Promoting Environment-Friendly Auto Designs

Bundesministerium
Fur Umwelt, Naturschutz und Reaktorsicherheit
German Federal Environment Ministry

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Objectives

• Evaluate levels of environmental impact of various body in white designs.
• Balance environmental concerns and economic development.
• Propose a policy that allows flexibility.
• Encourage manufacturing of vehicles with low environmental impacts through free market forces.
• Raise consumer awareness of environment.
Analysis (1)

• Cost analysis of each design based on BIW material compositions (54 BIW designs).

• Environmental analysis
  – Factors:
    • emissions
    • energy consumption
    • recyclability
  – Methods:
    • Ranking system
    • EPS

<table>
<thead>
<tr>
<th>Design Rank</th>
<th>Emissions</th>
<th>Energy</th>
<th>Recycling</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best</td>
<td>Use: 98%</td>
<td>Use: 95%</td>
<td>Use: 70%</td>
<td></td>
</tr>
<tr>
<td>Worst</td>
<td>Use: 98%</td>
<td>Use: 95%</td>
<td>Use: 70%</td>
<td></td>
</tr>
</tbody>
</table>

Ranking of Various Types of Environmental Impacts

- Weight: 50%
- Weight: 25%
- Weight: 25%
EPS Method

• Similar results than in the previous ranking.
• Need to consider full car weight for more accurate results.
• The assumptions used to calculate the full car weight are very important.

Results

• 3 Classes of vehicles:
  – A: Rule to be used for policy purpose:
    • At least 3 parts must be Al
    • Floor must be Al
    • Roof must be Al
  – B: many have 2 Al parts, remaining parts are mixture of steel and SMC.
  – C: high proportions of steel or SMC parts with one or none Al parts.
Fuel Tax Policy

- Add tax ceiling to gas price
  
  \$ 4/gal + tax = \$ 8/gal

- Discount consumer progressively based on
  “index” from \$8 to \$5.

- Tax ceiling will be increased until substantial
  results are seen.

- Classifications will change with new
  technologies, vehicle designs and regulations.

Fuel Tax Policy Implementation

- Gas price system monitored and enforced by
  electronic systems (chip in car, lock on tank).

- Electronic sensors at country borders.

- Gas Stations discount gas price according to
  car class.

- The system is auto-financed.

- Expected Revenues: \$ 22 Billion.

- Easy to implement if it is expanded to EU.
Manufacturers Ranking Policy

- A company ranking based on BIW average weight and % of recyclability will be published biannually.

\[
Coeff[i] = 0.25 \frac{R[i]}{\Sigma R[j]} - 0.75 \frac{W[i]}{\Sigma W[j]}
\]

- \( R[i] \) = percentage of recyclability.
- \( W[i] \) = BIW weight.
- 0.25 and 0.75, from Rank and EPS Methods.
- Recyclability can be encouraged before the law (95% by 2005) is instated.

Policy Impact: Consumer

- Consumer awareness
  - **Penalty** associated with environmental damage.
  - **Benefit** of preserving the environment.
- Encourage purchase of low impact vehicles.
- Life time reduction of high impact vehicles
  - High gas price vs. spending on new car.
- Result: demand for low index design will increase.
Policy Impact: Manufacturers

- Increase motivation for development of cars that meet low index standards.
- Flexibility allowed for manufacturers to develop designs in each BIW class.
- For same cost, incentive to produce low impact cars.

Policy Impact: Manufacturers

- Public exposure of company ranking encourages “greenness” competition among the auto makers.
- These can both be used as marketing strategies.
- Fuel tax will encourage “green” BIW designs.
Policy Impact: Economy

- Increased tax increases revenue.
- Revenue allocation
  - Reimbursement for costs of electronic system.
  - Aid for relocation because of policy effects.
- Progressively more revenue allocated to public transportation infrastructure.

Policy Impact: Environment

- Lowered emissions (especially use phase CO$_2$)
  -- ~ 6% reduction of total Germany emissions if Class A cars replace all steel cars.
- Lowered energy consumption.
- Promote resource conservation and reduced landfill
  -- Implementation of recycling technology required to achieve goal of 95% before 2005.
Recommendations for Manufacturer

- Increase Al composition in BIW to meet higher environmental standards.
- Implement marketing strategies that demonstrates the benefits of purchasing a Class A vehicle.
- Invest in environmental technologies R&D to meet future regulation standards and to increase market share.

Summary

- Necessity of lowering the current figures of fuel consumption.
- Necessity of improving recycling technology.
- The policies give the free market the power to help achieve the environmental goals.
- The general public will assume the responsibility of environmental protection.
- The recycling regulations will be more severe in the near future -- instigate changes sooner.
The Real Problem

- CO\textsubscript{2} emissions due to transportation has continuously increased while fuel efficiency has improved over the years.
- The real problem is the increased car population.
- Cannot limit car purchasing.
- Can create incentive for efficient car usage.

The Real Data

- Between 1990-1995: +5.5 Million cars
  - Expected for 1995-2010: +30%
- Energy Consumption: -4.1%
  - CO\textsubscript{2} Emissions: -12.5% (1990-1997)
- ELV vehicles: 2.9 million per year.
The Real Solution

- Reorganize carpool and increase public transportation usage
  - Goal
    - Reduce average mileage per person.
    - Reduce fuel inefficiency due to congestion.
  - Strategy
    - Limit speeds at peak engine efficiency.
    - More lanes for high vehicle occupancy.

Conclusions

- Short term need for consumer use of “greener” BIW designs.
- Government limits on the number of cars per capita.
- Long term need for extensive use of public transportation is critical.
Best Case Scenario Goals

• Don’t drive
  – By 2002, take the bus 85%
  – By 2003, use subway 89%
  – By 2004, ride your bicycle 93%
  – By 2005, rollerblades for everyone! 97%
  – By 2006, bioengineer wings for humans 98%
  – Teleportation is the solution by 2007! 99.9%
    (lose some molecules along the way)
  – Replicators need to be invented by 2008 100%
  – By 2010, pollute Mars. 20%
  – 2011: The Earth is declared National Park.