ECE 398GG – ELECTRIC VEHICLES

14. Light Vehicle Policy

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THE GOAL: CLEAN THE AIR

Problem of air pollution from automobile emissions:

- How to solve?
POLICY STRATEGIES IN TECHNOLOGY DEVELOPMENT

❑ Standards

❖ Technology Forcing (TF) - Clean Air Act
❖ Regulatory - Corporate Average Fuel Economy (CAFE)

❑ Incentives - Tax credits, Department of Energy (DOE) grants, purchasing (Government fleet purchases)
The Clean Air Act (CAA) is the comprehensive federal law that regulates air emissions from stationary and mobile sources.

1970 CAA mandated 90% reduction in tailpipe emissions over 4 – 5 years: TF

TF delivers new innovations, but risks and challenges

TF: RISKS AND CHALLENGES

- Targets are too hard to achieve
- Industry could push back saying technology is impossible to achieve
- Uncertain strategy with no guarantees of a technological breakthroughs

The CAFE legislation regulates the average fuel economy of new vehicles sales in US.

It establishes required fuel economy for the entire fleet of new vehicles (in mpg), with separate standards established for passenger cars and light trucks.

Vehicle manufacturers are required to have average fuel economy that meets or exceeds these fuel economy targets or pay a penalty.

ARGUMENTS AGAINST CAFE

- The rebound effect: higher efficiency means lower cost per mile. Therefore, people will drive more, nullifying the fuel savings from efficiency.

- Lighter vehicles are less safe.

50% increase in on-road fuel economy for light-duty vehicles from 1975 to 1995

Would it have happened from then existing market forces? Greene: No, since net cost+benefit of fuel economy improvement is +/- $100, not enough to motivate car buyer

CAFE: HOW IS A MANUFACTURER’S CAFE DETERMINED FOR A GIVEN MODEL YEAR?

- Fleet fuel economy is calculated using a harmonic mean

- For a fleet composed of four kinds of vehicle A, B, C and D, produced in numbers \( n_A, n_B, n_C \) and \( n_D \) with fuel economies \( f_A, f_B, f_C \) and \( f_D \), the CAFE (in mpg):

\[
\frac{\frac{n_A}{f_A} + \frac{n_B}{f_B} + \frac{n_C}{f_C} + \frac{n_D}{f_D}}{\frac{n_A + n_B + n_C + n_D}{f_A + f_B + f_C + f_D}}
\]

ACTIVITY:

- Manufacturer $X$ produces 3 passenger cars models in 2006:

<table>
<thead>
<tr>
<th>Model</th>
<th>MPG</th>
<th>Production Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>28</td>
<td>150,000</td>
</tr>
<tr>
<td>B</td>
<td>27</td>
<td>50,000</td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>10,000</td>
</tr>
</tbody>
</table>

- Is the manufacturer compliant with 2006 model-year CAFE standard (27.5 mpg)?
ACTIVITY:

- Now suppose that manufacturer $X$ has quit making model $C$ and introduced a new model $D$ in 2007:

<table>
<thead>
<tr>
<th>Model</th>
<th>MPG</th>
<th>Production Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A$</td>
<td>28</td>
<td>70,000</td>
</tr>
<tr>
<td>$B$</td>
<td>27</td>
<td>30,000</td>
</tr>
<tr>
<td>$D$</td>
<td>31</td>
<td>120,000</td>
</tr>
</tbody>
</table>

- Is the manufacturer compliant with 2007 model-year $CAFE$ standard (27.5 mpg)?
ALTERNATIVE FUELS: BARRIERS TO BROAD CONSUMERS ACCEPTANCE

- Lack of refueling infrastructure
- High cost
- Lack of vehicles engineered to operate on the fuel
- Difficulty breaking into an established market
- Perceived or real issues of safety and reliability
- Lack of driving range

LESSONS FROM ALTERNATIVE FUELS
(1988 – 2003 POLICIES)

- Range limitation and slow refueling may be the most critical technical barriers
- Niche markets don’t lead to mainstream consumer markets (fleets vs. consumers)
- Incremental benefits to consumers are small relative to conventional vehicle fuels (thus need policy to stimulate interest)
- Infrastructure may limit adoption; why would private sector invest? Clear stimulus from government is needed