

Results from the Swedish EV procurement project.

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1. SYNOPSIS

Electric or hybrid-electric vehicles has a potential for improving environment and efficient energy use but if no law forces the product to the market it is hard to see a market emerge. Technology Procurement as it is made in Sweden might be an effective voluntary tool to a market.

2. ABSTRACT

The Swedish EV procurement program is focusing on, both a passenger car and a medium duty van. Since 1992 a purchaser group has been working with user specifications of the two vehicle types. In February 1994, two RFPs (requests for proposal) were sent out to the international vehicle industry.

The paper will discuss the chosen vehicles and the background for the choice. It will also discuss the evaluation process ahead. The procurement is made in two steps, 8-10 vehicles will be evaluated and tested for 5-8 months. If this process is completed successfully, the main series vehicles will be purchased.

3. INTRODUCTION

Electric vehicles have been discussed as a means for solving both energy supply problems and environmental problems. The vehicle itself has been used from time to time in different situations, such as before the petrol engine had an electric starter, during war periods and for special purposes such as low speed vehicles for transport, but it has never really succeeded in competition with the petrol car.

Reasons to believe in a changed situation is now the legislation taken in California and some other states in the US. The legislation requires 2% of the passenger cars sold by the major manufacturers in 1998 to be "zero-emission" vehicles. In the years after 1998 the percentage of required "zero-emission" vehicles increases and smaller manufacturers too, must sell them.

The major problem regarding electric vehicles, or EVs, is often said to be the batteries, but after looking into the problems a little more one finds that range and speed combined are the real problem. Together these two problems often result in a situation where nobody can see the market evolve, the car has a short range and is slow, small numbers are sold, if any, which makes them expensive etc. Something like the legislation in the US has changed the manufacturers' interest, but it has not really tried to solve the problem with who will be the buyer.

Technology Procurement as it is named by the Swedish program for improved energy usage is a way to stimulate the buyer, a supply pull activity which may succeed in solving some of the initial problems.

Energy efficiency is of major interest for both EVs and hybrid electric vehicles (HEVs), because the real emissions from the vehicle also include electricity production emissions. Therefore it is most important in an evaluation program for EVs to look at energy efficiency.

The evaluation of the tenders will consist of many parts of which energy efficiency is only one: others are market acceptance, maintenance and service. This paper will discuss the project background and vehicle choice but mainly different aspects of evaluation such as acceptance and energy efficiency.

4. TECHNOLOGY PROCUREMENT (TEKNIKUPPHANDLING)

Technology procurement or teknikupphandling as it has been named in Sweden, is a market pull activity to stimulate users of a certain technology or activity to put pressure on the manufacturers to make the products more energy-

efficient and therefore more environmentally adapted. A basic idea is to summon a strong purchaser group. The group is made up of daily buyers of this technology who together make up a good share of the market or are the lead buyers whom others are following. All this to make the manufacturers listen to the users' needs and wishes. After having formulated requirements for the new or changed product they release a request for proposal, internationally, to show the manufactures that they are willing to buy the product and to get competition among the manufacturers. The requirements are in user terms, not technical specifications.

5. PURCHASER GROUP, USER SPECIFICATIONS AND CONSORTIA

The purchaser group/consortia in the EV procurement is basically found among local municipality organisations, electricity utilities and housing companies. Other organisations are delivery firms and regional health care. To form the purchaser group a questionnaire was sent out among local communities, organisations in EV interest groups and owners of large vehicle fleets. In an initial purchaser group, set up as a result of the questionnaire, the requirements for the vehicle and all arrangements surrounding the procurements were discussed. It was found that an earlier activity, 1989-1991, by the city of Stockholm could be a basis for the discussions. One of the findings was that it was of major importance who the buyers was to make the manufacturers listen and one of the requirements on this buyer were that it should be a vehicle fleet owner. It is most important to get good and sufficient service and maintenance of the vehicles.

Major user requirements discussed were range and vehicle type. Among the initial buyers the interest was focused on a small passenger car and a light duty van/minibus. It was also found interesting to discuss both pure EVs and HEVs. Range which is the main question for pure EVs was discussed intensely. It was decided, based on the firm thought that new technology was emerging and that a real market needed significantly better range than existing vehicles, that 100 km in city driving was needed, both for the car and for the van. For a hybrid vehicle, the range requirement was 40 km without the internal combustion engine. This to make sure to be able to drive in the inner city with no emissions.

The group also discussed requirements in terms of acceleration, speed and cargo weight and space, see table 1. The group also discussed formalities and found that for such a large procurement it was required to form a consortia among the purchasers. Within the work a study was made where the electricity production emissions and energy use were looked at in such a way that it was possible to formulate requirements at vehicle level in emissions and energy efficiency.

Table 1 Major performance requirements in the vehicle specification for the passenger car.

