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**Ambitious environmental and safety policies can assist a competitive European automotive industry.**

**Hydro develops lightweight solutions that help make these goals feasible.**

**Key messages**

**Hydro Aluminium welcomes CARS 21** as an opportunity for developing a coherent and competitive regulatory framework for the automotive industry in Europe.

**Ambitious policies can assist the competitive European automotive industry** when properly designed. These must be coherent and predictable. They must also be compatible with the global character of the automotive industry. On safety and environmental issues, that are particularly important for Europeans, we expect the EU to take the global lead. The automotive industry, together with its crucial suppliers, needs to be actively engaged in the policy-shaping process.

**Aluminium and magnesium solutions for vehicles not only reduce weight**, thereby improving fuel efficiency and reducing emissions, **but also improve safety**. Hydro develops cost-effective lightweight solutions, illustrated by our strong market position. Hence, our solutions help to make the goals of ambitious policies feasible.

## **1. Ambitious environmental and safety policies can assist the competitive European automotive industry when properly designed**

Regulatory objectives can both be ambitious and drive competitiveness when properly designed. Policies must be introduced in a transparent and predictable way, and the objectives kept stable in order to secure payback of the required research and development investments. Yet, we understand that policies need to evolve in order to drive innovation.

It is particularly important that new regulations are clearly designed when they are intended to improve overall sustainability (environmental improvements) and may increase car purchase costs without giving tangible benefits to the consumers in the short term.

We know that our OEM customers at times struggle with the cost implications of different legislation around the world for what are global products. Therefore we believe that globally harmonized rules would improve the competitiveness of the European automotive industry. We as a European based but globally acting supplier would also benefit from the ability to sell the same components in all regions without the additional cost of following local regulations.

When we ask for global harmonization of rules, we do not ask for the least common denominator. Rather, we expect the EU to take the lead on policies promoting safety, energy efficiency and the environment, and to help convince other regions to adapt the European level of ambition. This will advance global deliverability of European solutions, and the competitiveness of European suppliers.

Better policies need improved and appropriate processes. The automotive industry, with its crucial suppliers, must be actively engaged in the policy-shaping processes. Several innovative and positive policy-shaping initiatives have been taken lately. For example:

- The CARS 21 process itself, which seeks stakeholder input in designing a coherent regulatory framework for the automotive industry.
- The general trend of “extended impact assessments” for major Commission proposals. This is an opportunity for the Commission to draft legislation based on best available technologies and best practice.
- The joint industry report *Mobility 2030 – Meeting the challenges to sustainability* that was presented by the World Business Council for Sustainable Development in July 2004 [1]. Hydro, along with eight large OEMs, two energy companies and a tyre provider, were partners in the four-year project. The report provides a vision of how mobility, with focus on road transport, can be made more sustainable by identifying the seven most important goals that must be addressed, and sketching broad strategies for doing so.

## **2. Aluminium and magnesium solutions can reduce overall vehicle weight by up to a third, thereby saving around 20% fuel consumption, and also improving car safety**

It is important to make cars both lighter and safer. The weight of European cars has increased on average by 30% over the last 30 years. This is mainly due to the adding of more features like safety airbags and ABS, electrical motors, air condition, and much more. However, the increase would have been even more without the weight-savings of several components through lightweight material substitution and design changes. More radical light weighting approaches are now needed. Aluminium and magnesium provide the keys for doing so. As a rule of thumb, one kg of aluminium in automotive applications on average substitutes two kg of steel.

A recent study conducted by the German research institute FKA shows how much the weight of cars can be reduced through use of aluminium components [2]. Its reference car is derived from average values for five different European compact class cars. Based on traditional steel components, the weight of this conventional car was 1229 kg. Rebuilding the same concept car with mainly aluminium parts, it was demonstrated that the weight of the vehicle could be reduced by between 342-444 kg or 28-36%, without sacrificing vehicle performance.

A 10 % reduction in vehicle weight can produce a 5-7% fuel saving provided the vehicle's power-train is also downsized. This translates into similar levels of reduction of GHG and other emissions. Some of the energy saved through reduced weight is "lost" in the production of primary aluminium, since this is more energy-intensive than steel production. However, this initial high energy use is compensated through the use of recycled aluminium, which requires only 5% of the energy needed for producing primary aluminium. The authors of the *Mobility 2030* report point out that recycled aluminium constitutes a significant share of aluminium used in vehicles, and is likely to do so also in the future. By projecting likely shares of recycled aluminium, they calculate that the production-phase energy "losses" due to aluminium replacing steel will only be 10-30% of the fuel savings achieved in the use-phase.

In conclusion, aluminium and magnesium solutions provide substantial overall net energy savings. These savings can be up to 20% of the energy needed to produce a car and the fuel used to run it over its life-time. Furthermore, such energy savings can be applied to all kinds of powertrain & fuels combinations. As there is great uncertainty about what powertrain & fuels combinations will become dominant in the future, this is a major advantage. Light-weighting is a "no-regrets" winner for all feasible automotive scenarios.

