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ALTERNATIVE FUEL AS AN ECOPRODUCT

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Abstract:
This framework indicates the relevance of using LPG gas highlighting its advantages and drawbacks. The need to limit traditional fuels in favour of alternative has been underlined. Alternative fuel - LPG, is part of the concept of Sustainable Development Strategy, and its great popularity in Poland affects the interest in it and results in a discussion about reasons for growth of amount of LPG vehicles in Poland.

Keywords: LPG, traditional fuels, ecology.

1. INTRODUCTION

The development of interest among modern societies in the global ecology contributed to the emergence of an increasing number of organic products and implementation of instruments to encourage the purchase of such products. Marketing specializing in the orientation for organic products was first defined in 1976 (Henion & Kinnear) as "any marketing activity that can contribute to finding a remedy for environmental problems" (Henion & Kinnear, 1974).

2. STAGES OF GREEN MARKETING

2.1. Stage I

This stage was a response to the activity of the environmental movement, and its characteristic features are mentioned below:

- orientation on a particular business activity and ignoring the market context with its orientation to consumer needs;
- focus on the final product by ignoring the principle of ecological technological process;
- omitting legal regulations, which deal with corporate social responsibility in the environmental area in order to avoid the consequences of breaking the law.

2.2. Stage II

Stage II of green marketing has come at the turn of the 80s and the beginning of the 90s of twentieth century. One reason for the establishment of this stage was WECD Report of 1987, known as the Brundtland Report, which contained the ten commandments of threats to humanity. Brundtland Report has created the concept of sustainable development recognized and promoted by the European Union agenda as the EU Sustainable Development Strategy (*Sustainable Development Strategy*). The fundamental assumption of the second stage of green marketing was a real engagement of communities in the rational use of natural resources. Paradigm of sustainable development has become a complementary approach to innovation in the economy together with pro-ecology and social development. Social issues are supposed to increase social cohesion - bridging social differences, policy of equal opportunities and limiting the discrimination and marginalization of social groups. The attitude to the environment of reducing the harmful effects of technological processes on the environment and minimizing the detrimental impact on natural resources of consumption, helped to name the concept of sustainable development as an eco-development.

Sustainability has modified the traditional approach to marketing through:

- perception of the process of marketing research, production and distribution as factors which have an impact on the environment
- implementation of technologies which do not endanger the environment
- developing partnerships with organizations working in a business environment, government organizations, NGOs, consumer movement, consumer initiatives (Henion & Kinnear, 2008)
- green marketing becoming a strategic activity (as opposed to stage I, when it was a tactical action).

2.3. Stage III

Stage III of green marketing, from the mid-90s of twentieth century was characterised by efforts to build competitive advantage of companies based on environmental protection. Eco-marketing strategy is a stimulator of innovation, in the longer term it increases the benefits of achieving new markets through environmental orientation on pro-ecological consumers and ultimately reduces costs (Urbanska, 2009, pp. 65–66).

3. THE MAIN IDEA OF GREEN MARKETING

Responsible business and ecology in the western markets have completed the first stage of eco-fashion. Existing business initiatives can be divided into the following categoriesŁ

- *Eco-embedded* intentionally limited to the recognition of the elements of communication as environmentally friendly,
- *Eco-boosters* genuinely implementing strategies based on eco-trends and also promoting them in relations with business partners and individual customers,
- The emergence of environmental responsibility refers to three elements,
- *Eco-ugry* about economic revaluation and the low efficiency of green activity,
- *Eco-chic* i.e. environmentally friendly activities,
- *Eco-iconic* implemented by the companies fully aware of environmental responsibility and supported by millions of consumers (Maciorowski, 2008).

Ecological documentation that is initiatives supporting the paper, the reduction of greenhouse gases into the atmosphere, environmental activities of corporations, supporting global initiatives such as the Earth Day are examples of some activities of green marketing.

4. ECOLOGICAL INNOVATIVENESS

In today's business eco-friendly activities have become a norm. The objectives of eco-innovation in the company can be noticed in two main areas:

- innovations related to the business environment connected with minimizing environmental hazards and consequently, increase of the prestige of the company, increase market share, attracting new segments of customers
- innovations in the internal strategy of the company including its development, increased competitiveness of products, reduce of the risk of environment threat of a business, improve the health of employees and increase employees' identification with the company.

The source of innovation in a company is to adopt a paradigm of the need to preserve resources, especially non-renewable. To a large extent the pressure of consumer with high environmental awareness on companies are an impulse for innovation.

According to the OECD documents, innovations may apply to two groups:

- Technological innovations (TPP) on new products and processes concerning: organic product life cycle, reducing consumption of natural resources, lengthening the lifetime of objects, waste disposal, greening operations, ecologistics, improving safety for the user (Chodyński, 2007, p. 1),
- Organizational innovations related to the management of a company in the areas such as: improving safety, energy efficiency in the company, the reorganization of work, increased environmental awareness among employees.

