

VOLKSWAGEN

GROUP OF AMERICA

VOLKSWAGEN GROUP

Powertrain and Fuel Strategy



Oliver Schmidt

General Manager, Engineering and Environmental Office (EEO)

AGENDA

Vision of Volkswagen Group: Global Automotive Leader 2018

Powertrain- and Fuel Strategy

Drivetrain Electrification within the Volkswagen Group

The 3 new major Volkswagen engine lines

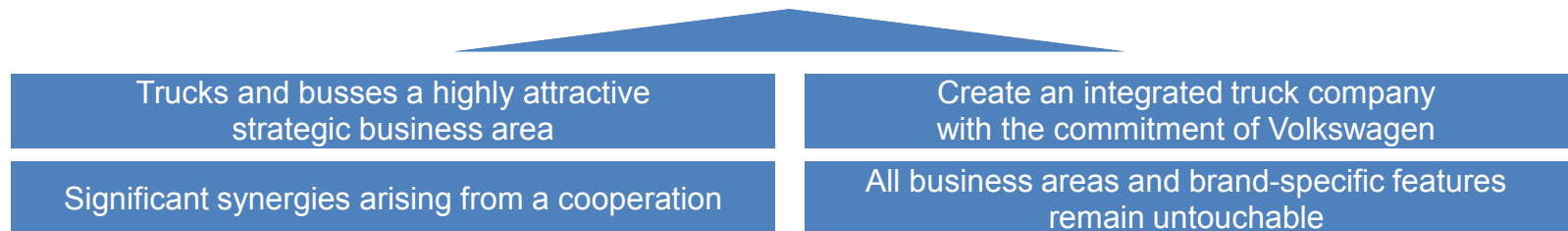
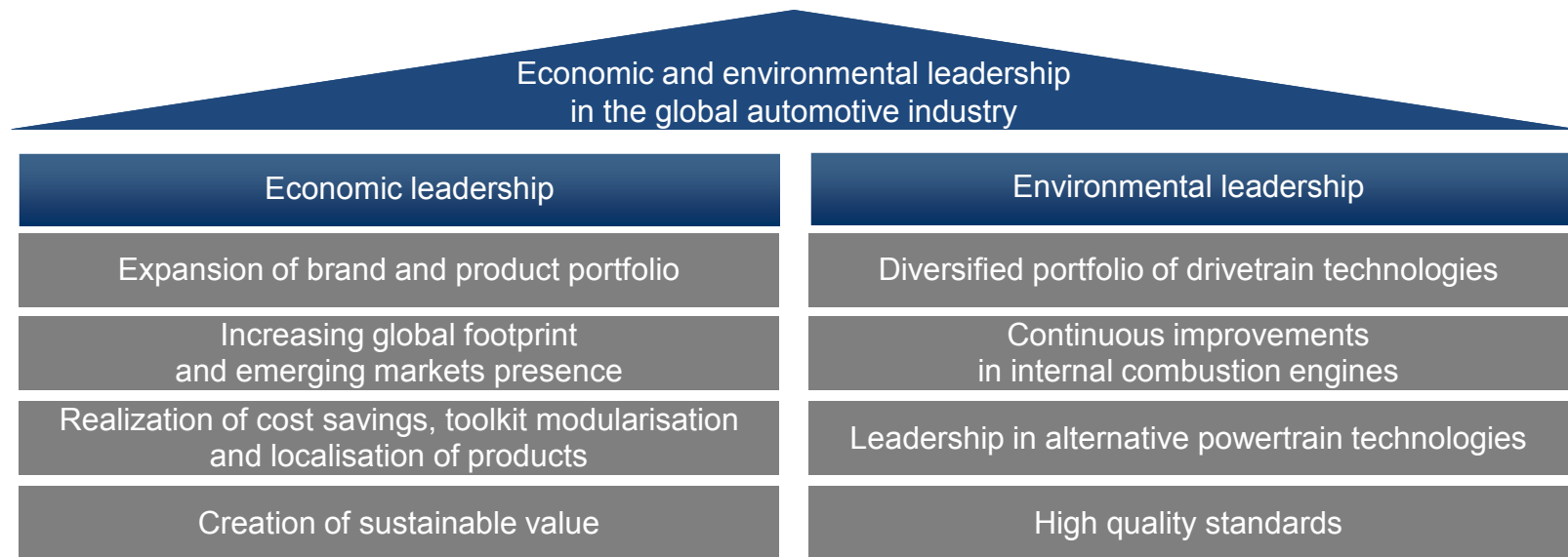
EA 211 Gasoline engines 1.0l to 1.6l

EA 888 Gen3 Gasoline engines 1.8l to 2.0l

EA 288 MDB Diesel engines

Summary

VISION OF THE VOLKSWAGEN GROUP: GLOBAL AUTOMOTIVE LEADER 2018



Brand implementation



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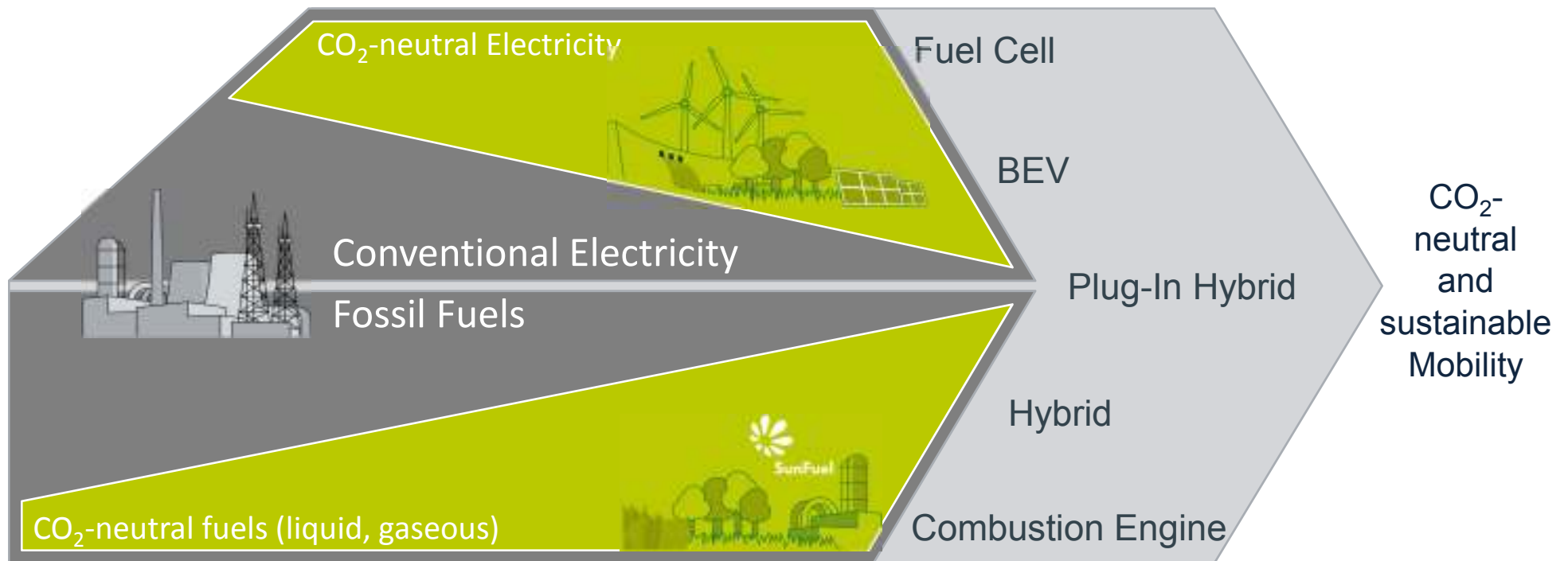
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POWERTRAIN – AND FUEL STRATEGY – VOLKSWAGEN GROUP



