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INVEST OR NOT? DOES A FUEL-EFFICIENT CAR MAKE SENSE TODAY?

Research Associates Andreas Manhart (Öko-Institut) and Oliver Salzmann (IMD) prepared this case under the supervision of Professor Ulrich Steger (IMD), Carl-Otto Gensch (Öko-Institut) and Rainer Grießhammer (Öko-Institut) as a basis for class discussion rather than to illustrate either effective or ineffective handling of a business situation.

This case study is based on publicly available data. However, the storyline, company, etc. are purely fictional.

Lars Eklund, CEO of Autostar--a rising star among European car manufacturers--was facing a tough decision. He had joined Autostar in 1995 as head of R&D and rapidly moved up the corporate ladder. In 2000, as head of marketing & sales, he had also successfully introduced Autostar's first luxury model to the market.

Since the end of the last decade, the European car market, on which Autostar was still largely focused, had been stagnating. Cheap imports from the US and Asia had increased competition. The company's sales had dropped and costs had increased due to rising overcapacities. Like most of its competitors, Autostar had to struggle hard to earn its cost of capital. The industry increasingly and successfully offered more powerful engines and more customization. As a result, cars became heavier making it more challenging to reduce fleet consumption. Fuel prices were rising due to taxation and increasing energy prices. However, implications were uncertain given the volatility and still moderate level of prices (if historical trends of inflation and household income were taken into consideration). Politicians were pushing for cleaner emissions through higher emission standards and tax exemptions, for example.

Eklund had been closely following the development and introduction of fuel-efficient cars such as the Volkswagen Lupo 3L TDI and the Toyota Prius over recent years. However he was skeptical about whether a fuel-efficient car was the right move for his company at this stage. He had just received a draft report that he had commissioned at the beginning of 2005 to analyze opportunities and threats in more detail. As he read the report's executive summary, he wondered:

Would it make sense to come up with a fuel-efficient model, taking into account that some competitors were actually intending to withdraw their models (e.g. the Lupo 3L), whereas others, such as Toyota--with their Prius model--had already occupied certain niches? What niche could be found? How could Autostar successfully enter and develop it, and how would its standard product lines fit in?

Autostar

Autostar was founded in 1907 in Stockholm, Sweden, as a manufacturer of bicycles and motorbikes. Cars only became part of its product portfolio in 1922, when the company merged with ADDTEK AB. In 2005 the company was still majority-owned by the family of Chris Berglund, its founder.

Over recent years, Autostar had managed to play an increasingly significant role in the European car market, primarily due to its strong commitment to quality and safety. In 2004 it produced roughly 400,000 cars at three major European facilities. Its main market was Western Europe, but it also exported to roughly 70 countries worldwide, mainly to South America, but also increasingly to Central Europe, Russia, India and China. It had a turnover of €5.5 billion and operated at a profit of €200 million.

Fuel-Efficient Cars - History and Technology[1]

Milestones: Golf Ecomatic, SMILE and SULEV, etc.

The need for fuel-efficient cars was being discussed as early as the 1970s. However, the topic only began to attract broader public attention in 1991, when Ferdinand Piëch, the then chairman of the board of Audi AG, highlighted the feasibility of "three-liter cars." The term "three-liter car" subsequently became a synonym for the vision of ecologically sound vehicles.

In response to increasing public pressure for energy-efficient cars, Volkswagen--as the very first mover--launched its Golf Ecomatic in 1993. However, sales were clearly below projection, primarily because users had to adopt a special driving behavior and Volkswagen stopped production in 1996. A year earlier Greenpeace had presented the SMILE (Small-Intelligent-Light-Efficient), a modified Renault Twingo with an average fuel consumption of only 3.3 liters gasoline/100km. Greenpeace accused the automobile industry of deliberately stalling the development and introduction of fuel-efficient cars.

In many countries, changing regulatory frameworks put increasing pressure on car producers to reduce their product's emissions (such as greenhouse gases, particulates). In both Europe and the US, the emission limits were tightened every couple of years. In California, where several urban centers in particular faced severe air pollution problems, the "Super Ultra Low Emission Vehicle" standard (SULEV) set extremely high requirements. In 2005 the latest public discussion in some European countries turned to particulate matter (due to their carcinogenic effects) emitted from diesel engines, and put further pressure on the automobile industries.

