COMMERCIALIZATION
FOCUS GROUP INTERVIEW
- Electric/Hybrid Vehicles -

Summary Report for

U.S. Department of Energy
Office of Technology Commercialization

August, 1978

EV-78-C-01-6457

REA

ELRICK and LAVIDGE, inc.

ELRICK AND LAVIDGE, INC.

COMMERCIALIZATION FOCUS GROUP INTERVIEW:

Electric/Hybrid Vehicles

BACKGROUND AND INTRODUCTION

The U.S. Department of Energy (DOE) is engaged in the development of commercialization programs for various energy-related technologies. All have in common the potential for reducing our reliance on imported oil.

As part of the planning process, DOE has contracted with Elrick and Lavidge, Inc., a marketing research firm, to conduct a number of focus group interviews on specific technologies. This report deals with the group interview conducted on the subject of Electric and Hybrid Vehicles.

The analysis of the group discussion which follows is to serve as one input in the finalization of the DOE commercialization program.

By design, the group included participants from varied backgrounds and interests. The objective was to represent all the important aspects and issues which will impact on the future development of the technology. The following individuals attended the session:

1. Representative of NASA
2. Chief Engineer - Electrical Vehicles
   Major Automobile/Truck Manufacturer
3. Representative of Electric Utility
4. Representative of Battery Manufacturer
5. Research Scientist
   Major Oil Company

6. Assistant Dean - Science & Engineering Dept.
   Major University

7. Government Representative
   Dept. of Industry, Trade & Commerce

The meeting took place in Southfield, Michigan, on Monday, July 31, 1978, and lasted approximately three and one-quarter hours. A tape recording of the entire session has been provided to DOE.

The analysis is divided into the following topical areas:

- Problems of Definition
- Commercialization Feasibility
- Future Market Potential
- Proper Role of the Federal Government
- Barriers to Commercialization and Possible Solutions.

The reader should keep in mind that the following report is based on the opinions and attitudes expressed by only seven individuals. The results should, therefore, be viewed as suggestive rather than conclusive.

SUMMARY

The following points summarize material discussed later in the body of the report.

1. Most group members feel that the technology is available today to produce electric vehicles suitable for some personal and commercial uses. However, commercialization on a scale which would have a significant impact on petroleum usage and afford vehicle, component, and infrastructure suppliers a profit will require ...

   (a) government incentives which result in substantially lower vehicle prices and/or operating costs than would otherwise be possible in the foreseeable future--prices and/or costs at least competitive with those of conventional internal combustion engine vehicles

   (b) research and development--particularly to increase vehicle range, increase battery life and reduce battery cost, and generally prove out reliability

   (c) time--for the R&D to produce results and for the necessary sales, promotion, and service support to be developed.

2. Chances of successful near-term commercialization are considered to be greater in the commercial than the personal (consumer/household) market.

3. An "aggressive, leading role" by the federal government will significantly speed up successful commercialization, in the opinion of most group members. Three essential elements of this activity are:

   - R&D
   - Demonstration program
   - Continuing monitoring of marketplace conditions and program progress against goals.

4. More specifically, government involvement as described by P.L. 94-413 and as practiced to date by the Department of Energy is considered appropriate. DOE is felt to have made a good start on a complex, unique problem.

PROBLEMS OF DEFINITION

The group quickly recognized the need to try to agree on some definitions before attempting to answer the question "Is commercialization feasible?" And, there were problems arriving at these definitions.

1. No one in the group was sure what DOE means by the term "commercialization." Some believe successful commercialization would necessarily mean to DOE "significant savings in petroleum consumption." But, what is "significant"? The group was unable to say.

2. A more widely accepted definition of commercialization, and one which DOE certainly implies in its background material, has to do with profitability. That is, commercialization implies that the venture is profitable for those (private sector) establishments directly involved. Interestingly, the invitee who was unable to attend the session--but who responded in writing (see "Appendix")--provided a dictionary definition:

   > Commercialize - To manage on a business basis for profit, to develop commerce in, to exploit for profit.

   But, this definition begs the question of magnitude. The group pointed out that it would be quite conceivable for a few very small manufacturers of vehicles and/or components to make a profit on E/HVs at some future point, yet for the Program to remain miniscule in terms of its impact on petroleum usage.