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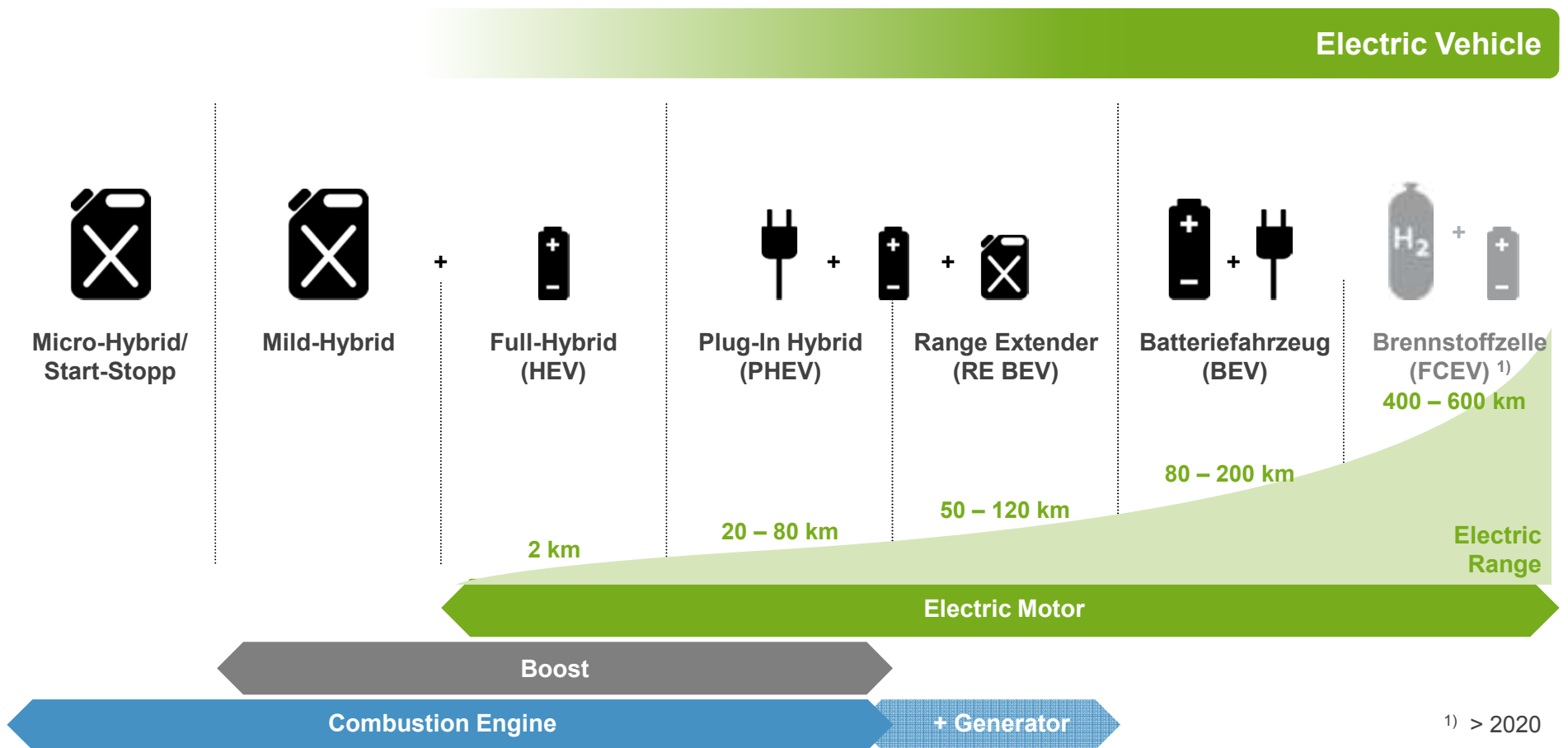
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DRIVETRAIN ELECTRIFICATION WITHIN THE VOLKSWAGEN GROUP



HISTORY OF ELECTRIC AND HYBRID VEHICLES IN THE VOLKSWAGEN GROUP



Since the 70's Volkswagen is seriously working on electric drivetrains, has explored a lot of different concepts and even released a few vehicles (e. g. Golf CitySTROMer)

2013 is the key year for Volkswagen regarding Electric Mobility. First the e-up! and shortly afterwards the Golf Blue-e-Motion will be launched

VOLKSWAGEN IS "ELECTRIFYING" EVERY SEGMENT

Hybrids / Plug-In Hybrids



VW Touareg



Audi Q5



VW Jetta



Kleinserie
VW XL1



VW Passat



Porsche
Cayenne S



Porsche
Panamera S



Audi A6



Kleinserie
Porsche 918
Spyder



Audi A4



Audi A8



Audi Q7

Battery Electric Vehicles



Kleinserie
Audi R8
e-tron



VW e-up!