[1] Excerpt from the SWOT analysis commissioned by Eklund at the beginning of 2005.

Cars were very emotive products and mostly purchased on the basis of brand, design, engine power and price. Since fuel prices were still moderate--if benchmarked against household incomes--low fuel consumption was not a significant selling point. Customers largely ignored life cycle or operating costs when making their purchasing decisions. This set fuel-efficient cars at a competitive disadvantage since--being based on more sophisticated technology--they were more expensive at the point of sale. However, depending on other moderating factors such as fuel prices and car taxes (scale of tax breaks for low-emission vehicles), lower operating cost could compensate for higher purchasing prices in the long term (*refer to **Exhibit 2** for a comparison of conventional cars and their fuel-efficient equivalents*).

Reaching the Three-Liter Goal: Gasoline or Diesel?

When Greenpeace built its SMILE, it deliberately chose not to use a diesel engine, which emits carbon particulate matter, but rather to use gasoline-based technology. This option made it more difficult to achieve the "three-liter goal," since the combustion of gasoline generated 14% less energy, although it generated 10% less CO_2. Thus a three-liter car running on gasoline was more energy-efficient than a three-liter car using diesel fuel. However, it was also much more difficult to engineer.[2]

The Hybrid Technology: Two Engines in One Car

While common concepts of energy-efficient cars mainly focus on lightweight construction, reduced road and air friction as well as efficient combustion engines, the hybrid technology represented a more fundamental kind of innovation. The coupling of a combustion engine with an electric engine made it possible to operate the car either in a combustion, electric or combined mode. Since the combustion engine was then mainly used in its optimal performance range, it could be tuned accordingly. Furthermore, a generator recycled waste energy during gliding and braking, feeding it back into the car's battery.

Products[3]

Volkswagen Lupo 3L TDI

In summer 1999 Volkswagen's Lupo 3L TDI was the first car on the market to meet the "three-liter target" (*refer to **Exhibit 1** for technical features*). At DM 26,900 (about €13,700), it was more than 17% more expensive than comparable Lupo models.

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[2] Tscköke. H. & H.-E. Heinze. Einige unkonventionelle Betrachtungen zum Kraftstoffverbrauch von PKW. In: Magdeburger Wissenschaftsjournal 1-2/2001. Magdeburg, 2001.

[3] Excerpt from the SWOT analysis commissioned by Eklund at the beginning of 2005.

Although VW was eager to be the first producer to offer a three-liter car, the company was careful to disassociate its product from an exaggerated eco-stigma. VW feared that such an image would scare off potential consumers. Hence, it positioned it as a "real car" with various technological innovations and without any compromises on road performance and safety.

Market research revealed, that the car's main selling points were low operational costs (according to 73% of Lupo 3L TDI users), environmental advantages (17%), the design (17%), the prestige of driving a three-liter car (14%) and its useful features as a city car (9%).[4] Other studies pointed to some flaws in the design, in particular the thin tires (to reduce friction) were perceived as "unsporty."[5]

During the first two years on the market, VW sold 16,000 Lupo 3L TDI, 70% of them in Germany which, according to the company, was a volume that matched their cautious expectations. Sales volume declined: In 2004 roughly 11,000 units were sold, accounting for a 3.3% share of all newly licensed Lupo units. In June 2005 Volkswagen announced that it was stopping production of the Lupo, arguing that the Brazilian manufactured VW Fox would successively take its position in the product line. Up until then it had sold roughly 30,000 units.

smart Fortwo CDI

In December 1999 the smart CDI was first introduced to the European market. Although it featured a consumption of 3.4 liters diesel/100km, the German laws on car tax rated it as three-liter vehicle (*refer to **Exhibit 1** for more technical details*). It was 14% more expensive than a comparable "non-three-liter smart." The smart Fortwo was a two-seater; its small size made it possible to park in a right-angle to the traffic flow.

