

# „DLR-Wabentank – *Shape Adaptable and Modular CNG Storage*“

07.11.2014, Magna-Helmholtz Research Day,  
Bad Homburg

Dipl.-Ing. Diego Schierle

Dipl.-Ing. Gerhard Kopp

Dipl.-Ing. Gundolf Kopp

Prof. Dr. Horst E. Friedrich

DLR Institute of Vehicle Concepts

Stuttgart



Wissen für Morgen

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# 1. Social Challenge

- We are reaching the limits of oil extraction
- Climate change is taking place
- Growing population, concentrated in megacities



## Vehicle Concepts

- Lower energy consumption
- Reduced CO<sub>2</sub> emissions by using CNG
- Reduce NO<sub>x</sub> emissions by using CNG
- Alternative and renewable energy sources
- ...



Source: <http://www.fotocommunity.de/pc/pc/mypics/1438338/display/18369424>



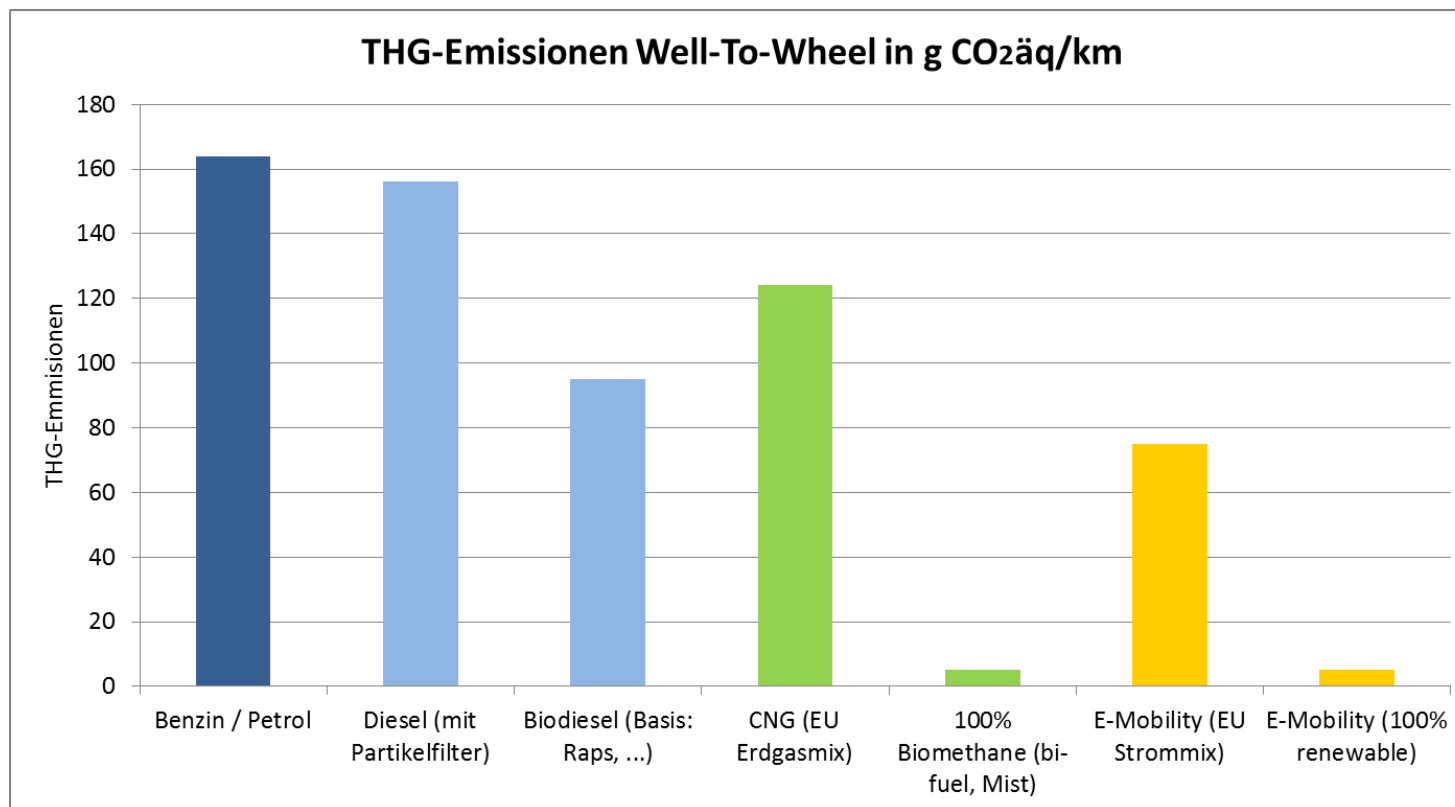
Source: DLR



Source: versust.blogspot



## 2. CNG as a mid-term possibility




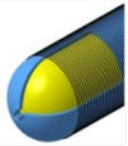

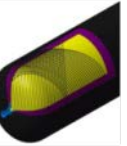
- By using CNG (100% biomethane) as a sustainable and low emission fuel a low emission future is possible
- Why is CNG barely in use?



### 3. Technology

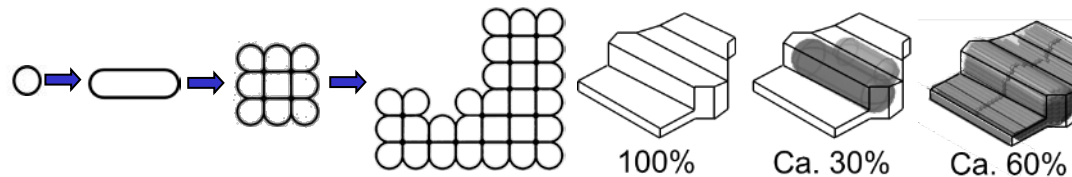
Tanks with a wide range of packaging variations are needed and an enabler for CNG-Vehicles

#### State of the Art

				
	CNG 1	CNG 2	CNG 3	CNG 4
Liner	Metal	metallic	metallic	Non metallic
Winding	-	Hoop wrapped	Fully wrapped	Fully wrapped

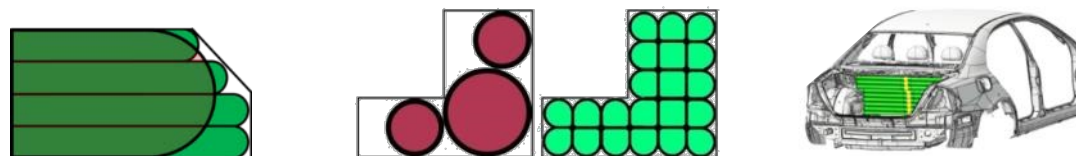
Innovation through  
→ **lightweight material**

