Options to Reduce Greenhouse Gas Emissions from Road Transport

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Hydrogen

There is no hydrogen in sufficient quantity Available now and it will no hydrogen in the next 30 years produced from renewable sources.

Hydrogen is used only as a deflection from the need to reduce climate gas emissions now.

If 10% of the today gasoline consumption would be available as hydrogen energy it could easily used to improve gasoline

Bio Fuels

Only the 2nd generation bio fuels (BTL, cellulose ethanol) offer a sustainable solution.

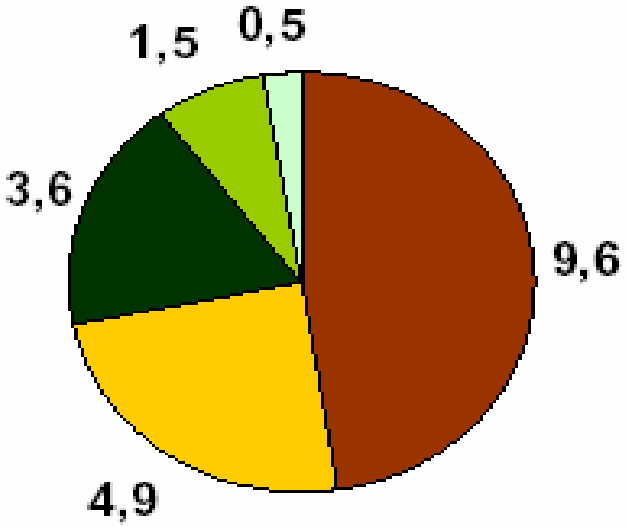
The bio fuels today used compete with food production, nature conservation and bio diversity goals.

There is a urgent need to develop a certification scheme for bio fuels.

The UBA is working in cooperation with ICCT on such a scheme.

Predicted Conversion of Natural Land into Agriculture Land for the Cultivation of Soya Beans in South America (2004-2020)

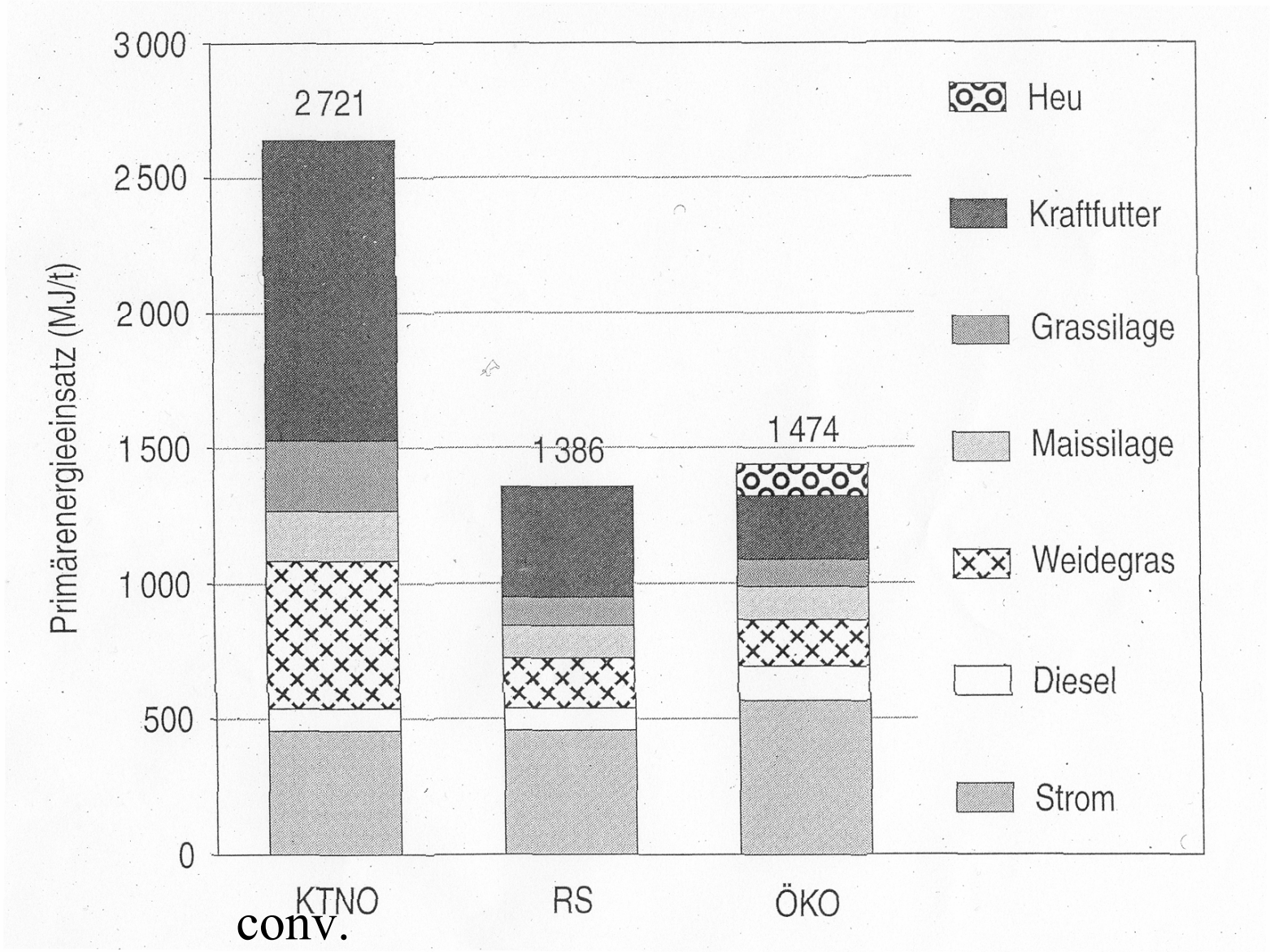
ca. 20 Mio. ha



- Bush Savannas
- Wetland Savannas
- Rain Forest
- Costal Forest
- Dry Forest

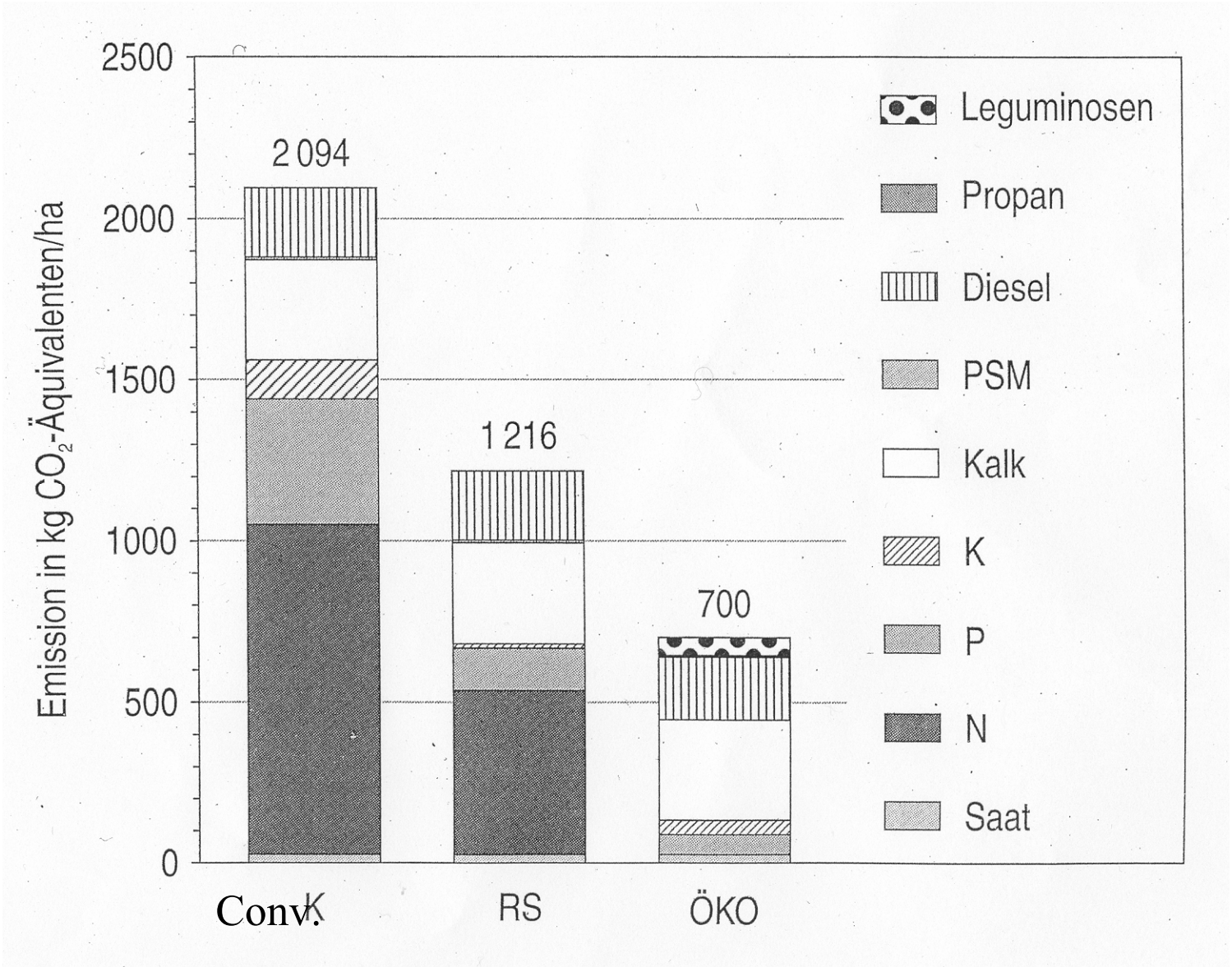
DROS (2004)