5. MOTORIZATION AS AN ECOLOGICAL PROBLEM

The development of motorization is a major ecological problem and is noticeable mainly among municipal agglomerations. The increase in amount of used fuel results in disadvantageous effects on natural environment through increased emission of harmful exhaust fumes to the atmosphere (Baczewski & Kałdoński, 2005, p. 59). Traditional energy exploits non-renewable sources such as: coal, brown coal, natural gas, crude oil. It is created through many sophisticated processes which include: extraction of a resources, processing and use for energy goals. On the other hand, unconventional energy uses renewable (inexhaustible) sources of energy such as: wind, water, sun, biomass, biogas. Exhausting reserves of traditional fuels which is caused by intensive use and large participation in contamination of the environment, forces on the one hand to look for new constructions of engines, and on the other hand to search for new sources of energy which can replace and limit harmful emissions of fumes. (www.ekoenergia.pl*)*

One should mention the following changes in the Polish marketing environment: greater prosperity, rapidly growing number of cars, larger population. These factors result in greater attractiveness of the Polish fuel market. Dynamic economic growth is correlated with increased demand for fuel and thus the Polish fuel market is considered one of the best developing in Europe. Due to the fact, distribution of fuel in Poland grows in importance (Urbańska, 2006, pp. 193–198).

Unstable supplies of crude oil and rising prices of these resources are the main reasons for searching for alternative fuels for internal-combustion car engines. The most significant part of exploitation costs are represented by the type of fuel used in the vehicle. In majority of countries natural gas fuels are less expensive which enable users to use vehicles more intensively. The systems of liquefied petroleum gas (LPG) provide greater satisfaction by many advantages of a vehicle such as increased engine's elasticity, decrease of the noise level and what is most important reduction of costs of exploitation. Above-mentioned factors contribute to greater interest in LPG fuel for cars. (Flekiewicz, 2002).

Heating value (i.e. the fuel mixed with air) is one of advantages of gas fuels, because it has a large influence on the power of car engine. Among these fuel groups, similar values are characteristic for: methane (CNG) in case of compressed natural gas, and propane butane (LPG) for liquefied gases. Expected increase of prices and uncertainty of prices of crude oil in the next following months encourage considering using alternative fuels. CNG and LPG are provided as reasonable alternatives. And these gases are used on the Polish car market as alternative gas fuels.

The main goal of CNG (Compressed Natural Gas) gas power is to limit toxic elements of fumes and decrease consumption of liquid fuels. More and more car makers offer new vehicles which are equipped with two-fuel supply (NGV - Natural Gas Vehicles) such as Fiat, GM, and French manufacturer PSA which produces under brands: Citroen and Peugeot.

Contrary to existing opinions, CNG is the safest fuel for vehicles. This safety is justified by high temperature of ignition which is close to 650^{o}C and is higher than for petrol (Romaniszyn, 2008, p. 30). This advantage in association with narrow range of flammability in the mix with air and high fugacity indicate that CNG driven cars are safer than cars fuelled by petrol or LPG. Globally there are 3,5 million cars adjusted to use CNG (data for 2008).

Table 1: The number of cars run by natural gas (CNG) and fuel stations adjusted to tank gas in particular countries.

Country	No of cars	No of stations
Argentina	1 200 000	1105
Brazil	600 000	600
Pakistan	540 000	491
Italy	400 800	463
India	159 159	166
USA	130 000	1300
China	69 300	270
Egypt	52 000	79
Venezuela	50 000	140
Ukraine	45 000	130
Russia	36 000	218
Bangladesh	26 500	50
Canada	20 505	222
Germany	19 400	337
Columbia	19 400	56
Japan	18 463	226
Bolivia	15 486	37
Malaysia	8 300	35
France	7 100	102
Belarus	5 500	24
Poland	250	30

Source: International Association for Natural Gas Vehicles, 2009

LPG fuel (Liquified Petroleum Gas), i.e. liquefied version of C3H8 propane and butane (isobutene) C4H10 is produced in the process of transforming crude oil thanks to so-called dissolving processes. In some markets also a liquefied gas from natural gas condensers, especially from gases associated with crude oil plays a significant role. It is assumed that this mixture of basic elements of LPG gas consists of: propane 40 % and butane 60 % (Steczko & Molenda, 2002. p. 353).

In Poland, the growing popularity of LPG is associated with economic benefits - the price of a liter of LPG fuel is about 40 % lower than the price of gasoline. In addition, relatively liberal regulations on the construction of fuel stations with LPG, low cost assembly and high availability of service stations are all factors increasing the popularity of this type of fuel in Poland.

