

MAGNA's motivation for developing hydrogen tanks and for integrating alternative drive systems

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**Arbeitskreis: Brennstoffzellen und Wasserstoff – Zukunft des Verkehrs?
Österreichische Technologieinitiative als Antwort auf weltweite Aktivitäten
Technologiegespräche in Alpbach (25.-27.08. 2005)**

MAGNA International - Organization



Range of Services

Automotive Development

Development of components, systems, modules as well as complete vehicles
Advance development
Safety

Complete Vehicle Production

Planning and operation of production facilities for volume production of vehicles

Modules & Components Production

Steel fuel tanks
Filling systems
Structure parts
Complete module assembly (Class A stampings)



Products and Services – Vehicle Production

General contractor



Manufacturing engineering / production planning



Off-road vehicles



All-wheel drive



Localization



Production peak shaving

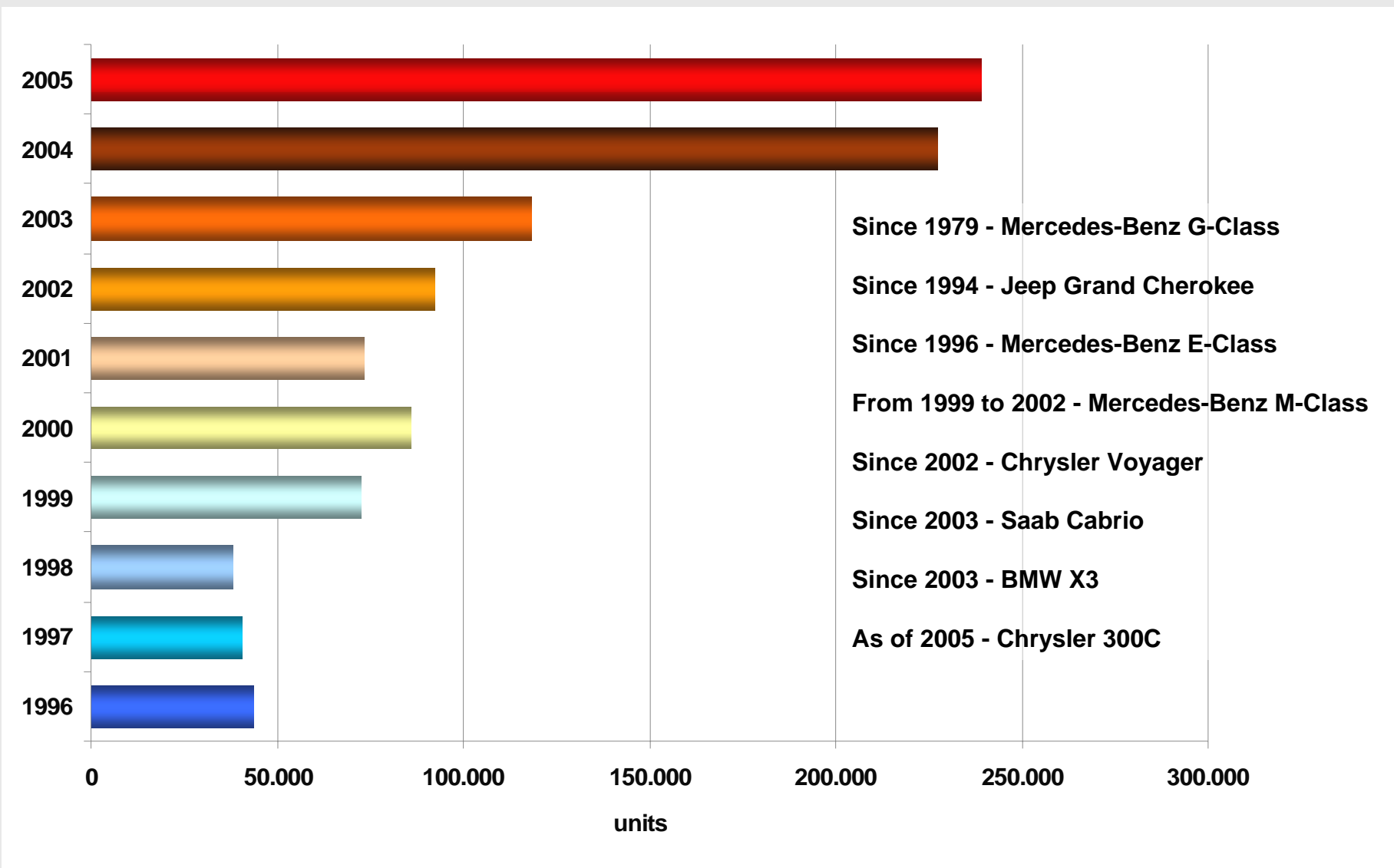


MSPS – flex plant



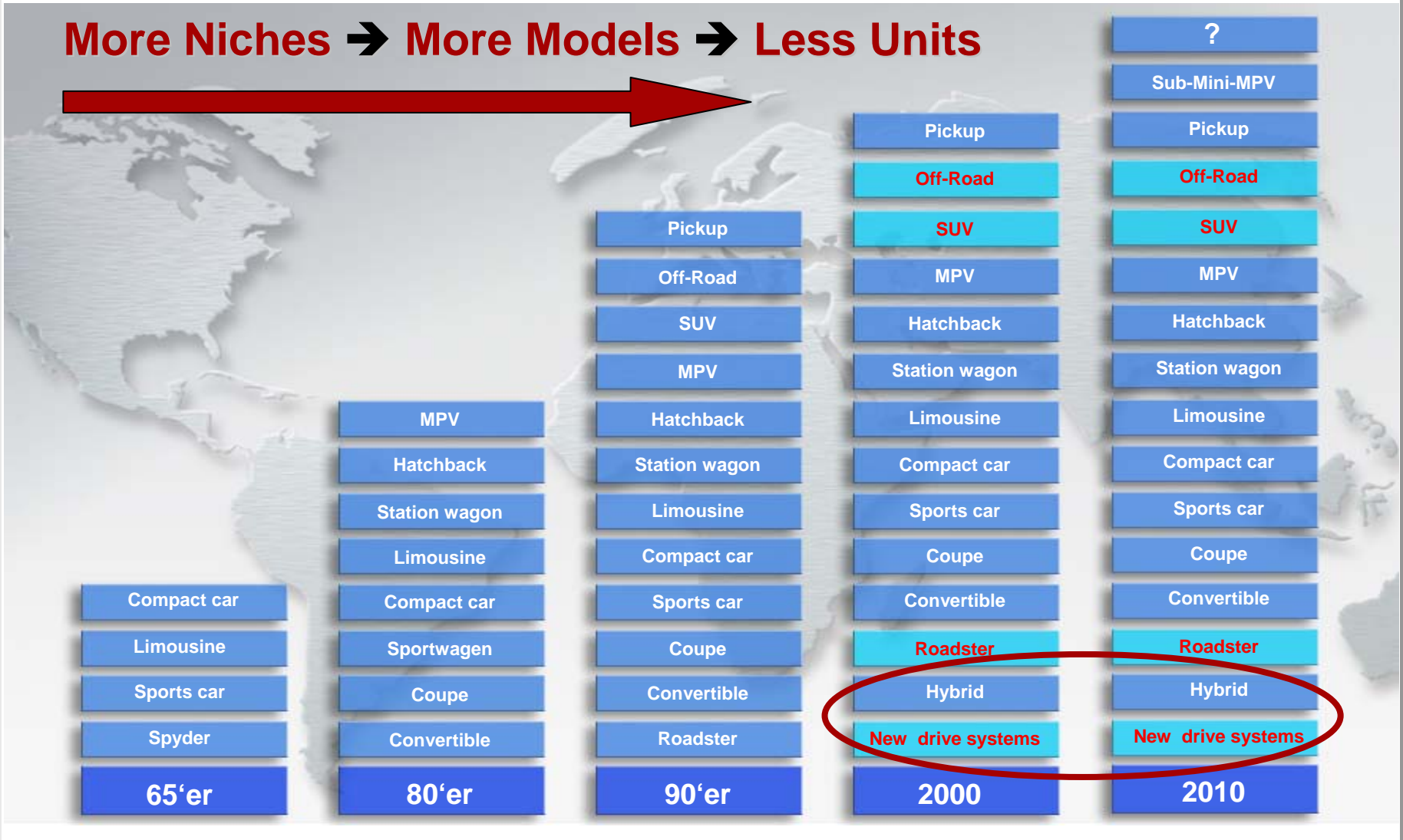
MAGNA STEYR

Vehicle Production

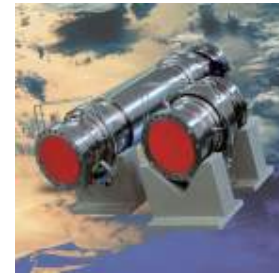


Increase of Niche Vehicles

More Niches → More Models → Less Units



Centre of Alternative Automotive Applications



Vehicle
Know-How



Hydrogen
Know-How

MAGNA STEYR aims to build a competence centre and accumulate hydrogen-specific knowledge and expertise in-house

Why do we need alternative fuels?

