

# Sustainable mobility for everybody - complementary solutions for passenger and commercial transportation

Roger Deckers

VDO Automotive AG



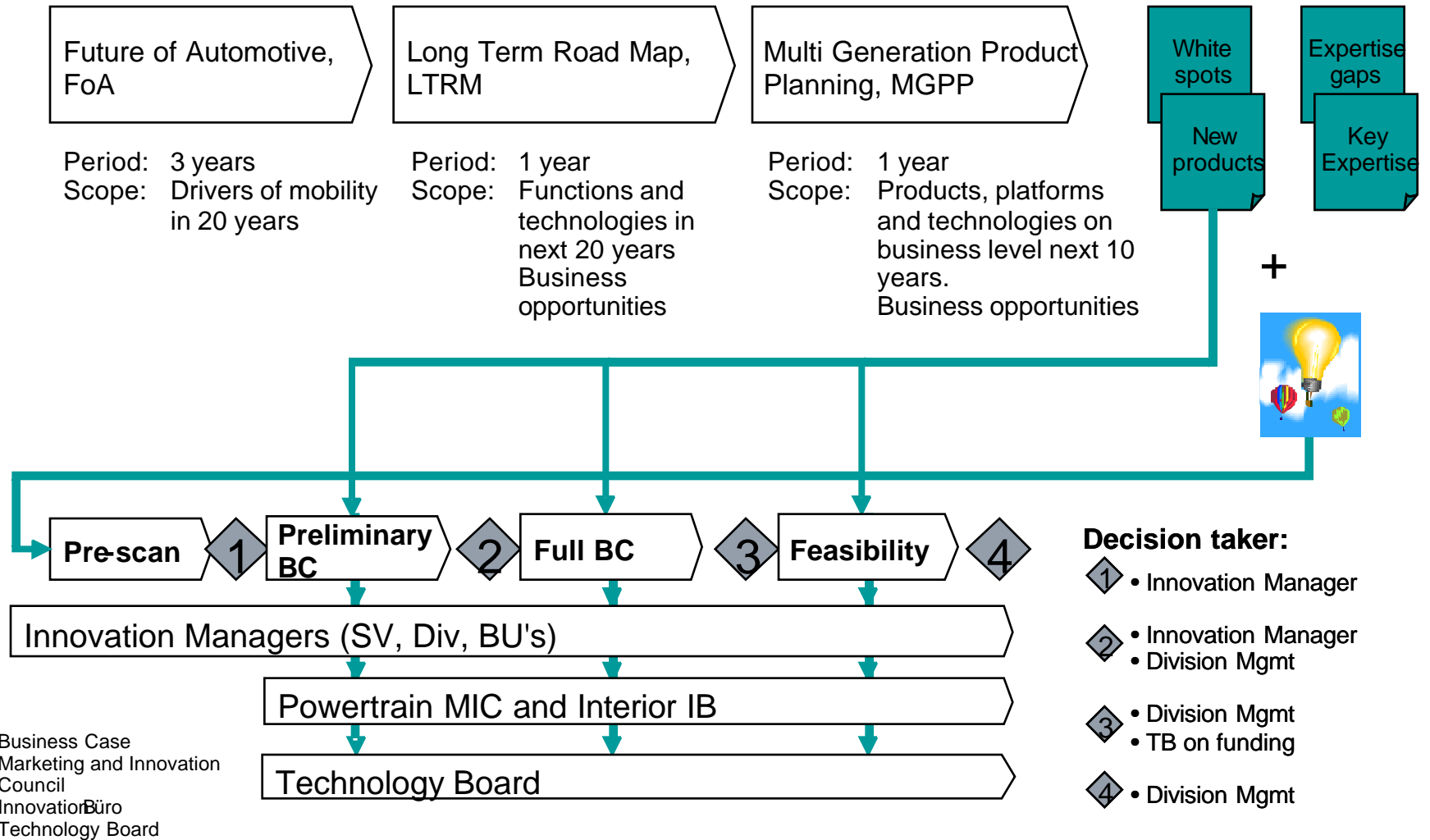
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- Innovation Management
- Macro Trends – the Future of Automotive and Commercial Transportation
- Our Visions
- Sustainable Solutions for Cargo and individual mobility....
- ....for everybody
- Conclusions & Outlook

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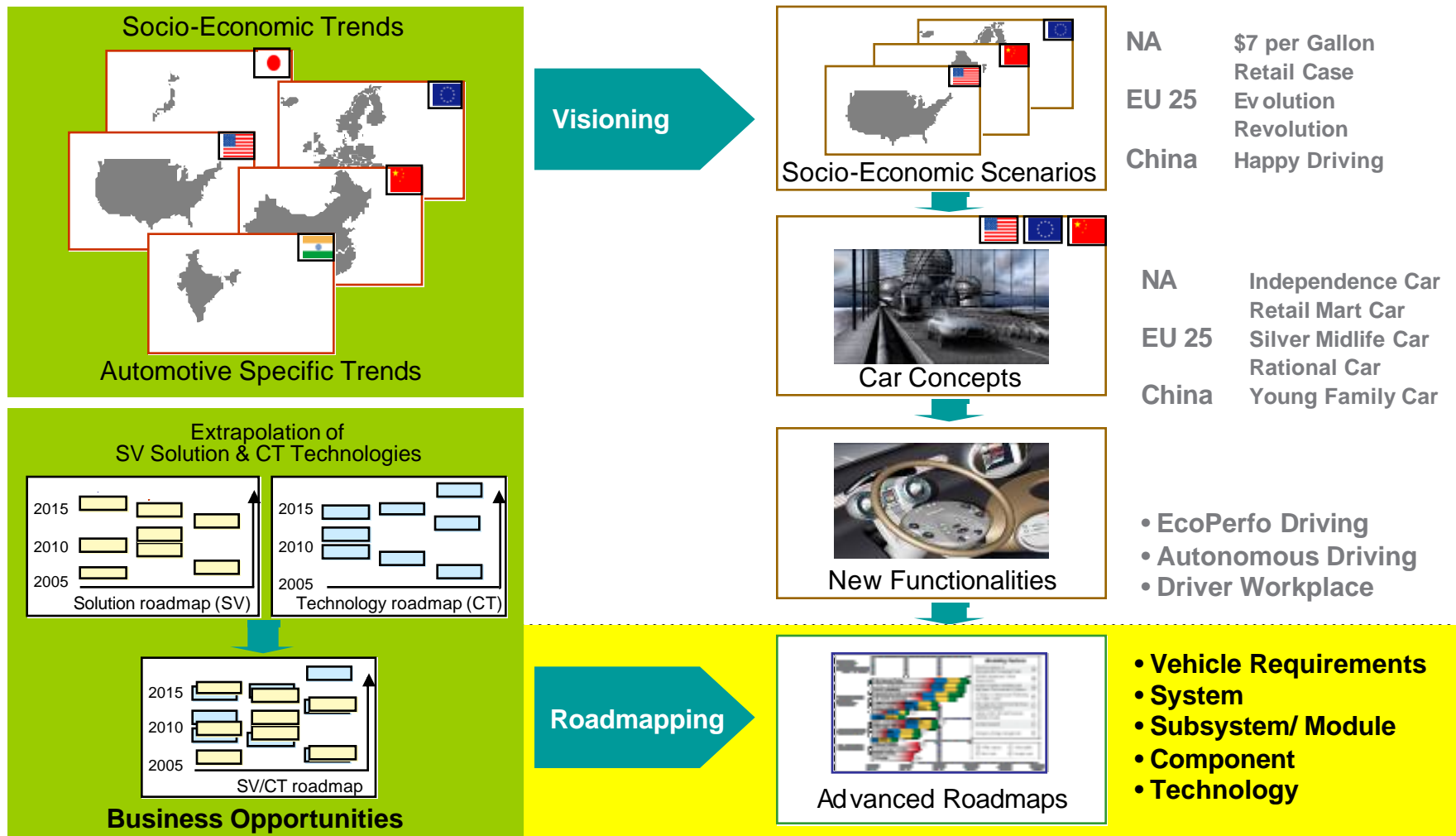
# The innovation management process