VW Golf
Blue-e-Motion



Kleinserie
VW Caddy
Blue-e-Motion

» Further brands of the
Volkswagen Group

On some pictures predecessor or conventional vehicles are shown

2010

2011

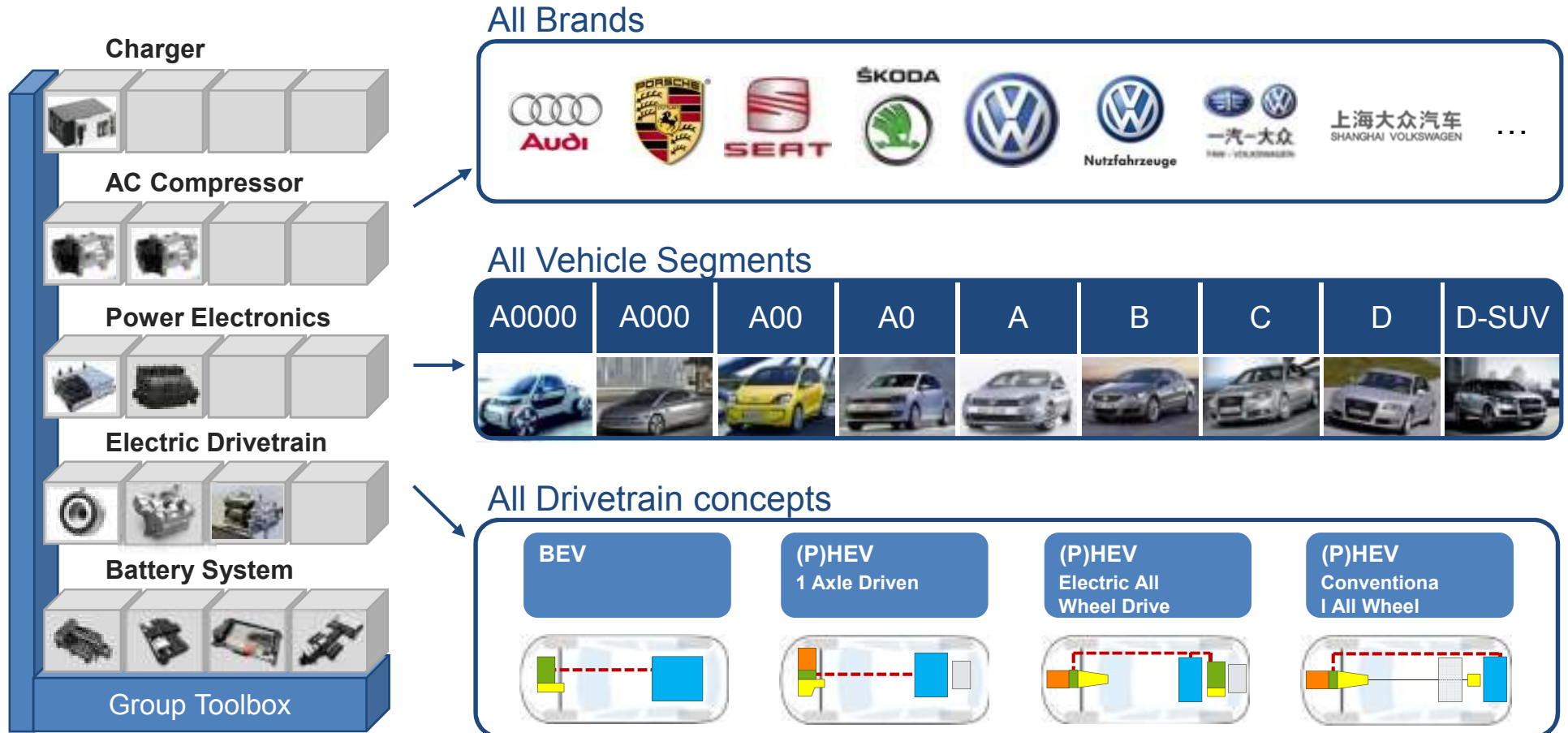
2012

2013

2014 / 2015

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VOLKSWAGEN GROUP MODUL STRATEGY FOR ELECTRIC DRIVETRAINS



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3 NEW MAJOR VOLKSWAGEN ENGINE LINES

To be prepared for the future Volkswagen is giving a major makeover to its engine lines



EA 211



EA 888 Gen3



EA 288 MDB

OBJECTIVES FOR DEVELOPMENT OF FUTURE ENGINE GENERATIONS

- Modular Approach to enable harmonized worldwide Production
- Standardization of mounting orientation within the Volkswagen Group
- Compact architecture to realize short overhang in the vehicles
- Reduction of the engine weight by up to 30%
- Reduction of Fuel consumption and CO2 Emissions by 10 to 20%
- Compliance with future emission legislation in all markets

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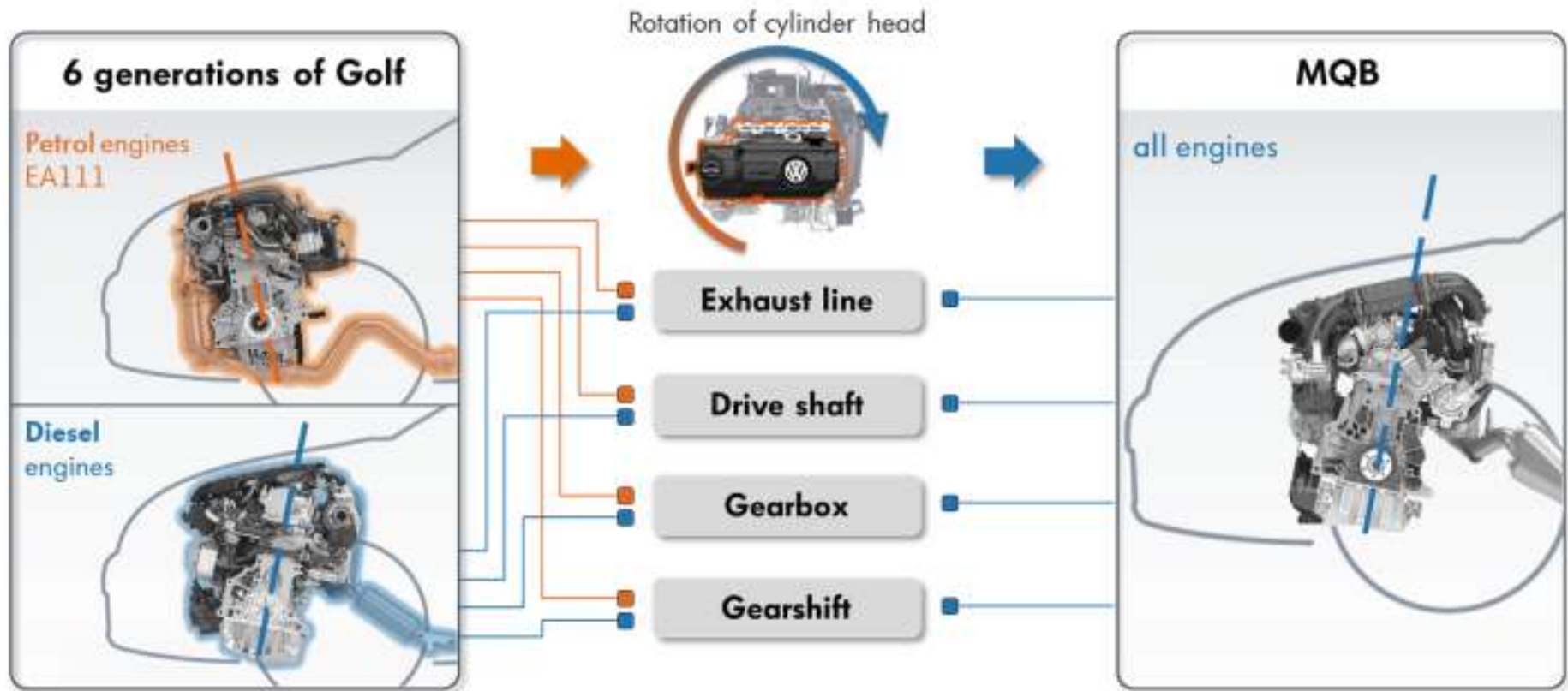
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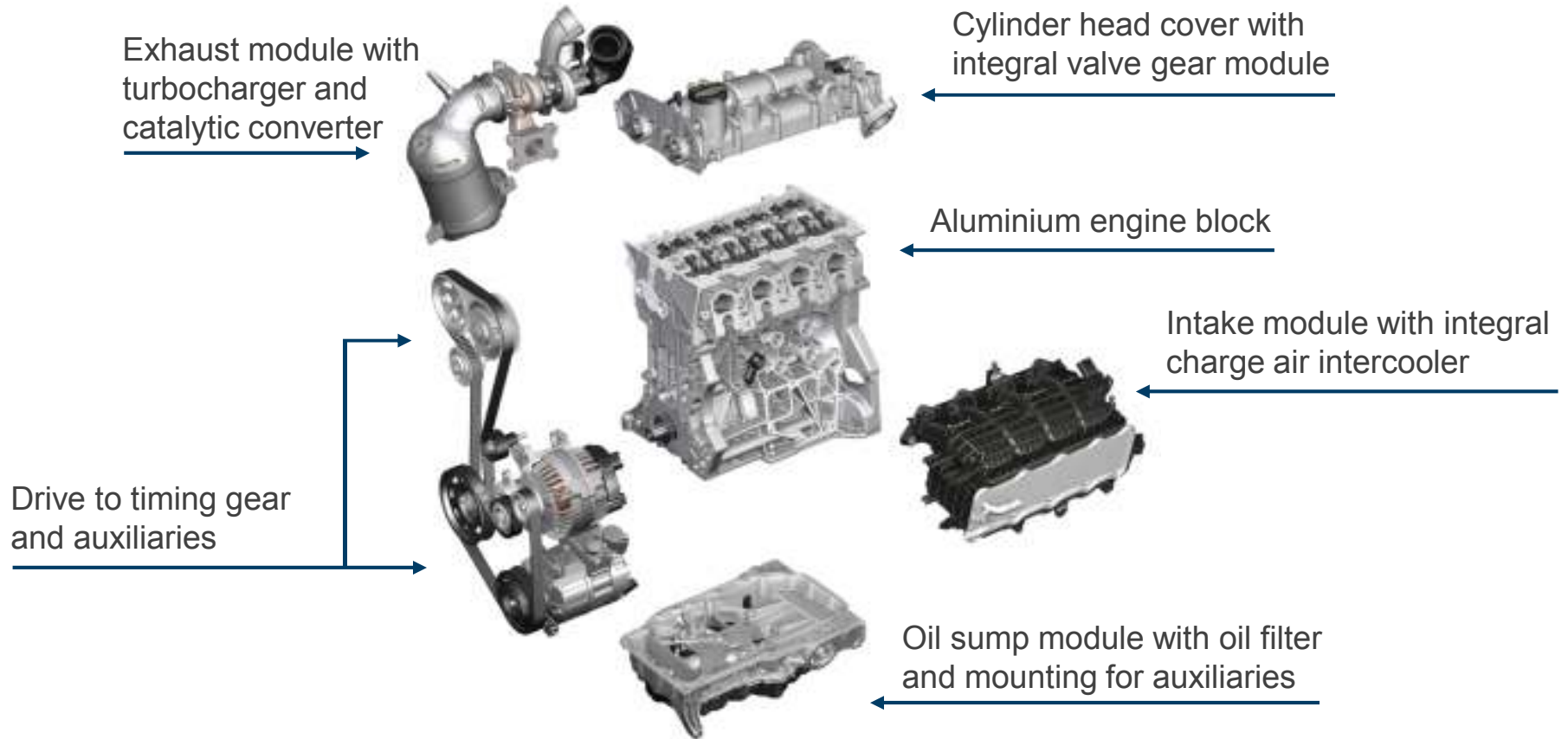
Summary

