Trends in the Automotive Markets and their Impact on Vehicle Development

More complex products to meet growing climate protection goals are at odds with the strong price pressure and the demand for Low Price Vehicles designed for mobility and awakened markets.
AtTrack GmbH, Gesellschaft für Mobilität contributes through technical and business solutions, such as the one presented Total Customer Integration (TCI), to master future challenges in the vehicle industry.

1 Introduction

Current trends in the automobile markets and their implication on products and the resulting requirements for vehicle development will be displayed.
Two trends are:

- The demand for sustainable vehicles with reduced CO_2 emissions
- New Low Entry segment in mature markets and Low Price Vehicles for mass mobilization in emerging markets.

The two trends hold conflicting objectives: the demand for environmental sustainability is asking for more resources to create and build cars and the complexity of the vehicles will be greatly increased. On the other hand the Low Price Vehicle (LPV) and price pressure on all segments require significant simplifications, **Figure 1**.

2 Market Situation

In 2004 mankind produced 27.5 billion tons of the greenhouse gas CO_2 just for energy reasons [1]. In mature markets, there is a growing environmental awareness, which rises pressure in terms of legislation and on the market place in general. The rising oil price - more than 100 $ / barrel only recently – hurts "Cost of Ownership" values and imposes related action on manufacturers.
Parallel to this, there are market shifts by weakness or neutrality of the "old" markets and partly accelerating growth in the "emerging markets". The fastest growing automobile market in the world is China, with an average annual increase in sales of 0.8 million units / year, followed by Russia with 0.3 million units / year and India with about 0.2 million units / year [2].
The growing mobility needs in the emerging markets are stoking the call for the "cheap" entry-level car. Current market studies assume that even 2010, the world market share in so-called Low Price Vehicles will reach 13% [3]. To mobilize a large segment of the population quick and in a cost efficient way can in the transition be performed by reduced product requirements. Thus, e.g. the One Lakh Car from India takes 4 persons on one hand, but confines itself with a maximum speed of 100 km / h on the other.
Market saturation and purchasing restraint in mature markets cause price pressure across market up to the premium classes. In the medium term it is expected, that the low end segment will gain over the others. For OEMs,

there will be a competitive advantage, being able to realize a Low Price Vehicle for comparably lower cost. First relevant products such as the Dacia Logan already entered the market place.

3 Two Noteworthy Product Trends

3.1 Alternative Fuel Vehicles and Hybridization

Natural disasters (Hurricans, tsunamis,…) stoked the discussion on the preservation of natural resources. Europe focuses on the prevention of the greenhouse gas CO_2.

On the short note manufacturers endeavour to reach fleet goals through friction and weight reduction measures, such as, for example, energy saving tires,.. . On the transition to new drive systems, the use of fuels from renewable resources plays an important role.

An example of the use of new technologies in already existing platforms is the soot filter for diesel vehicles. The development of the filter causes considerable extra effort in engine testing, **Figure 2**. To achieve an optimum deposit rate without too big an increase of the exhaust back pressure is the target.

The fact that apart from the additional component in the car, the impact of different fuel types has to be tested, increases the testing effort furthermore. But also the cost of systems integration increases for the OEM.

Two requirements must be met:

- Geometric integration, especially if the filters have not be foreseen in the base development.
- Dissipation of the additional heat, without putting other vehicle functions at risk.

This gets increasingly difficult due to the rising share of electronics in the vehicle. More and more "hotspots" must share space with more and more temperature-sensitive electronic components, **Figure 3**. Often, the package size and the density distributions of the physical sizes get rather complex. Virtual Reality (VR) specifics, such as the deep geometrical representation and the eye tracking is an essential aid to understand the complex relationships.

The public discussion regarding future propulsion systems initially was polarized between the Japanese manufacturer’s favourite hybrid technology and the already widespread existing diesel technology in Europe. Meanwhile, the debate calmed down. Important single technologies from the "hybrid package" will be gradually introduced for all vehicles, regardless of whether it is diesel or petrol driven. Among others they are:

- Recuperation
- Automatic Start-Stop
- Downsizing
- Thermodynamics management
- Decoupling of auxiliary drives

In order to fulfil these requirements, the use of one or more e-machines in the drive train (or enlarged alternator, starter), and a battery are

required, resulting in a hybrid strain. This in turn creates significant integration effort. VR integrated tools for laying flexible pipes help here, **Figure 4**.
Whether one stays with the hybrid drive train or whether one comes back to a single mode drive train is not yet finally answered. Increasing development activities in battery technology makes it possible to appear that purely electric, battery feed vehicles with sufficient range can be realized. If the questions about the battery for weight specific storage capacity, safety and durability are not answered, a "range extender" will be off the essence. This role will not take primary energy storage, but an energy converter. Short term an internal combustion engine fired by bio fuel proposes to be the right choice. Medium term on can see a fuel cell with the necessary energy via hydrogen use.

