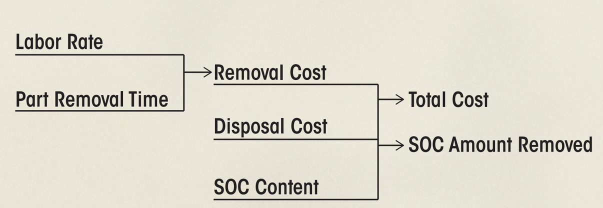
OBJECTIVE

To understand the financial implications of automobile design choices under EPR by considering the cost of removing contaminants during the dismantling stage of the vehicle life cycle.

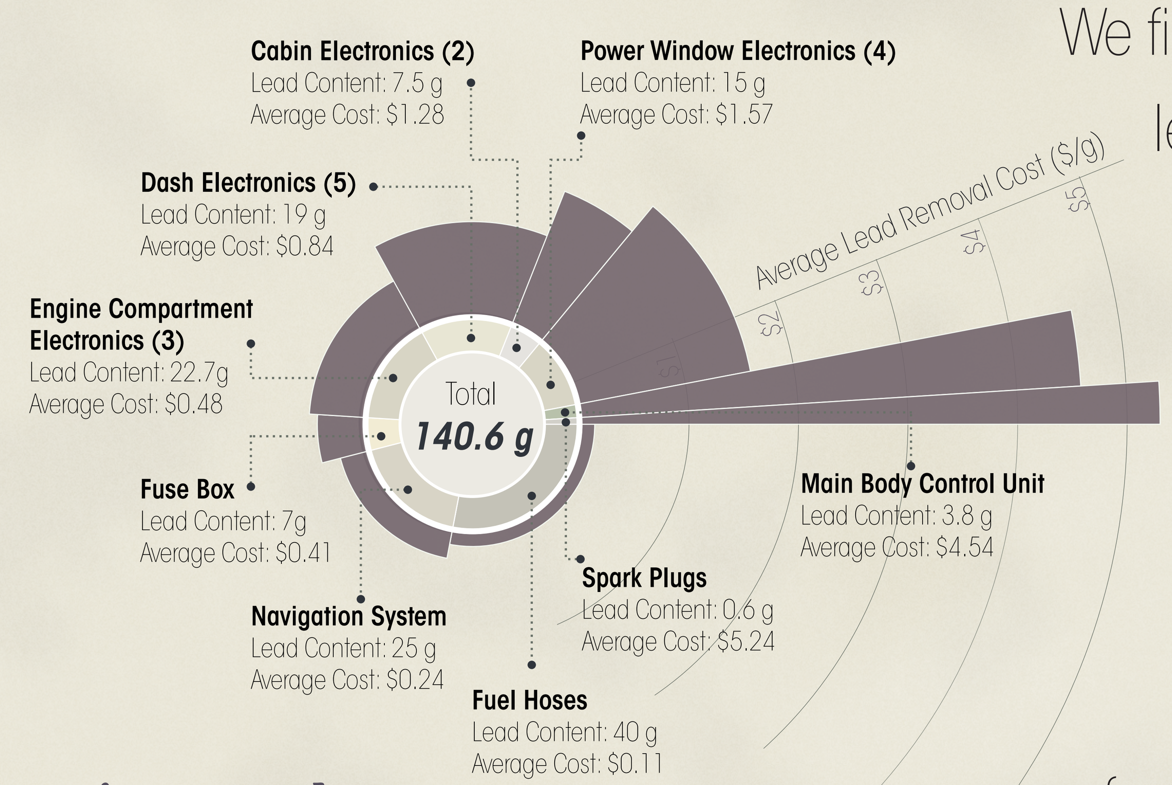
METHODOLOGY

Our model estimates end of life removal costs for lead and mercury by considering disassembly and disposal costs for parts containing those hazardous materials in the 2010 Toyota Camry.