UNIFICATION OF POWERTRAIN INSTALLATION POSITIONS



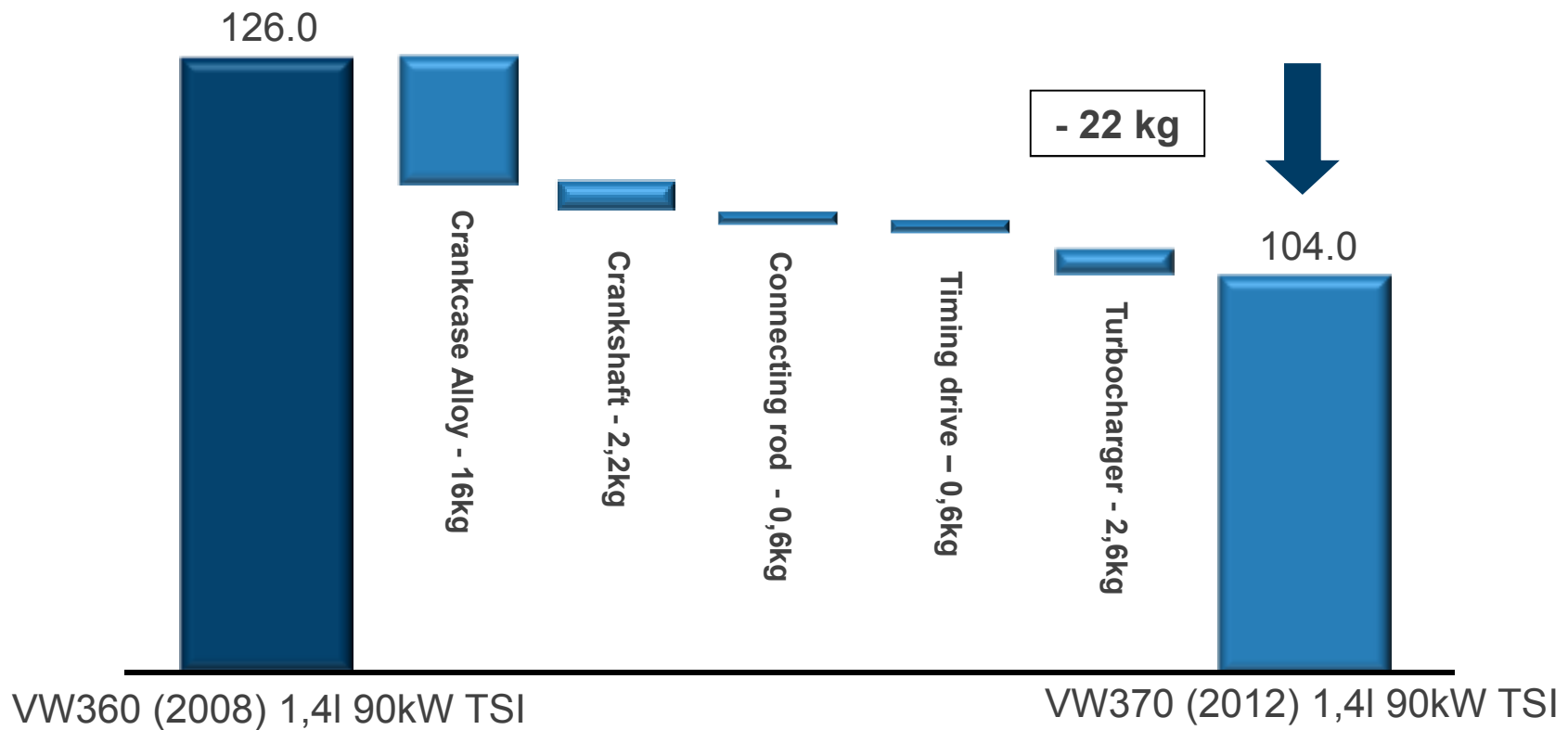
»» With the MQB all engines receive a uniform assembly position

EA211 – MODULAR APPROACH

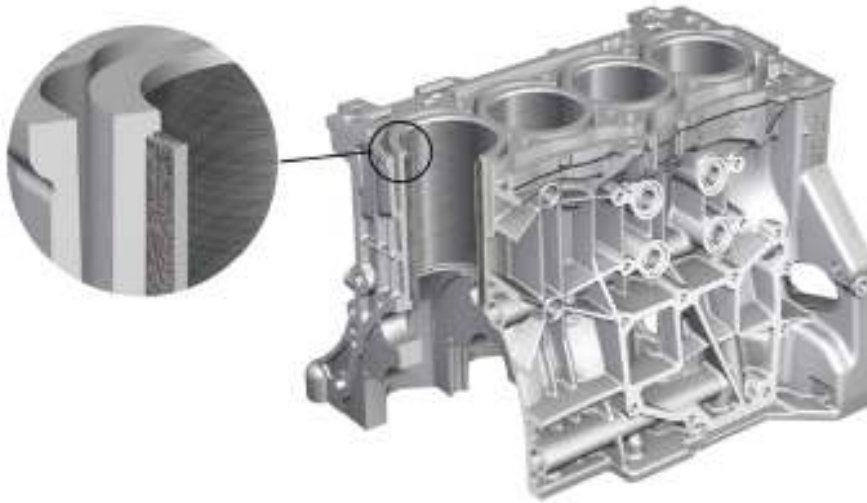


EA211 - WEIGHT REDUCTION WAS A MAIN FOCUS DURING DEVELOPMENT

DIN-engine mass [kg]
DIN 70020-GZ



EA211 - WEIGHT REDUCTION WAS A MAIN FOCUS DURING DEVELOPMENT



Crankcase 1.4 TSI EA211 **-16kg**
(moving from cast iron to diecast Aluminum)

