Munich, November 4, 2011

SUSTAINABLE TECHNOLOGIES – THE CHANGING FACE OF MOBILITY.

PHILIP KOEHN
VICE PRESIDENT VEHICLE ARCHITECTURES AND CONCEPTS

BMW GROUP

Rolls-Royce
Motor Cars Limited

CHANGING ENVIRONMENT FOR INDIVIDUAL MOBILITY. THE KEY DRIVERS.

Environment

- Climate change
- Destructive consequences

Urbanisation

Politics

- Fleet regulations
- City driving restrictions
- CO_2 taxation

DRIVERS FOR SUSTAINABLE MOBILITY

Economy

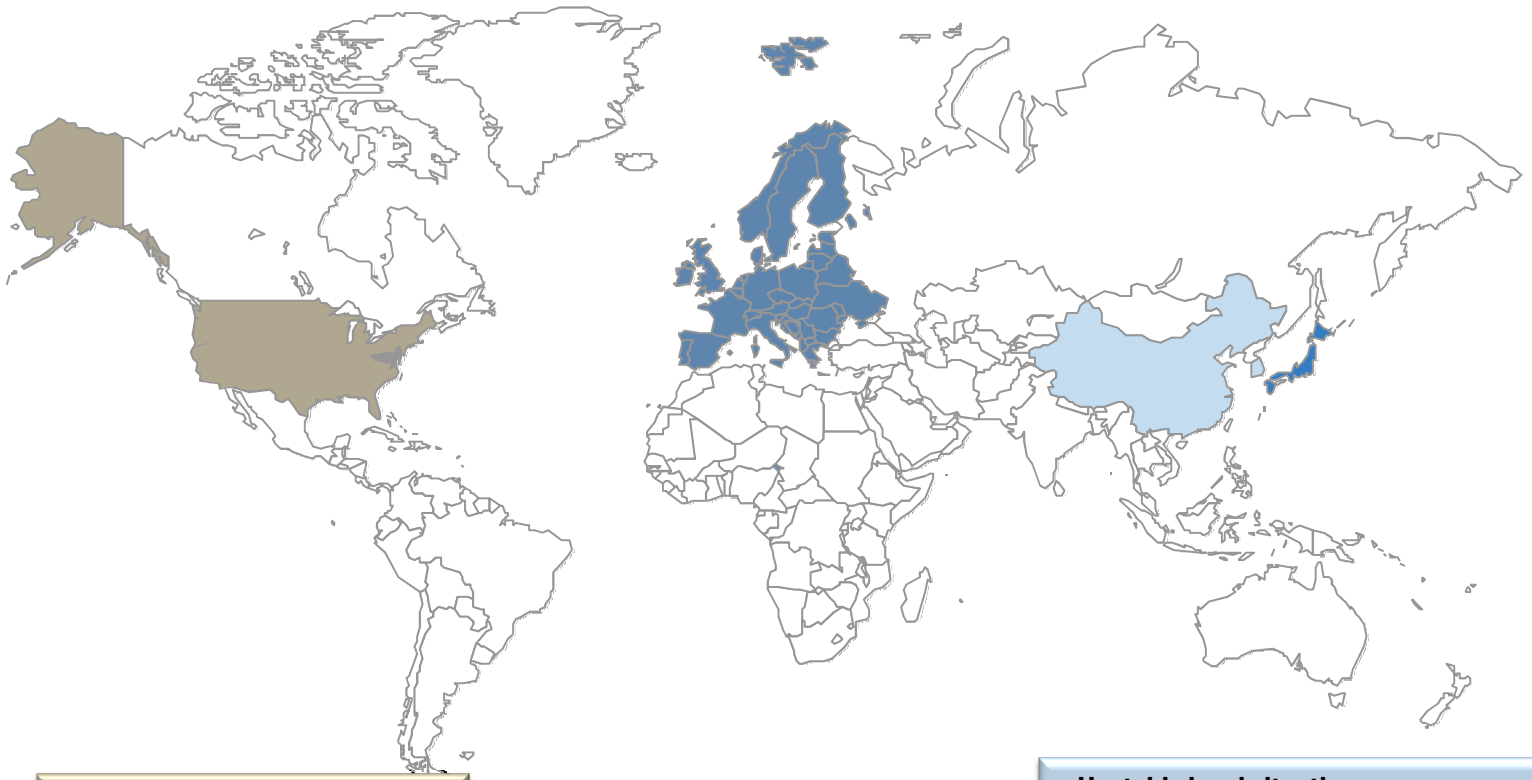
- Resource scarcity
- Price increases for fossil fuels

Culture

- Sustainable mobility as an element of urban style
- Growing social responsibility

Changing values

GLOBAL CO_2 REGULATION IS BECOMING STRICTER.