Model Description



RESULTS



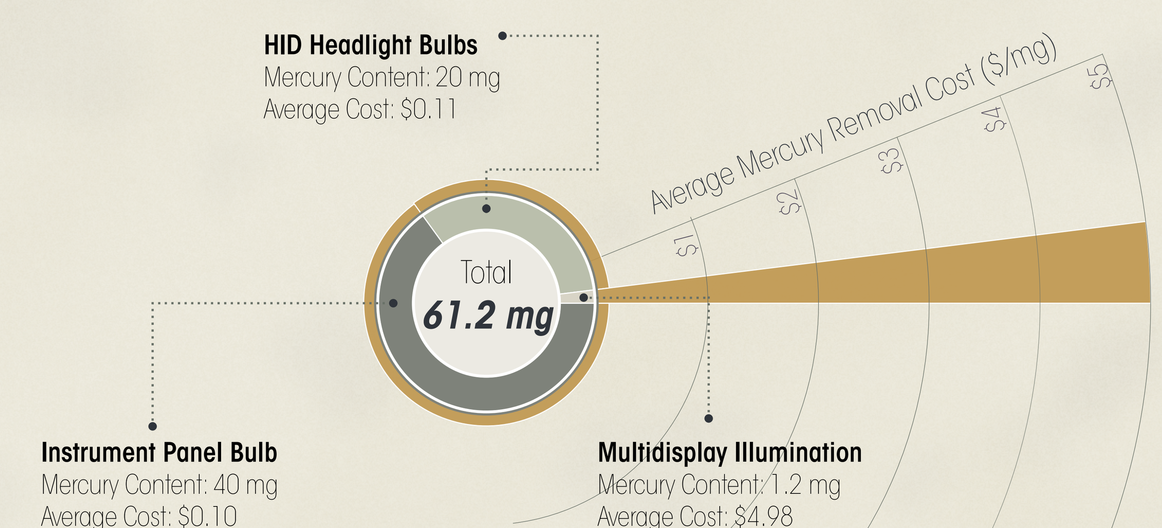
Removing Lead

Total Cost per Vehicle: ***$93.77***

We find that 141 g of lead and 61 mg of mercury exist in parts which can feasibly be removed, but which are not currently removed from vehicles at their end of life. The average cost per gram of lead removal varies from $0.11 for fuel hoses to $5.24 for spark plugs. The average cost per gram removed varies from $0.10 for instrument panel bulbs to $4.49 for multidisplay illumination. The cost to remove the lead is $93.77 per vehicle, and the cost to remove the mercury is $12.34 per vehicle. Across the entire 2010 Camry fleet, this amounts to 46 metric tons of lead, which can be removed at a cost of $31M, and 20 kg of mercury, which can be removed at a cost of $4M.