#### Basic Concept – DLR-Patent



Innovation through  
→ **design**

#### Variability in the use of the available space

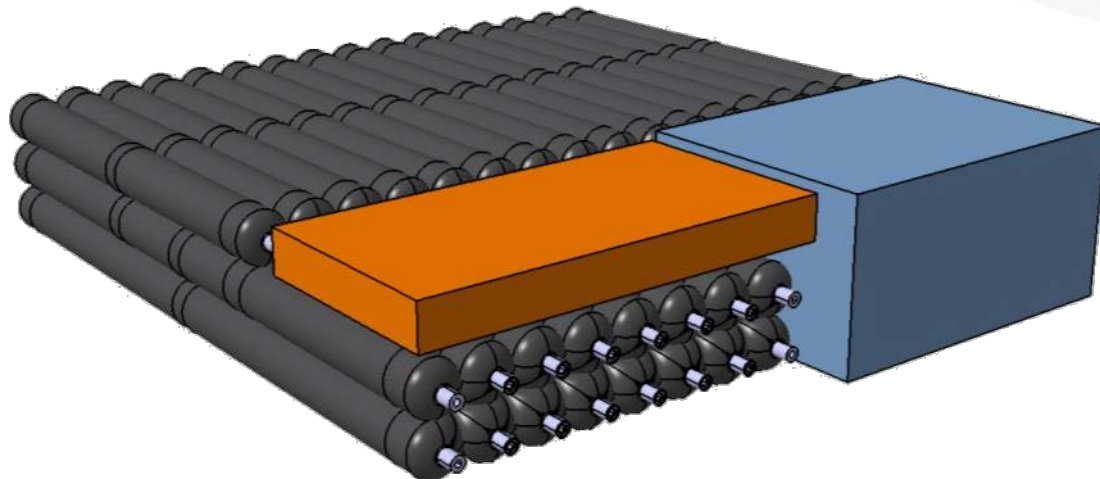
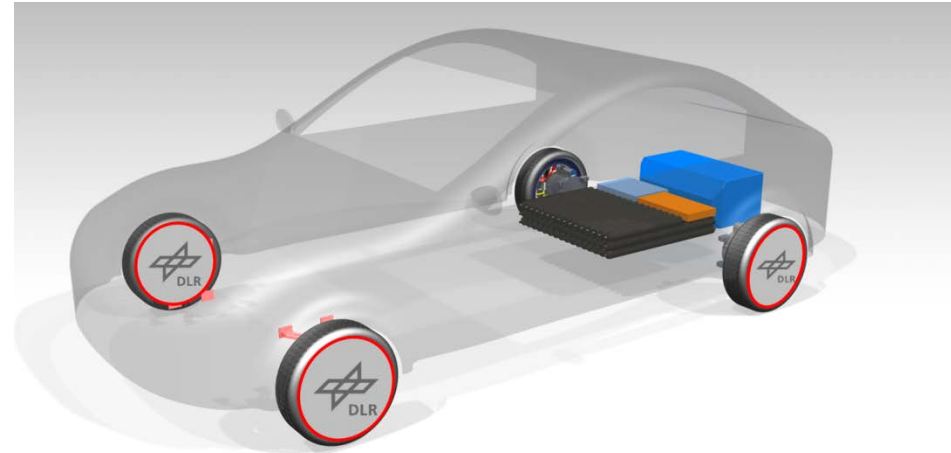
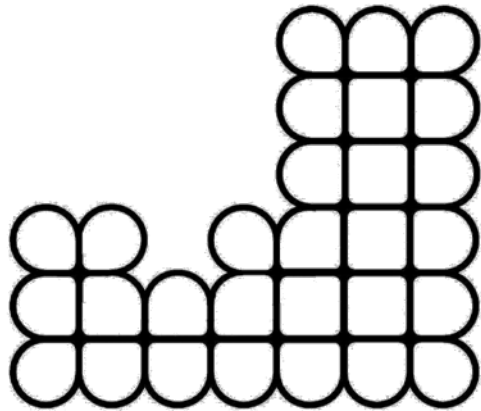