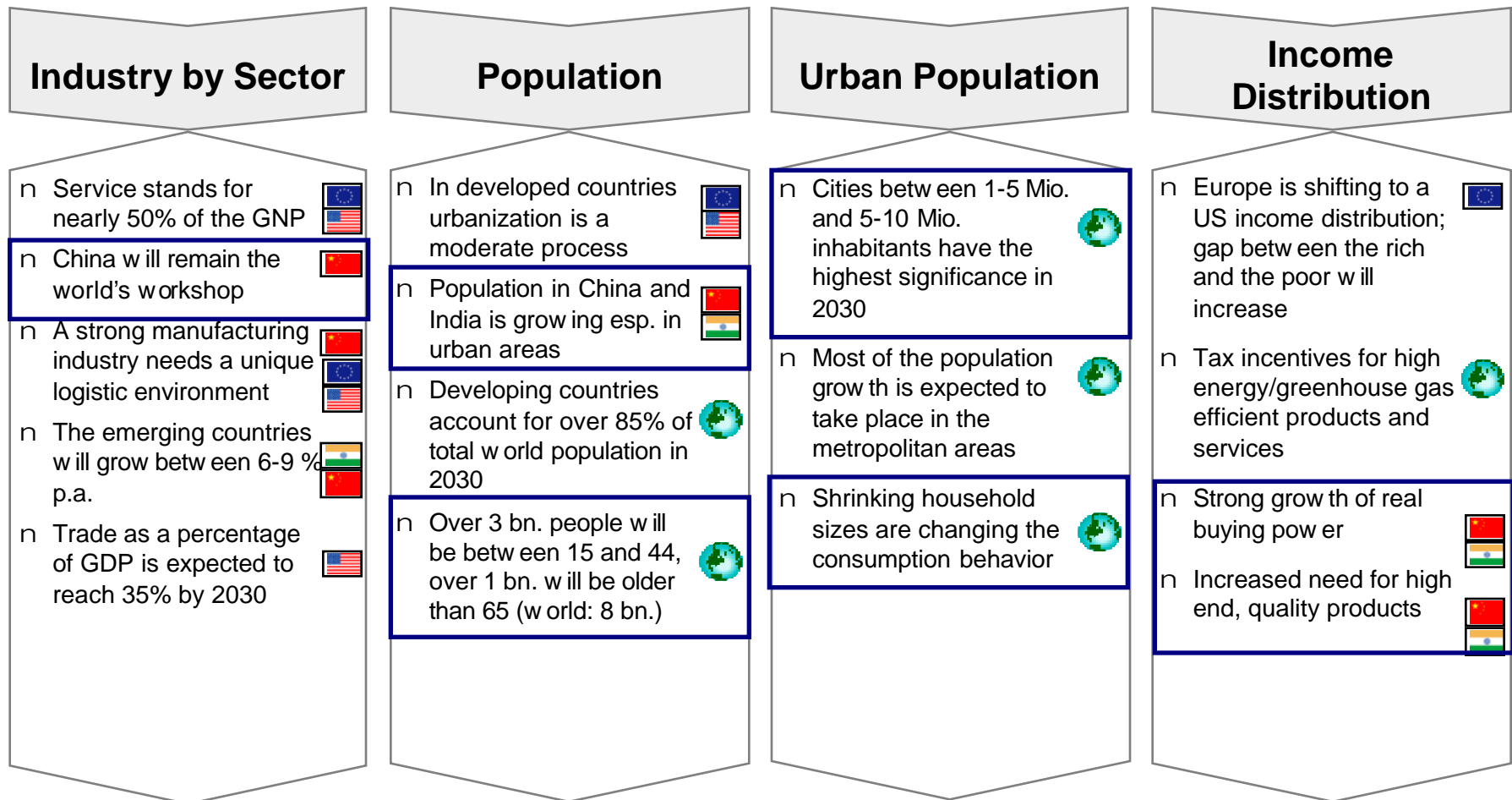
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# Process & Structure: From Trends down to roadmapping



## Trend Extrapolation – Industry, Population & Income







## Trend Extrapolation – International Trade










## Trend Extrapolation Infrastructure

### Infrastructure Expenditures

- n Investments into water supply will dominate total expenditures. 
- n Developed countries will spend about 30% of their expenditures into transport infrastructure. 
- n Emerging countries will only spend about 10% of their expenditures in transport infrastructure but will invest more than 62% into water infrastructure. 
- n Major ports: Modernizations started (new handling locations, new container terminals) 






Significant investments into transport infrastructure only in developed countries

### Transport Infrastructure Expenditures

- n The total investment into transport infrastructure will still be dominated by roads. 
- n In average the expenditures for airports and ports will double 
- n The investments in airports will be approx. 17 times higher 
- n In average the expenditures for roads, ports and rail will triple 
- n Refurbishment counts for over 60% of the transport Infrastructure expenditures 





Total investment into transport infrastructure will still be dominated by roads

### Road Infrastructure Assets

- n Road infrastructure is mainly paved 
- n Most of the roads are village roads with bad quality -> effects on logistic time & costs 
- n India's road network is about 3.3 Million km long, of that 2% are highways 
- n Interstates represent just 1% of total US highway miles, but carry 41% of heavy truck traffic. 
- n About 1,3 trillion vehicle miles will be traveled on Interstates by 2030 

Undeveloped countries have to build up a sustain road infrastructure







### Road length

- n The length of the road network will increase by 16%. But the share of paved or gravel roads will increase by 35% 
- n Compared to the average growth of the road network, the share of paved or gravel roads will increase twice 
- n India's road network will be the second largest in the world (after the US) 
- n The share of road network and paved / gravel roads remains constant (50%) 

Paved or gravel roads will increase






## Trend Extrapolation Mobility & Resources

### Total Energy Demand

- n By 2030 China will be the second largest consumer of energy worldwide 
- n In the emerging countries the annual growth rate of energy demand is 10 times higher than in EU and 5 times higher than in the US  
- n Transport is accountable for about 25% of the total energy demand 
- n The energy demand for transport will double, but still represents 10% of the total energy demand only  






**China will be second largest energy consumer**

### CO<sub>2</sub> Emission

- n Transport is accountable for 33% of the total emission 
- n China will close up to the USA in the CO<sub>2</sub> emission 
- n The leverage for CO<sub>2</sub> reduction is very high for transportation 
- n The leverage for CO<sub>2</sub> reduction is very high for power generation 
- n In the developed countries will be a high legislation pressure on transportation to reduce CO<sub>2</sub> 





**High pressure on transportation in CO<sub>2</sub> reduction**

### Transport Energy Source

- n The fuel market will be dominated by traditional fuels based on oil 
- n Fuel price is volatile on a relatively high level 
- n Increased need for gaseous, synthetic and biofuels 
- n With liberal commercial terms and moderate crude oil price only Brazil can produce bio ethanol cost effective 
- n 3-5% of the total energy demand for transport will be supplied by non oil based fuels 