   The group was never able to settle on a precise definition, but rather suggested this is something DOE should do while providing goals and guidelines for the Program. These goals should be quantified, if possible:

   - How profitable? By what measures? Over what time period or periods?
   - For what proportion of the companies involved? Or, if for the "industry" in total, how is this defined?

- How much impact on petroleum usage?
- When? Over what time period?

3. Another definitional problem has to do with the term "vehicle." Several people pointed out that there are already commercially successful (i.e., profitable to their manufacturers) businesses which involve the production and marketing of battery-powered electric vehicles "for personal and commercial transportation" (DOE's concept statement uses this phrase).

   - Golf cars
   - Lift trucks
   - Personnel carriers used in plants, warehouses, etc.
   - Mine vehicles.

   The group did not believe these are what DOE has in mind. Certainly they do not represent much in terms of transportation-energy requirements, and are moreover established, commercially viable products already.

   The suggestion was that "on the road" be added to the definition, something the group assumed DOE has in mind in any event.

4. Finally, there was a problem understanding what is meant by "hybrid vehicle," even though what seems to be an adequate description was given in the DOE background material. The problem apparently is that none of the group members (at this date) has much knowledge or concern regarding this type of vehicle. Nor was the group able to discuss this concept in any detail during the session.

COMMERCIALIZATION FEASIBILITY

The first, offhand reaction of several participants to the question "Is commercialization of this technology feasible?" was affirmative. It was pointed out that electrical machinery in general is inherently as reliable as or more reliable than

equipment powered by internal combustion engines (ICE). Moreover, there was the feeling that the technology to provide EVs capable of meeting some market needs is available now. Some basic design engineering and field testing "to get the bugs out" is all that is needed to produce a vehicle, or vehicles, that can do certain jobs as well as their ICE counterparts.

But, would this amount to commercialization? Not really, considering the magnitude-of-impact and profitability requirements alluded to earlier.

1. At the present time, EVs (the group agrees with DOE here) would have to be sold to the general public at prices substantially higher than those of the ICE alternatives if manufacturers were to make a profit--unless there were offsetting incentives from the government in one form or another. Without the offsetting incentives, why should consumers buy? What added benefits would they be getting for their extra dollars? None of real significance to many people, it was felt.

   Perhaps a few individuals would be willing to pay more for an extremely quiet, smooth-operating vehicle; and there will always be some true innovators, perhaps some people as well who want to "do something" personally and directly about energy/ecology problems. But, there probably are not enough of these people to make a market of any significance, and certainly not to make one large enough to attract major manufacturers of vehicles, batteries, other components, etc.

2. In the commercial area, the chances of near-term commercialization appear more favorable to the group. But they questioned DOE statements about imminent life-cycle cost parity here. They wonder where DOE secured its figures, and suspect that the data came from U.S. Postal Service experience. If so, they question the validity of the information since "the Post Office doesn't have to pay for its money." Mention was also made of the possibility that data obtained from British experience were used--but are these valid for the U.S.?

As the discussion unfolded, it was recognized that many barriers to successful commercialization do exist. These are discussed in detail in a subsequent section of the report. However, in general, the consensus can be summarized by one man's statement that "it's a real chicken-and-egg problem"--how do you get to the point where a manufacturer can justify investing in the mass-production facilities necessary to get costs to a competitive level? One set of figures mentioned as minimum requirements: Production volume of 100,-000 to 125,000 vehicles; capital investment, $150-million. (Interestingly, it was also indicated that both of these thresholds could be reduced substantially were it possible to offer an EV as an option to an existing ICE model. This approach probably bears serious consideration.)

The above comments notwithstanding, the group seemed optimistic about the possibility of commercialization feasibility, "sometime," with the right incentives and leadership. These (as discussed below) are seen necessarily coming largely from the federal government, or if not that, then possibly from outside the U.S., via the efforts of foreign manufacturers and/or their governments.

FUTURE MARKET POTENTIAL

One group member described a key aspect of the market potential issue by saying that the problem here is a unique one. A significant market for EVs will materialize someday, in any case, owing to rising petroleum prices, petroleum shortages, petroleum usage restrictions, or whatever; but what is needed is to move ahead of natural marketplace forces and create a response --an EV product or products that will meet the market needs when they (inevitably) develop.

However, the group was almost totally unable to react intelligently to DOE descriptions of possible levels of future market potential. One member seemed to reflect the attitude of the group in saying, "We're engineers, not marketing people. We take market projections as givens, and work from there."