Conrod 1.4 TSI **EA211**
Weight: 370 g



Conrod 1.4 TSI **EA111**
Weight: 523 g

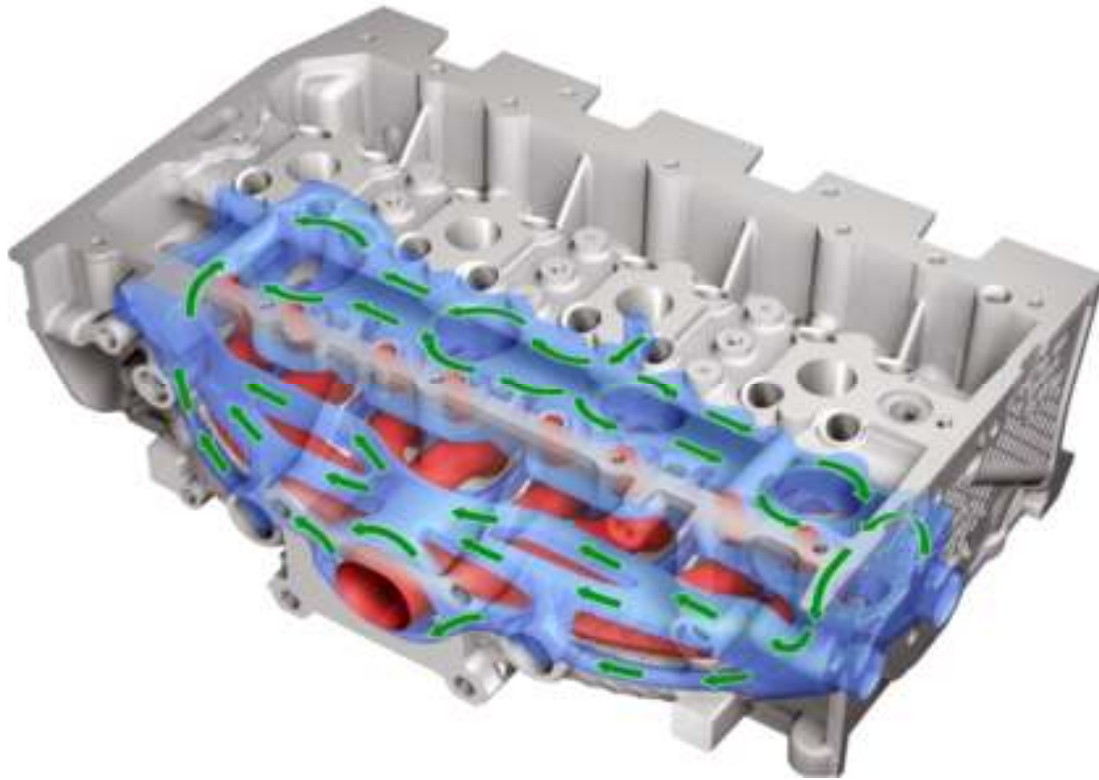


Crankshaft 1.4 TSI **EA211**
Weight: 9.17 kg



Crankshaft 1.4 TSI **EA111**
Weight: 11.6 kg

EA211 – CO2 REDUCTION



Integrated Exhaust Manifold

- Faster engine heatup
- Faster cabin heat up
- Reduction of exhaust temperature by 100 K
- Reduction of fuel consumption by up to 2l / 100km at Top Speed

EA 211 ACT – CYLINDER DEACTIVATION

Innovation made by Volkswagen

- 0,4 l/100 km Fuelsavings
 - 8 g less CO₂/km
- } In NEDC



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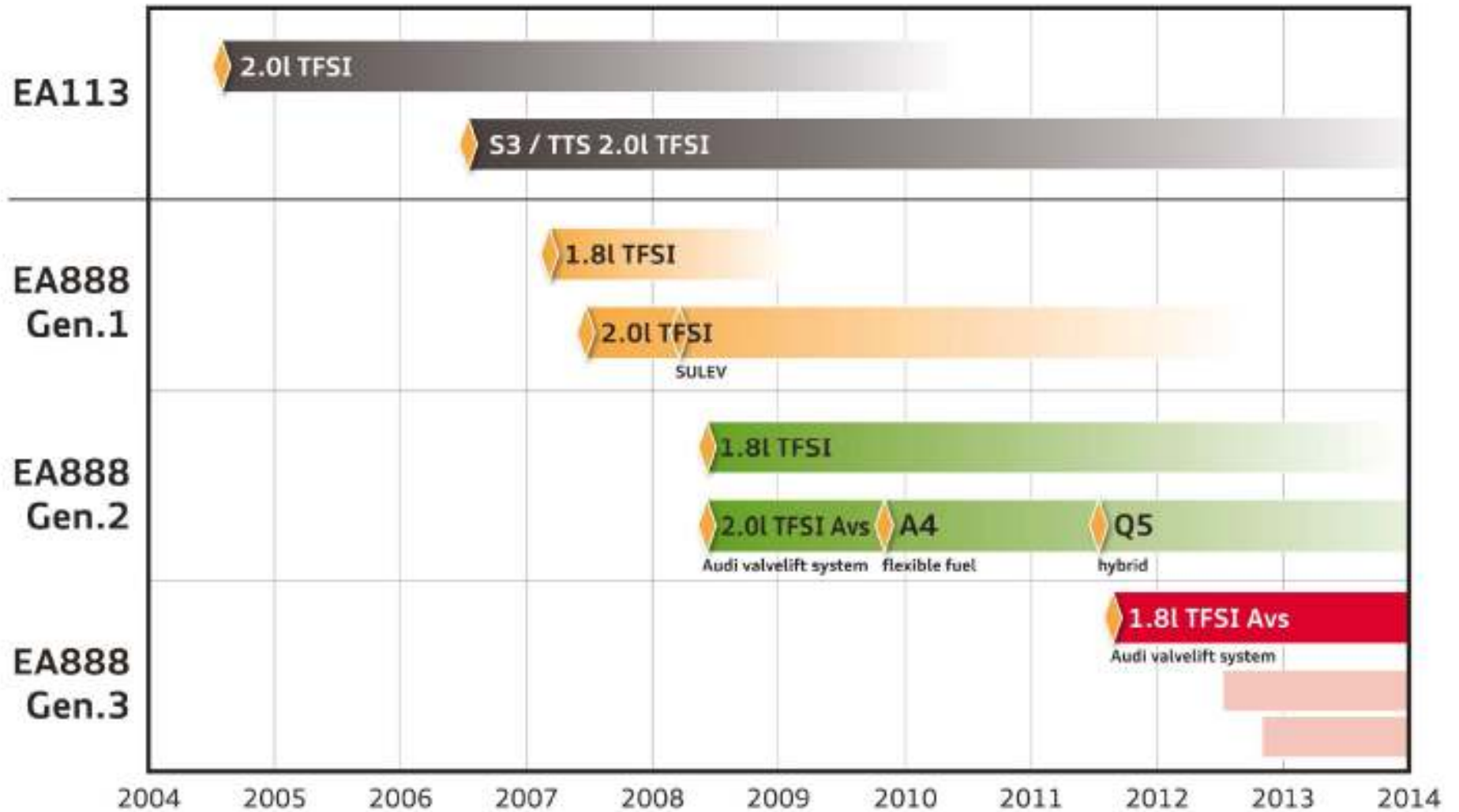
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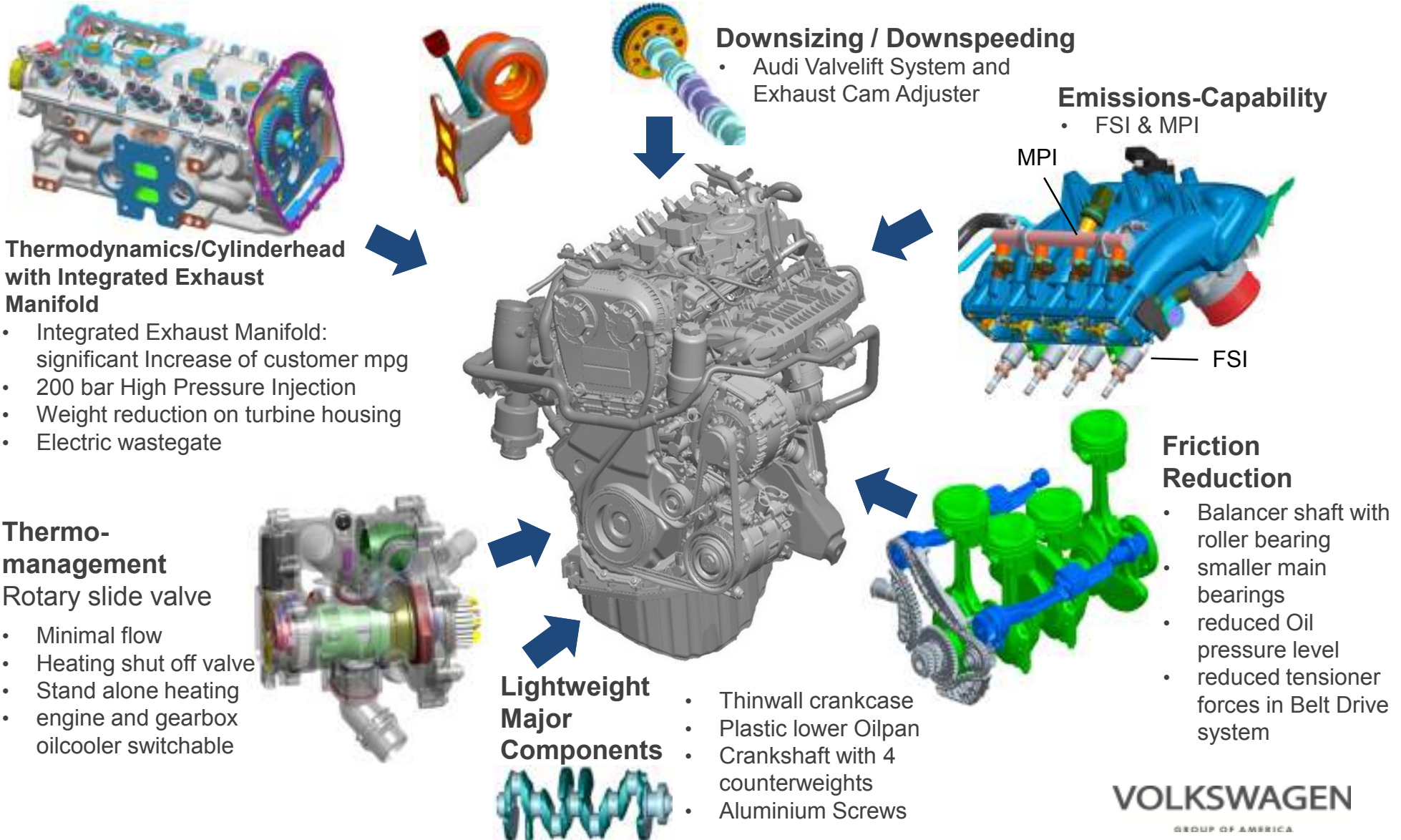
EA 288 MDB Diesel engines