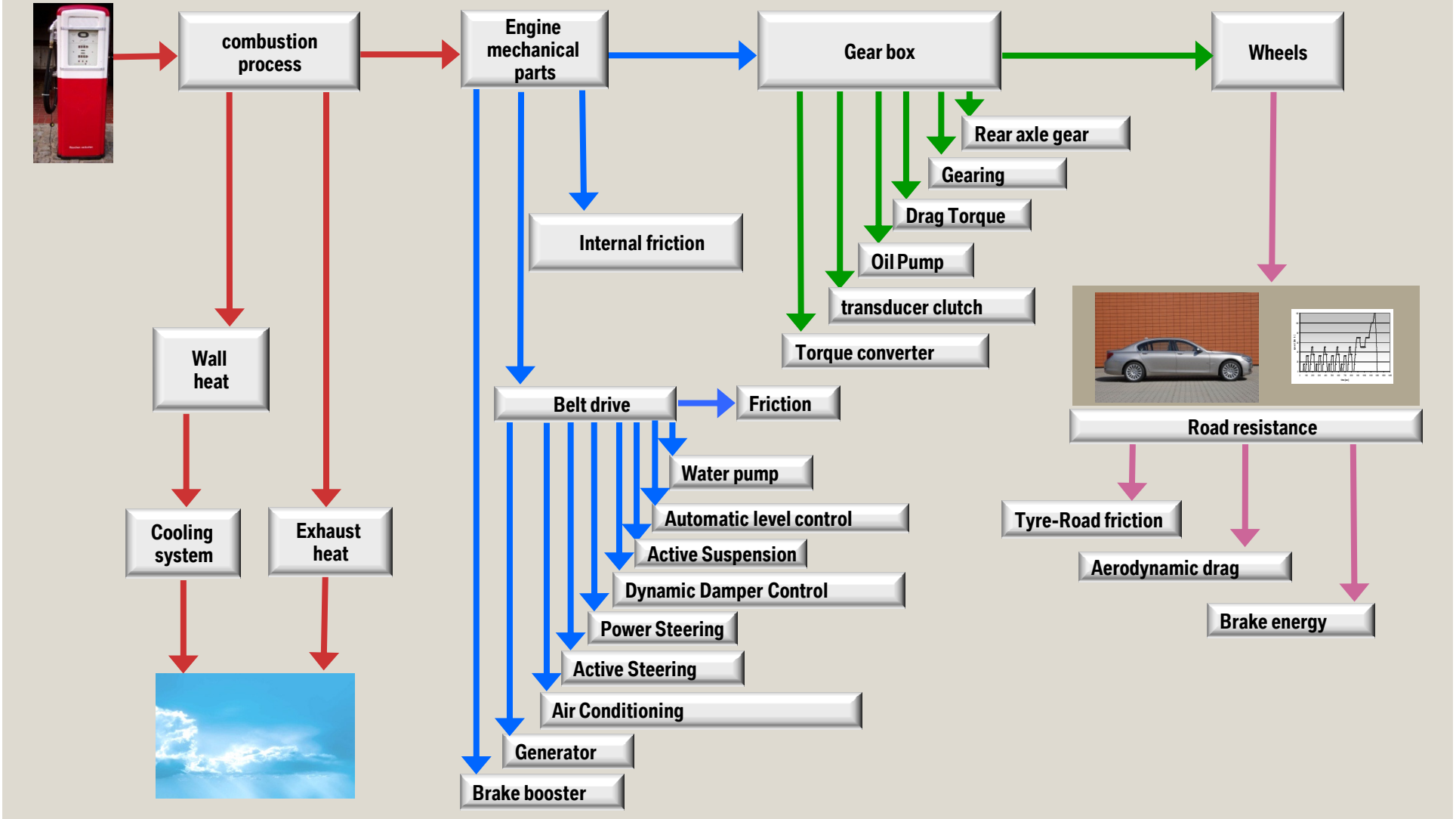
Amendment to CAFE 2010
→Penalties
Greenhouse Gas EPA 2010
→ no registration
Greenhouse Gas CARB 2010
→ no registration

- Self-imposed obligation 2008
- 120g CO_2 Legal Limit / 2012
- 95g CO_2 Legal Limit / 2020
- 75g CO_2 Legal Limit / 2025

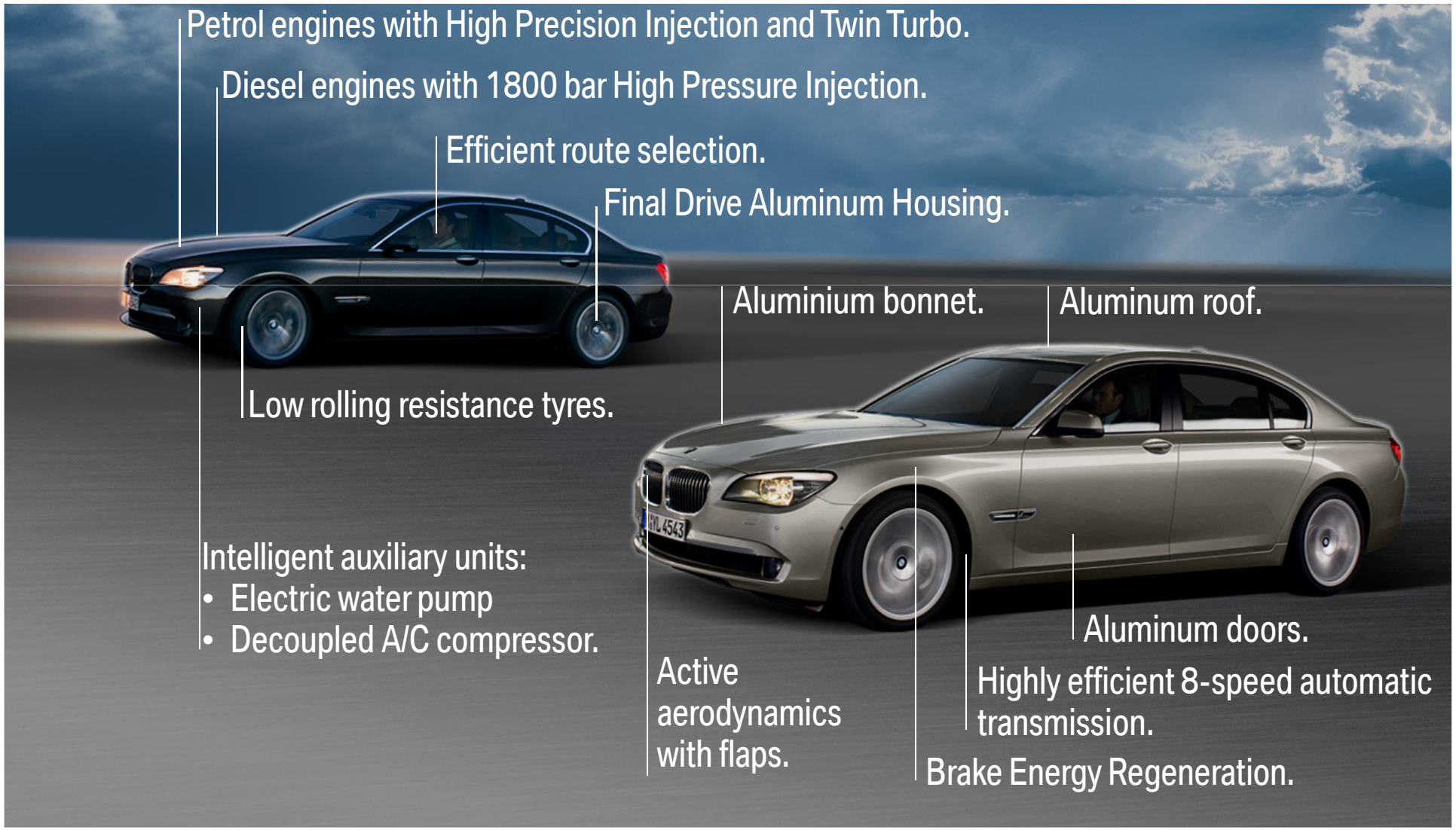
- Unstable legal situation
- Penalties for individual vehicles
- Increasing share of NEV vehicles expected