One member did say that his company's projections to the year 2000 are similar to DOE's pessimistic figures, though the path is different, with more build-up toward the end of the 1978-

2000 period. Another (an electric utility representative) indicated that his company's studies of the potential impact of EVs on electric demand in their market area suggest an increase of approximately one percent. The time frame here was hazy. Both of these examples seemed to the group to suggest that eventual EV market potential may be quite small in relation to the total vehicle market, and made them pause to wonder whether the results of any program such as DOE has embarked upon can ultimately be worth the effort. Again, however, the group lacked a real sense of comprehension when it came to market potential calculations and goals.

Another key thought that emerged involves the idea of market segmentation, particularly within the consumer (personal-use) market. The group agreed with DOE's thinking that a very substantial share of personal (household) transportation needs currently being met largely by second-plus ICE vehicles could be met by EVs, if not under today's 35- to 40-mile range limitations, then with modestly increased range capabilities which seem quite achievable in the near future. The problem is that consumers are not felt to think in this fashion. They want and expect a "second car" that can meet most or all of their needs, not just "90 percent of them." Furthermore, they probably are not aware that such a high percentage of their requirements involve very limited day-to-day mileage.

So, the problem is to identify, measure the potential of, and then promote successfully one or more segments of the market that have transportation requirements that fit the EV's near-term range limitations and can be made to realize this, or that can be persuaded to reorganize their use of the household's vehicles (including an ICE first car in most cases) appropriately.

PROPER ROLE OF THE FEDERAL GOVERNMENT

The group was virtually unanimous in stating that an "aggressive, leading role" should be played by the federal government. Industry will then cooperate in the effort and be in a position to respond enthusiastically with investment capital, production, and marketing effort "when the economics are there."

P.L. 94-413 is felt to have provided the basis for an excellent start in this direction. Three key aspects of the resulting DOE activity are considered essential:

- R&D
- Demonstration programs
- Continuing study and evaluation of marketplace conditions, relative energy costs and availabilities, equipment development and production costs, program progress toward goals, and realism of goals themselves.

"Create the right climate" is a phrase one member used. To the group, this implied the above activities plus ...

- striving to eliminate "internal conflicts" within the government; e.g., DOE/DOT interfacing problems
- striving to head off or counteract consumer group pressures such as those anticipated from the Center for Automotive Safety when and if efforts are made to relax safety standards as applied to EVs
- avoiding letting the Program become or appear to become so complicated that interested parties sit back in resignation to "wait and see what happens."

Federal government involvement, it is felt, should be approximately as described in P.L. 94-413 and as practiced to date by DOE. DOE was in general commended for taking a "thoughtful, good look" at what is obviously a very complex and unique problem, and the only positive suggestions were confined to matters of detail and execution.

1. Be sure demonstration programs are focused geographically and by market segment. Do not make the mistake, cited by the Canadian representative, of scattering demonstration vehicles so widely that proper sales, service, and other infrastructure facilities cannot possibly develop. Also, where the commercial market is involved, be sure the organizations that receive vehicles receive enough of them, for a long enough time period, to develop real experience. (Do not make the mistake of "letting every Post Office that wants one have one.")

2. Related to the above point, some participants felt that at least some of the demonstration programs should be run as actual test markets, involving "real world" selling, advertising/promotion, service facility development, pricing, etc. This would be so that realistic sales potential figures, obtained under various conditions and marketing programs, can be developed. Other group members felt it would be impossible to do this on the small scale implied by the DOE vehicle demonstration plans for the next several years. But, virtually everyone agreed that demonstration projects should include careful tracking of what happens at the user level ...

   - technical problems encountered
   - actual usage patterns and practices
   - attitudes (likes and dislikes)
   - perceived benefits and limitations
   - service practices and problems
   - vehicle and component life.

3. Do not overlook product engineering (as distinguished from technical R&D) in the development and demonstration efforts.

   - Recognize that the U.S. public has 50 or more years' experience operating and maintaining ICE vehicles. EVs should be made as similar as possible in terms of how they operate (brake, steer, shift, etc.), where the controls are located, how the vehicles are maintained, and so forth.

   - Do not fail to recognize the apparently mundane problems--easily surmountable perhaps, but still problems--that exist with things like battery chargers, many of which will apparently over-charge if not used or designed properly.

4. At the same time, keep in mind (and DOE is perceived to be doing this) that it is probably impractical to attempt to try to replicate the ICE vehicle in terms of design, standards, etc., much less performance. Such an objective is "the long route to go"--if it can be gone at all.