- **Dependency on petroleum exporting countries**
- **Limited reserves of fossil fuels**
- **Reduction of greenhouse gas emissions**



**Secure individual mobility
of future generations**



MAGNA's Motivation

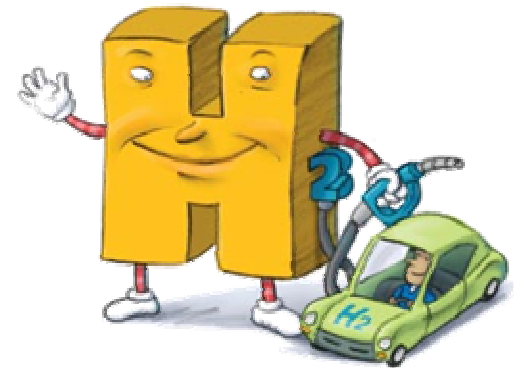
- **Increasingly strict requirements concerning vehicle emissions to reduce the negative consequences of traffic for humans**
- **Alternative propulsion vehicles are the niche vehicles of tomorrow**
- **Hydrogen storage development for alternative propulsion vehicles as new core business & space technology spin-offs**
- **Leading and coordinating position in multi-national projects on European and international level**



Alternative Propulsion Systems

Advance the technology of alternative propulsion principles by constant development of procedures, systems and components

- **Our Aim:**
Fastest possible market entry of innovative & competitive hydrogen storage systems
- **Our Strategy:**
Development of optimally integrated complete storage concepts: vehicle – storage system – power transmission and engine
- **Our Key Technology:**
Automotive hydrogen storage systems
- **Our Vision:**
World-wide break-through of the clean hydrogen technology



Challenges



Filling Stations



Parking of Vehicles



Tunnels



Data Transfer



Fire Brigade / Rescue



Accidents

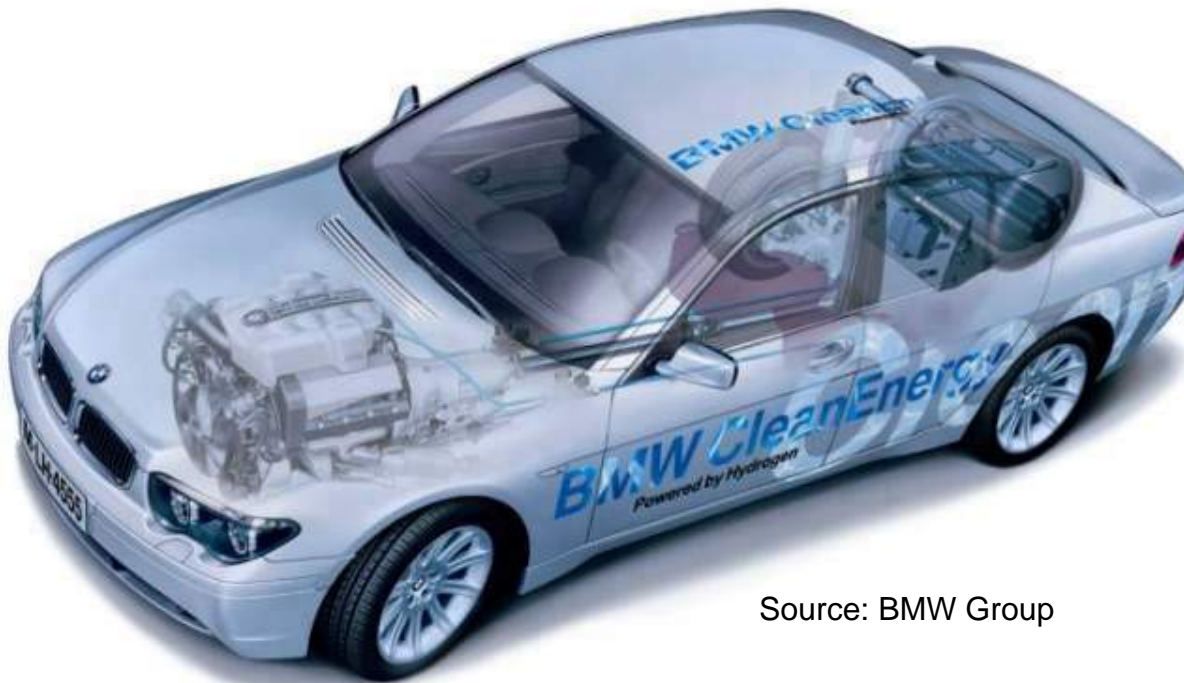


Maintenance / Service

Sources: Aral, BMW, DaimlerCrysler

L-H₂ Tank – Series application for BMW

Engine:	12-cylinder ICE
Performance:	150 kW
Torque:	300 Nm
Top speed:	226 km/h
Fuel:	Liquid hydrogen / gasoline