A similar life-time perspective applies to costs, where the initial cost of the lightweight components often are higher than competing solutions but where the fuel savings of the life-time can overcompensate this difference.

The recycling qualities are a major strength for aluminium and magnesium. As stated above, remelting aluminium into new products only requires 5% of the energy needed for producing primary aluminium. This can be done without degrading the quality. The combination of aluminium's and magnesium's inherent economic value with present market



mechanisms and regulations (e.g. the ELV directive) will secure that these metals will be recycled at very high rates in the automotive industry.

Vehicle weight also influences car safety. Reducing weight can improve ride and handling and reduce braking distance. Lightweight solutions can also increase stiffness, improving handling further. In an impact situation, vehicle weight will influence the amount of kinetic energy to be absorbed during the crash, but also the amount of structure available for absorbing energy. It is well established that when crashes occur, occupants in heavier/larger vehicles are at lower risk than occupants in lighter/smaller vehicles. However, in two-vehicle crashes, an increase in mass of one vehicle exposes the occupants of the other vehicle to increased risk. Increasing the length, but not the weight, of a vehicle also protects its occupants but without any adverse impact on occupants of vehicles into which it crashes. Hence, vehicles can be made *both* lighter *and* safer by increasing vehicle length while keeping or reducing the weight.

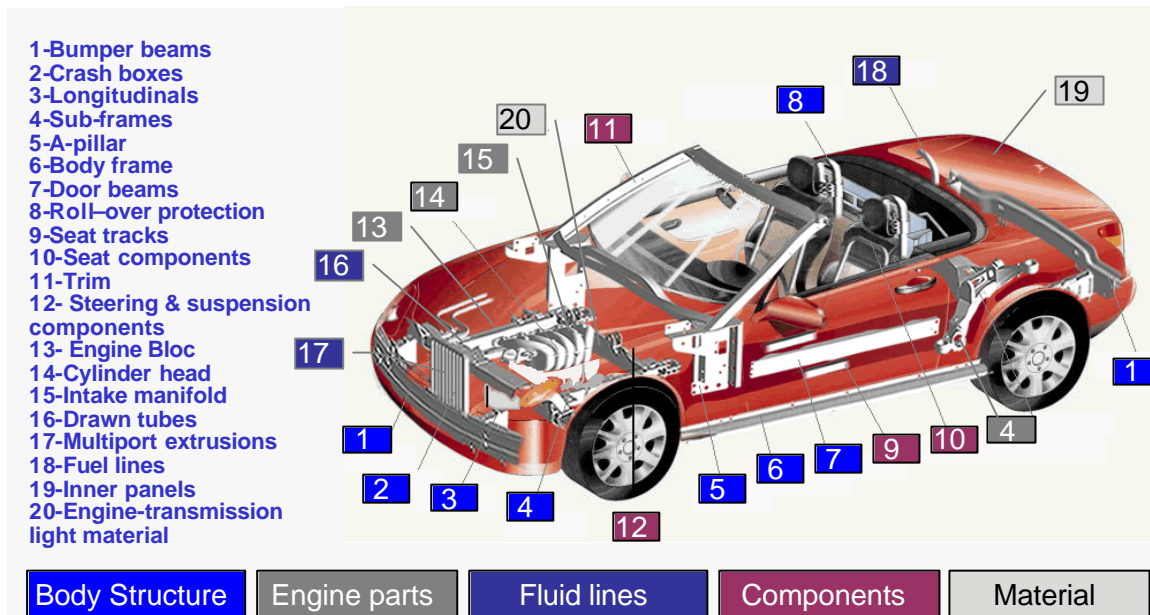
### **3. Together with OEMs, Hydro develops aluminium and magnesium solutions that make cars lighter and safer**

Hydro Aluminium is the largest European based integrated aluminium company, and number three in the world, with global sales of nearly €10 billion. Our sales of vehicle components in 2004 were over €1.2 billion. In addition we sell light metal alloys, strip and extruded material of € 900 million to other automotive industry actors, that they transform into components. Two thirds of our 27 000 employees are in Europe.

Hydro has been a large supplier of aluminium and magnesium components to the European and global car industry since the innovative magnesium engine of the VW “Beetle” in the 1950s. We have integrated environmental concerns into our search for new applications in several parts of the car, thus enabling lower weight. The illustration below shows components supplied by Hydro that can be found in cars today (see Annex for more details):

## Hydro Aluminium Automotive products

*Manufactured in today's cars*



### ***Developing competitive and sustainable solutions the Hydro Way***

As outlined before we welcome the EU's initiative for innovating the regulatory framework in order to make the European automotive industry more competitive and sustainable. Hydro "signs up" to the dual objectives of competitiveness and sustainability as this is at the core of our 100 year history. We have manifested these deeply held principles and beliefs for the future, and formulated them as *The Hydro Way*:

"Our mission is to create a more viable society by developing natural resources and products in innovative and efficient ways."