Energy Conservation Law
2010 Stage 1
2015 Stage 2
Public ostracism

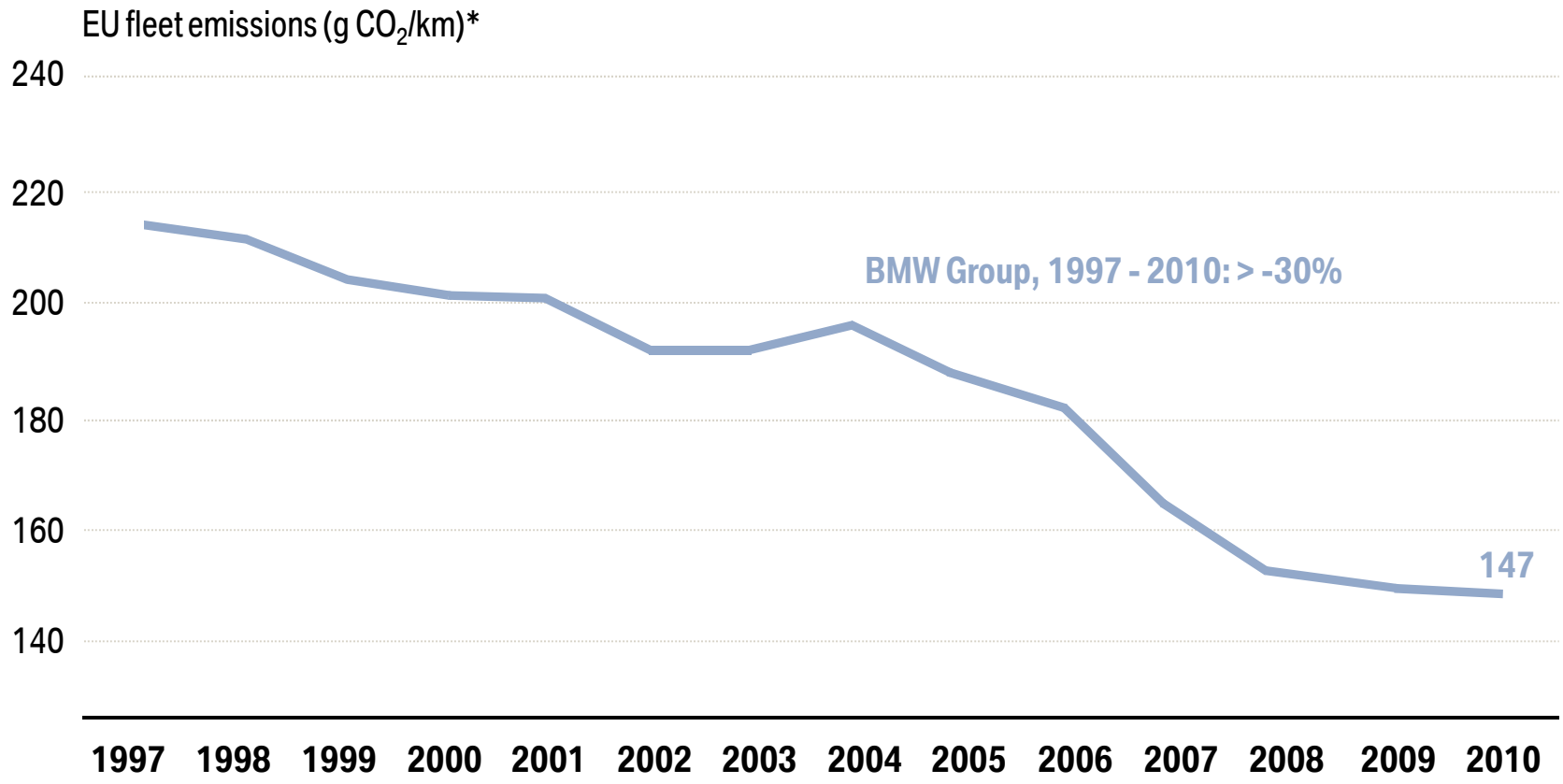
BMW EFFICIENTDYNAMICS – WE HAVE UNDERSTOOD THE COMPLEXITY OF THE ENERGY FLUXES IN THE VEHICLE AND DERIVED CO_2 MEASURES.



BMW EFFICIENTDYNAMICS – WE APPLY CUSTOMIZED EFFICIENCY PACKAGES FOR OUR PRODUCTS.



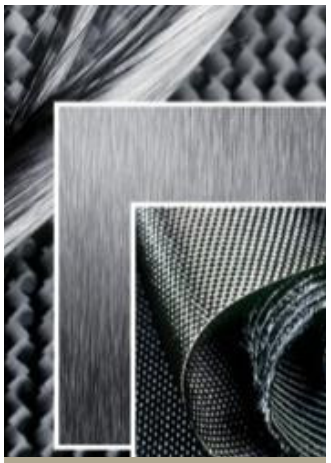
BMW EFFICIENTDYNAMICS – BMW GROUP FLEET CO_2 EMISSIONS SO FAR HAVE BEEN REDUCED BY MORE THAN 30% (1997-2010) IN EUROPE.



