PAYBACK ANALYSIS OF E85- AND CNG-POWERED VEHICLES IN HUNGARY

Péter Jobbágy[1]

[1]*University of Debrecen Centre for Agricultural and Applied Economic Sciences Faculty of Applied Economics and Rural Development Institute of Business Economics Hungary, H-4032 Debrecen, Böszörményi út. 138.*
jobbagyp@agr.unideb.hu

Abstract: As a result of my analysis it was found that when purchasing a new alternative fuel car only a CNG-powered vehicle could be a reasonable choice, the extra cost of which (depending on its scale) ensures a return within 2 – 7 years, i.e. over the real expected duration of use of the car. However, the spread of these cars is determined by the lack of CNG fuel stations in Hungary. The E85-powered so called FFV-s could become a competitive alternative with lower ethanol prices or moderate government support (for example a registration fee allowance similar to that enjoyed with hybrid vehicles, or reduced taxes)..

Keywords: fuel, alternative, return, personal car, driving performance

1. Introduction

As part of the fight against global warming there is a high reliance on the use of alternative, renewable fuels all over the world. Nothing confirms this better than the fact that the production of first generation bioethanol has increased from 49.5 billion litres to 88.5 bn. litres over the last five years, while at the same time the production of first generation biodiesel has almost doubled – from 9.3 million tons to 18.1 mill. tons (F.O. Licht 2011). However this tendency is accompanied by major political, social and scientific debates, which repeatedly question the positive judgement on bio fuels and consider the increase in production responsible for the price increase of agricultural products, the aggravation of starvation in countries in the Third World, and the clearing of rain forests and demand a limitation on the use of bio fuels or a change to the latest generation of bio fuels (which currently exist mainly in a trial form) (Bai 2011).

However, there is less discussion about the fact that, for instance, the EU-undertakings in the field of renewable fuels (2003/30/EC) cannot be carried out without a significant modification of vehicles, i.e. to ensure widely used first generation bio fuels can be mixed with the conventional fuel in a given percentage without the risk of motor or fuel-air system breakdown (www.zoldauto.info).

Therefore developed countries are attempting to promote the spread of alternative-powered vehicles by a wide range of methods. In the EU there are numerous possibilities for drivers requiring non-conventional fuels (e.g. E85, bio diesel, plant oil, electric cars, bioCNG) and in recent years various alternative-powered vehicles that have recently been designed or rebuilt domestically have begun to appear. The most typical example of this is probably the sharp increase in the trade in E85.

Considering the developments mentioned above, I analysed the return provided by E85- and CNG-powered vehicles from the potential consumers' point of view. In the course of my analysis I only briefly referred to other factors (e.g. range, refuelling/filling time, access to filling stations, safety) influencing the use and thus the spread of these vehicles. Since some renewable fuels are able to operate on recently modified vehicles as well as purpose built new ones, I also carried out the analyses on this scenario. By defining the rate of return on the annual driving performance of an average Hungarian vehicle, I took inflation, the expected price increase in traditional fuels and the affect of excise duty on E85 – 40 HUF/l (Act XCVI of 2011) – into consideration too.

2. Materials and methods

I tried to choose as the subject of my analysis those types of alternative-powered vehicles that are available with their traditional equivalents (Otto-powered). In Hungary CNG-powered vehicles are considered an extreme case, and are not distributed in all cases in the country (e.g. Opel distributes, VW does not); however they can easily be purchased in Austria or Germany and for those who are living near to the border the inadequacy of the national filling station-network does not cause any problem because CNG-powered vehicles are also available for private individuals in Austria, Slovakia and in Romania (Time for Gas 2011).

The prices of vehicles that can only be purchased abroad (certain CNG-powered cars) have been converted into HUF for easier comparison; the exchange rate is 1 EUR=280 HUF, and 1 USD=200 HUF. With these vehicles I did not calculate a registration fee since it is irrelevant in terms of the return

because, as per current regulations only hybrid/electric vehicles qualify for the tax allowance (Act CX of 2003).

In the case of fuels I calculated with the following prices:

- Petrol 95: I used the retail prices of the third quarter of the year 2011 (380 HUF/l) recorded by the Energy Efficiency, Environment and Energy Information Agency Non-profit Company (www.energiakozpont.hu) and I calculated an annual 5% price increase. Over the past years excise duty on fuels has been increased twice within a short period and the VAT-rate has also been modified; thus a considerable petrol price increase has occured (Szarvas 2010). In the previous period (between 2000 and 2008) the level of the petrol price fluctuated between -3% and +4% compared to previous years so if petroleum prices stabilize, this tendency may continue in the mid-term. However in view of the difficult economic situation of the country, a new excise duty increase can occur at any time; due to this risk I calculated for a higher fuel price increase.
- In the case of E85 I used the average price in September (305 HUF/l) based on www.holtankoljak.hu. As in the previous years the price of E85 fluctuated together with the price of petrol, falling short of the petrol price by 90-100 HUF. However this difference was reduced to 75 HUF by passing more than half of the excise duty on to consumers, which makes bioethanol non-competitive for consumers. In the course of the analysis I assumed that the market will slowly return to a difference of about 90 HUF/l.
- In case of CNG I calculated with the constant price – 249.9 HUF/kg of the CNG filling station in Győr (www.biobumm.hu). This is among the lower prices in the EU, thus in the mid-term I calculated for the same price increase as for petrol prices; in the long-term (simultaneously with the increase in CNG driving) I calculated for a price increase (6.5%) in excess of that for petrol.