Range, electric, hybrid-electric	100 (120) km, 40 km	Acceleration 0-50 km/h	10 s
Speed	100 km/h	Seats	4
Cargo weight	350 kg	Cargo space	250/1200 l
Energy Consumption	0,2 kWh/km,ton		

6. GOALS

The immediate goal with an EV today is emission reduction, locally, regionally and globally. In the early seventies it might have been the oil crisis which was the major driving force. The basic problem with EVs in both aspects are the short range and therefore limited use and market for the product. Hybrid electric vehicles might be the solution to both problems but no such vehicle existed on the market when the project started. In any case there were not sufficient products on the market, but most major manufacturers had started looking seriously at EVs or HEVs due to the California low emission law and increased environmental interest.

Earlier projects in Sweden and other countries showed that the technology was interesting and promising, but most projects failed on simple things such as maintenance, service and acceptance among users. Another thing found was that no market was created after a trial when no real interest was shown from the manufacturer, i e no one took the decision to continue the production, reasons for this being cost and risk.

All this as a basis was used to form a request for proposal (RFP), which was looking as much at the manufacturer as at the product itself. The manufacturer had to show its interest and capacity to continue the process, i e to put EVs or HEVs on the market and to give them sufficient support. I e the purchaser group was looking at a manufacturer who

had a service and sales network or was in the process of setting one up. This along with cost was found to be the most important aspects of the procurement. The cost requirements were expressed as life cycle cost and it was stated that the project was looking for a vehicle with a life cycle cost near to or on a level with an ordinary vehicle.

7. PROCEDURE

The idea is to show the procedure and the way the consortia was formed. This to show the interest from the buyers and the importance of getting project and vehicle accepted.

Technology Procurement can be made more or less formal. The difference from an ordinary purchase and evaluation of tenders and TU might be small. In some of the procurements made by the program it is sufficient to release a RFP without any stated number of products to be purchased. In this case it was felt by the purchaser group that a more formal procedure was necessary. One of the reasons was the need to show the manufacturers the strength and willingness to buy the new product now and in future. For this reason two consortia were formed. The basis for each consortia was a contract among the purchasers stating the number of vehicles each consortia member was willing to buy, given that the requests stated by the RFP were fulfilled and that the price of the product did not exceed a certain figure stated individually by each consortia member. The contract also stated how decisions were to be taken by the consortia, the procedure for the process etc.

Within the consortia an Executive Committee (EC) was chosen in early 1994. Its responsibility is basically to evaluate the tenders and later on evaluate the vehicles. Among the members, Negotiating Team was also chosen.

Earlier in the process it was decided that the procurement would be done in two steps. First between 5 and 10 pilot series vehicles would be bought and tested by the consortia. The tests are to be done both at the buying organisation and also at a lab. After this step and a successful evaluation the real purchase of vehicles would take place.

In February 1994 both ECs released RFPs on behalf of the consortia.

8. EVALUATION OF TENDERS

Before receiving the tenders on June 1, 1994, the EC of the Car consortia worked out an evaluation plan for the tenders. The plan included mandatory requirements which led to immediate disqualification if not fulfilled. Among those where:

- Approval according to the Swedish Road Administration's "Regler om fordon" (a prerequisite for Swedish type approval)

- A minimum of four seats

- Compliance with the exhaust emission requirements of the RFP

In addition to these requirements it was foreseen that the technical aspects of the vehicles should be possible to evaluate in accordance with the requirements in the RFP. The plan also included treatment of formal discrepancies of proposals and possible non-compliance with the requirements. Beside this the evaluation also included important non-technical criteria such as:

- Financial status of bidder

- Proposed time of delivery

- The proposed product with regard to;

 - Such exterior design that could lead to problems regarding buyer acceptance

 - Possible newly developed and mainly untried components that may increase the buyer's risk

 - Normalisation of quoted performance data with regard to standards and measurements norms

 - Such improvement potential that is assessed as being possible to implement within five years (i.e. the projected economic life of the vehicles)

 - Bidder's experience from and resources for the manufacture of electric or hybrid-electric vehicles

 - Bidder's system and capabilities for quality assurance

 - Bidder's plans and resources for the marketing of electric or hybrid-electric vehicles

 - Bidder's concept for minimising the negative environmental impact during the life of the vehicles

 - Bidder's existing or planned service resources for electric or hybrid-electric vehicles in Sweden

 - Quoted prices

Projected life cycle cost of the proposed vehicle
Warranties offered

All the above mentioned criteria are most important for the building of a market.

Basically most of the above apply to the Van/Minibus Consortium as well but at the time this is being written this Consortia has not published any results.

9. TENDERS AND CHOICE BY THE CAR CONSORTIUM

By the 1 of June 18 proposals were sent in from 14 different bidders. All in all there was 23 alternatives. The geographic base for the production were; Denmark, Finland, France, Italy, Norway, Sweden, Taiwan, the Czech Republic, Germany and the USA. The bidders represented several categories of producers from enterprises without volume production to companies with volume production of conventional vehicles.

The only types of batteries offered were lead acid and nickel cadmium and most of the proposals had a direct current motor. Most of the proposals had an automatic transmission.

After an initial check of the proposal all where found more or less non-compliant with the RFP, it was also found that none of the proposals was fully satisfactory with regard to performance requirements. In many of the proposals the price level was far too high.