In the autumn 2004 following the decision of the President of Polish Committee for Standardization a new norm PN-EN 589:2004 was set - Fuels for LPG vehicles. This norm indicates requirements associated with LPG used as a car fuel (which results from the fact, that this norm is based on the newest European norm EN 589 of 2004). High and unstable prices of petrol and diesel fuel oil inclined drivers to look for savings. One of the most popular solutions is to install gas facilities. LPG is used mainly as a fuel for petrol engines both internal combustion engines with spark-ignition with central port and multi-point fuel injections. LPG is associated with at least two myths. (Romaniszyn, 2008, p. 21)

First myth: LPG is harmful to the engine. In fact LPG has a higher octane rating than petrol engine and therefore it burns more cleanly than petrol or diesel and is especially free of the particulates from the latter. It allows for a longer exploitation of an engine oil because it doesn't dilutes it as petrol.

Second myth: gas installation in car is dangerous. Many people are frightened by the vision of explosion of a flammable gas cylinder. In fact the risk is minimal, assuming that the installation is of high quality, is installed in a reputable workshop and is used in compliance with producer guidelines.

Opinions about gas installation as delayed-action bombs are grossly exaggerated. LPG tanks are not more dangerous for users than plastic tank with petrol. As opposed to petrol, gas tanks are well secured from potential explosion. Petrol is kept in a plastic tank without any safety valves, gas has strong tanks and three electric safety valves. First one is on the tank, the second before a regulator and the last on a regulator. Additionally each installation is equipped with a fourth mechanical valve placed on the tank. Tanks are legalized in case of LPG in each 10 years (Andrejkovc & Hajduova, 2009, p. 45).

6. LPG DRAWBACKS

For every user of vehicles fuelled by gas, information about drawbacks of liquid gas LPG is especially important. Among disadvantages the following features should be mentioned:

- installation of gas facility in new cars may be associated with loss of warranty – if it's not done in an authorized workshop of motorization corporation; installations in these places are usually 50% more expensive than in private workshops,
- smaller boot - gas tank usually is located in boot space; cylinder tanks permanently limit the place (there is no possibility of enlarging the boot by folding back seats), and toroidal tanks are positioned in spare wheel place and do not use the space however the wheel needs to kept inside the boot,
- technical state of the engine needs to be checked more often – gas is a fuel which is more demanding than petrol, because it is more difficult to flame and requires a higher temperature to be used; therefore, the intake system and ignition system need to be regularly checked, and in some cars with particular technical solutions, spark plugs, high voltage cables and air filters need to be replaced more often,
- registration inspections are more expensive – cars with auto gas installations need to be inspected each year and allowed to be used; in case of new cars (up to 4 years), which are inspected for the first time after 3 years, and the next inspection is after another 2 years, the time frame between inspections is shortened to 1 year,
- in case of LPG parking in some underground areas is forbidden – propane-butane gas (LPG) is heavier than the air, which creates a potential very large danger of fire or explosion. Therefore special ventilation systems and appropriately located signal detectors of gas need to be installed.

7. LPG ADVANTAGES

LPG is a source of high quality energy and is used in such areas as: industry, craft, agriculture and car engines fuel. Liquid gas is known as environment friendly fuel. The most important advantages of liquid gas are as follows:

- using LPG as an alternative fuel apart from benefits for environment is associated with a greater economy of car exploitation; the cost of driving 100 km with LPG is on average approx. 45% lower than a drive with the same car fuelled by petrol,
- an engine works more silently and is more flexible – gas fuel has a higher octane rating (about 110), which secures a fluent work of engine and greater flexibility,
- security – installations have all European and national safety certificates, therefore there are no contradictions of allowing the vehicle to move and any reasons to claim that gas installations can be dangerous, especially when the system has several security mechanical and electrical settings,
- increased range - gas installation is an additional system – petrol is still a base fuel; a possibility to freely switch and choose to kind of fuel results in a significantly increased range,
- ecology – this is the least appreciated advantage of gas installation in Poland – as a society we still learn how to ecologically think and behave, which may take a while without any preferences and incentives from the government. Many countries of the western Europe have preferences for auto gas and ecological awareness of citizens is incomparably higher (some European cities where air pollution and preservation of historical monuments are serious problems, there are restrictions associated with car traffic however they do not concern gas cars and electric cars),
- market lifecycle of gas-fuelled cars is longer – LPG is introduced to tanks in optimal form – i.e. gas; constructors for many years have taken efforts to put petrol in this physical state to combustion chambers, and in the case of gas its physical features allow to do it – combustion is softer and more efficient, and protective layer of engine oil is not rinsed off from walls of cylinder.

8. CONCLUSIONS

The growing popularity of alternative fuel in Poland such as LPG is not necessary a manifestation of ecological behaviour of Polish consumers. It is rather determined by the high gasoline prices and increasing confidence in this type of fuel. Dependence of the Polish market on global oil prices, instability in post-crisis affect the high growth of LPG powered vehicles. While this type of alternative fuel in Poland has little in common with ecological awareness, in effect becomes an important element of technological innovation.

Long-term institutional reform and financial planning which favours ecological efficiency may encourage activities, which can be supported by market instruments. Abandoning subsidies for projects dangerous for natural environment in favour of activities environment-friendly which facilitate development and use of ecological innovations in industrial production, transport, energy sector and agriculture may significantly contribute to secure and sustainable development of economy.

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