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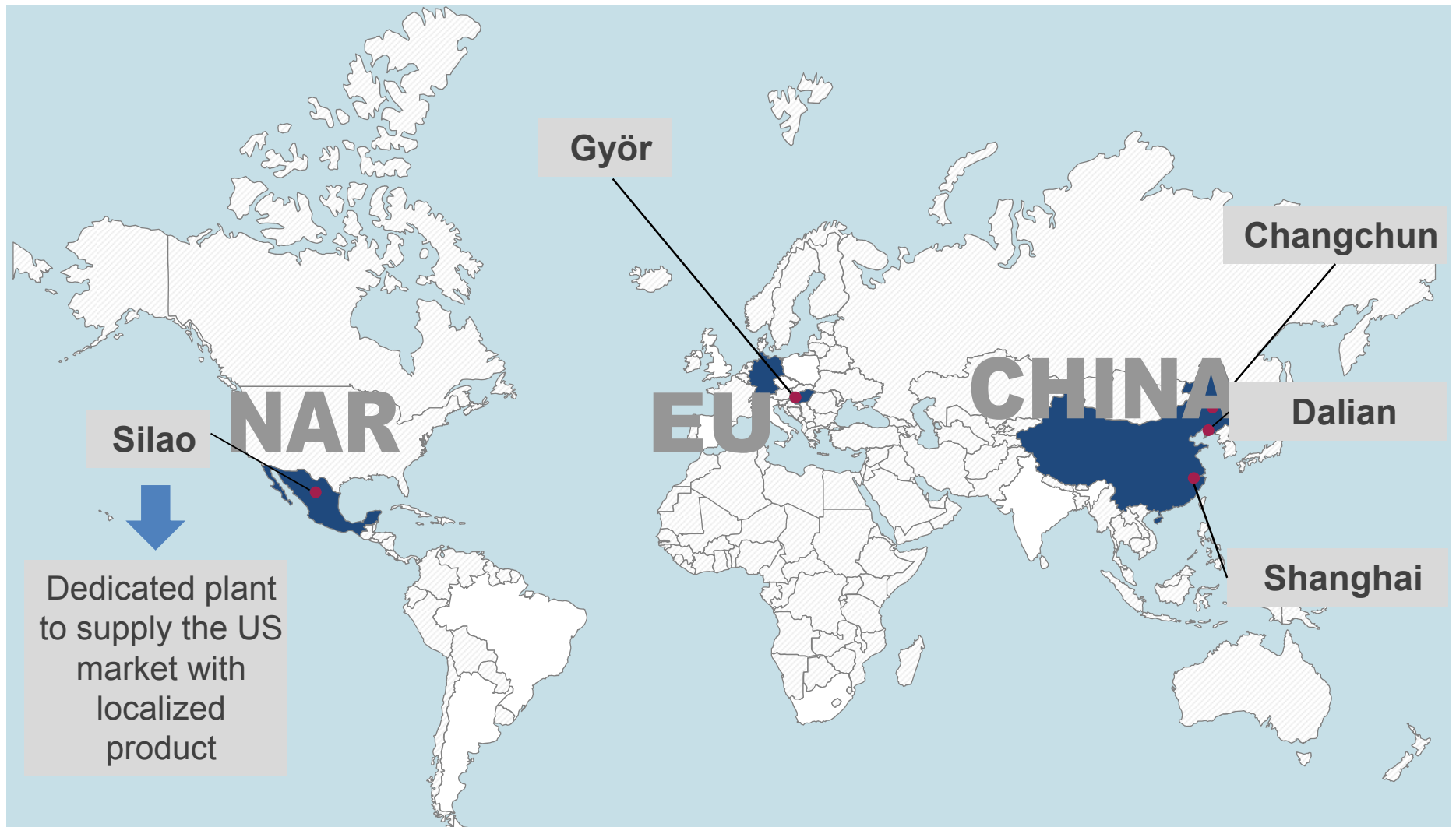
EA888 – ROADMAP