**The fuel market will be dominated by traditional fuels**

### Transport Energy Demand

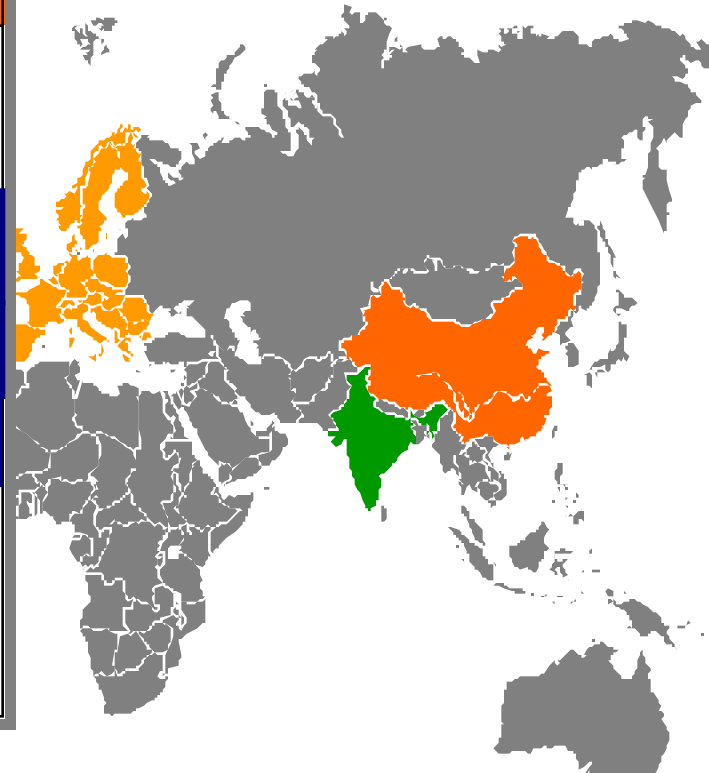
- n Passenger transportation is accountable for most of the energy demand 
- n The fuel market will be dominated by traditional fuels based on oil 
- n Fuel price is volatile on a relatively high level 
- n Increased need for gaseous, synthetic and biofuels 

**The fuel market will be dominated by traditional fuels based on oil**

## Scenarios Socio Economics – India & China

The Micro Tiger
<ul style="list-style-type: none"> <li>• Neither growth nor arise of new megacities</li> <li>• Low pace development of rural &amp; medium cities</li> <li>• Slow growth of GNP / capita (700 \$ → 4,000 \$)</li> </ul>
<ul style="list-style-type: none"> <li>• Low investment in road &amp; city parking infrastructure</li> </ul>
<ul style="list-style-type: none"> <li>• Safer rural environment</li> <li>• Safer transportation drives ecology</li> </ul>

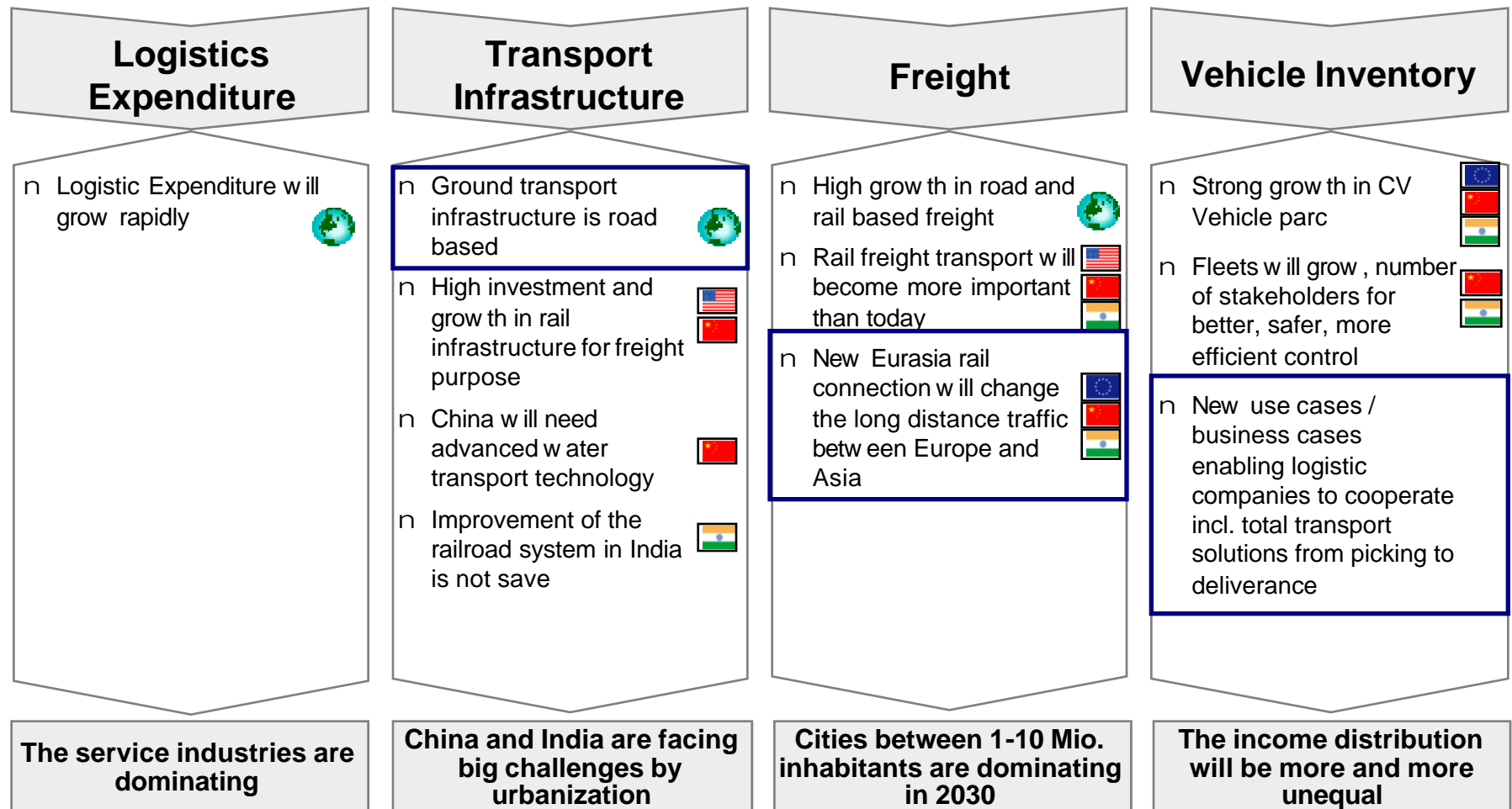
Bouncing Boom
§ Domination of new midsize cities (1 to 5 million)
§ High income gradient
§ Fast growing motorway network (#2 world)
§ Export orientated manufacturing
§ Rising domestic consumption
§ Import of raw materials and mineral oil at coastal area
§ Ecological/ energy / economic instability might bounce back



**India:** Safety and ecology will supposedly clear the way for economic growth, yet in a slow pace

**China:** Dominance of growth requires regulations and standards

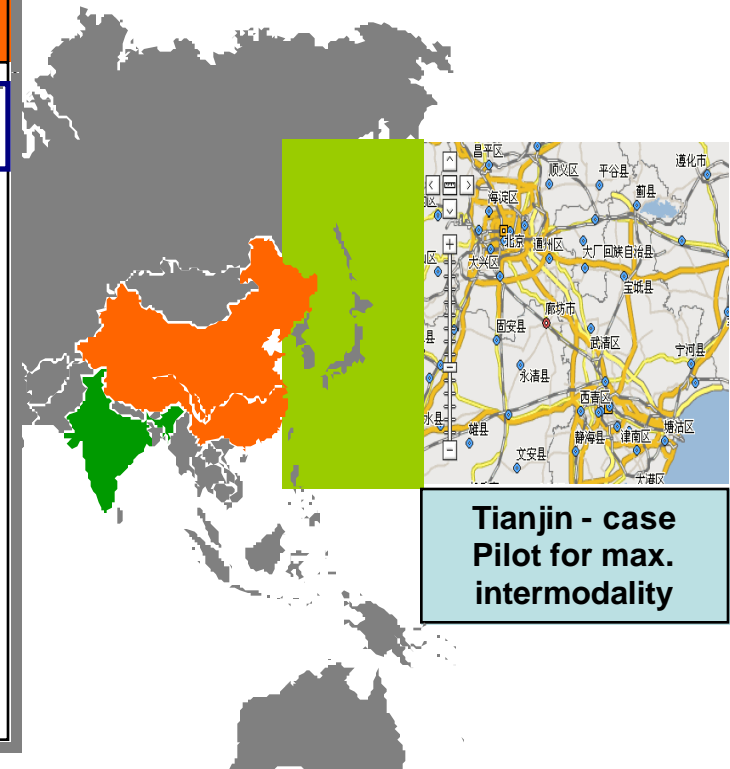
## Trend Extrapolation Industry, Population & Income