Primary Energy Use of conv. Agriculture and Eco Farming

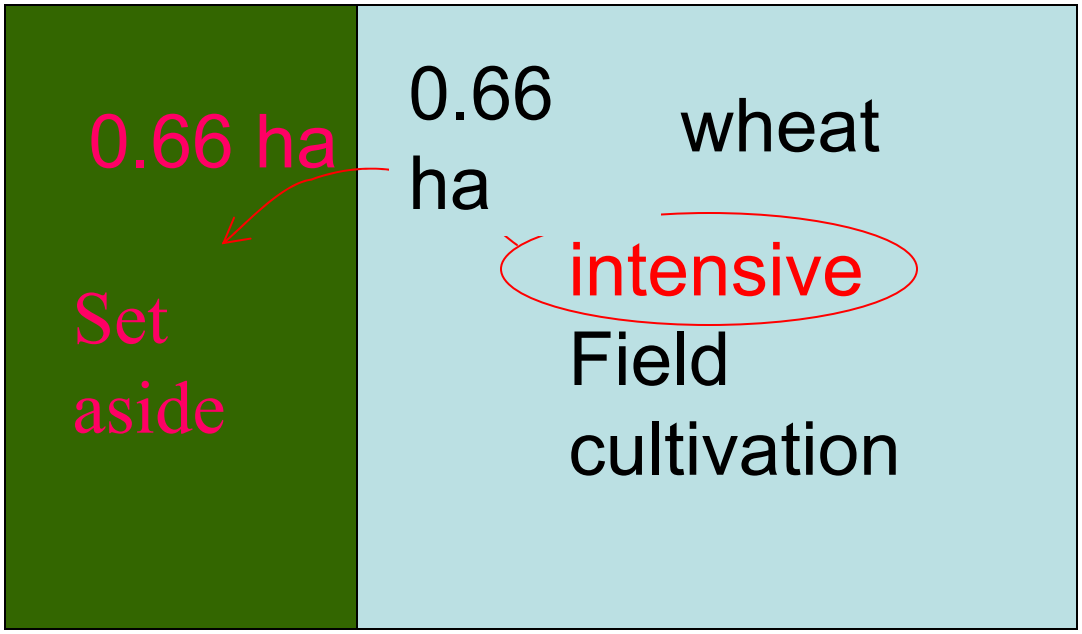


conv.

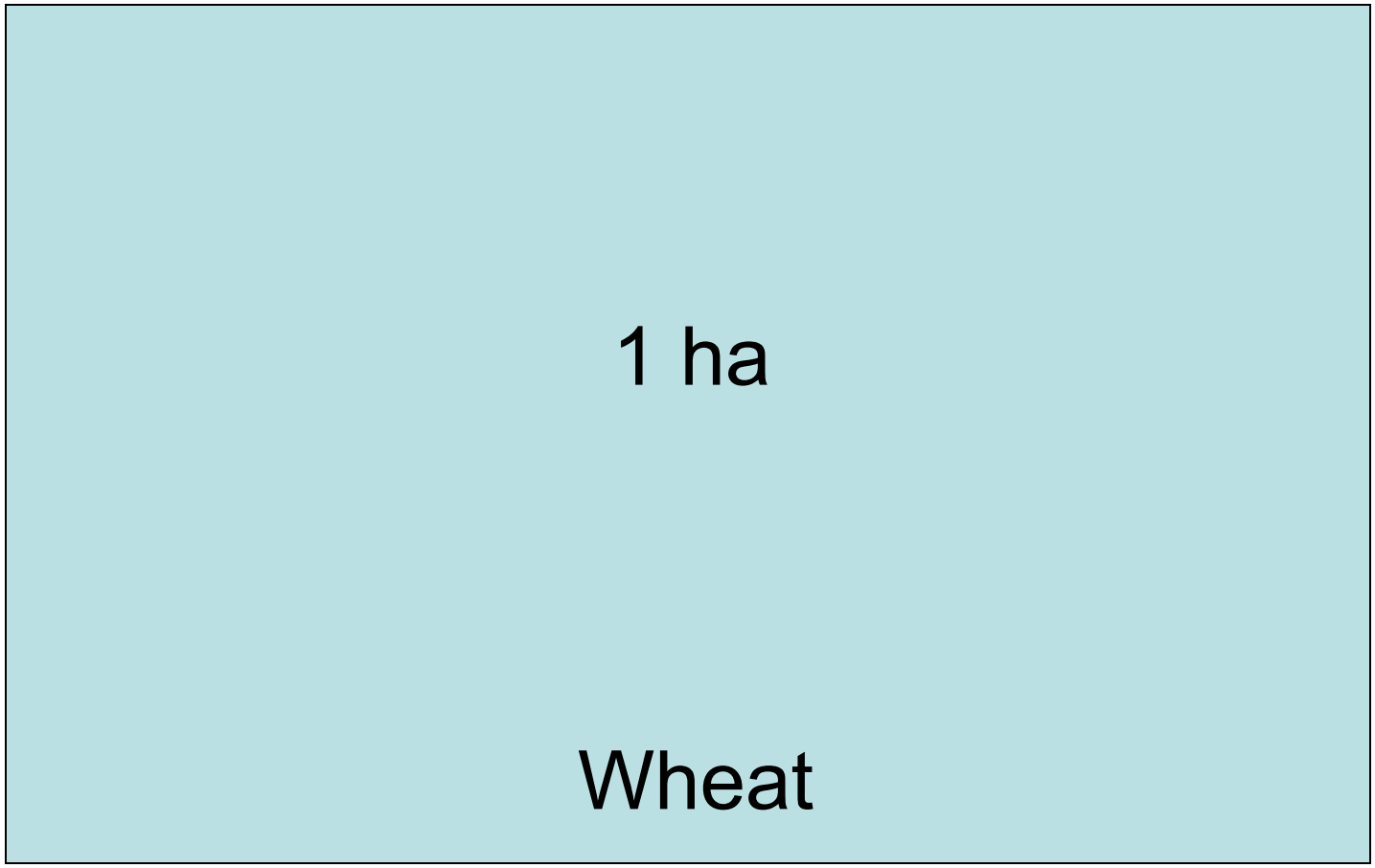
Climate Gas Emissions of conv. Agriculture and Ecological Farming



Agricultural Alternatives



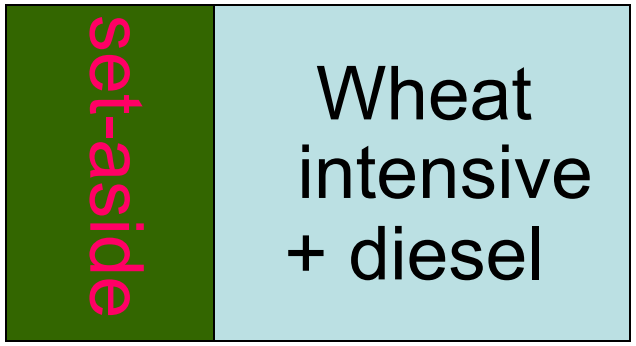
today



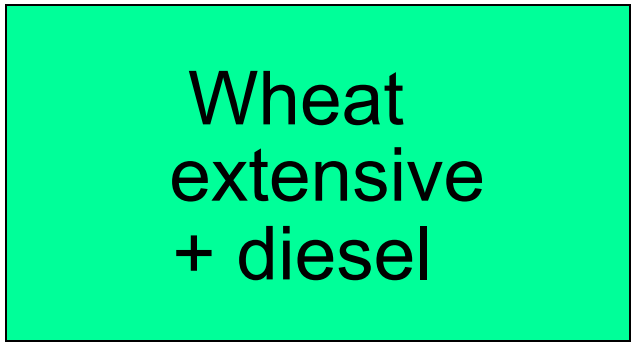
Alternative:

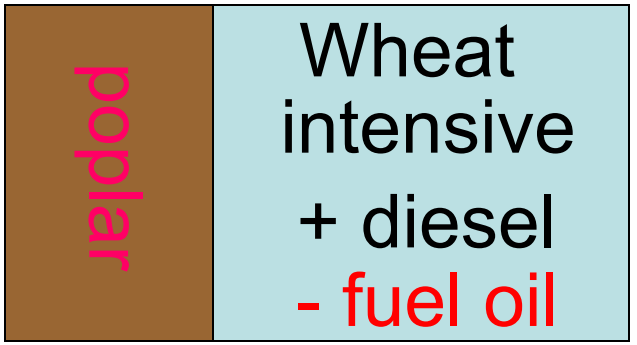
Extensive Agriculture

Different Alternatives of Land Use



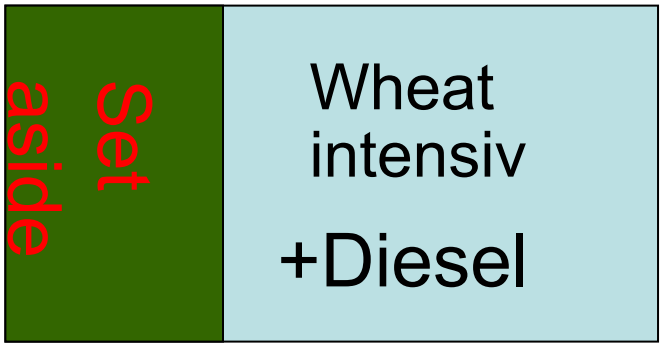
+ resulting fuel options (quantity corresponding to RME on 1/3 ha)





Agricultural Alternatives

\+ Biotopes/species protection – intensive agriculture



3097

2326 [ifeu 2000]