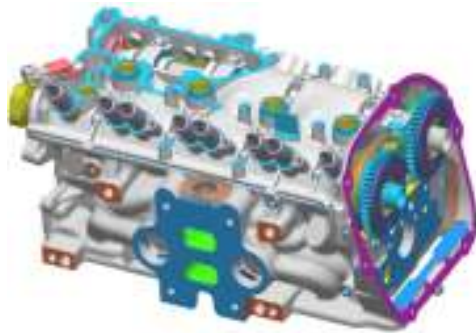
EA888 – TOOLBOX



EA888 – WORLDWIDE PRODUCTION 2014



EA888 FOR THE US OUT OF SILAO



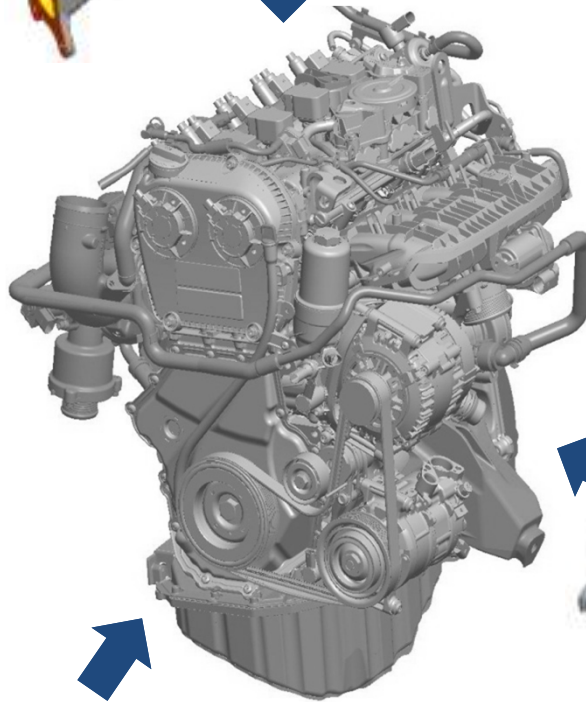
Thermodynamics/Cylinderhead with Integrated Exhaust Manifold

- Integrated Exhaust Manifold: significant Increase of customer mpg
- 200 bar High Pressure Injection
- Weight reduction on turbine housing
- Electric wastegate



Simple Exhaust Camshaft

Intake Manifold without MPI Injectors



Thermostat



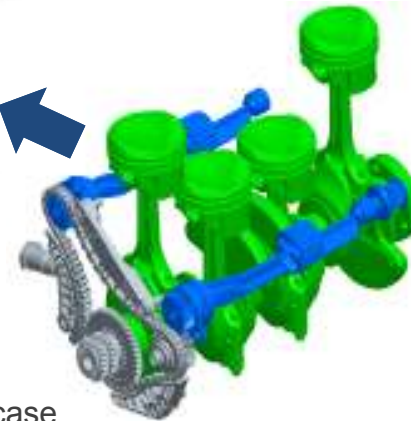
US-specific Components

To be updated with future stringency of GHG Rules

Lightweight Major Components



- Thinwall crankcase
- Plastic lower Oilpan
- Crankshaft with 4 counterweights
- Aluminium Screws



Friction Reduction

- Balancer shaft with roller bearing
- smaller main bearings
- reduced Oil pressure level
- reduced tensioner forces in Belt Drive system

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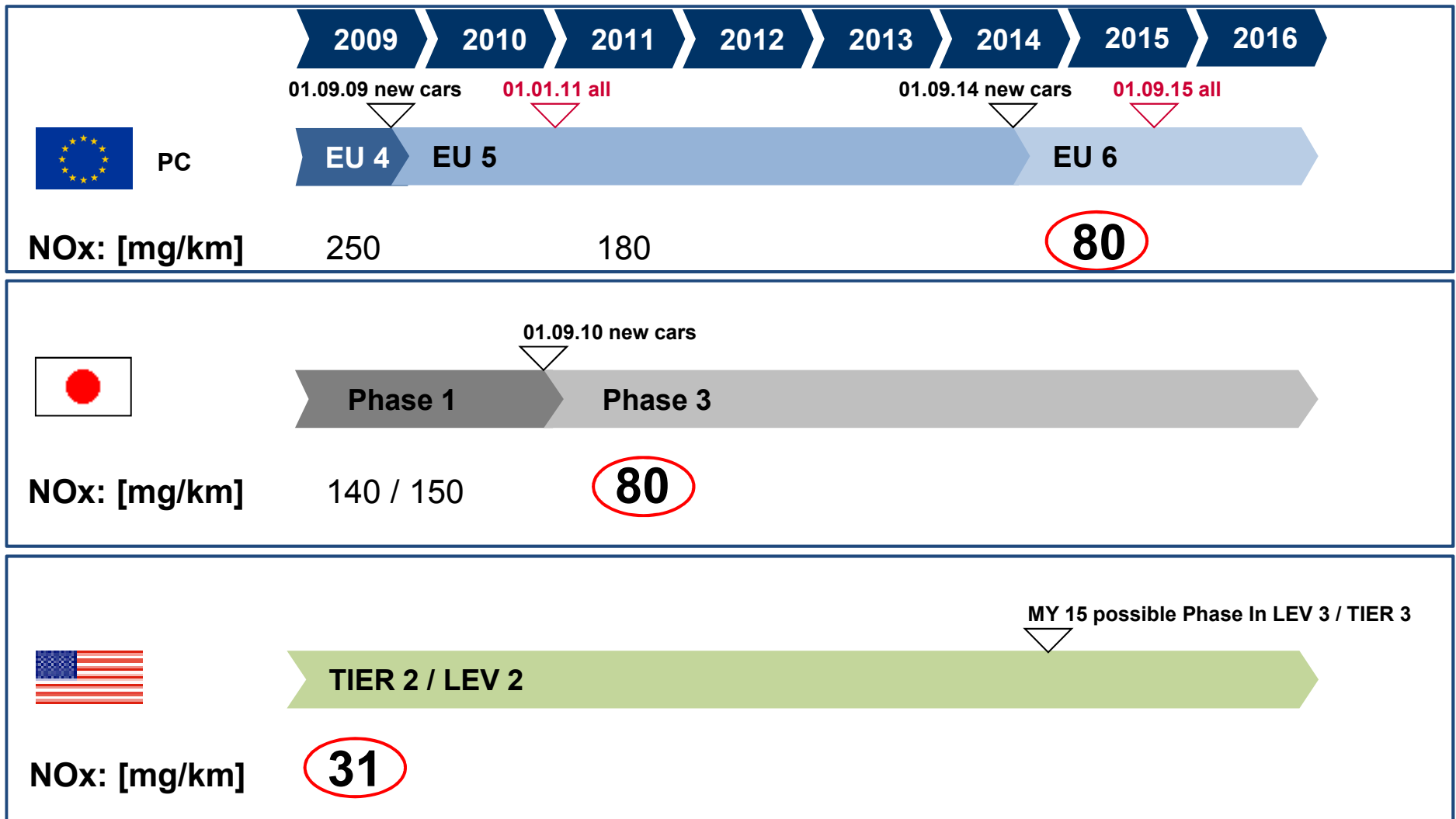
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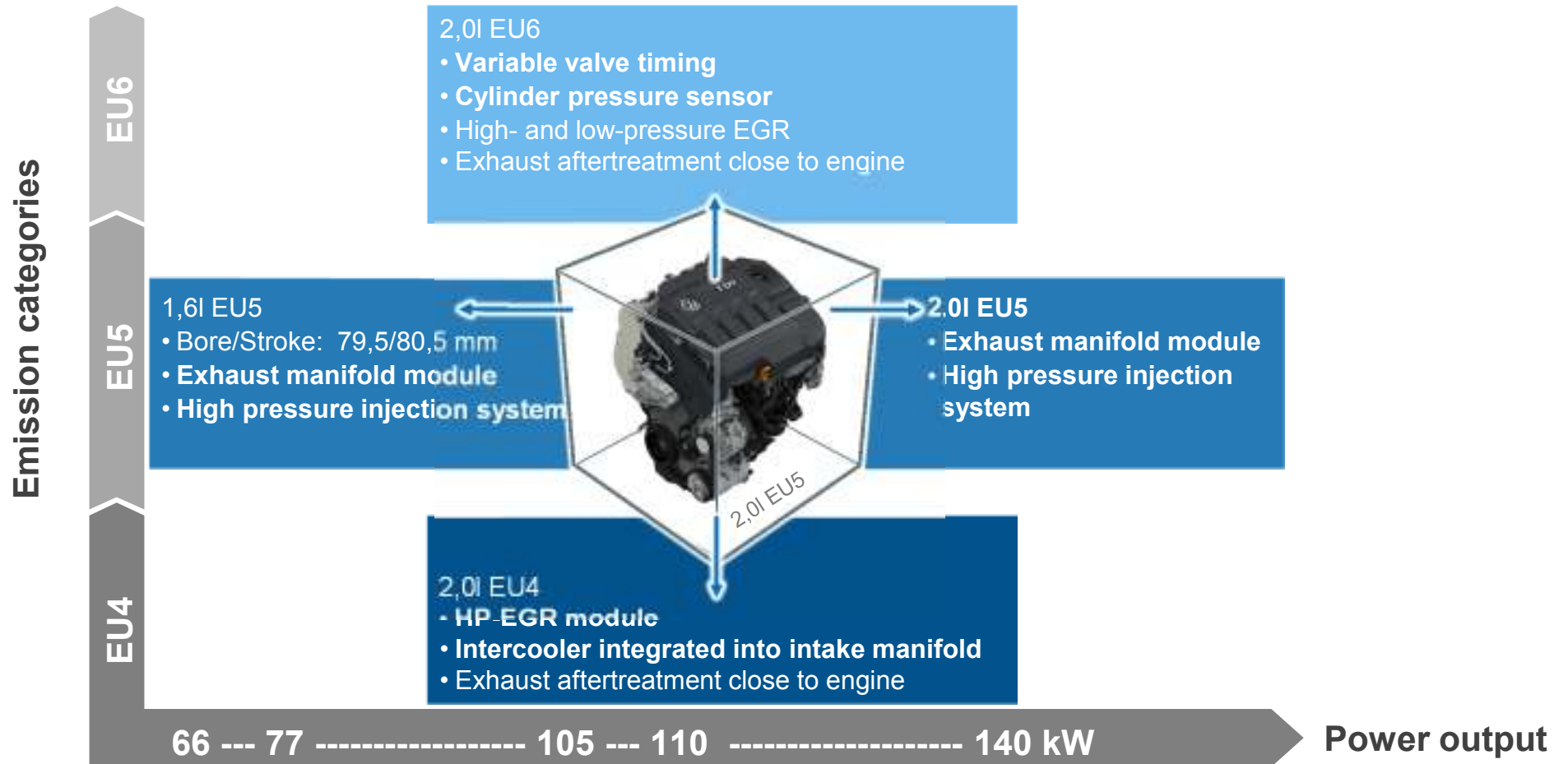
EA 288 MDB Diesel engines