## Scenarios logistic companies – India & China

Slim Trader
<ul style="list-style-type: none"> <li>• Inner City transport still dominated by 2-4 wheelers</li> <li>• Long haul still not much improved due to road infrastructure</li> </ul>
<ul style="list-style-type: none"> <li>• Road transport overarches rails still</li> <li>• TCO reduced and shift toward higher driver (training) and fuel costs</li> <li>• Cargohandling improved as stakeholders diminish and fleets increase</li> <li>• Good, truck and driver tracking generalized</li> </ul>

Ruled Trader
§ Manufacturer-led supply chains
§ Freight distribution will be enabled by institutional / governm. / I&C architectures
§ Smaller, more frequent deliveries, multiple drops, narrow time windows for delivery
§ Optimized supply chain with higher efficiency (less waste)
§ Incentive for HDT (> 20t) in roadpricing promoting highway usage

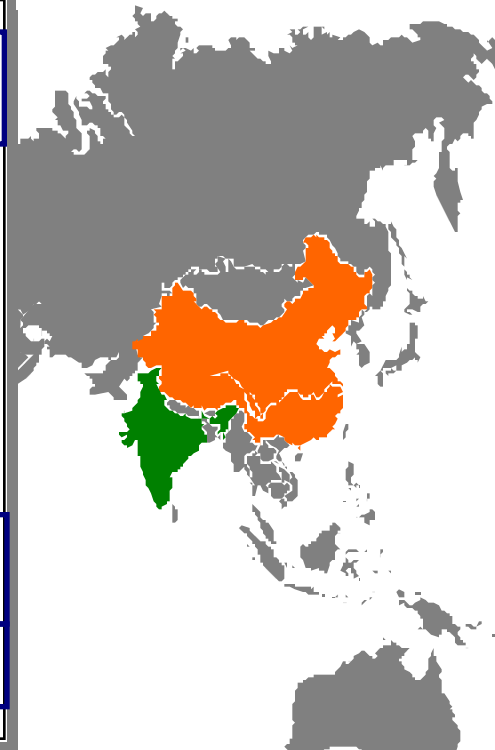


**India:** Fragmented economy growth requires local logistical solutions

**China:** Logistics is the key factor for sustainable growth, conditioned by systematic approach

## Scenarios for commercial vehicles – India/ China

Safe Tiger	Hitec Boomer
§ Overall weight control and more 20t+ trucks	§ Technical gap between China and EU will be closed
§ Smallest delivery vans (1t) due to low labour costs & city architecture	§ Variety of propulsion concepts given energy supply gap
§ Alt. fuel driven HCV (Biodiesel) and LCV (CNG, Bioethanol). Start-stop overall. EU HCV&LCV	§ Trained drivers controls new technologies
§ ADAS equipment & vehicle controller & C2X	§ Testing, registration, certification, non conformity system fully developed
§ Mandatory Pedestrian protection systems for LCV	§ Own innovations for new technology in CV established
§ Mandatory passive safety systems for HCV	§ Mandatory passive and active safety systems



**India:** Robust trucks and small city delivery vans with fast following technology

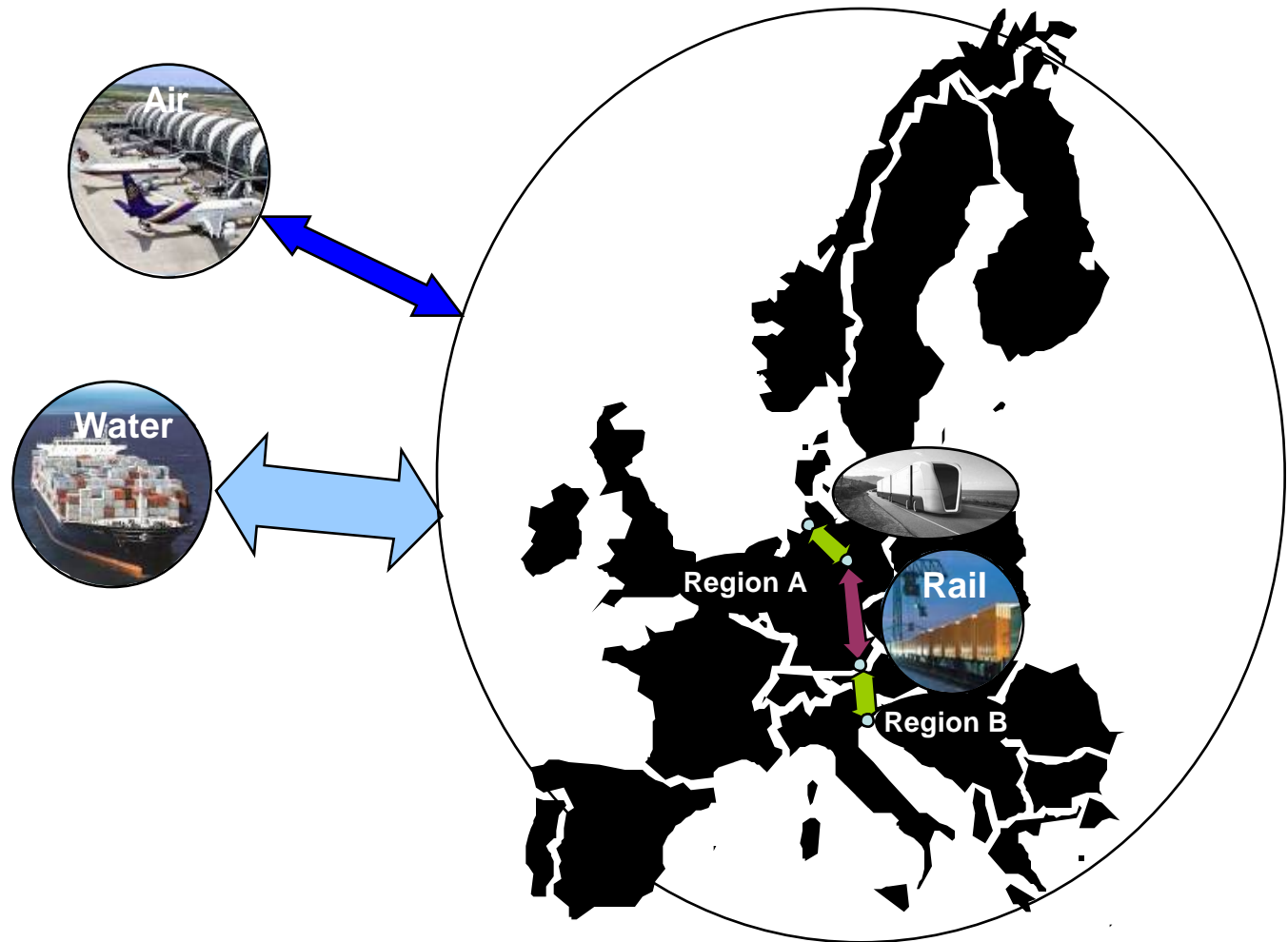
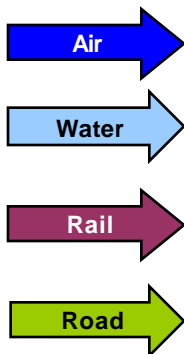
**China:** High speed, high payload, clean, safe and total efficient HCV, with non-conformity checks

# EU-27 - The Total Picture: seamless transport from (air-) ports to end consumers

## The Story

- Important transport distances will be 0-200 km and >500 km.
- For long distance freight road transport will compete with rail.
- Most of commercial transport within EU is still done by road.