-Mercedes Benz E-Class:  
-ca. + **38% Volume demonstrated**



### 3. Technology – DLR-Wabentank

A hybrid and shape adaptable high pressure storage

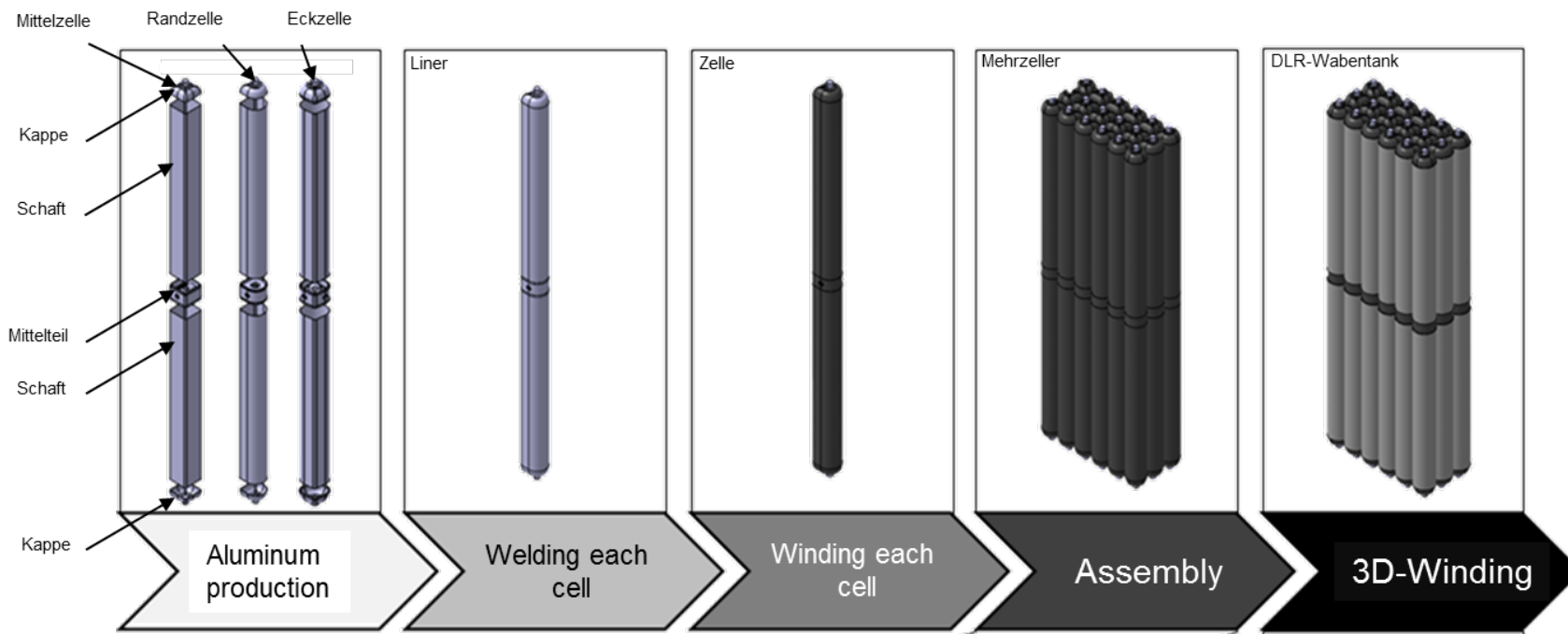


Shape adaptable,  
modular construction leads to  
significant volume gain (> 30%  
possible)