The smart was one of the first cars sold on the Internet, targeting young urban consumers. Slogans ("smart is not only a car--smart is a lifestyle"), design and product range (e.g. various color combinations, open-topped version) pointed to a marketing concept of distinctiveness and individuality. The smart was commonly bought and used as a second car for urban traffic. Its ecological advantage was hardly communicated. Visually, there was no distinction from other models.

Until July 2004, DaimlerChrysler sold 100,000 smart CDIs and thus labeled it the "worldwide best selling three-liter car." Although media reported sales growth for the smart fleet in September 2004, the brand was still far from being an economic success. Recapitalization and cost-cutting measures were on their way. In 2004 the share of the CDI models newly licensed in Germany accounted for roughly 30% of all smart Fortwo models.

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[4] Hoffmann, J. Automobilmarketing im Spannungsfeld von gesellschaftlichen Umweltzielen und Kundennutzen. Frankfurt a.M; 2002

[5] Gensch, C.-O. & R. Griesshammer. PROSA-PKW-Flotte. Öko-Institut. Freiburg, 2004.

Toyota Prius

At the end of 1997 the first model of the Toyota Prius was brought to the Japanese market. Toyota then gradually modified and introduced it to the American and European market. In contrast to the Lupo and smart, the Prius was a medium-sized five-seater, powered by hybrid technology and well equipped with air-conditioning and navigation system. In 2005 it was one of the few cars meeting the Californian SULEV emission standard.

Toyota positioned the Prius as an icon of modern car technology. It emphasized its high quality and road performance in combination with its ecological advantages. On its website, it provided detailed information on available tax breaks and fuel efficiency. Furthermore it issued a long-term warranty, e.g. in Germany for five years or 100,000 km (whichever expired first).

Like the Lupo, the Prius won numerous awards. Up until 2004, it had sold roughly 160,000 units worldwide. Customers typically had to wait several months for their Prius to be delivered.

The car's success was commonly attributed to its strong image of distinctiveness and coolness, also due to the low noise emissions and its futuristic interior. A Prius generally drew attention. Furthermore, technology and low fuel consumption were significant selling points. The Prius increased Toyota's share of the global car market: Only 40% of Prius owners had actually owned a Toyota before (compared to a 60% share for owners of other Toyota models).

Most owners used their Prius as their first (rather than second) car. Hence the Prius actually replaced cars with lower fuel-efficiency.[6] Its commercial success triggered numerous activities in the automobile industry to develop energy-efficient hybrid technology.

[6] ETH Zürich (Publisher): Characteristika und Beweggründe von Käufern des Toyota Prius 2. Forschungsbericht der ETH Zürich, Zürich 2005.

Exhibit 1
Characteristics of Fuel-efficient Cars

	VW Lupo 3L TDI	Smart Fortwo CDI	Toyota Prius
Segment	subcompact	subcompact	medium-sized
Number of doors	3	3	5
Number of seats	4	2	5
Engine	3-cylinder-diesel	3-cylinder-diesel	4-cylinder-benzin + electro motor
Cylinder capacity	1.2 litre	0.8 litre	1.5 litre
Engine output	61hp / 45kW	41hp / 30kW	110hp / 82kW
Maximum speed	165 km/h	135 km/h	170 km/h
Consumption	2.9 l diesel/100km	3.4 l diesel/100km	4.3 l super/100km
Particulate filter	no	no, announced for 2006	not necessary
Weight	830 kg	730 kg	1,315 kg
Special characteristics	Stop-start-automatic	Right-angled parking possible	Touch-screen, navigation-system
Safety	2 airbags, ABS	2 airbags, ABS	6 airbags, ABS
Emission standard Euro 4	yes	yes	yes
Emission standard SULEV	no	no	yes
Price in 2005	15,100 Euro	10,600 Euro	23,900 Euro
Yearly total costs at 12,000km/year*	5,326 Euro (= 44.4 Cent/km)	4,564 Euro (= 38.0 Cent/km)	6,854 Euro (= 57.1 Cent/km)
Guarantee	?	2 years	5 years / 100,000 km
Marketing aspects	real car, technology	lifestyle car	technology, fuel-efficiency
Number of licensed models in Germany in 2004	373 (3.3% of Lupos licensed)	26,610 (30.9% of Smart Fortwos licensed)	1,453