3.2 Low Price Vehicles (LPV)

Under this umbrella term, two new vehicle classes are adopted:
In the developed markets, a new low-price segment opened below the current lower class (UKL). Dacia Logan opened this segment. In awakening mobility markets along with local requirements entirely new simplistic platforms come up. The first vehicle of this category is the just launched Tata Nano.
In both cases, it was necessary for the OEM, to refer to the mobility needs of the specific customer group.

3.2.1 LPV for mature mobility markets

One of the success factors for the new low-cost entry-level class is a better understanding of the user's desires. With the Dacia Logan one has broken the coupling between vehicle size and price, obliging that a cheap car has to be small. According to our investigations, there is no positive correlation between customer preferences "small purchase price" and "small vehicle".
LPV for mature markets have to comply with the high legal standards there in force, so that in this area no savings can be realized.
For the consistent approach of target costs, it is next to the tougher definition of the user values of the specific user group, to define the non value items in order to eliminate them. The necessary "definement" (opposite of refinement) refers especially to comfort functions and technical characteristics. Thus, e.g. the suede covered trunk of the executive limousine with the eyes of the next lower user profile can be seen as polluting burden. Double Seal levels, as well as redundant adaptive heaters and more.
OEM, which have been offering lower-class vehicles already are rather no favourites for building up a new platform for the new LPV class in mature markets. Three potential cost positions point to the second use of a expiring platform:
• Double-use of a already realized development
• Double-use of existing production equipment
• Scaling in the component procurement

Most producers combine the above mentioned cost potentials with the production of vehicles in the emerging market for the mature markets in order to use the more favourable cost structure.

3.2.2 LPV for Emerging Mobility Markets

Quite unlike the previously described LPV for mature markets, it is for the Emerging Markets.
The objectives of such a product guide us almost inevitably to a new platform under the following circumstances:

- Extreme cost target
- Use reduced legal requirements
- Other user profile of the target group

The aim of such a platform is the mass mobilization of a burgeoning mobility region. One example is the Tata Nano, with a base price of 1 Lakh which is about € 1750.- wants to appeal to a wide audience in the Indian market. The problem with such a development is that during the development no safe customer preference profiles exist. In the first step it is not possible to determine these, because the typical customer never previously owned a car, but at best a scooter. It is here where by taking the Total Customer Integration (TCI) with its consistent use of virtual methods the potential customer is consequently linked into in the very early product development phase. By using virtual mock ups, loading operations, user habits, egress/ingress have to be examined in depth, with the target to optimize, **Cover**. Unlike differentiated usage profiles of premium vehicles, it provokes the creation of the broadest possible user profile. That the product has to cope with minimum variabilities makes the task even more complicated. Thus, e.g. Tata Nano has only minimal seat-adjustment functions, and still has to cope with most of the 5% women and 95% men stature.

4 Summary and Outlook

From simple to complex and back again - this cycle seems not even to stop in front of the automotive industry. On one hand the tip of complexity is still not reached with multicylindrical engines, multi-gear lay-outs, but also the sustainability driven hybrid drive trains. On the other hand high cost constraints until up to the middle class and Low Price Vehicle requirements of mature and emerging markets ask for - what we would call by today's standards – a brutal simplification.
The increased use of VR can give more certainty about decisions in the early product design phase, especially when they are vehicles for new, unknown customer groups.
Because certain is one thing: On both ends of the spectrum, it is more necessary for the developer than ever, to have the customer is the centre of all his effort.

References

[1] n.n., Treibhaus Erde, ADAC Motorwelt 10/2006
[2] n.n., China überholt Japan, Automobilwirtschaft 3-2007

[3] Schneider W.H.: Kleiner Preis, großes Wachstum, Automobilwirtschaft 3-2007

Captions:

Cover: Ergonomic analysis in the cockpit (Source ICIDO)

Figure 1: Driveline technology - From simple to complex and back

Figure 2: The Development of a Diesel Particulate Filter (Source KST)

Figure 3: Temperature build up in the Turbocharger (Source KST)

Figure 4: Assembly investigations under consideration of flexible tubing (Source ICIDO)

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