*** Until 2008: EU 15 – since 2009: EU 27.**

BMW EFFICIENTDYNAMICS.
SHORT, MID AND LONG TERM SOLUTIONS.

Engine technology



Intelligent light weight construction

Aerodynamics

Intelligent energy management systems, Active Hybrid

Alternative energies: Hydrogen, Electricity

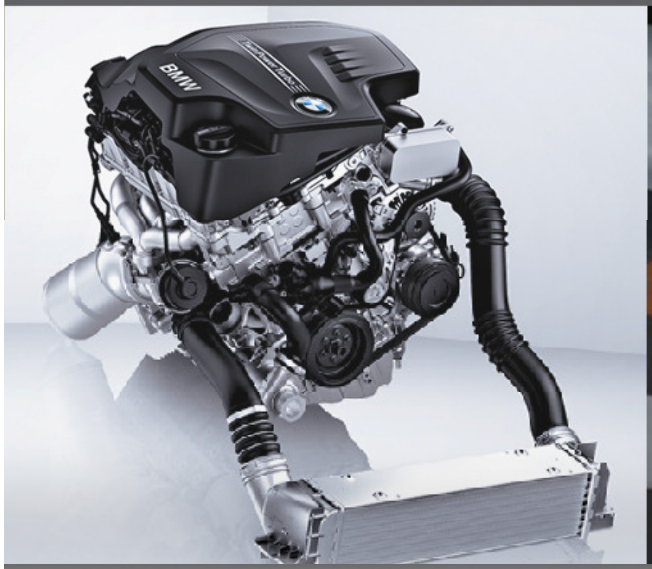
short-term

mid-term

long-term

THE NEW BMW ENGINE PORTFOLIO.
BMW TWIN POWER TURBO.

TwinPower



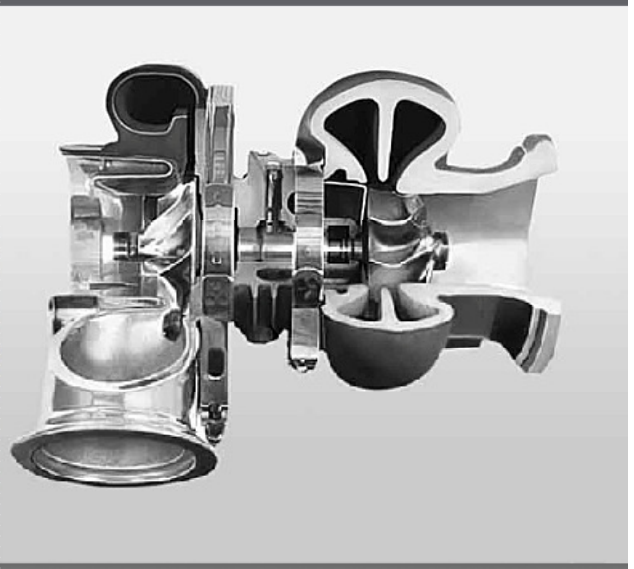
Variability

Vanos (variable valve timing)
Valvetronic (variable valve lift)
Variable Turbine Geometry