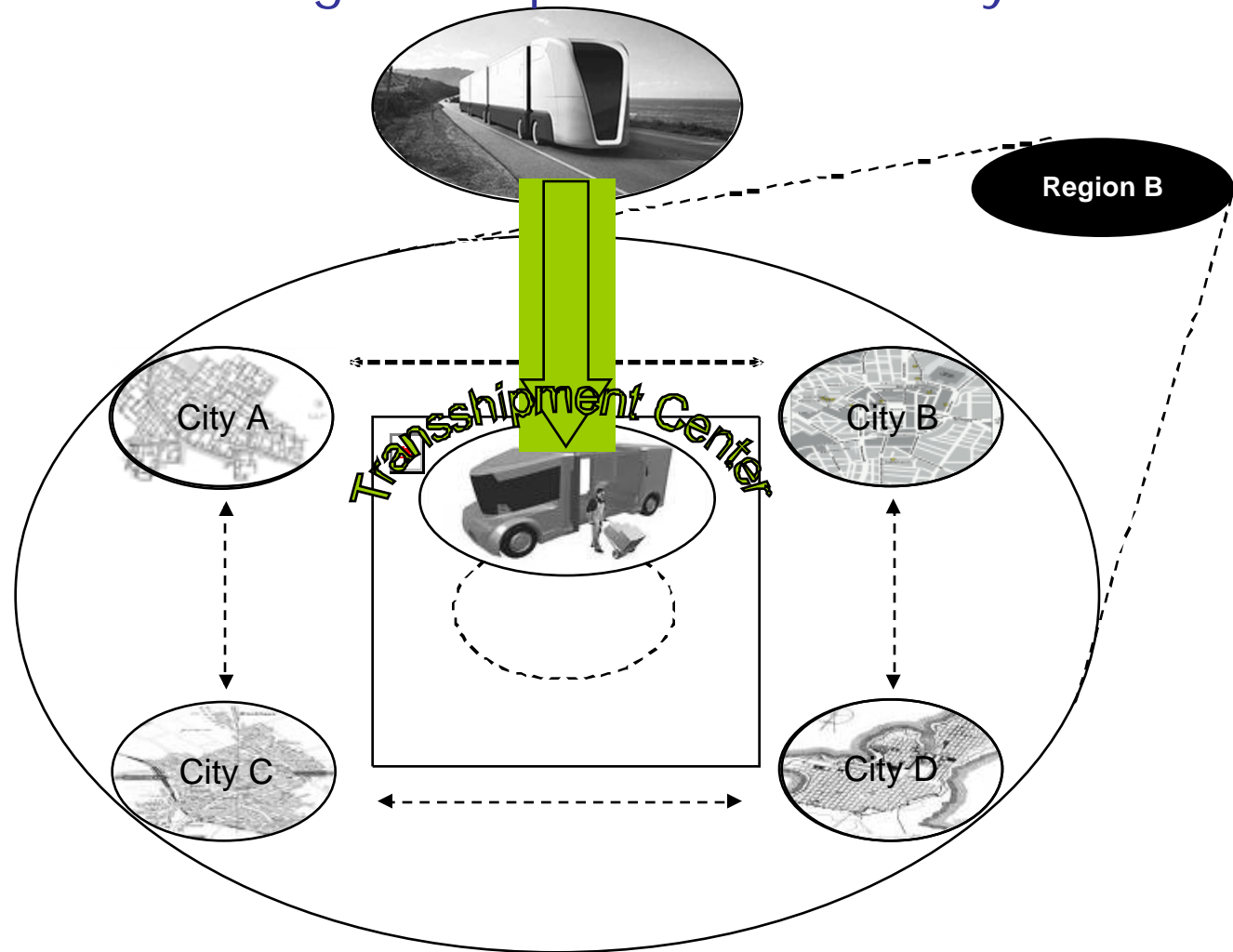
## Transport Mode



## EU-27 Regional Zoom: Cargo transport dominated by HCV

### The Story

- HCVs will dominate the cargo exchange between mega regions, while local distribution within a mega region is handled through LCVs.
- Highly efficient automated cargo handling centers are crucial to meet the requirements from price driven competition.







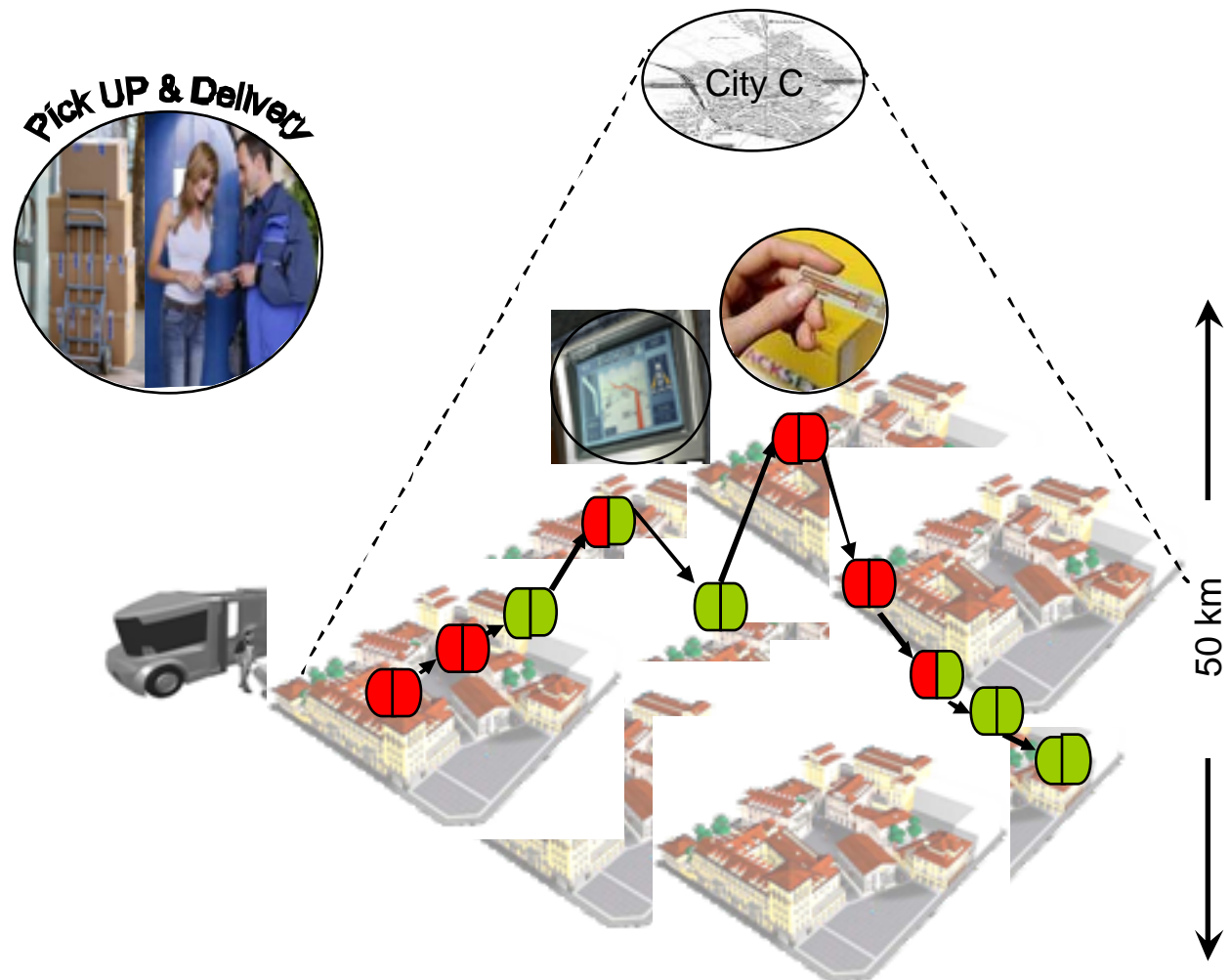
## EU-27 – City Zoom: Consumer driven LCV cargo transport

### The Story

- Objective: Ecological and environmental regulations and price driven competition in inner city transport
- Concept scenario low noise, low emission and high energy efficient LCV's
- With pick-up and delivery driven intelligent packages, operating widely automated on a 24/7 basis.