# 4. New Production Approach Type 3

## Modular and Fully Scalable High Pressure Storage

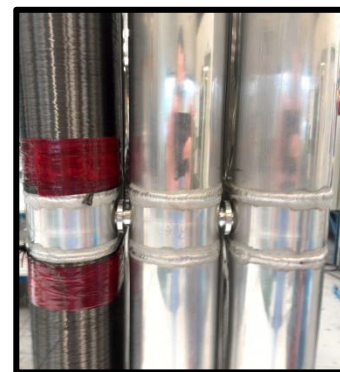


nach: Schierle, Friedrich – FKFS-8. Tagung Gasfahrzeuge 2013



# 4. New Production Approach Type 3

## Modular and Fully Scalable High Pressure Storage



Aluminium  
production

Welding each  
cell

Winding each  
cell

Assembly


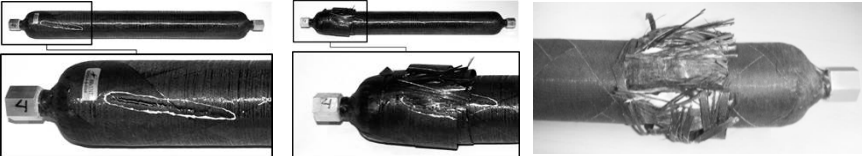

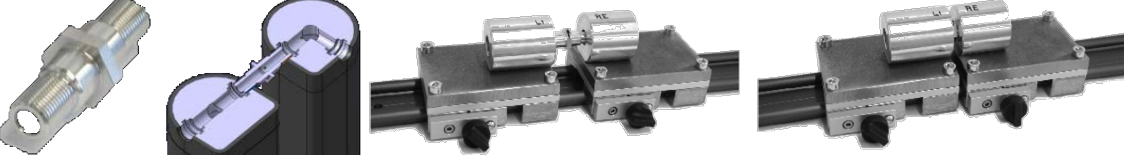
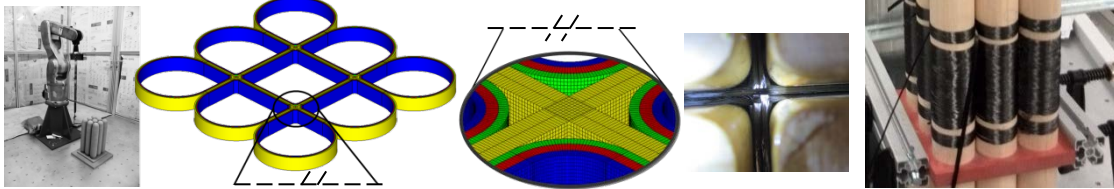
3D-Winding

nach: Schierle, Friedrich – FKFS-8. Tagung Gasfahrzeuge 2013





# 5. Project Progress

	Progress	Validated
Liner		<ul style="list-style-type: none"> <li>• Gas tight</li> <li>• Strain at failure OK</li> </ul>
Monocells		<ul style="list-style-type: none"> <li>• Burstpressure</li> <li>• Pressure cycles</li> </ul>
Winding non-rotational cells		<ul style="list-style-type: none"> <li>• Non rotation-symmetric winding</li> </ul>
Gas-connector		<ul style="list-style-type: none"> <li>• Burstpressure</li> <li>• Pressure cycles</li> </ul>
3D-Winding		<ul style="list-style-type: none"> <li>• Validated in Oktober 2014</li> </ul>

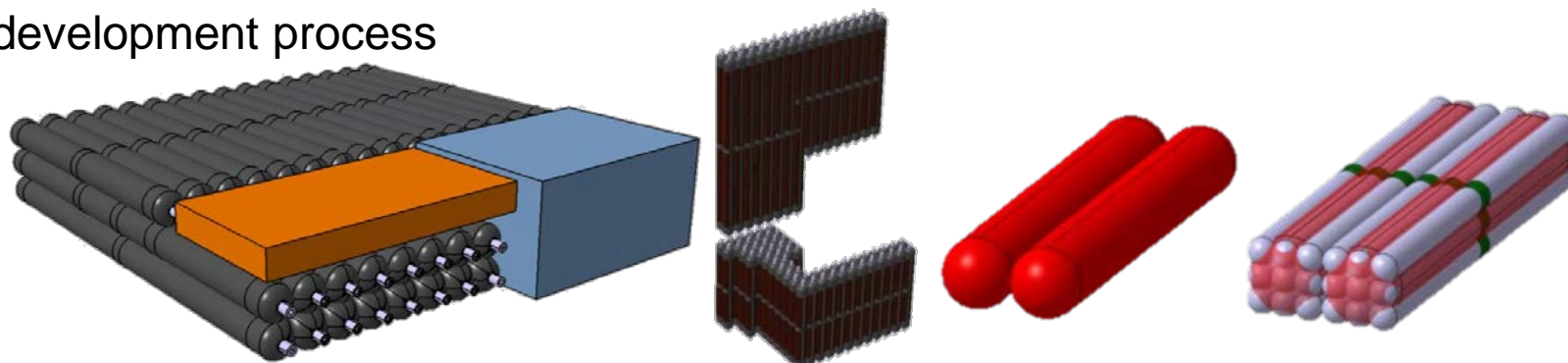


## 6. DLR-Patent Potential

- The production of the first **modular-free-shapeable CNG tank**

→ Increasing range	=	+15% (2 vessels)
	=	+30% (vehicle)
→ m/V	=	ca. 0,46kg/l
→ €	=	ca.18€/l (first calculations)

- DLR-Patent is able to be incorporated at any stage in the vehicle development process



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