5. On the technical side, but without going into detail, the following R&D areas were suggested for emphasis:

   - Short- and long-term battery development (It was commented that battery breakthroughs have been "imminent" for the past 10-20 years, without much practical progress having been made with respect to developing the kinds of capacity and life needed for EVs.)

   - Manufacturing (automatic winding in particular) of large motors such as will be required for EVs

   - Use of electronics in EV systems

   - Resolution of the question whether AC or DC should be used in the propulsion system.

6. Several participants asked why DOE does not contemplate developing and using electric buses as demonstration vehicles. They recognize that the petroleum savings potential is insignificant, but feel the bus offers a means for large numbers of people to see firsthand what can be accomplished with electric/battery propulsion, without requiring them to risk a purchase or make special investigative efforts.

7. Finally, there was some concern that the DOE Program may not provide adequately for monitoring foreign developments:

   - What foreign manufacturers are doing
   - What foreign governments are doing
   - What is happening in foreign vehicle markets.

   The Japanese, in particular, were mentioned here. "We don't know what they're doing, but we're worried," was one comment. "They're good at coordinating programs," was another.

   Several thoughts are implied by these comments:

   - The U.S. may be able to benefit from emerging foreign technology.

- The U.S. may be able to benefit from foreign manufacturers' market-development experience.

- Foreign markets for EVs may develop more rapidly than U.S. markets and offer U.S. manufacturers an opportunity to achieve attractive sales levels (via export) sooner than they could if confined to the domestic market.

- Foreign developments are a potential threat. As with compact cars some years ago, foreign manufacturers may be faster to recognize an opportunity in the U.S. and develop the products and marketing programs necessary to capitalize on it.

BARRIERS TO COMMERCIALIZATION AND POSSIBLE SOLUTIONS

A considerable amount of time and attention was spent discussing this issue during the session. Some relevant comments were made by respondents in conjunction with other topics, but the major discussion of this issue was focused around a specific review of the personal and commercial vehicle matrices incorporated in DOE's analysis of the barriers and potential solutions relative to successful commercialization.

After a few minutes of discussion, it became quite apparent that participants did not fully understand how to interpret the matrices and the information therein. Even after this was explained, most members were unable or unwilling to think through and evaluate the material explicitly.

However, it was possible to generate useful discussion of the listed barriers in terms of their perceived importance and the completeness of the list. Following this, possible solutions/actions were reviewed with respect to those barriers considered to be of major importance (ratings of "4" or "5").

The group's feelings can be summarized as follows.

Personal-Use, Specific-Mission EVs

- Performance

The opinion of the group was that this is probably not as significant a barrier as indicated (4), assuming "performance" means things like acceleration, top speed, maneuverability, etc. The assumption behind this obviously is that usage would involve short, in-town-type trips--that is, that the principal market would involve the kinds of specific-mission uses or segments suggested earlier by the group as well as in the DOE background material.

- Range

This was considered to be as serious a barrier as indicated. With respect to removing the obstacle, the group seemed to think that longer-term rather than near-term R&D is likely to provide the final answer (reversing DOE's assessment). Also, the barrier may be partially alleviated by market demonstrations (to which the group would give a higher "action" rating) if the demonstrations can be made to show significant numbers of people how little they really need extensive range in a second car, or how easily they could modify their use habits to work within the EV's range limitations. (This discussion is also relevant to the "public acceptance" barrier discussed later.)

- Purchase Cost

The group feels this is one of the two or three major barriers for the foreseeable future. As things stand now, it is a matter of asking people to pay more dollars for the same or less in the way of benefits, and this simply does not suggest successful commercialization. What actions will be most effective with respect to this barrier? Incentives for industry should probably receive more than a "3" in the group's opinion. But the real problem is the "chicken-and-egg" problem referred to earlier--convincing one or more vehicle manufacturers and manufacturers of major supporting products unique to EVs, such as batteries, that there is sufficient demand (whether induced by incentives or otherwise) to invest in the tooling, equipment, sales, service, and other facilities and resources necessary to get manufacturing and marketing costs down dramatically.

Again, several respondents talked in terms of 100,000-plus unit runs, possibly less if EVs could be offered as options to existing ICE models.

- Operating Costs

It was considered questionable whether poeple pay enough attention to this factor to warrant giving it a "4" rating as a barrier. Principal ameliorating actions would be as indicated in DOE's matrix, with the additional note that perhaps the single major factor is likely to be R&D to increase battery life.