### Legend

- Pick Up 
- Delivery 



# European Scenario for Green and Smart Heavy Commercial Vehicle 2030

## Always On

- § Maximum security (anti theft & anti terrorism forced by governmental regulations)
- § Just-in-time delivery
- § C2X (to freight, to car, to infrastructure, to environment by Galileo to VCC (DTCO))
- § Driver optimized HMI

## The Story

Significantly increased transport volumes combined with door to door services lead to connected, seamless automated "Giga Liners" driven by energy efficient powertrains to meet ecological and environmental regulations and price driven competition.

## Zero Accidents

Collision avoidance by ADAS



Interregio Mover  
Big Load Carrier

## Zero Emission

- § Low emitting Propulsion technology (EU 7+, low CO<sub>2</sub>), e.g. bio fuels, mild hybridization
- § Fully closed loop power train control and link to ADAS and C2X

## Managed Complexity

Function oriented E/E architecture, e.g. 5 module 2E Architecture

## Maximum Efficiency <sup>1)</sup>

- § Autonomous Cargo Hub (transshipment center)
- § Intelligent Package, sorting and routing
- § 24/7 economy
- § Volume-time optimization, e.g. GigaLiner (25 m)
- § Maintenance free truck
- § Aerodynamic design (freedom of truck length)
- § Scalable, modular truck (software/functions)
- § Automated Manual Transmissions

<sup>1)</sup> TCO (Total Cost of Ownership) minimization

# European Scenario for Green and Smart Light Commercial Vehicle 2030

## Always On

- Maximum security (anti theft & anti terrorism forced by governmental regulations)
- On demand door to door delivery
- § C2X (to freight, to car, to infrastructure, to environment by Galileo to VCC (DTCO)
- § Driver optimized HMI

## The Story

Cities with demand driven consumption need connected and seamless automated zero polluting high efficient LCVs to meet ecological and environmental regulations and price driven competition.

## Zero Accidents

- § Collision avoidance e.g. ADAS
- § Autonomous urban driving e.g. rural drive assistance



## Zero Emission

- § Low emitting Propulsion technology (EU 7+, low CO<sub>2</sub>), e.g. bio fuels, full hybrids (E-corner), plug-in batteries
- § Fully closed loop power train control and link to ADAS and C2X
- § Noise reduction

## Managed Complexity

Function oriented E/E architecture, e.g. 5 module 2E Architecture

## Maximum Efficiency <sup>1)</sup>

- § Autonomous Cargo Hub (transshipment center)
- § Intelligent Package, sorting and routing
- § 24/7 economy
- § Easy driver access
- § All-axel-steering
- § Energy efficient vehicles (e.g. power train, design,..)

<sup>1)</sup> TCO (Total Cost of Ownership) minimization

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# Our visions meet market needs based on global megatrends

## Global Megatrends: Urbanization and Demographic Change

challenges

Increasing mobility

Shortening of natural resources

Growing need for environmental care

Growing demand for safety and security, information & communication

Shift of economic gravity among regions

challenges

### Automotive-Specific Trends

"Sustainable Mobility"

"Increasing Safety & Comfort"

"Seamless Connectivity"

"Managed Complexity"

### Vision of the Car and Truck of the Future/ Typical Applications

#### "Zero Emission"

e.g. Piezo Injection  
e.g. Hybrid Drives

e.g. eCorner  
"Drive-by-wire" Concept

**Car of the future**

**Truck of the future**

#### "Zero Accidents"

e.g. pro.pilot  
Network or Driver Assistance  
e.g. Electronic Wedge Brake



#### "Always On"

e.g. Car-to-Car Communication  
e.g. Integration of Nomadic Devices via Wireless Hub

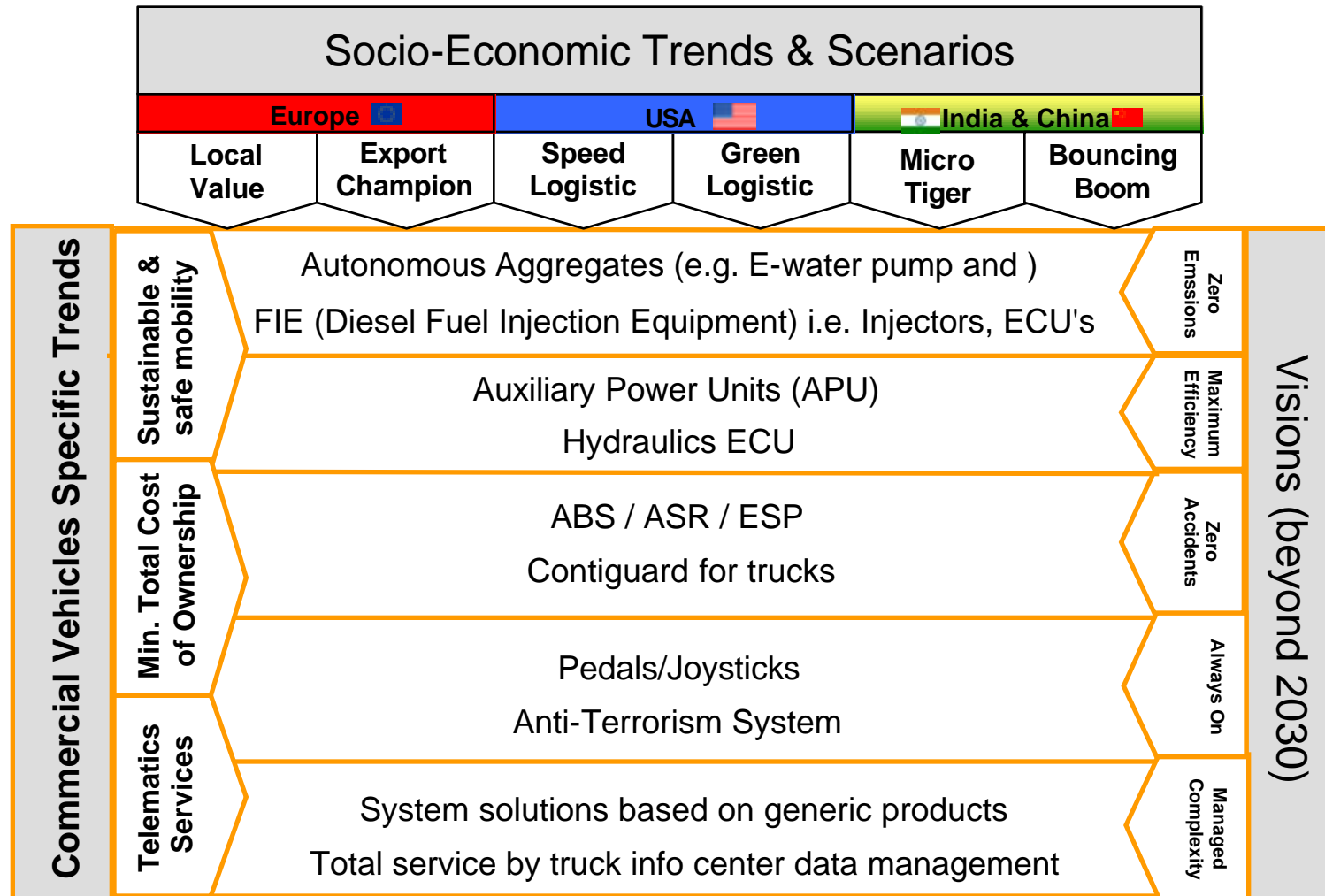
#### "Always Easy"

e.g. 5 Module Approach for E/E-Network  
e.g. Platform-based BCU  
e.g. CESAR Cockpit