Direct injection

High precision injection
Next generation common rail

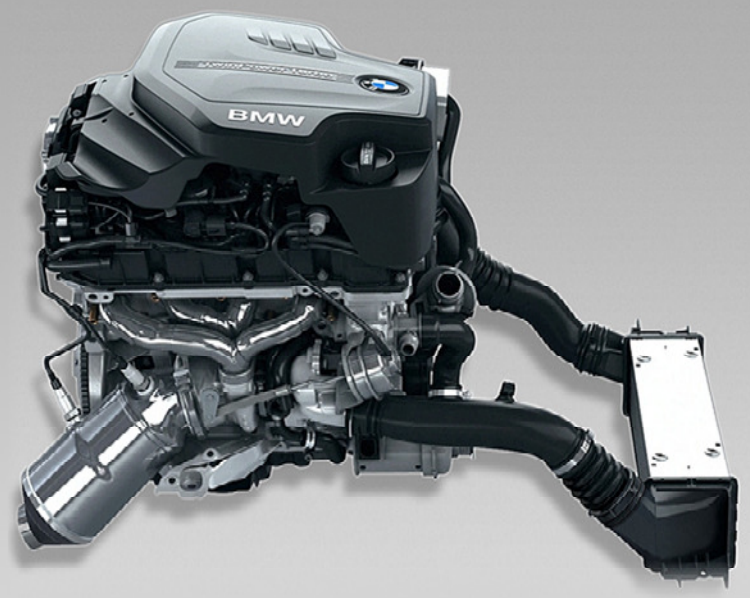
Turbo



Turbo charging

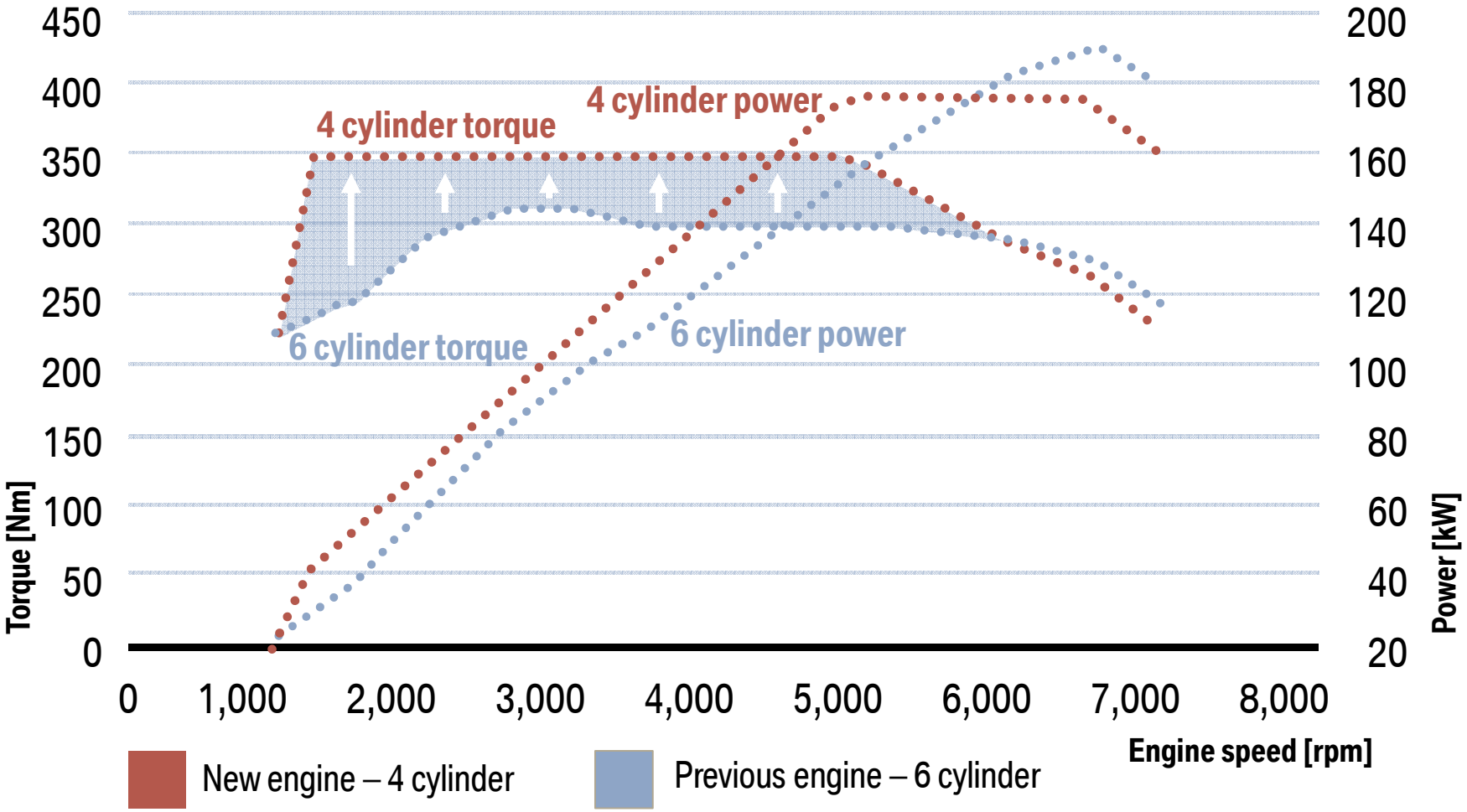
Single turbo
Twinscroll turbo
Twin turbo

THE NEW BMW TWIN POWER TURBO 4 CYLINDER PETROL ENGINE – POWER AND TORQUE.



Power	**kW**	180
@ Speed	**rpm**	5,000
Torque	**Nm**	350
@ Speed	**rpm**	1,250-4,800
max. Speed	**rpm**	7,000
spec. Power	**kW/l**	90
spec. Torque	**Nm/l**	175

THE NEW FOUR-CYLINDER PETROL ENGINE COMPARED TO THE IN-LINE SIX-CYLINDER PETROL ENGINE.



THE NEW FOUR-CYLINDER PETROL ENGINE COMPARED TO THE IN-LINE SIX-CYLINDER PETROL ENGINE.

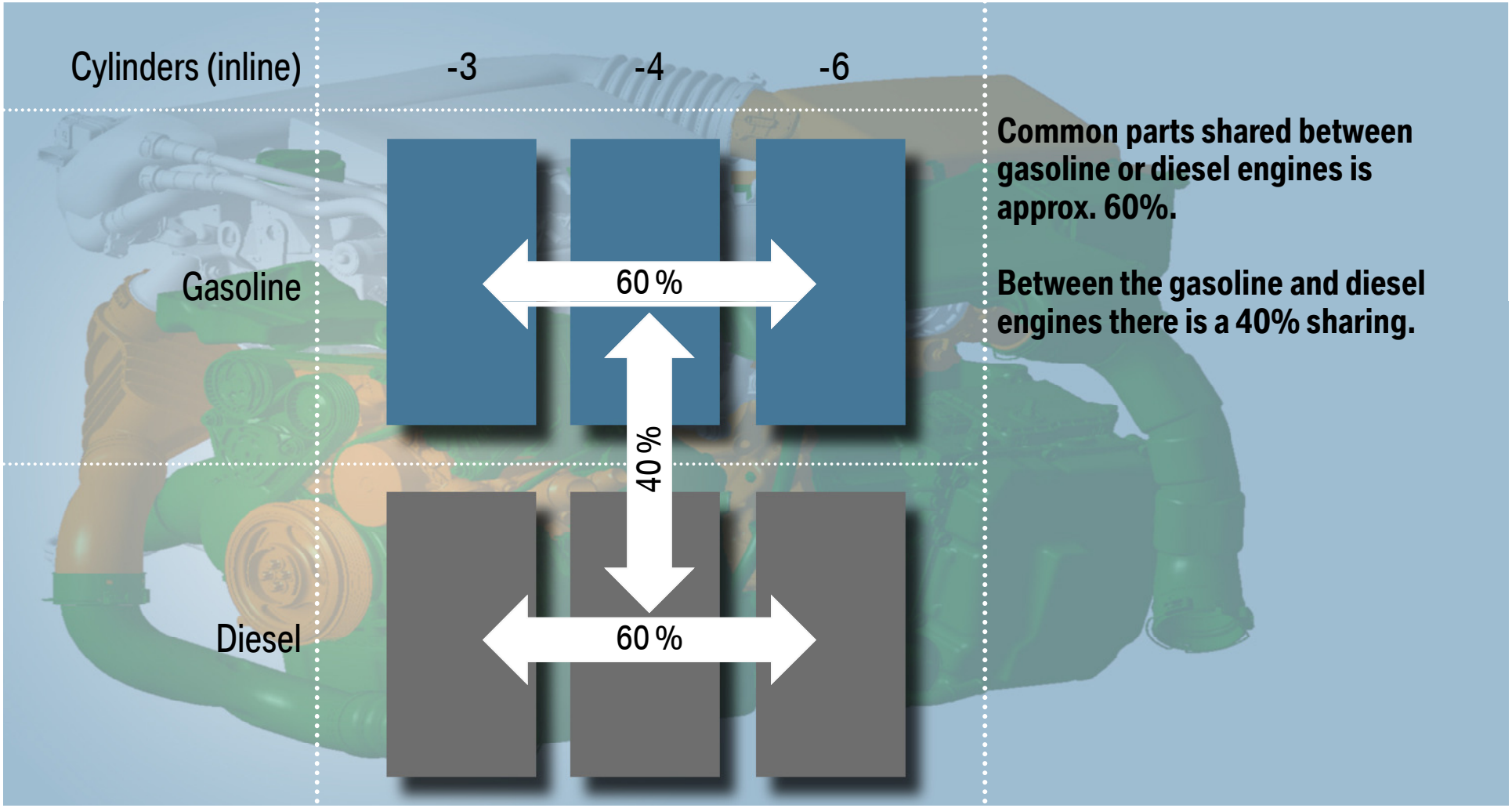
Output (kW/hp)	180 / 245	- 5 %
	190 / 258	
Torque (Nm)	350	+ 13 %
	310	
Acceleration 0-100 km/h (s)	6.1	- 0.7 seconds
	6.8	
Top speed (km/h)	240	+ 4 %
	230	
Fuel consumption* (l/100 km)	7.9	- 16 %
	9.4	
CO_2 emissions (g/km)	183	- 16 %
	219	
Emission Control Level	EU5	
	EU5	