For more details from the evaluation see references. The final result was that the two electric versions of the vehicles Peugeot 106 and Renault Clio where found so close in cost and performance that the EC decided to test both vehicles. It was decided to negotiate an option agreement on the purchase of pilot series cars from each manufacturer. The major requirements in comparison with those stated by the RFP can be seen by comparing table 1 and table 2.

Table 2 Major performance specifications for Peugeot 106 and Renault Clio, for a comparison see table 1.

Range, electric, hybrid-electric	85 km	Acceleration 0-50 km/h	10 s, 9 s
Speed	90 km/h, 95 km/h	Seats	4
Cargo weight	300 kg	Cargo space	96/376, 235/630 l
Energy Consumption	0,2 kWh/km,ton		

10. THE VAN/MINIBUS CONSORTIUM

At the time this paper is being produced no formal decisions by this consortium have been taken but negotiations with vehicle manufacturers are taking place.

11. MARKET RESEARCH

An early version of market research was done within the project. This research was basically done within the purchaser groups and later among manufacturers. The initial idea was to see if there existed a group of buyers strong and interested enough to continue with a formal Procurement project. This was done in two steps, first to form a purchaser group, second when the initial members formed the consortium which required formal decisions from all the member organisations. In the second part of the project market research will increase in importance, i e to show an increased interest and usefulness of the vehicles. I e to show both users and manufacturers the pros and cons of the products. The market research will not be limited to the products in the project but related instead to the national goals of emissions and energy efficiency.

In April 1995 telephone interviews were held with a representative selection of fleet owners in Sweden (ordinary vehicles). The idea is find out knowledge of the possibility to buy electric or hybrid-electric. Is there any interest in buying, if so who is influencing this interest and what are the reasons. If purchases have already been made, who is using the vehicle and how does it work? Is there still an interest in buying new vehicles? The idea is to find out about knowledge, reasons and trend. Another reason behind the interviews is to find out if NUTEKs support for the project

has had an impact on the market, and so the interviews will be held at least two times. A second interview probably one and a half years after the first.

Another type of market research will be made among the users of project cars. Again it is of major interest to find out if the vehicles are found interesting enough to spur both the users and owners to buy more. It is also of major importance to find out things that are not working and possible ways of solving those problems.

12. EVALUATION OF PRE-SERIES VÉHICLES

After having decided to try two vehicles the aim is to test at least 5-10 of each vehicle type. Basically all the cars will be used in daily work at the owners' choice. The owners are organisations within the consortium signed up to buy more cars if the consortia EC finds the evaluation satisfactory. The cars will be driven in all types of environment including the northern part of Sweden (Skellefteå). The cars will all be equipped with an onboard logger to check the real usage and the energy consumption.

One of the reasons for accepting a vehicle with a shorter range than initially stated is the possibility for rapid charging. The possibility to extend the range through rapid charging will be tested both on the pilot series vehicles and among the main series cars.

Two cars of each type will also be chosen for laboratory tests. The idea is to measure and check both range and energy consumption related to the EU standard driving cycle. The range is supposed of be a most straightforward measurement. The only difference is that the vehicle also will be tested at a temperature of -15 °C. Energy consumption on the other hand will be performed rather differently than proposed standards within the EU today. Basic measurements will of course be energy consumption during the cycles, i e the battery has to be in the same status before and after the test. This test will also be made at a temperature of -15 °C. Not included in the EU tests today are lights and heater, but which might use as much as 20-30% of the total energy consumption of the vehicle. This has basically to do with the cold climate, but also with requirement to drive with lights on all day in Sweden. Another interesting aspect of the energy usage is self discharge. All batteries do discharge when not used and given that a car is normally in use for three hours two hundred days a year the car is not in use for 93% of its lifetime. Initial calculations show that this might influence the total energy consumption significantly.

The evaluation of the pilot series cars will also include acceptance by the users and service and maintenance. All in all this evaluation will decide if the main series cars will be bought at all and if it is to be the Peugeot or the Renault, as only one of the cars will be chosen.

13. SUCCESS OR FAILURE?

The goal is to reduce emissions and improve energy efficiency. Given that the success has to do with market acceptance and increased sales. No impact on emissions will be made unless a significant share of the vehicles purchased are electric or hybrid-electric. No specific number is specified for success but a base level is 500 vehicles sold within the project during 1996 and 1997. This amount only accounts for 0.2% of the sold cars so a rather rapid increase in sales must take place outside the project support in order to account the project a success. A total success would be to compare with the 2 percent forced sales in California during 1998, but if 0,5 to 1 percent is reached one might also call it a great success.

14. CONCLUSION

The Technology Procurement project has taken one step further, and hopefully the market for more environmentally adapted vehicles as well. Many more steps remain to be taken where both the buyers and the manufacturers together can create this market. This work has shown that both the manufacturers and the buyers are unfamiliar with this type of technology and demands but that this type of project can bring them together in a market-natural situation. It is now important that also more formal frameworks such as national and international legislation give environmentally better products an advantage over ordinary vehicles.

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