Green house gases kg CO_2-equiv./ha

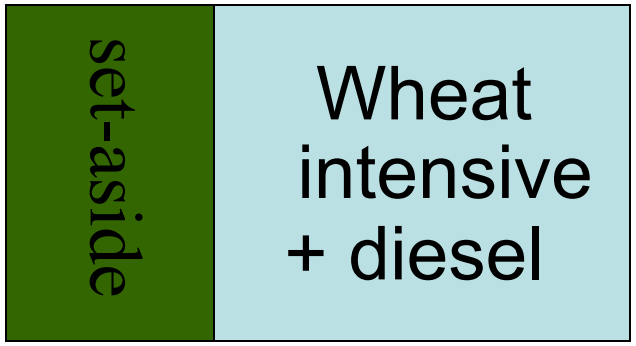
1449

\+ Ressource/climate + many other advantages

Different set aside options

GHG-Reduction Costs

[€/t $CO_{2Eq.}$]



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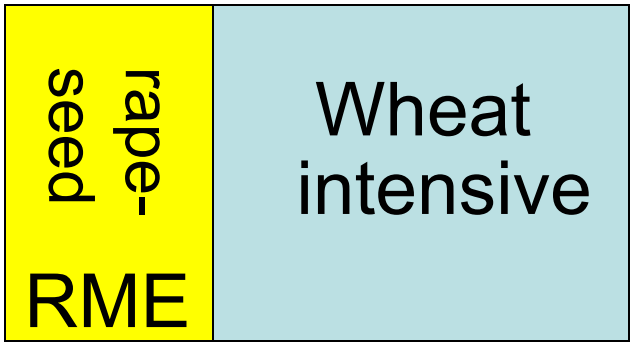

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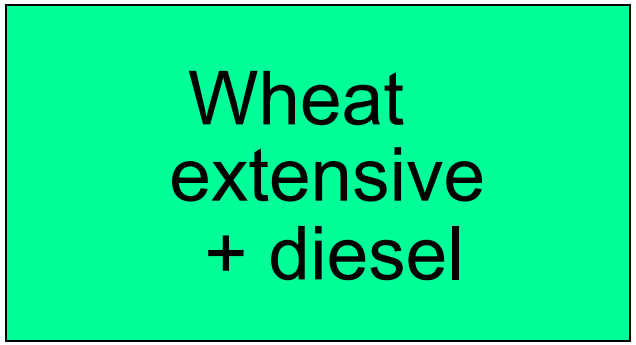

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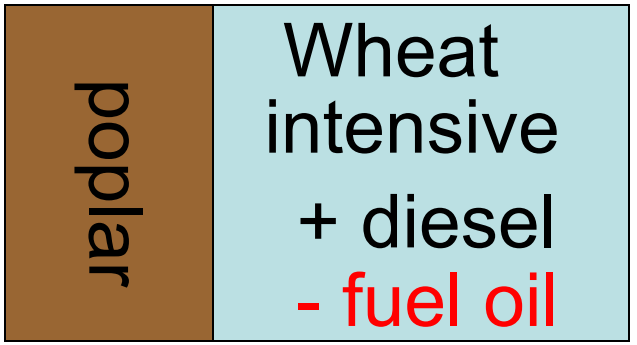

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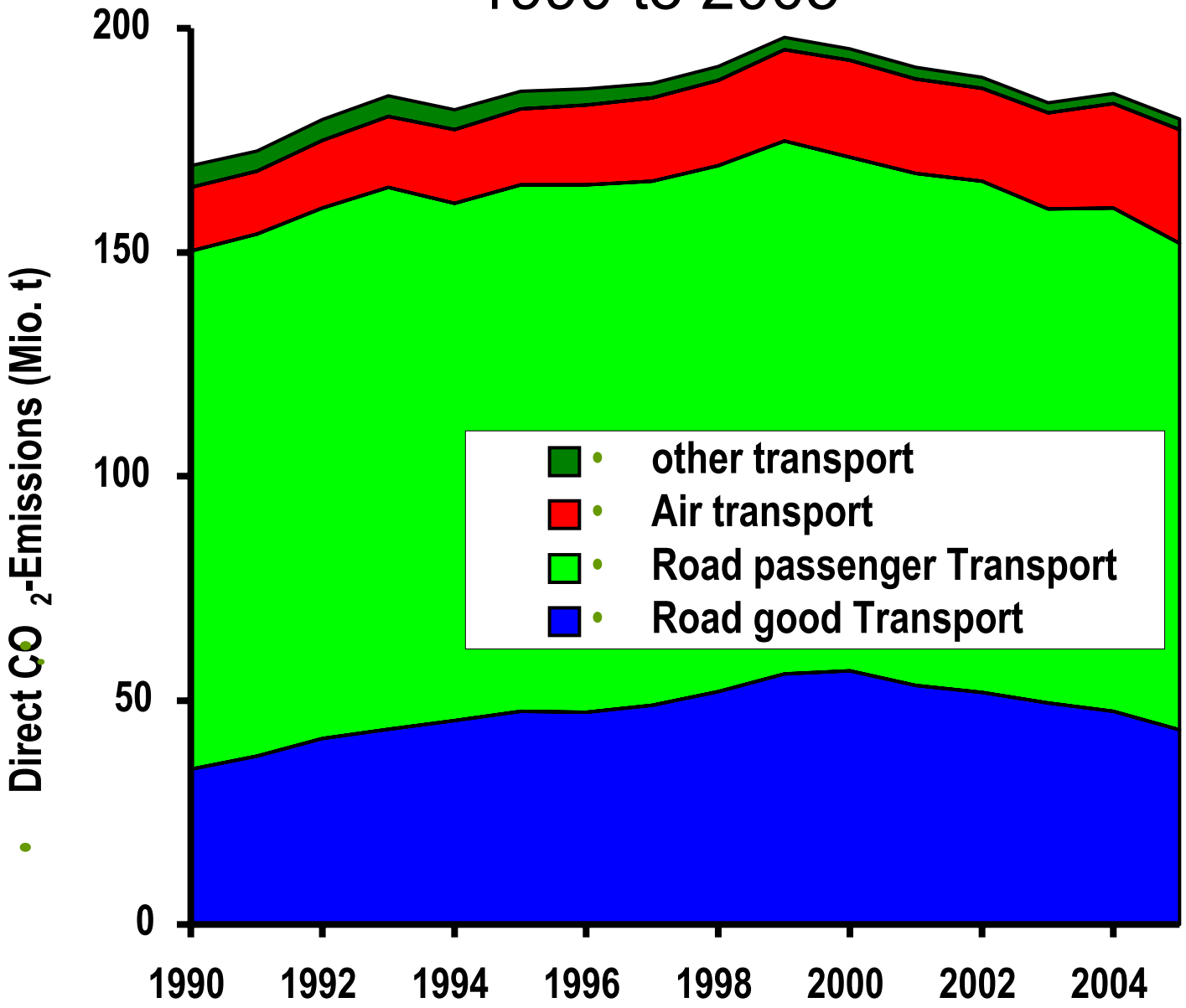
CO2 Emissionen in Germany

1990 to 2005



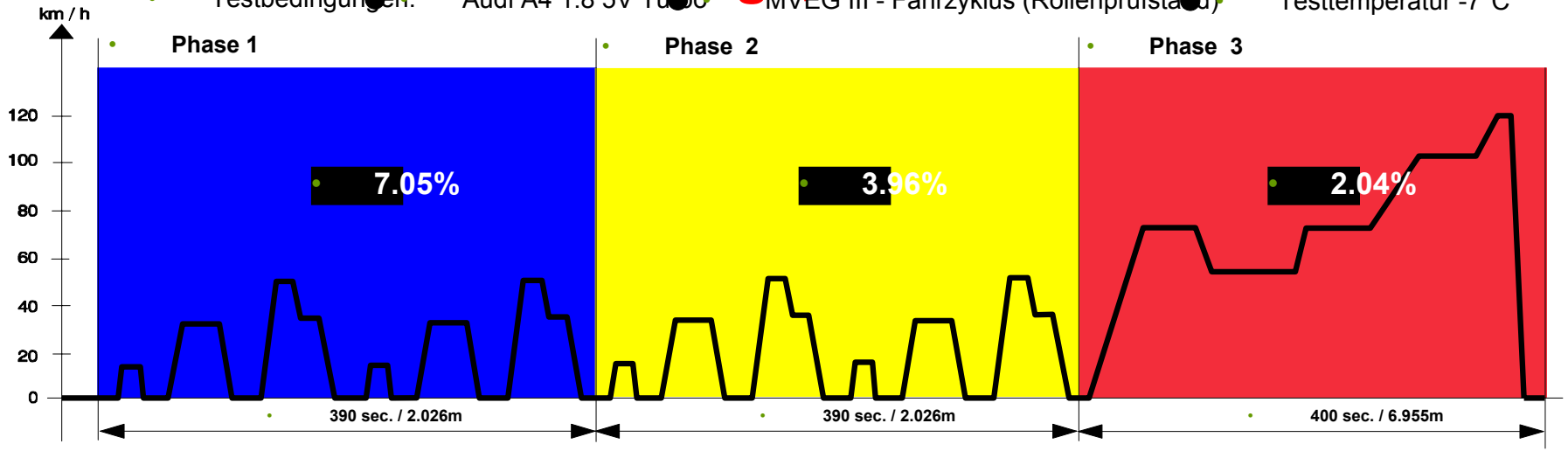
Lubrication Oil

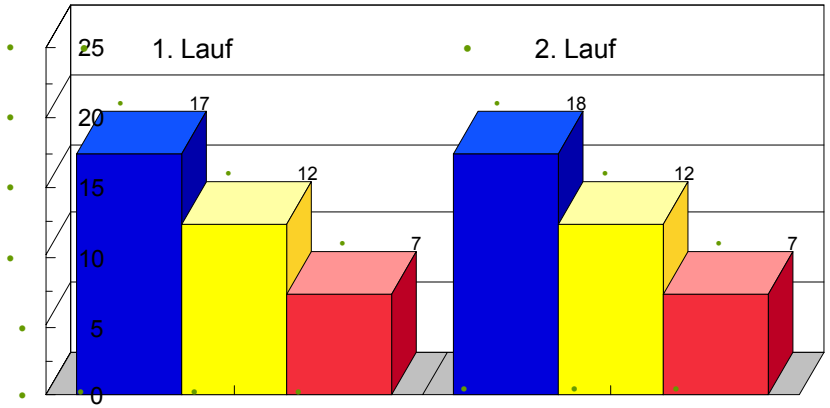
Fuel Saving Test according to the AUDI-Test Procedure