Source: BMW Group

L-H₂ Storage System - Assembly

Our focus on hydrogen constitutes a considerable competitive advantage over other automotive suppliers



Micro-Series manufacturing



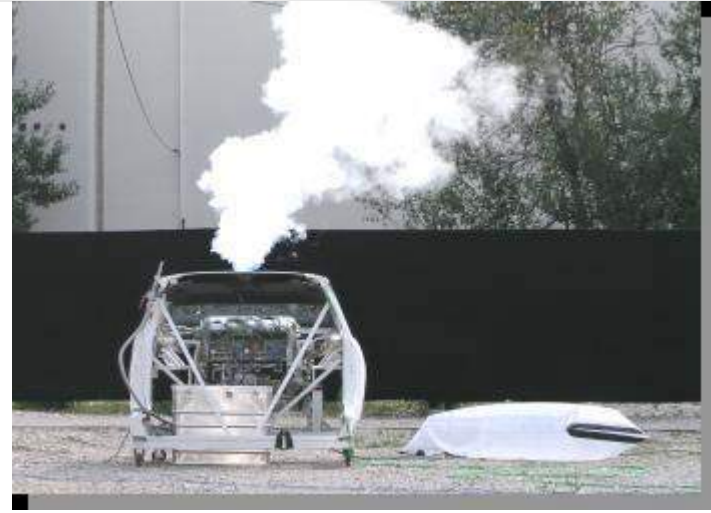
Quality inspection

Design Validation Tests



Liquid Hydrogen Test

Source: Energie Technologie GmbH / Munich, Germany



Vacuum Loss Test



Crash Test

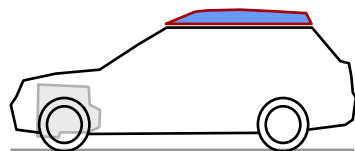
Source: BMW Group / Munich, Germany



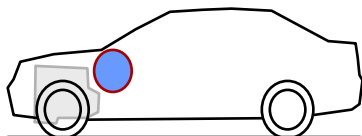
Bonfire Test

Source: BAM / Berlin, Germany

Possible tank locations



1 Tank, roof rack



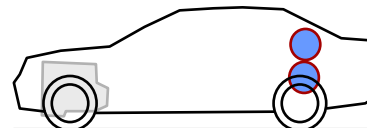
1 Tank, in front of the instrument panel



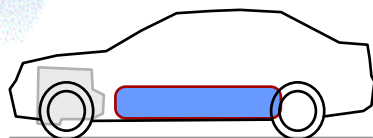
1 Tank, behind the passenger compartment



2 Tanks, below the passenger compartment

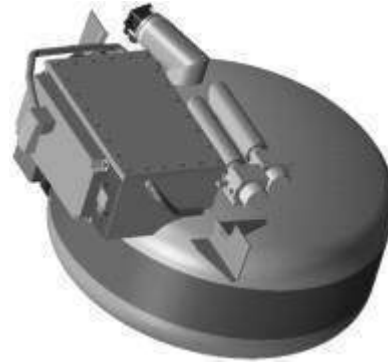
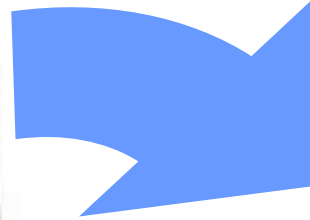


2 Tanks, behind the passenger compartment



1 Tank, in the center tunnel

L-H₂ Storage System – Design Steps



State of the Art System

- Stainless steel
- Cylindrical vessel
- Unique designed parts
- Prototype / micro series

Next Generation

- Stainless steel and/or Aluminium alloy
- Adjustable integration
- Niche production of components