In all cases the basis for comparison was the petrol models of the analysed brand being of a similar or largely similar power and similarly equipped, as indicated in the list price..

To compare for typical consumers I used the data for consumption indicated by the factory. In the base-case I calculated for a 20,000 km driving performance, which corresponds to the national average annual driving performance of vehicles (www.autostitkok.hu). I analysed how the return would change in the case of greater use i.e. 30 – and 40,000 km.

The analysis was extended to 7 years since on the basis of Appendix No. 2 of the corporate tax law (Act LXXXI. of 1996) personal cars shall be written off within this period. According to Greene et al. (2005) as well as Santini and Vyas (2005) most consumers in the U.S. expect a very short payback period (less than 3 years) so (considering the more moderate financial potential of Hungarian consumers, and thus their lower expectations as well) it is necessary to point out that if the extra cost of the car does not return within 4-5 years the investment is not profitable if we merely take economic aspects into consideration. In the course of the analysis I assumed that maintenance costs were the same so I disregarded these.

To calculate the dynamic rate of return I included discounting on the basis of the inflation forecast of the Hungarian National Bank (www.mnb.hu).

3. Results and discussion

3.1. Flexi-fuel vehicles

The analysis includes the new Ford Focus 1.6 Trend (flexi-fuel 120 HP, normal model 125 HP) and the Volvo S40 2.0 Kinetic (both are 145 HP) models. As the flexi-fuel Focus is not currently marketed in Hungary I considered German prices as standard. Table 1 demonstrates the results of the analysis. The table shows clearly that an FFV is not worth buying in the current economic situation though this is not due to the extra cost, since this is insignificant, but to the extra consumption, which cannot be compensated for by the lower price of E85. For this reason with an increase in annual driving performance the NPV decreases.

Table 1: Returns for Ford Focus and Volvo S40 FFV-s

Model	Extra cost (th HUF)	Consumption gasoline/ E85 (l/100km)	Driving performance (km)	NPV in the 5th year (th HUF)	NPV in the 7th year (th HUF)	DPP (year)
Ford			20,000	-294	-394	-
Focus 1.6	70	6.0/*8.3*	30,000	-409	-562	-
Flexi-fuel			40,000	-525	-730	-
Volvo			20,000	-425	-561	-
S40 2.0	120	7.6/*10.6*	30,000	-585	-792	-
Flexifuel			40,000	-744	-1,023	-

Source: Author's own calculations

The return would be possible in two cases; firstly if the ethanol ingredient in E-85 were exempted from excise duty again. In this case environmental driving would mean minimum extra costs (NPV in the 7th year between -60 and -140 th HUF) which consumers would be ready to pay. Knowing the domestic tax system, this version does not seem likely. The other option would be the extension of the registration fee allowance (uniformly 190 th HUF); in this case the Ford Focus Flexi-fuel would cost 288 th HUF less and the Volvo S40 Flexi-fuel 830 th HUF less; this allowance would compensate the extra costs of the consumption within

the first 5 years in the case of the Ford and in the total period under analysis in the case of the Volvo – calculating on a 20,000 km driving performance per year.

3.2. CNG-powered vehicles

I chose two family cars; the Opel Zafira 1.6 CNG Turbo Essentia (150 HP) and the Volkswagen Touran 1.4 TSI EcoFuel Trendline (150 HP) from among CNG-powered motor vehicles. The basis of the comparison were the Opel Zafira 1.8 Essentia (140 HP) and Volkswagen Touran 1.4 TSI (140 HP) models. The Opel model is available in Hungary, the Volkswagen is not; therefore in this case I calculated with German prices. Table 2 clearly shows that the Opel Zafira, which is offered at a significantly lower extra cost, returns the investment within 2 years and by the end of the analysed period it provides a 1,400 th HUF saving for its owner, while a return on investment with the Volkswagen Touran – sold with an extra cost more than three times higher – cannot be expected within the analysed period. By increasing the driving performance however, the return period can be decreased to 5 years.