Castrol Formula SLX 0W-30 compared to SAE 15W-40

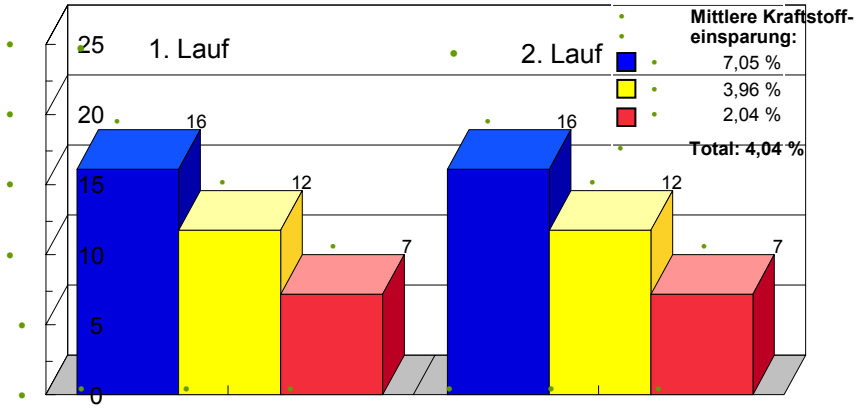
Fuel saving4.04%

Testbedingungen: Audi A4 1.8 5V Turbo MVEG III - Fahrzyklus (Rollenprüfstand) Testtemperatur -7°C