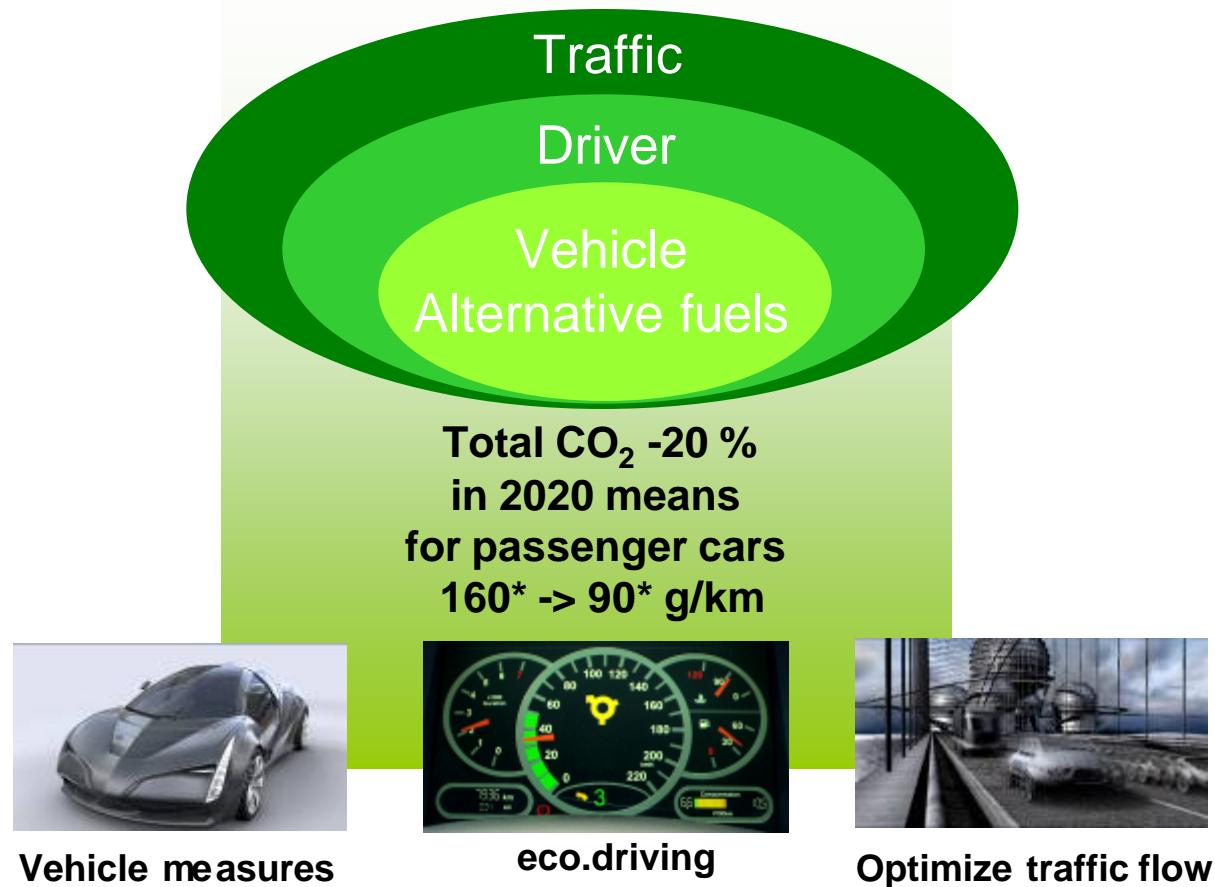
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## Potential New Functionalities for Commercial Vehicles