Future System

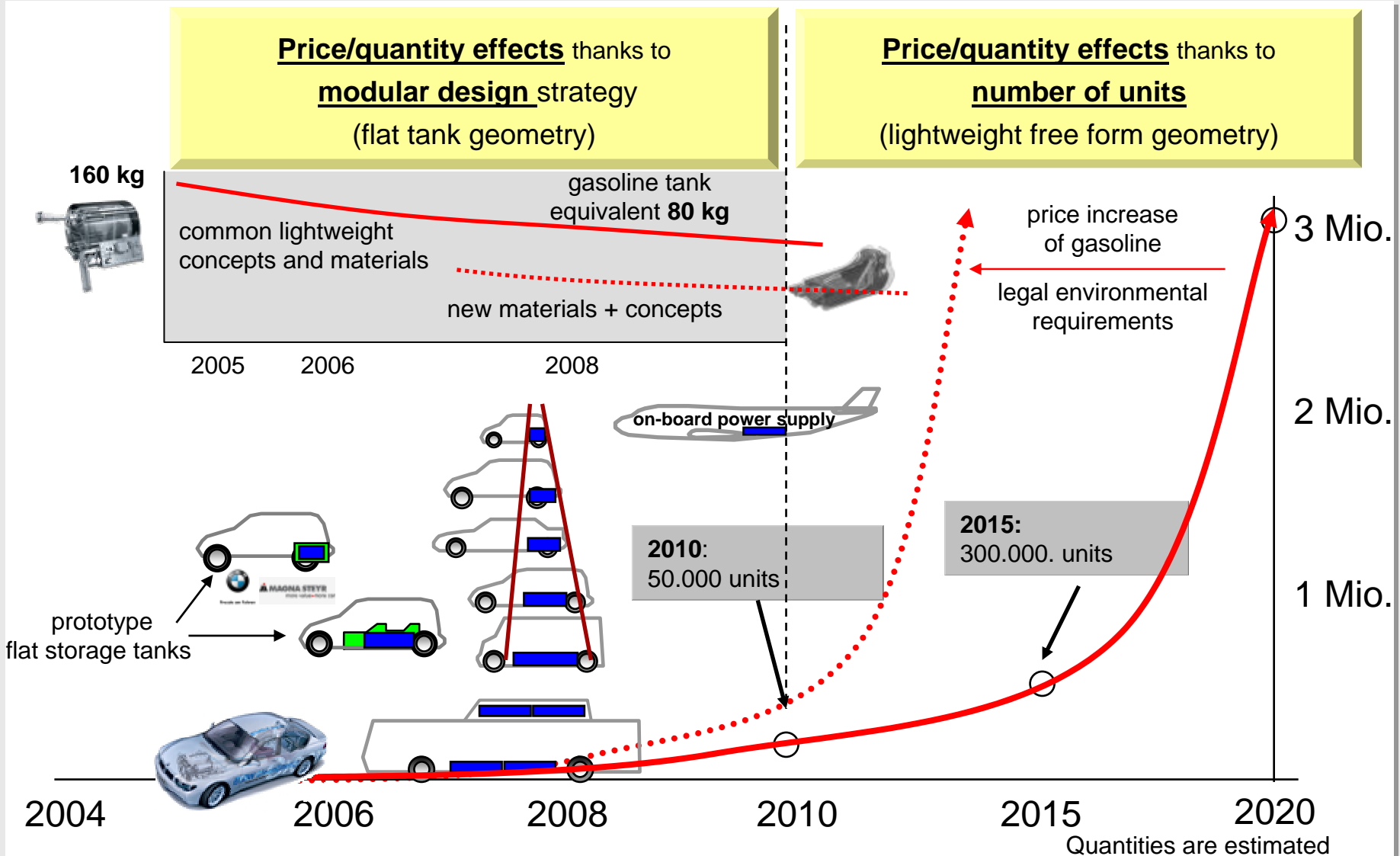
- Lightweight materials
- Free-form geometry
- Automotive design and production technologies
- Flexible modular system
- Recycling