Removing Mercury

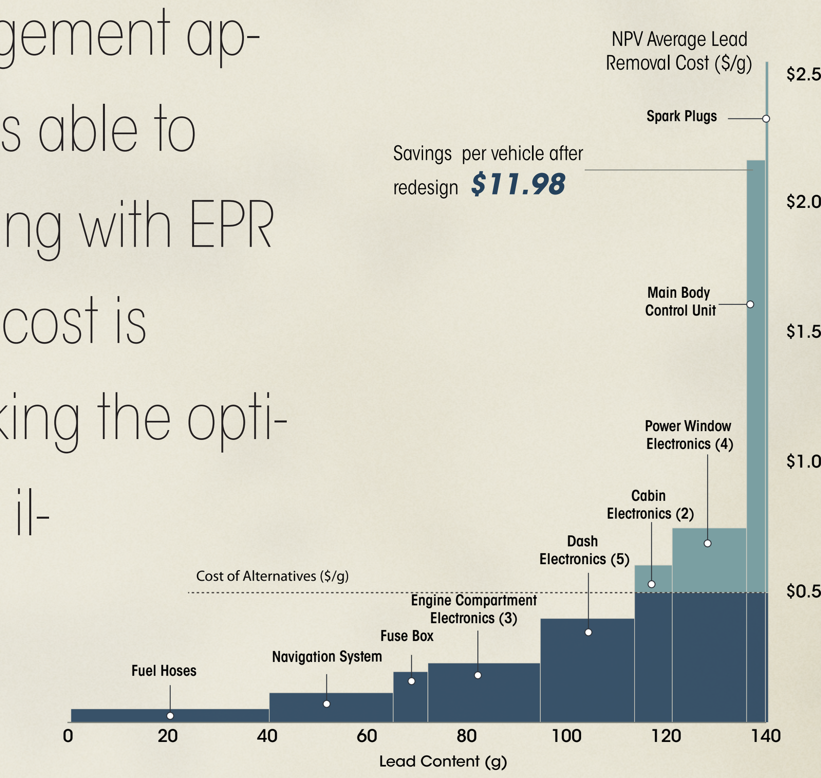
Total Cost per Vehicle: ***$12.38***



ANALYSIS

Implications for Manufacturers

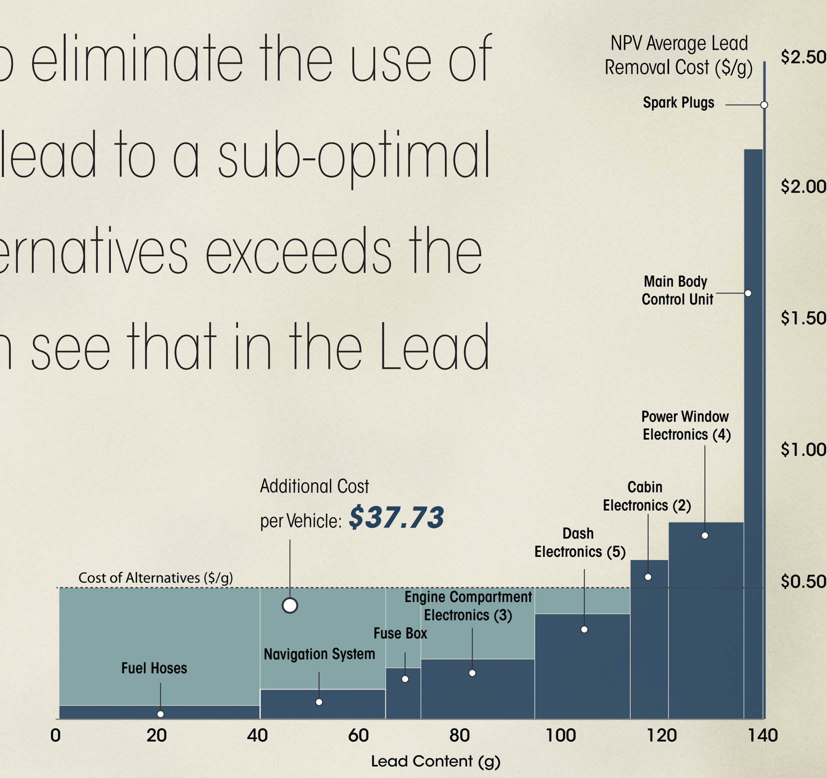
By using a life cycle management approach, the manufacturer is able to reduce the cost of complying with EPR policy. The NPV of the EPR cost is $44.55 per vehicle. By making the optimal design decision in the illustrated scenario, at a $0.50 cost of alternatives, the manufacturer is able to reduce this cost by $11.98 per vehicle.



Cost-Minimizing Design Decision under EPR

Implications for Policy Makers

Requiring manufacturers to eliminate the use of lead-containing parts can lead to a sub-optimal outcome if the price of alternatives exceeds the EOL removal costs. We can see that in the Lead Ban scenario, at a $0.50 cost of lead alternatives, the manufacturer will incur an additional cost of $37.73 per vehicle over the optimal design EPR scenario.



Sub-Optimal Result of Lead Ban

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