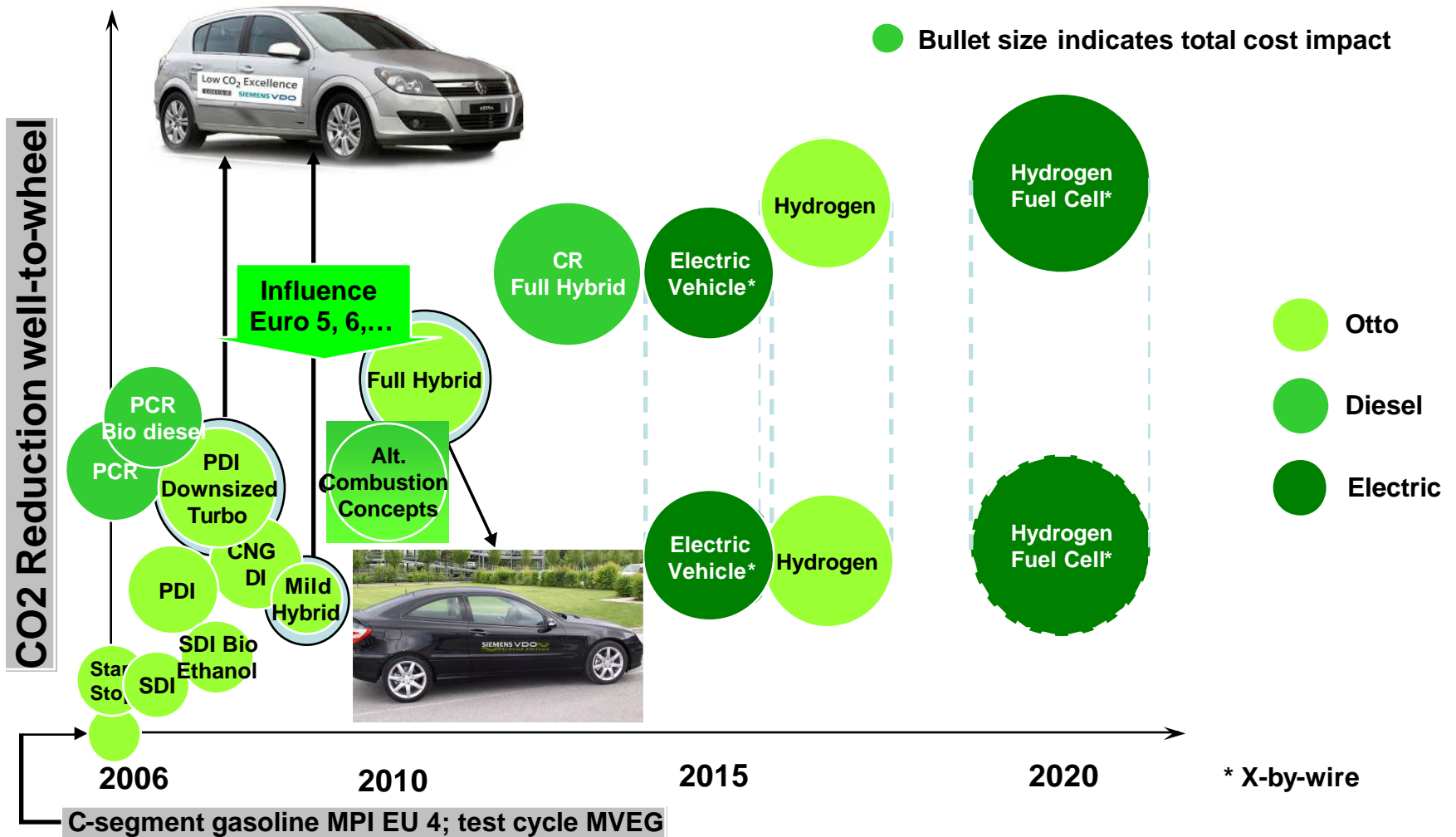


## Three complementary ways into a sustainable future





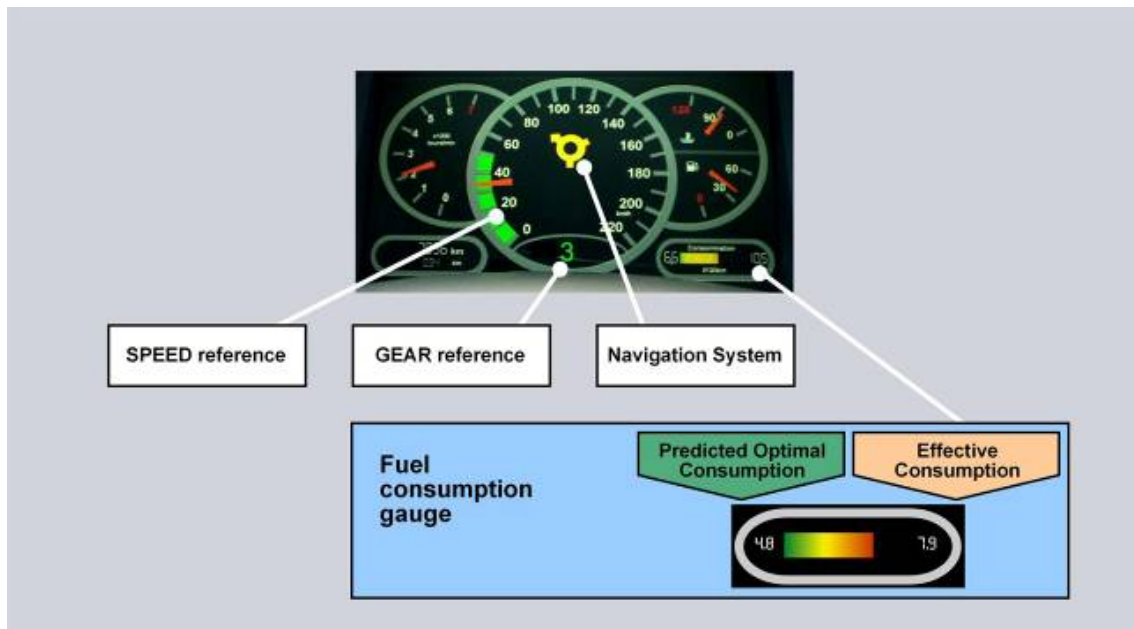
# Climate protection & energy efficiency: an integrated approach



## Human and Machine eco.driving

### Features

- § Calculates the optimal speed and gear ratio
- § A gauge indicator predicts fuel consumption in actual conditions
- § Trip planning profile optimization from navigation system
- § Communicates with external traffic center control
- § Analysis of driver's impact



The same information displayed on a portable phone



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## International Cooperation Objectives ERTICO- Representing EU's ITS Community

- Leverage knowledge exchange to and from Europe and Emerging Markets
- Ensure latest technology is available in product offerings for Emerging Markets
- Promote EU standards and technologies globally



## Matching of EU-SIMBA Region Priorities

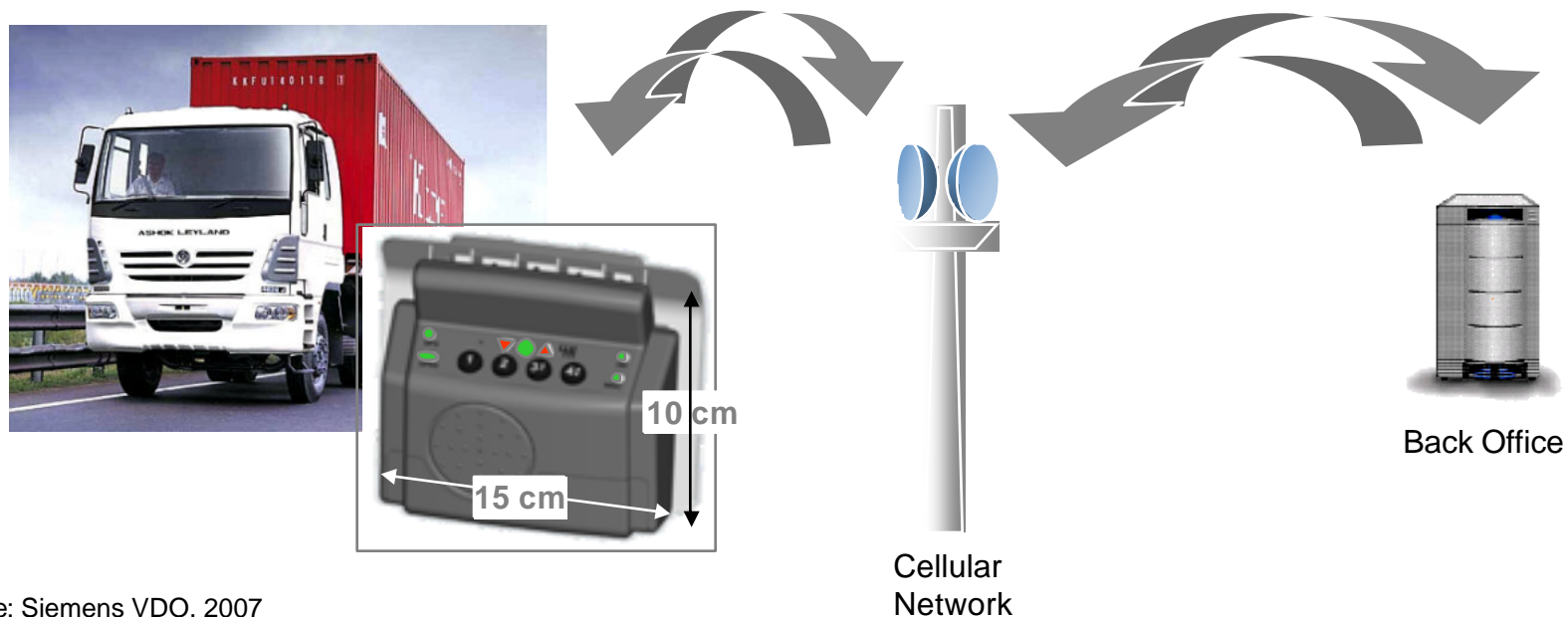
 <b>EU Priority</b>		 <b>China</b>	 <b>India</b>	 <b>SA</b>	 <b>Brazil</b>
<b>ITS</b>	Electronic Toll Collection	X	X	X	X
	ITS for Public Transport	X	X	X	X
	Integrated Traffic Management	X	X	X	X
	Real-time Traffic Information	X	X	X	X
	Incident Detection & Emergency Response	X	X	X	X
<b>Infrastructure</b>	Pavement Management- & Bridge Management Systems		X		X
	Alternative and Recycled Construction Materials		X		X
	Heavy Vehicles & Road Wear			X	X
	Road Infrastructure Safety	X	X	X	X
<b>Automot.</b>	Alternative Fuels	X	X	X	X
	Vehicle Safety	X	X	X	X
	Public Transport Systems based on Buses	X	X	X	X

Source: ERTICO, 2006

## India's 1st Commercial OEM ITS Solution

**150,000 units for ITS solutions** (*Project start: mid 2006*)

- § GNSS/GSM OBU, hands-free bi-directional voice communication
- § Tracking vehicles (Fleet Management)
- § Call on request
- § SOS button
- § Congestion warning button (Traffic Information)



Source: Siemens VDO, 2007

China Demo Car:  
 Demonstrating affordable  
 technologies for sustainable  
 mobility meeting market  
 requirements



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## Conclusions and Outlook

- **Environmental, energy and safety needs sets the pace for road transportation**
- **Mega trends are basis for our visions and derived strategy**
- **All stakeholders, i.e. automotive industry, road infrastructure, governments and consumers should cooperate in complementary packages**
- **Inner city: electrified propulsion and light weight vans with ITS and CE technologies.**
- **On-spec and thereby lower cost, but not necessary low tec solutions for BRIC**
- **The SIMBA-programme shows successful examples and first cooperation**
- **The main key of success is the fact that both worlds will learn from eachother:**
  - the growing economies will define market needs and specify requirements for low/medium cost solutions,
  - Architecture concepts will be conceived by system oriented OEM's and Tiers
  - Component development and manufactuering by the regions .
  - By this approach the product portfolio will meet the stringent markets needs (environment, energy, safety) at affordable costs.
- **VDO Automotive AG has set up several demo car programs especially for emerging countries showing market oriented solutions exactly living the strategy of low cost at medium tec specification utilizing the regional as well as the central R&D competences in an optimal way.**



Thank you for your attention !