Einzelergebnisse: **SAE 15W-40**



Einzelergebnisse: **FORMULA SLX 0W-30**

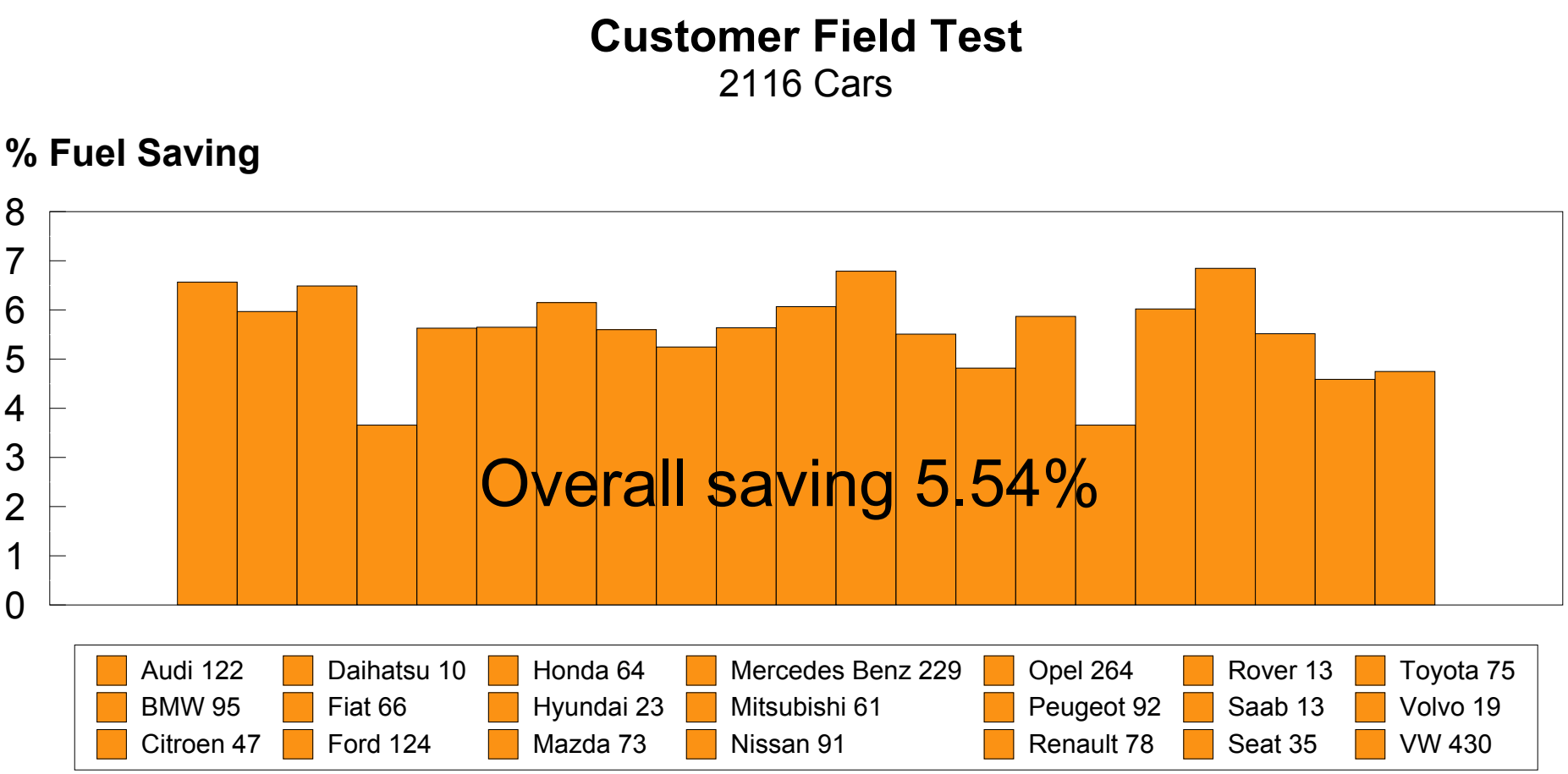
Kraftstoffv

Phase 1 Phase 2 Phase 3 Phase 1 Phase 2 Phase 3

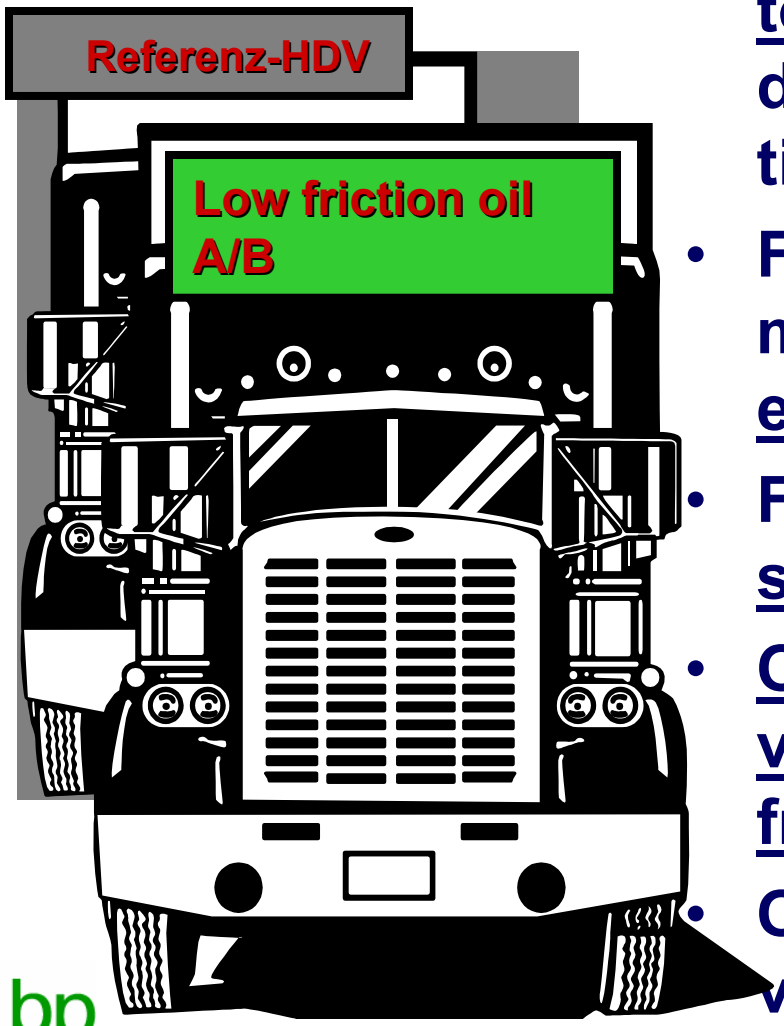
Kraftstoffv

Phase 1 Phase 2 Phase 3 Phase 1 Phase 2 Phase 3

PC-Privat Custumer Test (2116 Vehicles) with Castrol SLX 0W-30



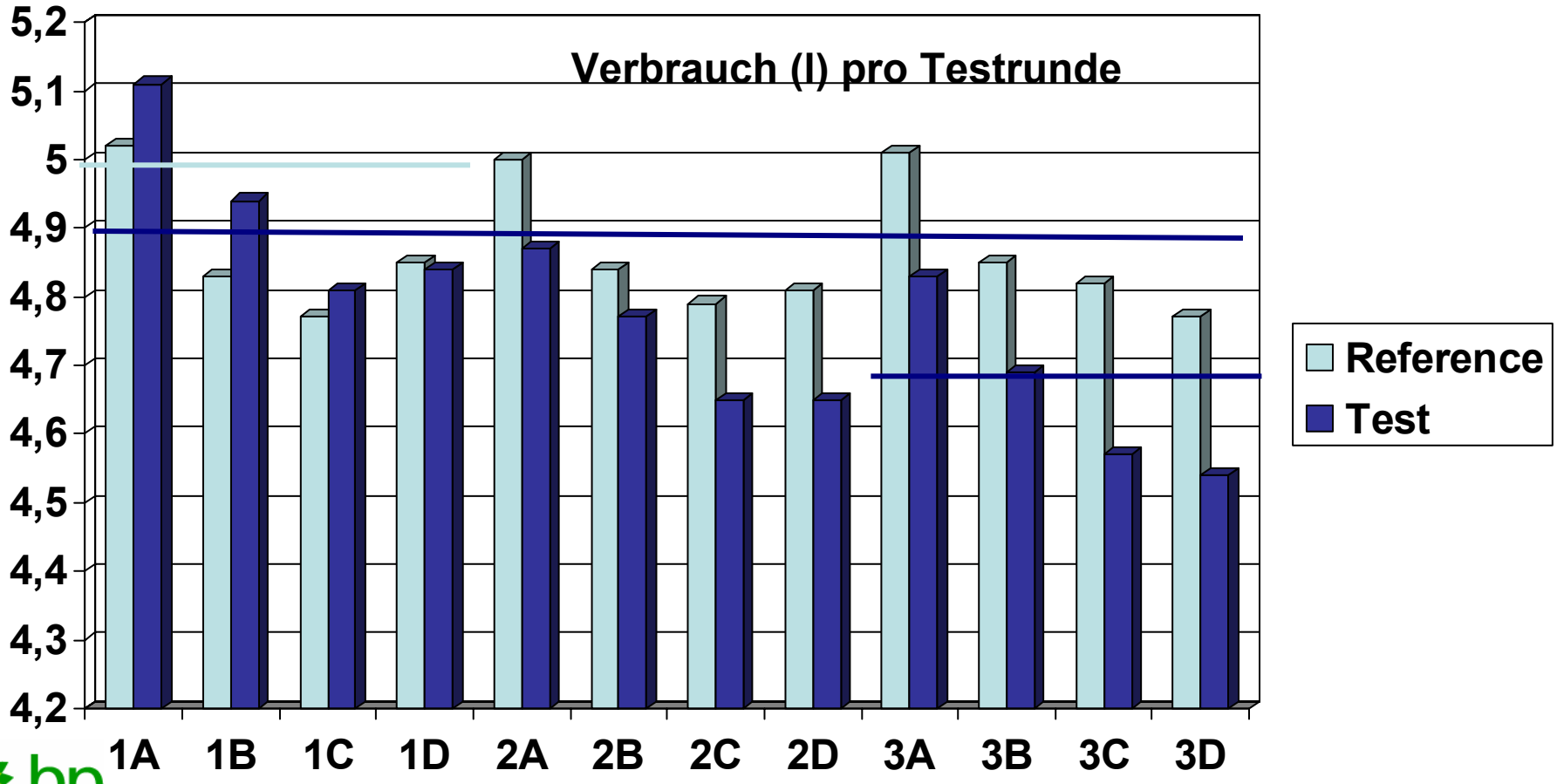
Test Procedure„ Twin Test“



- Two idendical vehicles drive together in a coordinated driving manner at 3 days 2-4 times the same round.
- Fuel consumption measurement with separate extra-tanks and balance
- First day (reference) with same lube oil in both vehicles
- On the second day one vehicle changes to low friction lube oil;
- On the third day second vehicle change also to low friction oil

Twin Test Evaluation (Visco 7000 5W-40 und Energear SGX in comparison to Mineral Lube Oil)

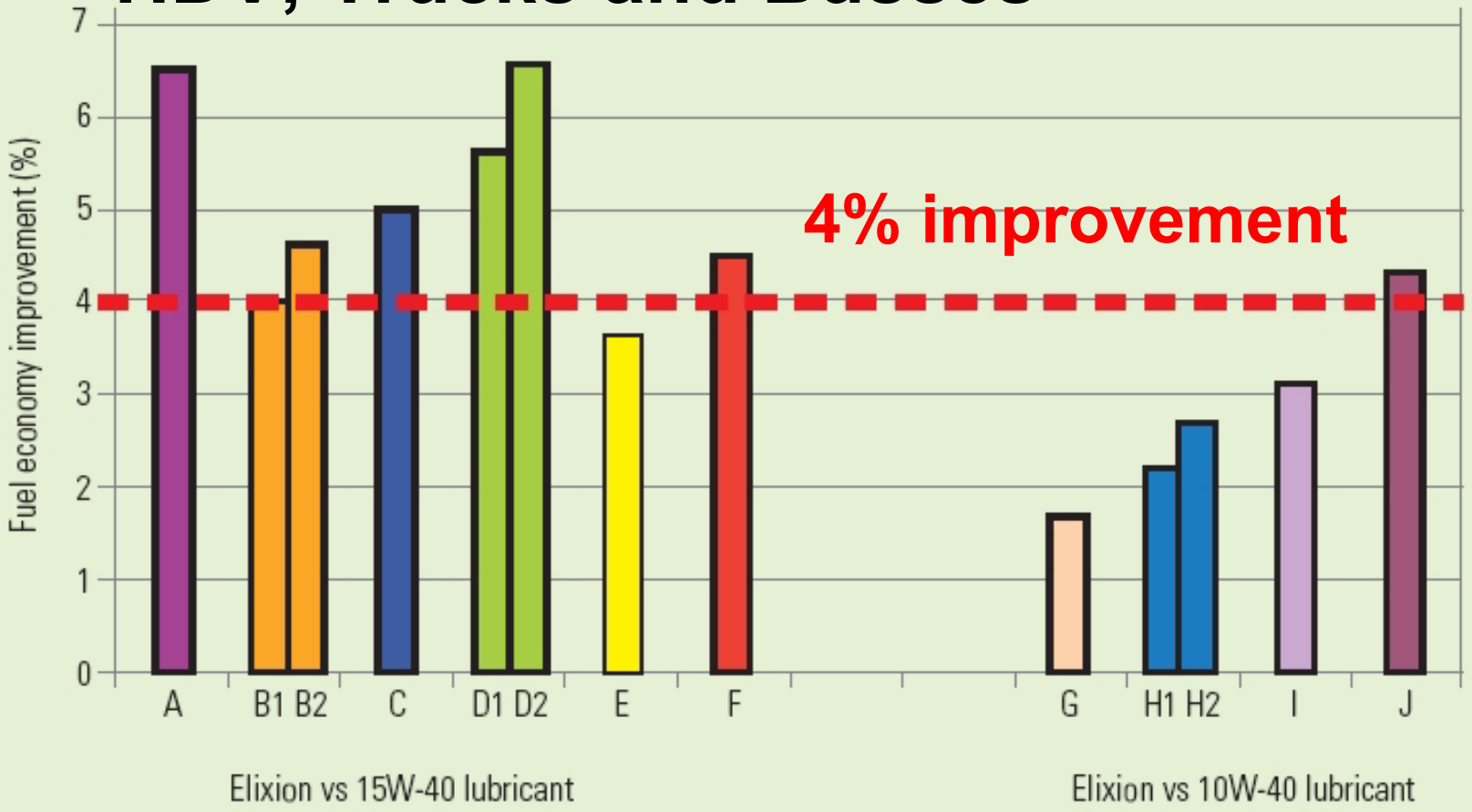
Test to Ref: +1,2 %	**- 2,6 %**	**- 4,1 %**
Lube Oil influence:	**- 3,8 %**	**- 5,3 %**



bp

Fuel economy on test

HDV; Trucks and Busses



The graph shows the result of an extensive series of field trials carried out on fleets of commercial trucks and buses (plotted as A-J above). Elixion, BP's heavy duty diesel engine lubricant, was used in the trials, and consistently demonstrated improved fuel economy compared with conventional engine lubricants, giving an average improvement of around 4 per cent (red dotted line)