* Average fuel consumption in the EU test cycle.

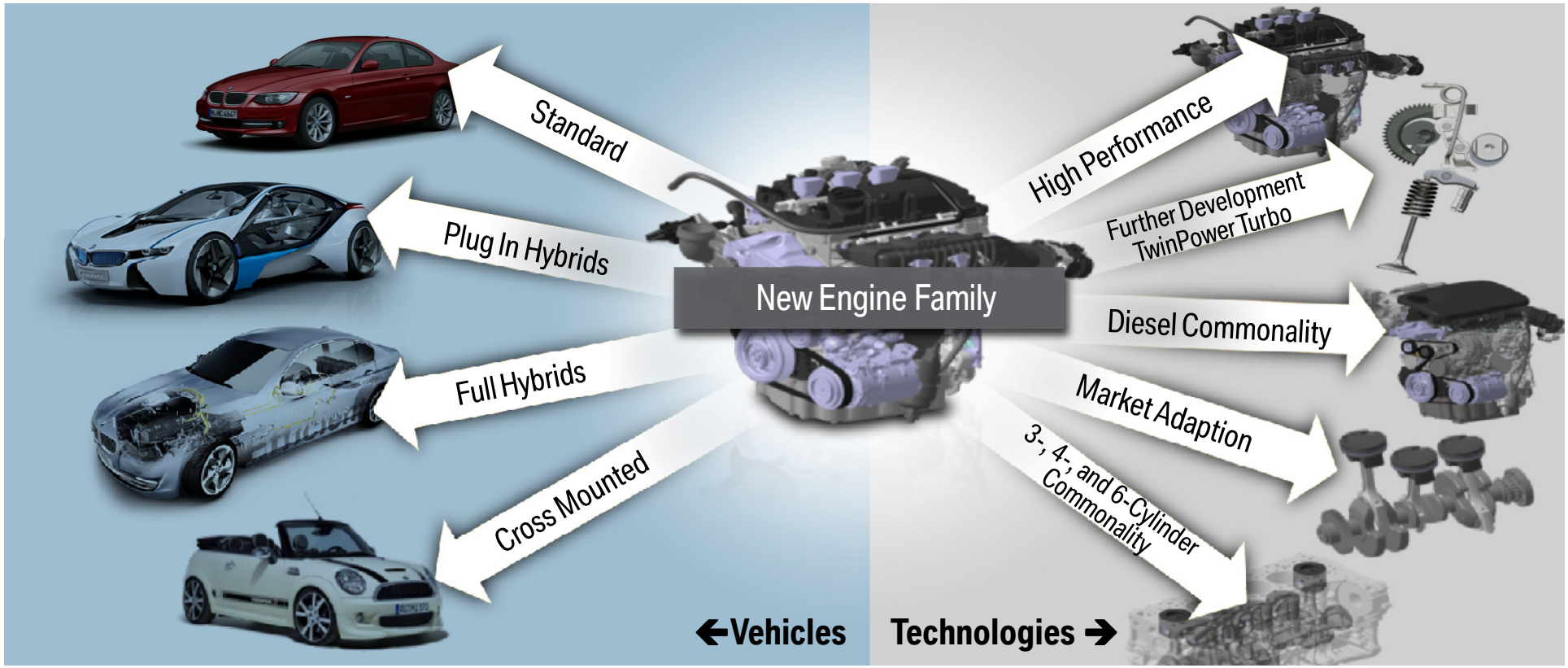
BMW X1 xDrive28i (four-cylinder), BMW TwinPower Turbo technology, Petrol direct injection (High Precision Injection) VALVETRONIC, Double-VANOS

BMW X1 xDrive28i (six-cylinder), VALVETRONIC, Double-VANOS

THE NEW BMW EFFICIENTDYNAMICS ENGINE FAMILY– INTERFACES BETWEEN THE ENGINE AND THE VEHICLE ARE OPTIMIZED OVER THE WHOLE PRODUCT RANGE.



THE NEW BMW EFFICIENTDYNAMICS ENGINE FAMILY - SCALABILITY OF BASIC DESIGN OF ENGINE FAMILY ALLOWS A BROADER APPLICATION ACROSS VEHICLE PROJECTS AND TECHNOLOGIES.



CHANGE OF VALUES.
CUSTOMER PREFERENCES ARE CHANGING.