- R.O.I. Risk

This is the "bottom line." That is, R.O.I. risk is from the standpoint of group members the ultimate barrier, the resultant of all of the others, and it fully deserves a "5". Feelings were that actions needed here include all of the key actions needed to overcome the other key barriers. In addition, it was noted that engineering demonstrations should receive a higher score than "2", in that if properly conducted they should serve to allay some manufacturers' fears regarding technical feasibility.

- Markets/Users

This was considered to deserve a "5" rather than a "4" in terms of barrier importance. The reasons have already been largely discussed, but they boil down to the idea that unless sizable enough market segments which the EV can realistically serve are found and the people represented can be cultivated successfully, the show will stop. There was no serious quarrel with the actions ratings in the matrix.

- Support Infrastructure

This barrier was felt to deserve a "4", at the very least, in terms of importance. There was no serious disagreement with the action ratings, but group members did emphasize the breadth and complexity of the problem, mentioning specifically the need to assure the following kinds of support:

  - Repair parts availability
  - Service facilities

- Qualified service personnel
- Battery replacement (availability, facilities, reclamation)
- Insurance
- Possibly recharging facilities.

- Public Acceptance

This is a key barrier which in the opinion of the group must be viewed market segment by market segment rather than in broad, general terms. It is highly inter-related with other barriers, particularly technical and economic (purchase cost, range).

With respect to actions, even greater importance than indicated was placed on market demonstrations to acquaint the public with EVs and their characteristics, and hopefully to demonstrate their reliability, functional adequacy, and so forth.

- Production Capacity

This factor was not well understood by group members. However, one individual said that if R.O.I. risk is reduced to an acceptable level, obviously the necessary productive capacity will be built. The assumption here is that the companies with appropriate interest and technology will have the funds available, and the group seemed to feel these are likely to be major corporations such as those (particularly) in the automotive, battery, and electrical equipment industries. But it is interesting to note the comment of a major automobile manufacturer--that companies such as his have major alternative demands for capital (such as are involved in complying with emerging government standards of various kinds). Also, they typically have a variety of new product opportunities available, any number of which might at the appropriate time promise greater returns than an EV venture.

- GSA Purchase Restrictions

This is a berrier of some consequence in that GSA represents a sizable vehicle market. However, this factor did not seem to rate a "4" in terms of importance, judging from group concern. There were no comments about action ratings with respect to this factor.

- Other Significant Barriers

  In addition to the above, the following barriers were mentioned as having some possible significance:

  (a) The possibility that safety and other standards may be set too high for EVs--too high to permit rapid commercialization, and higher than necessary in view of the vehicle's limited likely capacities and usage --was emphasized several times. Possible solutions were seen as appropriate regulatory actions and inter-government coordination.

  (b) A few group members wondered about the future availability of sufficient electric power, particularly at peak load times of day. The public utility representative indicated that based on studies his company has made, this is not likely to be a major problem at EV sales levels considered likely in the foreseeable future. The group seemed to accept this, but had no information on which to base their conclusions other than the statements of the one individual in question.

  (c) Reliability/maintainability/durability received a "4" on the commercial matrix, but only a "3" in connection with personal use. The group felt both barrier ratings should be higher.

Commercial-Use, Specific-Mission EVs

Here, the group disagreed significantly with DOE on the relative importance of the barriers, but not a great deal on solutions/actions.

- Factors which the group thought should be given higher barrier ratings than they were given by DOE were principally factors relating to life-cycle cost--i.e., the economic issues: purchase cost, operating costs, capital investment requirements, product liability risk, R.O.I. risk, availability of (and cost of) financing. As indicated earlier, the group seriously questions DOE's contention that EVs will be operable in commercial, specific-mission uses at life-cycle costs approaching those of ICE vehicles at any time in the foreseeable future.

- Reliability/maintainability/durability was also, as previously indicated, suggested to be of even greater importance than indicated by a "4" rating. Apparently the feeling is that limited commercial experiences to date have been fraught with problems in this regard, and that this is quite well known among commercial fleet operators.

- On the other hand, two barriers, performance and range, are less serious than suggested in the DOE commercial matrix, according to group consensus. The feeling is that there are plenty of commercial requirements that can readily be "programmed" to fit the performance and range characteristics of EVs, even those which could be made available today or in the near-term future.