Source: BP Frontiers magazine, August 2005

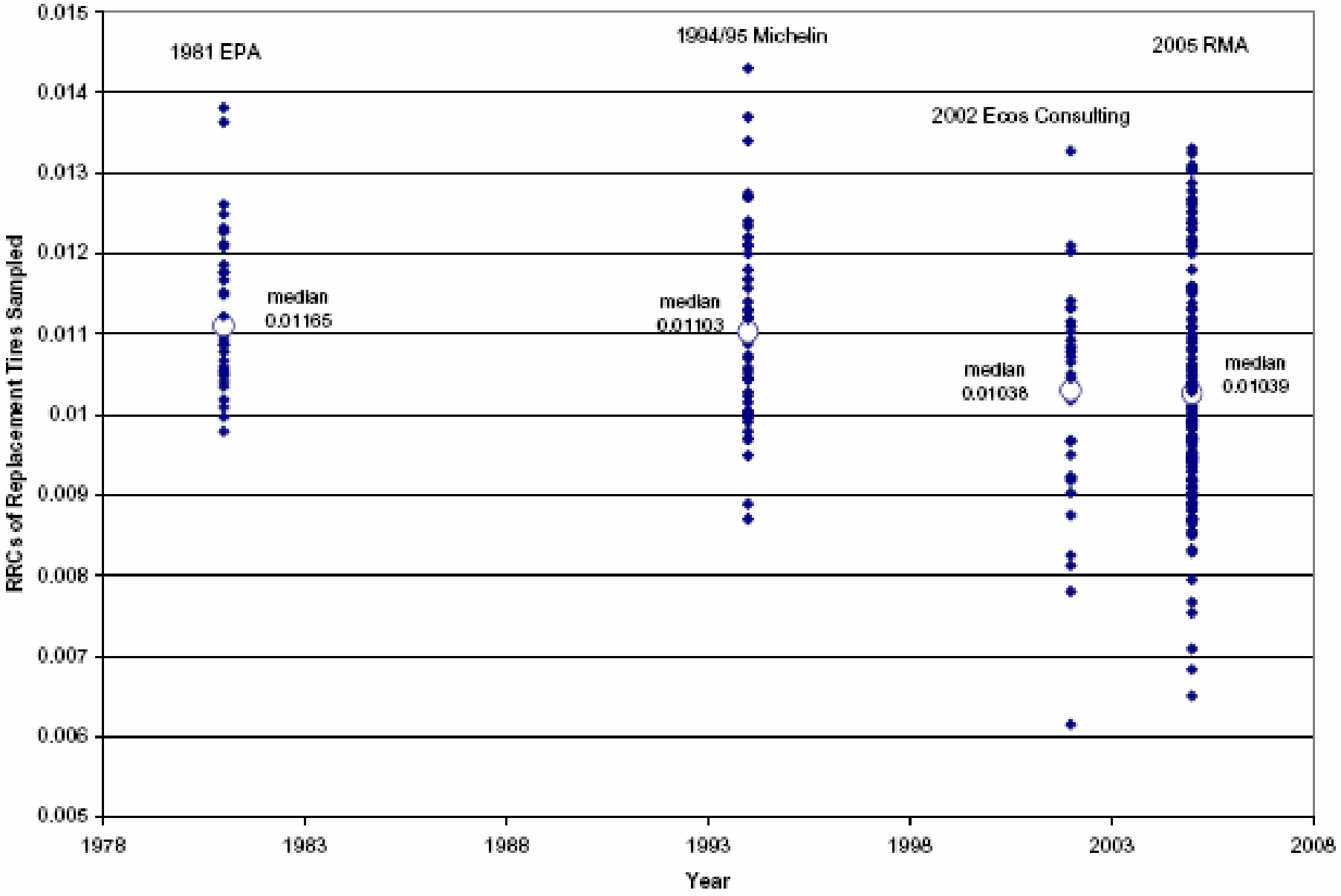
Tires

Potential of Fuel Saving by low rolling Resistance Tires

30% reduction of the rolling resistance reduces the fuel consumption :

city driving:	**4- 6%**
extra urban driving (70 to 89 km/h)	**3- 5%**
autobahn driving (120 km/h):	**2- 3%**

RRC Ranges for Replacement Passenger Tire Data Sets, 1981 to 2005



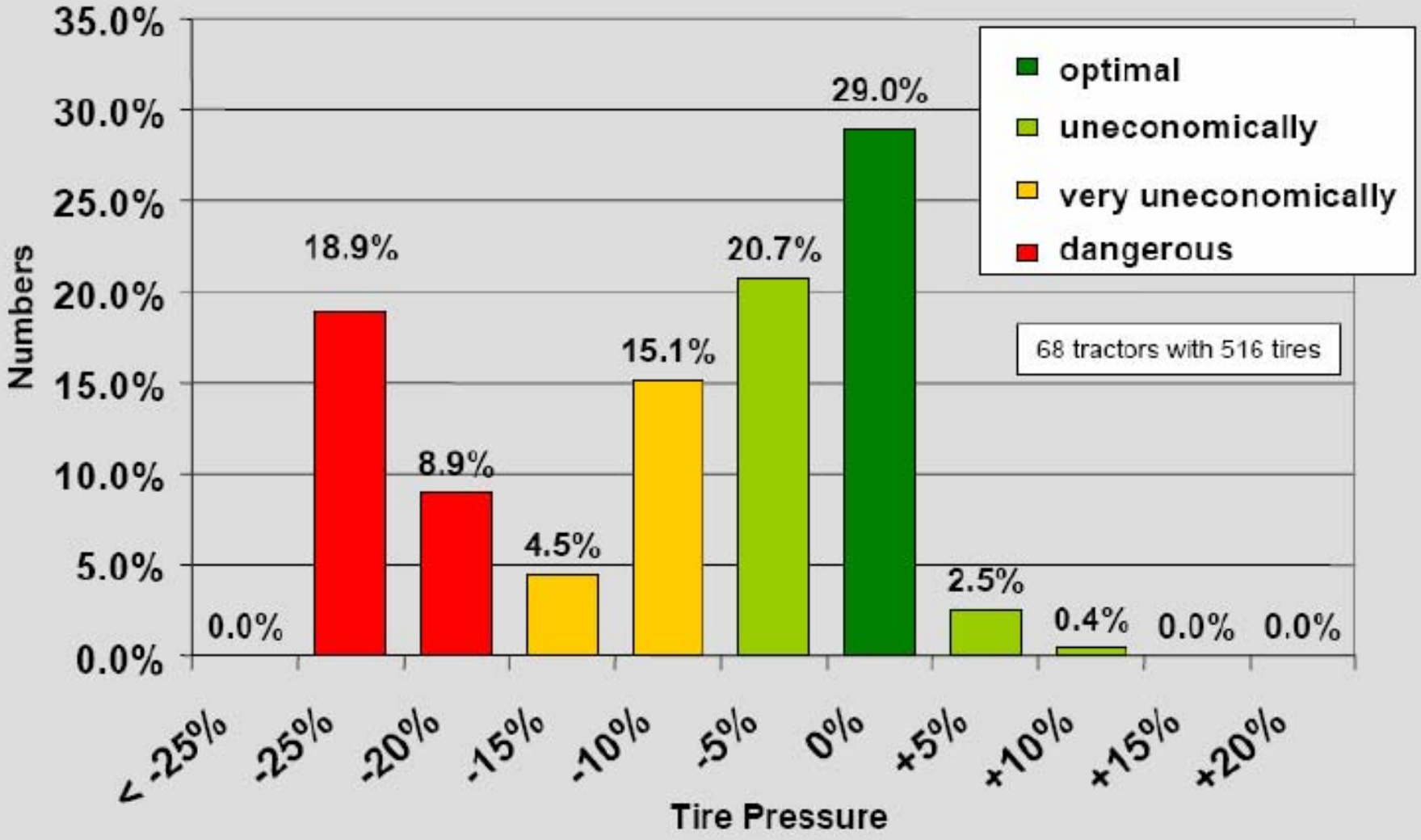
Source:Tires and Passenger Vehicle Fuel EconomyT R B S P E C I A L R E P O R T 2 8 6,2006;

Rolling resistance of truck tires will typically vary from 4.5 lbs/1000 lbs to 8.0 lbs/1000lbs.

ESTIMATED ANNUAL FUEL COST*

Scenario	Type	Steer	Drive	Trailer	MPG	$/Year
1	Deep tread duals	XZA3	XDA-HT	XZE	5.60	$35,587
2	Fuel efficient duals	XZA3	XDA3	XT-1	6.00	$33,333
3	Fuel efficient X One	XZA3	X One XDA	X One XTA	6.28	$32,103

* Scenario #2 at 6.00 mpg serves as the basis for comparison for scenarios 1 and 3. $/year amounts are estimated using $2.00/gallon and 100,000 miles/year.



Study of tire pressures on Truck Tractor units in Germany

Source : Continental

2/ Benefits of a TPMS system

SCHRADER ELECTRONICS

•Tire Wear increases with incorrectly inflated tires (under and over inflated)

- •0.2bar under – inflated 10% reduction in tire life
- •0.4bar under – inflated 25% reduction in tire life
- •0.6bar under – inflated 50% reduction in tire life

-source Continental

•Fuel Consumption increase with incorrectly inflated tires (vehicle load, driving style, tire type etc effects these numbers)

- •0.2bar under – inflated 1% increase in fuel
- •0.4bar under – inflated 2% increase in fuel min
- •0.6bar under – inflated 4% increase in fuel min

If vehicles had correct tire pressure then potential to save in Germany alone 200million litres of fuel. *If all of EU then potential to save 700million litres of fuel (estimated SEL)*