Customers are increasingly **sensitive** towards:

- climate change
- personal contribution to environmental pollution
- Increasing fuel prices
- emerging energy sources / carriers such as electricity & hydrogen
- sustainabilitiy as part of a modern lifestyle



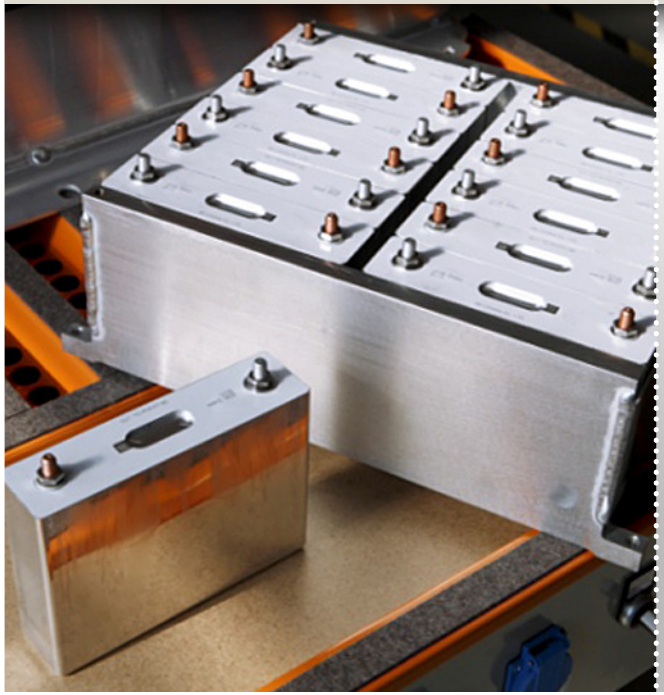

BATTERY ELECTRIC VEHICLES AT THE BMW GROUP – BMW 1602er (1972).

Lead battery:
- weight: ca. 2,100kg
- volume: ca. 1,200l

Fuel:
- weight: ca. 30kg
- volume: ca. 40l

BMW GROUP'S ELECTRIC DRIVE TRAIN PORTFOLIO – INHOUSE DEVELOPMENT OF THE "KEY COMPONENTS".

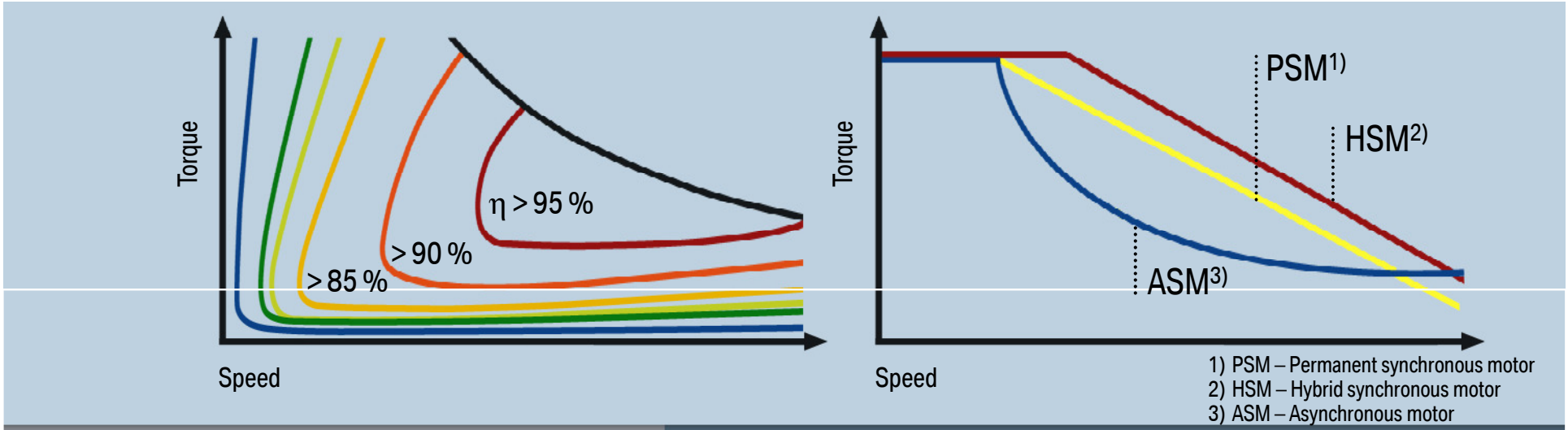
High voltage battery

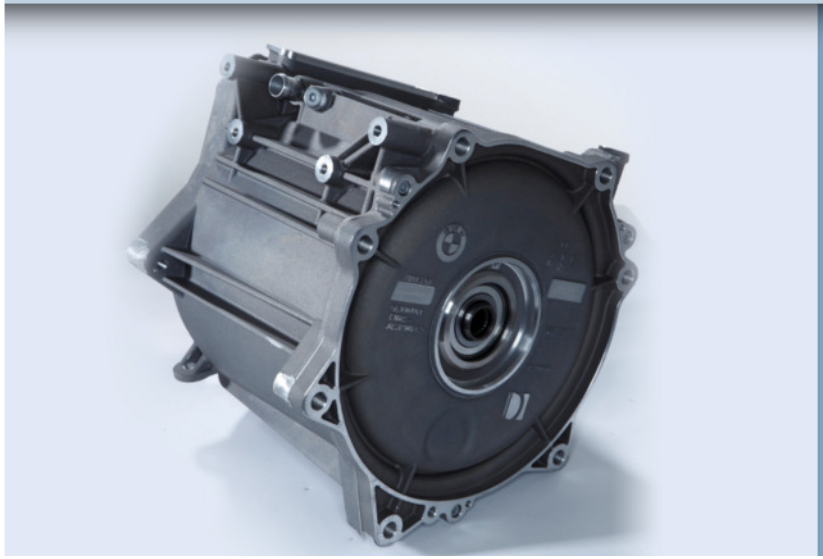


Power electronics

Electric engine

BMW GROUP'S ELECTRIC DRIVE TRAIN PORTFOLIO – ELECTRIC ENGINE.





Potential for optimization

- Improvement of efficiency (battery costs, range)
- Wide range behaviour (reduction gearbox)
- Power density (volume)
- Noise (acoustic)

BMW ACTIVE HYBRID VEHICLES.