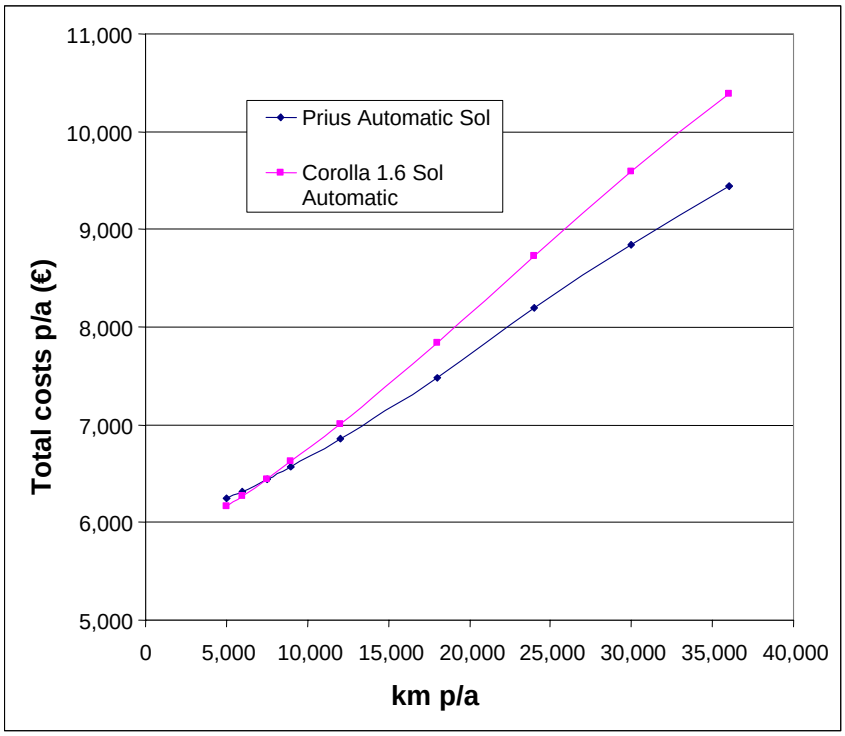
* Calculation for Germany only

Exhibit 2
Purchasing Prices and Total Costs*
Comparison between Conventional and Fuel-Efficient Cars

	Purchasing Price (€)	Total costs at 6,000 km p/a	Total costs at 12,000 km p/a	Total costs at 18,000 km p/a
VW Lupo 3L TDI		€5,015 p/a = 83.6 cents/km	€5,326 p/a = 44.4 cents/km	€5,689 p/a = 31.6 cents/km
VW Lupo 1.4 44kW	11,225	€4,468 p/a = 74.5 cents/km	€5,036 p/a = 42.0 cents/km	€5,627 p/a = 31.3 cents/km
Smart fortwo coupe 30 kW	10,395	€4,202 p/a = 70.0 cents/km	€4,564 p/a = 38.0 cents/km	€4,921 p/a = 27.3 cents/km
Smart fortwo coupe 37 kW	8,980	€3,814 p/a = 63.6 cents/km	€4,281 p/a = 35.7 cents/km	€4,721 p/a = 26.2 cents/km
Toyota Prius Automatic Sol	23,900	€6,315 p/a = 105.2 cents/km	€6,854 p/a = 57.1 cents/km	€7,485 p/a = 41.6 cents/km
Toyota Corolla 1.6 Sol Automatic	19,900	€6,264 p/a = 104.4 cents/km	€7,009 p/a = 58.4 cents/km	€7,838 p/a = 43.5 cents/km

*Total costs take account of depreciation, interest, fixed costs (insurance, vehicle tax etc.), variable costs (tires, fuel, maintenance and repairs, etc.) and the residual value, over a use phase of four years.

The following graph compares the total costs of the Toyota Prius with those of a "conventional" Toyota model, the Corolla, which is most comparable to the Prius in terms of size, road performance, safety and configuration. It shows that the Prius has lower total costs at a yearly mileage of roughly 7,500 km and over.



Source: Ökoinstitut