-source Continental

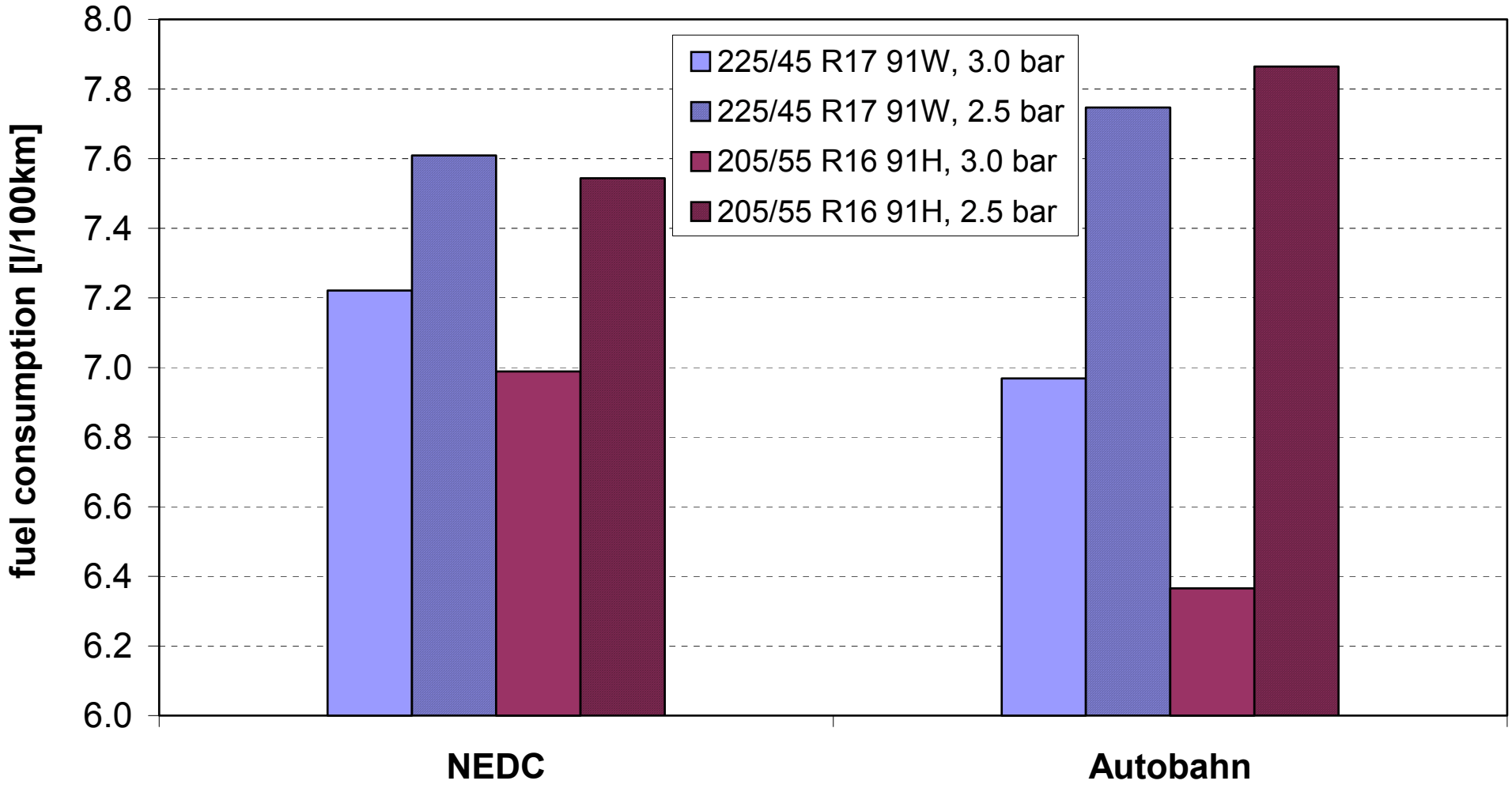
•Under inflated tires

- •0.5bar under – inflated tires reduce lane changing ability
- •0.5bar under - inflated tires can promote oversteer if on one axle
- •Tires under 1.5 bar have a greatly reduced ability to resist aqua-planning.
- •under – inflated tires reduce vehicle stability. The greater the amount of under-inflation of tires the greater reduction in vehicle stability.

-source Beru

Improvement of Fuel Consumption

It isn’t only rolling resistance but also wind resistance by wider tires



Driver Training

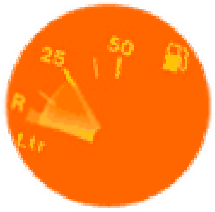
Fuel economy and CO2 reduction potential

- **ECO-DRIVING advanced training**
- **Up to 25% individual fuel savings potential**
- **5-10% savings on average in practice**

- ***ECO-DRIVING.... HOW?***
- **Less engine speed: gear change at 2000 – 2500 RPM [cars]**
- **Less vehicle dynamics (acceleration/ deceleration/ speeding/ overtaking/ aggression: anticipation)**
- **less idling and cold start short trips, tyre pressure up**
- ***CAPACITY* >>Training, communication, in-car devices (on-board computer, cruise control, RPM, MDD, GSI)**
- **EU 15 reduction estimates:**
- **10% fuel costs = 25 billion litres / Euro = >50 Mton CO2**

Source:Martin Kroon

In-car devices



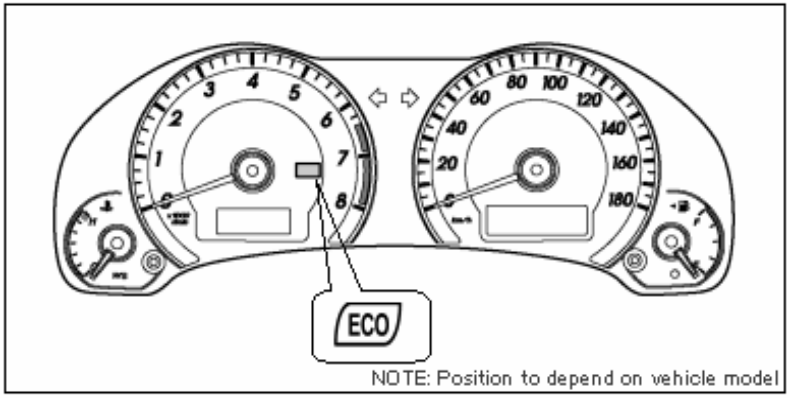
Feedback unit

Source:Martin Kroon

Toyota Launching “ECO” Drive Indicator

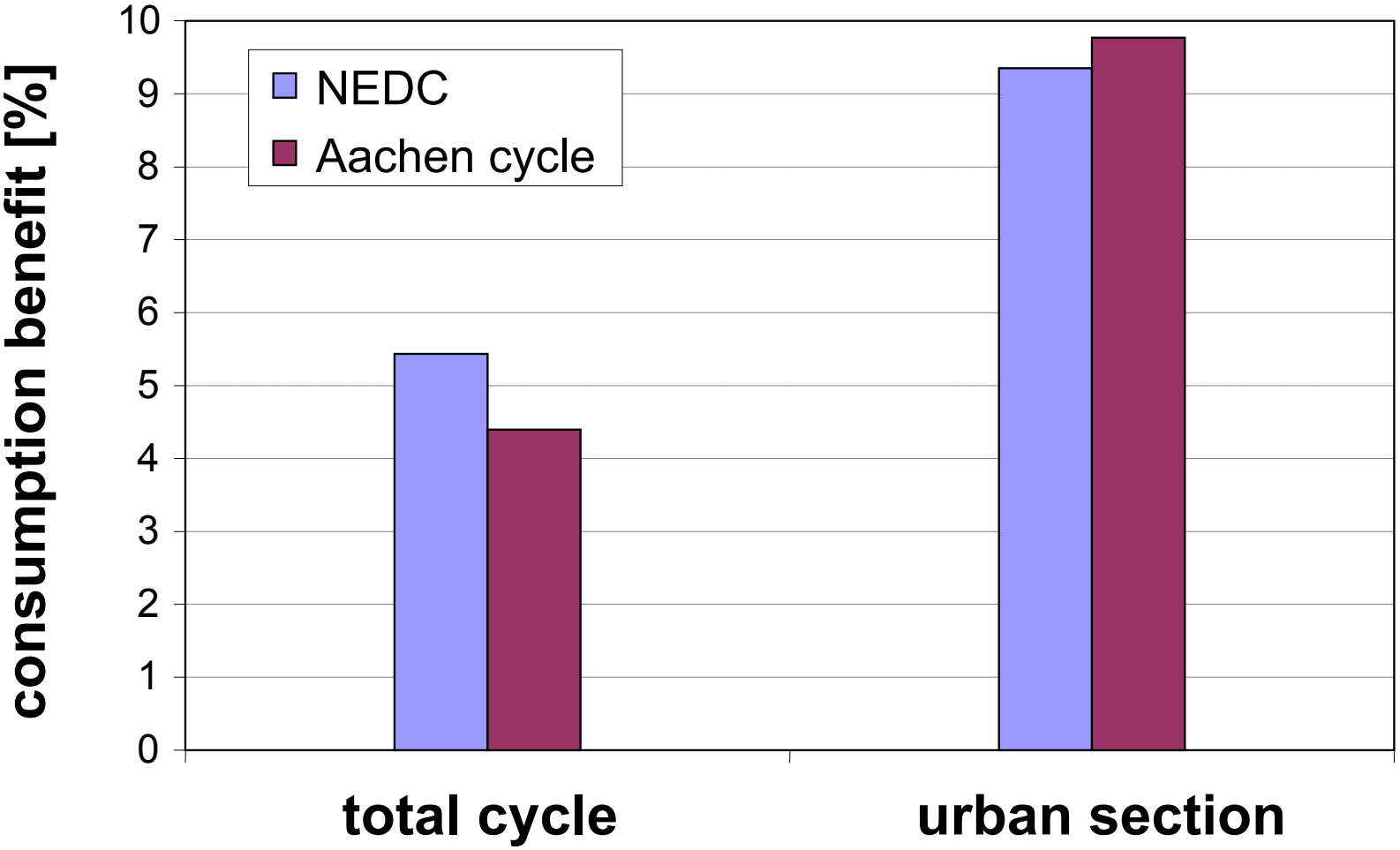
Posted on: October 2nd, 2006

Toyota is introducing a new feature in its Japanese market automatic vehicles called “Eco Drive Indicator” which alerts the driver when they are driving the vehicle in an ecological manner. The “Eco Drive Indicator” feature turns on a dash mounted display showing the driver is driving the car efficiently by monitoring speed, acceleration and engine/transmission efficiency. Research shows that the “Eco Drive Indicator” will allow for a **four** percent increase in fuel economy in the vehicles equipped with the feature.