Summary

EA288 – EMISSIONS IN THE US ARE CHALLENGING



EA288 – SIGNIFICANT DISTINGUISHING FEATURES

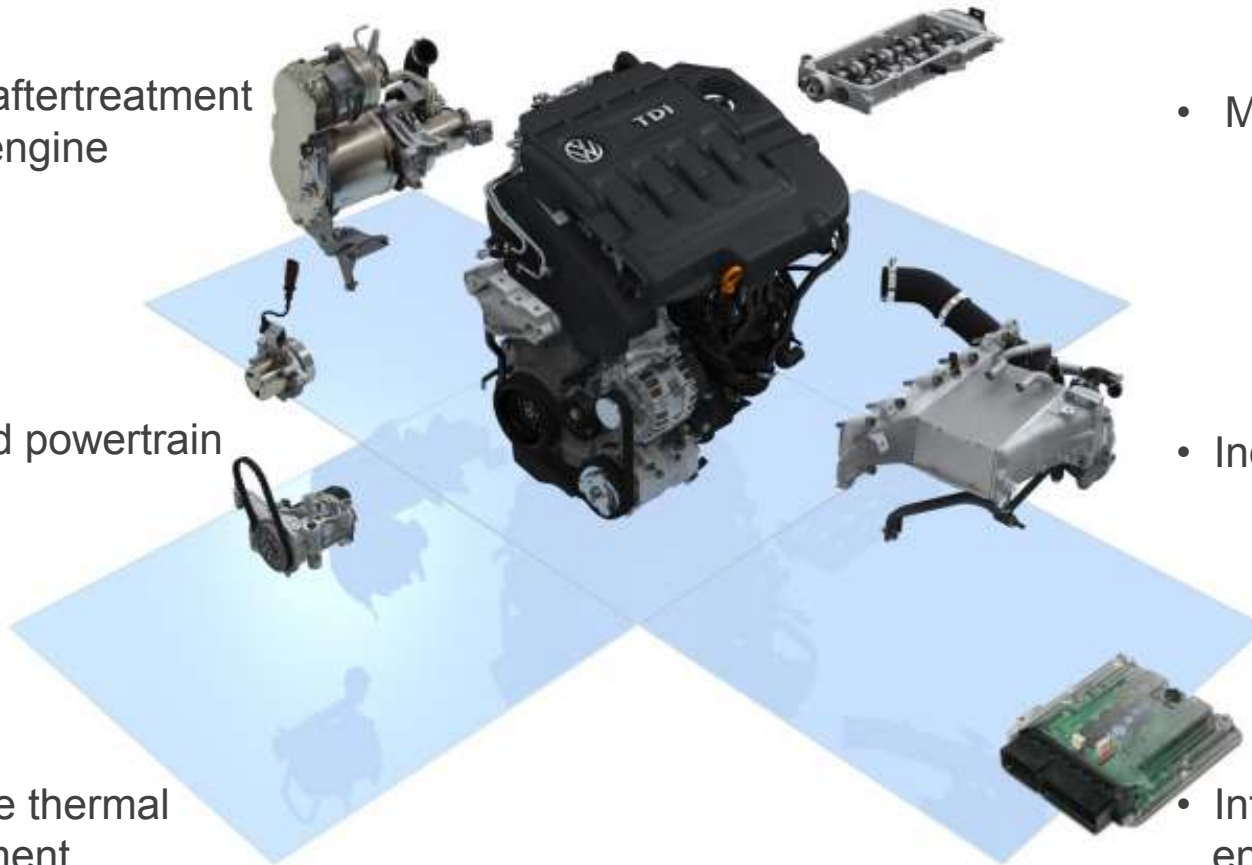


EA288 – MAIN MODULES OF THE DEVELOPMENT

- Exhaust aftertreatment close to engine

- Optimized powertrain

- Innovative thermal management



- Modular EGR system

- Indirect aircooling

- Intelligent control systems engine control unit

EA288 – INDIRECT CHARGE AIR INTERCOOLING



- Water cooling
- Integrated into intake manifold
- Reduced volume of air system
- Cooling or heating performance can be regulated

Emission benefit and improved throttle response

EA288 – EXHAUST EMISSION CONTROL CLOSE TO ENGINE



- Oxidation catalytic converter

EU4

- Oxidation catalytic converter
- DPF

EU5

- NO_x storage catalytic converter

EU6

- SCR-System

EU6
BIN5

**Fulfillment of all
emission levels due to the
modular design**

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SUMMARY

Volkswagen is ready to face the challenges ahead with its new powertrain Lineup



GHG I and II



Fleet average 95 g/km



Fleet average 5l/100km

All new products are approved by the board and will soon be available in the US ✓

Electrification: Golf BEV and Audi A3 e-tron Test fleet currently running in the US
Rollout of Hybrid powertrains into the Volume segment with the Jetta Hybrid

EA 211: Market Introduction with Jetta Hybrid late 2012

EA 888 Gen3: Factory in Silao already delivering pre-production engines

Market introduction of the 2.0l TSI in early 2013

Rollout of the 1.8l TSI replacing the R5 2.5l MPI (MY 14)

EA 288 MDB Market Introduction as MY14 in Audi A3 successor



DISCLAIMER

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If any of these or other risks occur, or if the assumptions underlying any of these statements prove incorrect, the actual results may significantly differ from those expressed or implied by such statements.

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