Success is not only a function of getting most out of natural resources. It is also about balancing efficiency with continuous innovation. Our instinct to commercialize has enabled us to strengthen our cooperation with customers and the ability to stay ahead of changes in how they operate, how people live and what they need. We firmly believe that we cannot have true, long-term business success without societal success. While contributing to building better societies, we must remain competitive and always look for win-win opportunities that benefit both Hydro and our social partners.

Hence, without hesitating we support the EU's dual objectives of competitiveness and sustainability. Hydro will together with OEMs continue to develop new applications of aluminium and magnesium that use their respective constructive advantages, while at the same time achieving the inherent environmental and safety advantages of the materials.



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[1] World Business Council for Sustainable Development, "Mobility 2030": Meeting the challenges to sustainability", 2004.

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[2] Forschungsgesellschaft Kraftfahrzeugbau mbH Aachen (FKA), Body Department, "Final Report: Lightweight Potential of an Aluminium Intensive Vehicle", Project Number 24020, Contractor: European Aluminium Association, December 2002.



## **Annex: Hydro Aluminium Automotive Applications**

### **1. Application of Structural components**

The potential of using aluminium for improved car collision safety through the novel “crash box” design of traditional bumpers has been exploited by Hydro. Here the material characteristics of aluminium allow the absorption of the energy of a crash, thus reducing harm to passengers and vehicles. Importantly, lightweight safety devices like “crash boxes” improve the safety for passengers in both vehicles involved in a two-vehicle collision.

Today, Hydro is the world leader of aluminium crash management systems. Each year we produce more than 8 million bumper systems throughout the world, including in the major European car production countries. In close co-operation with OEMs we develop and manufacture unique solutions for each car model. The solutions need to meet a diverse set of end-user requirements:

- Reduce injuries of passengers in case of high speed crashes through more robust deformation of the car front end, allowing better energy dissipation before passengers have to resist the remaining force through retention systems, such as seat belt, air-bags.
- Improve driving properties which contributes to active car safety.
- Reduce weight.
- Reduce repair costs for low speed crashes.

### **2. Application of Castings components**

Replacement of grey cast iron by aluminium for both gasoline and diesel cylinder heads started towards the end of the 1970's on the basis of refined casting technology and aluminium's heat transfer advantages. Within less than ten years, the substitution was almost total. Foundries that now belong to Hydro were active in this development. Still today, aluminium is the only material used for cylinder heads. Technology development is ongoing in order to support gasoline direct injection and the increased pressures in diesels needed to meet Euro V and anticipated Euro VI standards.

Aluminium substitution of grey cast iron in engine blocks started with gasoline engines in the 1990's. Foundries that now are part of Hydro were at the forefront. This has led to present substitution rates of 60% for gasoline blocks and less than 20% for diesel. The driver for substitution of blocks is weight. Hydro's technology development within blocks is now focused towards diesels. This is particularly important due to the increased popularity of diesels in Europe. We are now able to provide the technology (alloys, casting technology) needed to make it feasible for using aluminium in modern diesels with its high pressure rates, that are at three times those of gasoline. Around 80% of the metal used for both blocks and heads comes from recycling.

Today Hydro produces 4.5 million cylinder heads and 1.5 million engine blocks.





### **3. Application of Precision tubing**

In the 1970's Hydro took the lead in developing aluminium tubes for cars, replacing heavier copper and brass solutions. When air conditioning became standard in the EU during the 1990's, we maintained our leading supply position. Our expertise also enabled introduction of aluminium tubes in new applications, e.g. fuel lines. Hydro's tubing solutions save weight and make it possible to use lesser amounts of harmful refrigerants, due to the excellent heat transfer properties of aluminium.

Following our leadership position in aluminium tubing, Hydro took an interest in the new transcritical CO<sub>2</sub> air conditioning technology developed in 1989, now known as Shecco™. This can reduce greenhouse gas emissions from automotive air conditioning considerably. Hydro has developed the aluminium tubing solutions required for its implementation, as already demonstrated in dozens of prototype cars. We are now turning these prototypes into cost-effective solutions.

### **4. Application of Magnesium alloys**

Hydro is the world's leading provider of magnesium alloys. We focus on high pressure die casting, and almost all alloys provided by us are transformed into safety, structural or power- train components for cars. We work closely with OEMs, Tier-1 suppliers and die casters in developing components and improved production processes.

Magnesium alloys are used for components such as instrument panels, front-end modules, inner doorframes, airbag housings, steering wheels and steering components. Magnesium components can often be manufactured as one piece, reducing the need for separate joining and assembly processes required for alternative materials. For example, one magnesium instrument panel can replace a steel construction of several stamped parts.

The high-pressure die casting process provides an efficient way of quickly producing complex volume components. Excellent recycling capabilities of magnesium guarantee an efficient use of resources, reducing waste to the minimum. Attractive properties of magnesium include light weight, ductility for safety parts, and noise, vibration and heat reduction