Simple Solutions

Consumption benefit with start-stop operation



Insulation for cooling vans

Better insulation for less CO2 emission

Twin seal concept for rear & sliding doors. Adjustable extra seals reduce the penetration of energy (heat) into the load area

- **Molded, CAD designed PU panels in the combination of vacuum panels are reducing the K-factor to world record value of 0.27 w/m² K in comparison to regular insulation, which is about 1.0 w/m² K ***
- **→ Reduces operation time of cooling unit with the reduction of energy consumption → less fuel → less CO2!**

* K-factor: heat transfer coefficient !

Electric driven cooling units for cooling vans

Electric driven compressor runs cooling unit always with the highest possible performance regardless engine speed. No performance in idle speed (cities) no energy waste on highways with high engine speed.

Reduction of fuel consumption (CO2 reduction), also due to aerodynamic design

Refrigerant volume is very small (only 800 gr.);
Should be CO_2 in the future

Working cooling unit in parking position without vehicle engine is running (in the battery capacity limit) → no pollutant!

Change of Modal Splits

- Transfer of 5% of PC city trips to public transport
- 30% of all trips shorter than 5 km to bicycle reduces the CO2 emissions by 3-4 Mill. t.
- To achieve this goal it is needed to implement a number of single measures. These are e.g. improvement of the infrastructure, a customer related service of the public transport companies, reduction of restrictions of to enter the system and the creation of a bicycle culture like in Netherland.

Overall it is expected that the measures for the change of modal split reduces

the CO_2 emissions by 15 Mill. t/a.

Modal Split in California

Flight SFO-Sacramento- SFO : 100kg CO_2

Drive SFO-Sacramento- SFO : 50 kg CO_2

Bus SFO- Sacramento- SFO : 15 kg CO_2

Transport
Avoidance of Transport

- To avoid transport it is required to keep compact low traffic settlement structures following the concept „City of the short trips“ .
- To promote regional production and distribution structures.
- An improved integration of transport and settlement planning within the city institutions is required.

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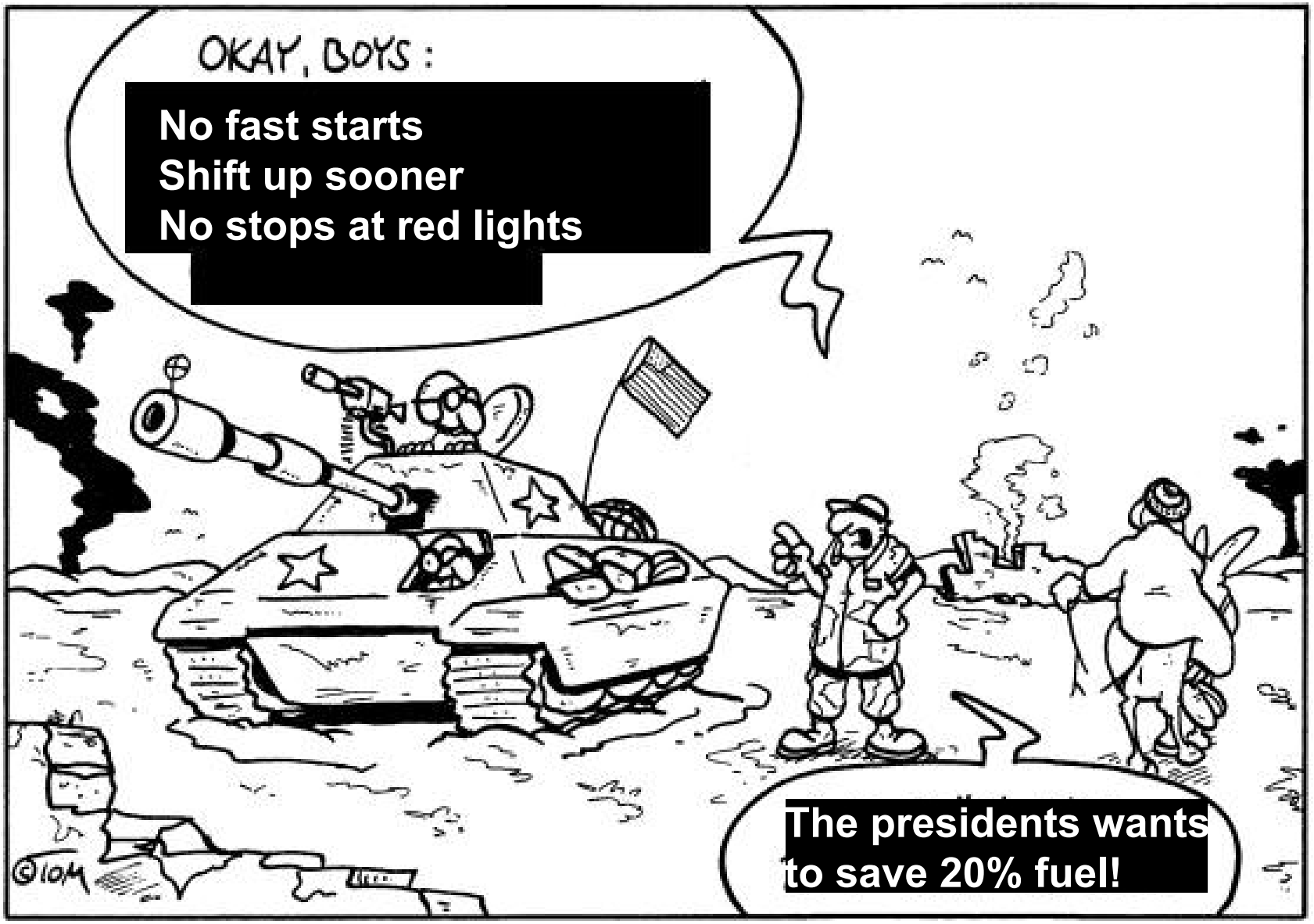
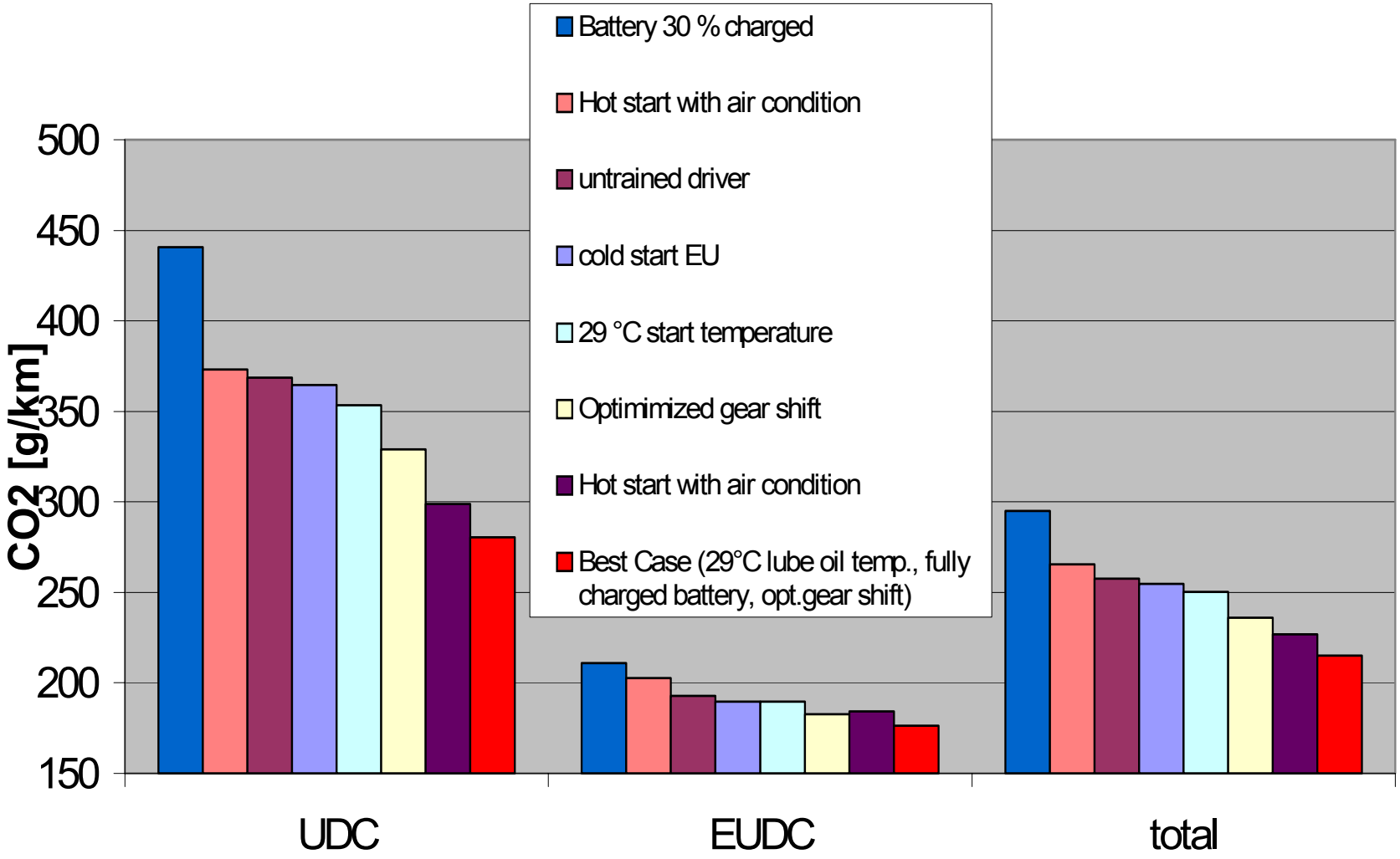
Integrated Approach



Photovoltaic Cells

Influence of different Parameters to CO_2 Emissions



A small photo voltaic cell can be used to recharge the battery if the car is parked and can also supply the electricity to ventilate the parked car.

Two luxury models on the market are equipped with such a device.