Table 2: Returns for CNG-powered vehicles

Model	Extra cost (th HUF)	Consumption gasoline/ CNG (l/100km; kg/100km)	Driving performance (km)	NPV in the 5th year (th HUF)	NPV in the 7th year (th HUF)	DPP (year)
Opel			20,000	854	1,397	2
Zafira 1.6	585	*7.2/5.3*	30,000	1,538	2,337	1.3
CNG			40,000	2,222	3,278	1
Turbo						
VW			20,000	-661	-152	-
Touran	1711	6.8/4.7	30,000	-212	436	5.7
1.4 TSI			40,000	237	1,023	4.5
EcoFuel						

Source: Author's own calculations

A case study estimates the payback periods of light-duty natural gas vehicles at less than 3 years for average users in Argentina, Brazil, India, Italy and New Zealand. Only in the U.S. was the payback period definitely higher (about 6 years) (Yeh 2007). In Hungary the average payback period is more than 3 years but it could be decreased if the registration fee allowance on hybrid/electric vehicles were extended to CNG-powered personal cars. In this case the extra costs of the Opel Zafira would decrease to 297 th HUF, which in practice would be returned within 1 year with an average driving performance, while the Volkswagen Touran would cost 1,600 th HUF more, which would be returned within 7 years – calculating for an average (20,000 km/year) driving performance.

4. Conclusion

In the current situation, for the casual observer only the CNG-powered personal cars can be considered as a renewable alternative, and only those types that are offered at a lower extra cost, such as the Opel Zafira or the Chevrolet Nubira (Jobbágy et al. 2010). An essential condition for the spread of these vehicles is the development of public filling-stations, towards which fuel-distributors have begun to take slow, tentative steps. From the government's side it would be especially profitable to support this kind of effort, thinking particularly of the production and distribution of CNG obtained from the sewage-plants of big cities, since these vehicles cover their costs within a reasonable time without any support and (by using bioCNG) contribute significantly to the fulfilment of national renewable fuel targets.

E85-powered, flexi-fuel vehicles would give a greater or lesser financial loss to their owners in the current economic situation; thus it is not likely that they would choose these types or run them with fuel. However this situation can easily be reversible, if the unified registration fee allowance – which currently only applies to electric/hybrid vehicles– were extended to E85-powered, flexi-fuel vehicles. In this case an increase in their market share can be expected.

The bio fuel act at present in force (Act CVII. of 2010) does not make compliance with EU requirements in the terms of the use of renewable fuels possible, therefore for the government it would be practical to support the spread of CNG- and E85-powered personal vehicles. Expenditure on support (development of the bioCNG filling-station network) and lost revenue (the registration tax allowance) would be returned from the reasonable level of excise duty on these fuels.

References

1. 1996. évi LXXXI. törvény a társasági adóról és az osztalékadóról
2. 2003. évi CX. törvény a regisztrációs adóról
3. 2010. évi CVII. törvény A megújuló energia közlekedési célú felhasználásának előmozdításáról és a közlekedésben felhasznált energia üvegházhatású gázkibocsátásának csökkentéséről
4. 2011. évi XCVI. törvény egyes gazdasági tárgyú törvények módosításáról
5. **Bai, A. (2011)**: Újabb generációs bioüzemanyagok perspektívái. Magyar Tudomány, Vol. 172 Issue 7 pp. 861–871
6. DIRECTIVE 2003/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport. EK dierktíva. Official Journal of the European Union L 123/42.
7. F.O. Licht's World Ethanol and Biofuels Report, Vol. 9 Issue 13
8. **Greene, D.L., Patterson, P.D., Singh, M., Li, J. (2005).** Feebates, rebates and gas-gruzzler taxes: a study of incentives

for increased fuel economy. Energy Policy, Vol. 33 Issue 6 pp. 757–775. http://dx.doi.org/10.1016/j.enpol.2003.10.003

9. **Jobbágy, P., Bai, A., Juhász, I.L. (2010).** A biometán perspektívái a hazai közlekedésben. Mezőgazdasági Technika, Vol. 51 Special Issue
10. **Schäfer, A., Jacoby, H.D. (2006)** Vehicle technology under CO_2 constraint: a general equilibrum analysis. Energy policy, Vol. 34, Issue 9 pp. 975-985. http://dx.doi.org/10.1016/j.enpol.2004.08.051
11. **Szarvas, Gy. (2010)** Benzinár-hullámvasút – Üzemanyagárváltozások és okaik 2007 – 2010 folyamán. Totalcar 2010. http://totalcar.hu/magazin/kozelet/2010/10/21/benzinar-hullamvasut/
12. **Time for Gas (2011)** Fuel prices. Statisztika. Time for Gas Vol. 8. Issue 47
13. **Yeh, S. (2007)** An empirical analysis on the adoptation of alternative fuel vehicles: The case of natural gas vehicles. Energy policy Vol. 35 Issue 11 pp. 5865–5875. http://dx.doi.org/10.1016/j.enpol.2007.06.012
14. Internet: www.zoldauto.info; www.energiakozpont.hu; www.holtankoljak.hu; www.biobumm.hu; www.autostitkok.hu; www.mnb.hu