CURRENT PRODUCT RANGE:

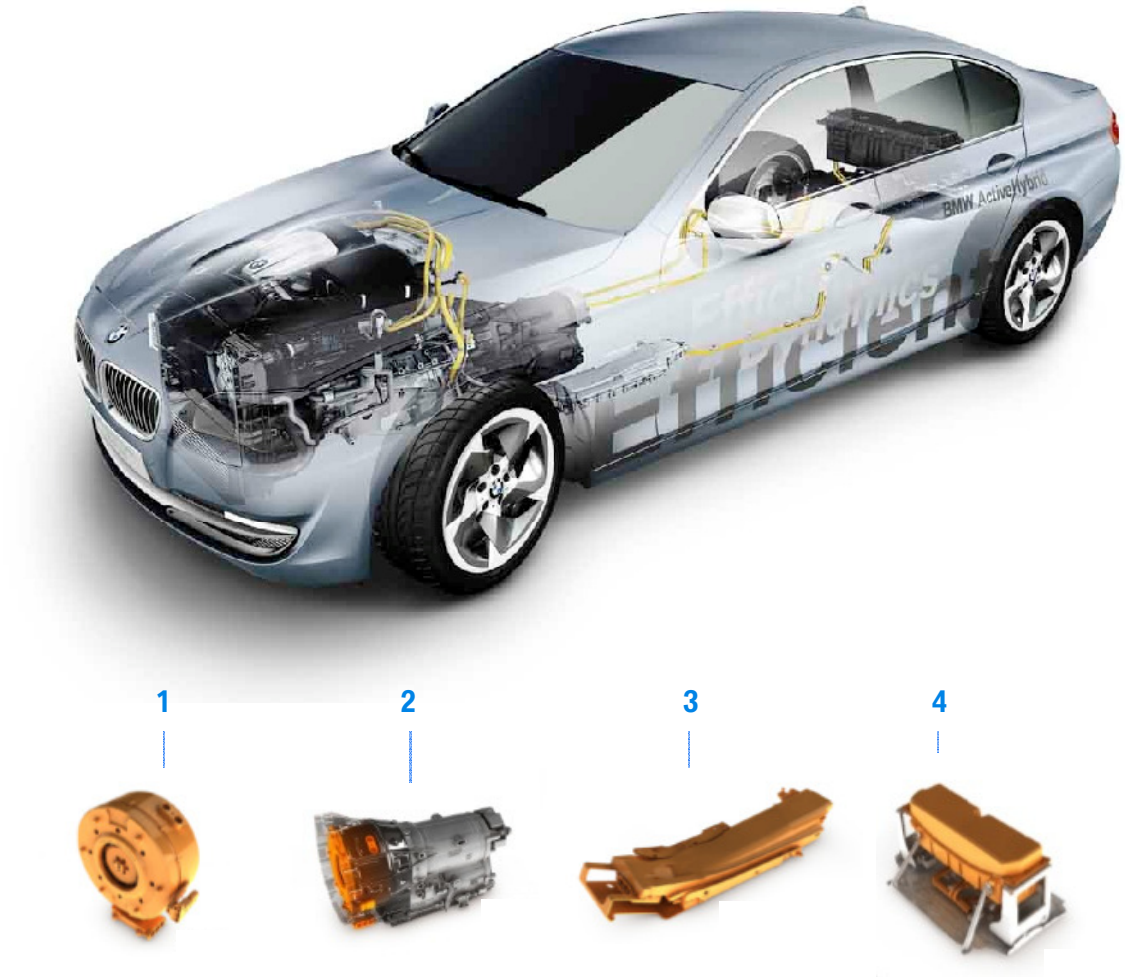
X6 Active Hybrid

- Full (Two-Mode) Hybrid system
- Emission Standard ULEVII / EU5
- System Power: 485 hp, 0-60 mph: 5.6s
- Consumption: 9.9l/100km (28.5mpg)
  (-20% compared to base X6 xdrive 50i)

7 series Active Hybrid

- Mild Hybrid system
- Emission Standard ULEVII / EU5
- System Power: 465 hp, 0-60 mph: 4.9s
- Consumption 9.4l/100km (29.1mpg)
  (-15% compared to base 750li)

BMW CONCEPT 5 SERIES ACTIVE HYBRID.



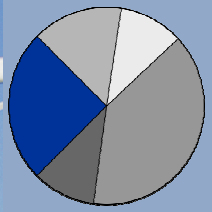
Features:

- Future-oriented full hybrid system
- Battery technology: Li-Ion
- Auto Start Stop
- Brake Energy Regeneration
- Boost function
- All-electric zero-emission driving in city traffic
- Intelligent energy management

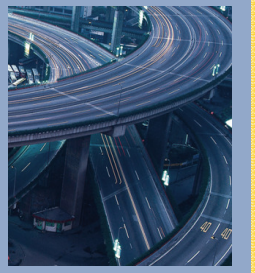
1 Electric motor
2 8-speed automatic transmission
3 High voltage electronics
4 High voltage battery

MINI E AND BMW ActiveE SERVE AS KEY LEARNING PROJECTS OF OUR MEGACITY VEHICLE.

Use of renewable energy.



Market potential.



Transfer scenarios.

User behavior.

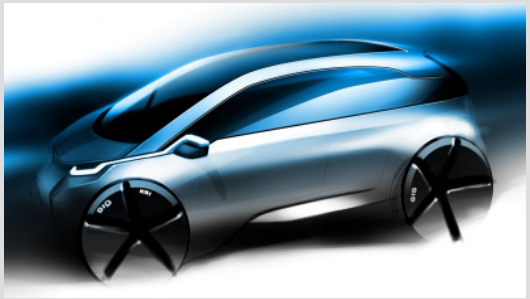
Acceptance.

Demands of e-infrastructure.

Strengths and weaknesses.

MINI E 2010

BMW ActiveE 2011



Megacity Vehicle – BMW i3 2013

THANK YOU.