Challenges

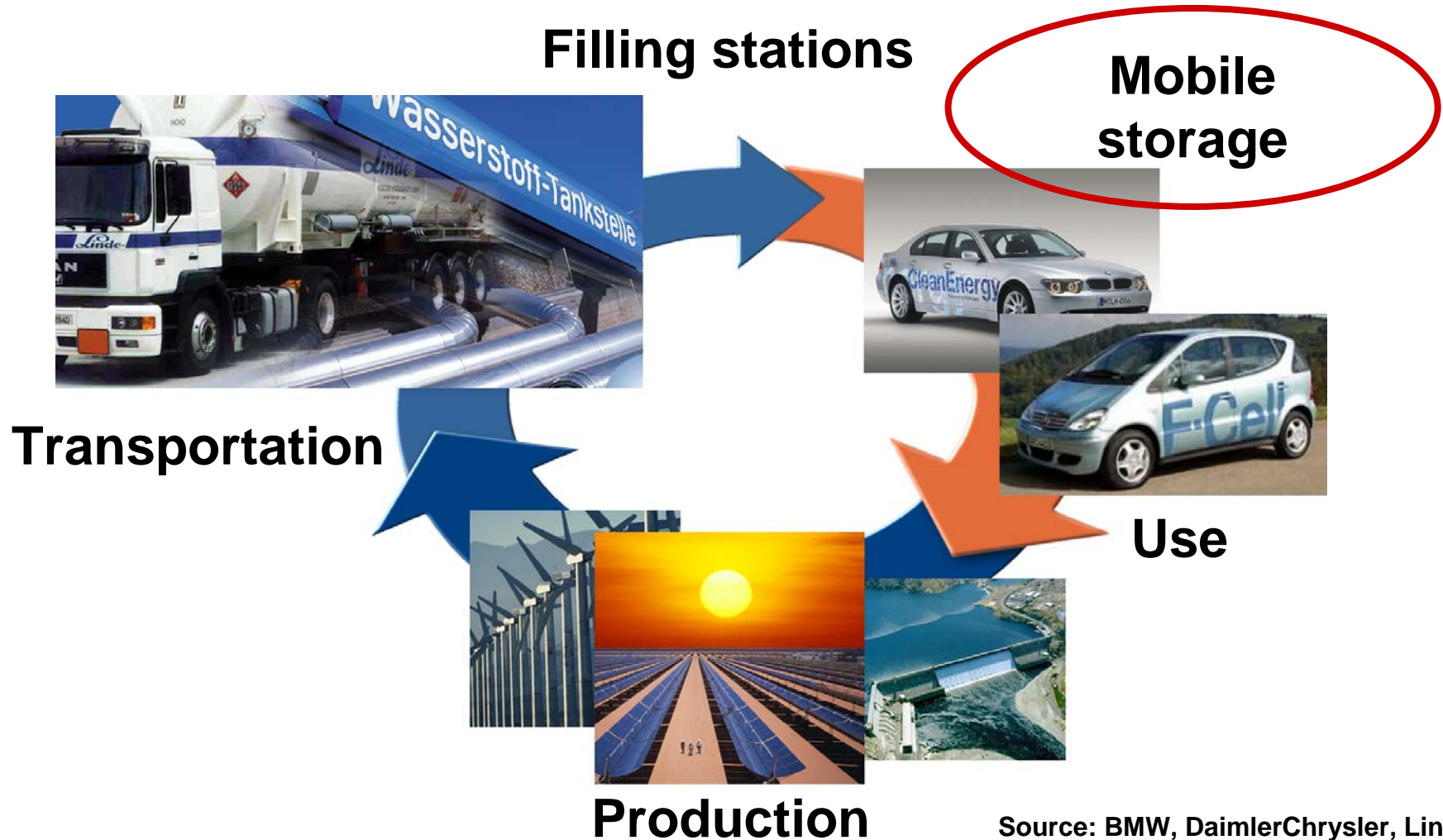
- Vacuum stability
- Reduced heat entry
- Material properties
- Thermal shock
- Recycling



Prospects for Hydrogen Storage Systems



The Hydrogen Cycle



Source: BMW, DaimlerChrysler, Linde

Hydrogen Centre Austria – Graz

Contribution to a fundamental economic and organizational infrastructural change of the current energy and fuel economy

HyCentA



Supply Infrastructure

- liquid hydrogen tank 17.600 l,
- liquid nitrogen tank,
- special gases,
- compressed hydrogen till 450 bar

Test Equipment

- test benches with modern measurement
- equipment for compressed and liquid hydrogen

Filling Equipment

- filling station for liquid and compressed hydrogen

Conclusions

- **Evolving the hydrogen economy will take time, strong partners and financial commitment**
- **Acceptance of industry and public required**
- **Europe takes leading position in development of hydrogen powered cars**
- **Step into “Hydrogen Age” will be a challenge for universities, research institutes and industry**
- **The first series Hydrogen Storage System will be engineered and produced by MAGNA STEYR by 2007**



Many thanks for your attention!
