Options and Requirements for Low Emission Vehicles

Rudolf Petersen

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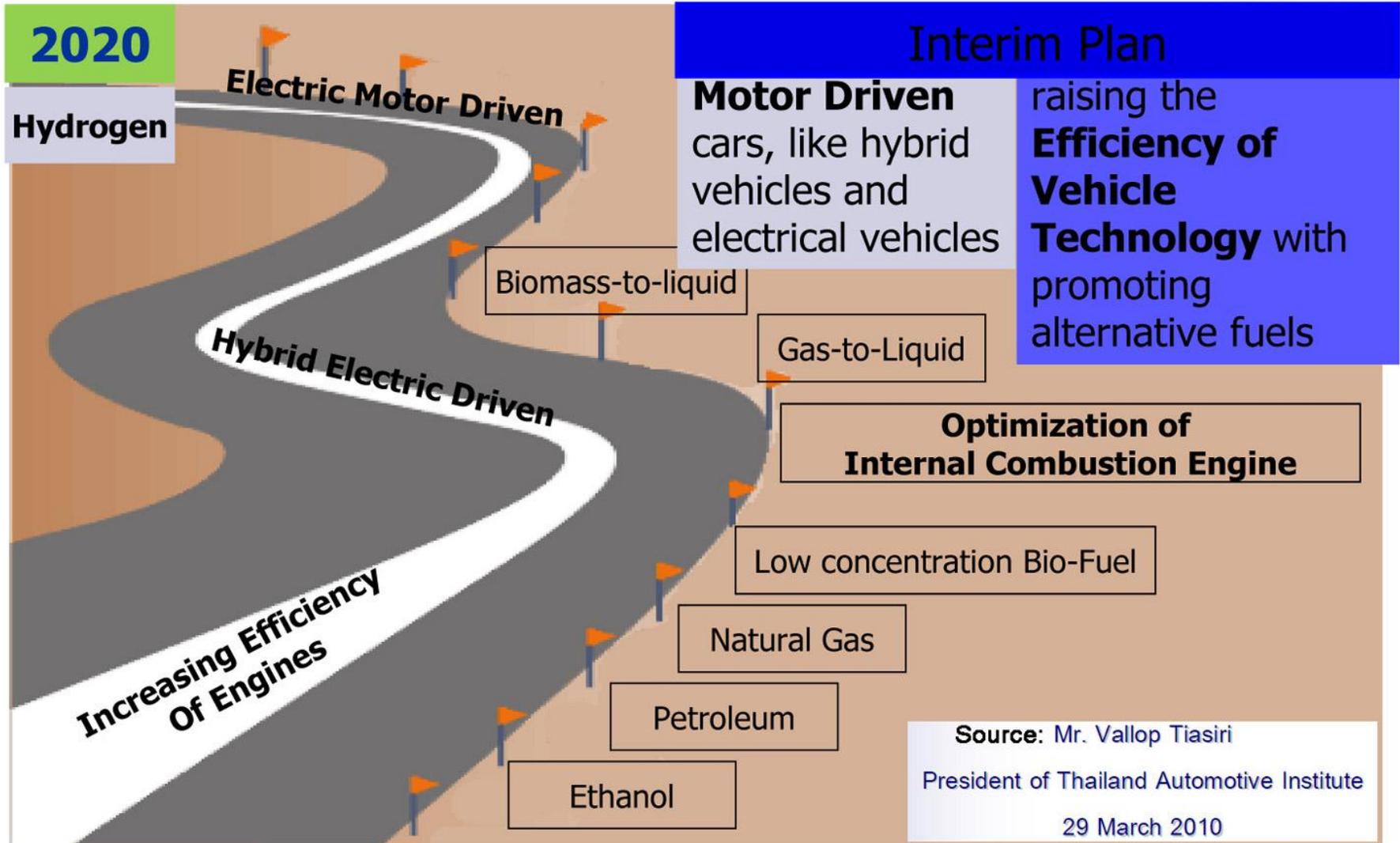
Lowering Emissions of …

- Toxic substances
  – Carbon monoxide CO
  – Nitrogen Oxides NOx (NO, NO2)
  – Various Hydrocarbons HC,
  – Small Particles (PM10, PM2.5, PM1)

- Greenhouse gases
  – Carbon Dioxides CO2
  – Methane CH4, others like N2O

Automotive Technology Trend

2020

Interim Plan

Hydrogen

Electric Motor Driven

Motor Driven cars, like hybrid vehicles and electrical vehicles

raising the **Efficiency of Vehicle Technology** with promoting alternative fuels

Biomass-to-liquid

Gas-to-Liquid

Hybrid Electric Driven

Optimization of Internal Combustion Engine

Low concentration Bio-Fuel

Natural Gas

Increasing Efficiency Of Engines

Petroleum

Ethanol

Source: Mr. Vallop Tiasiri

President of Thailand Automotive Institute

29 March 2010

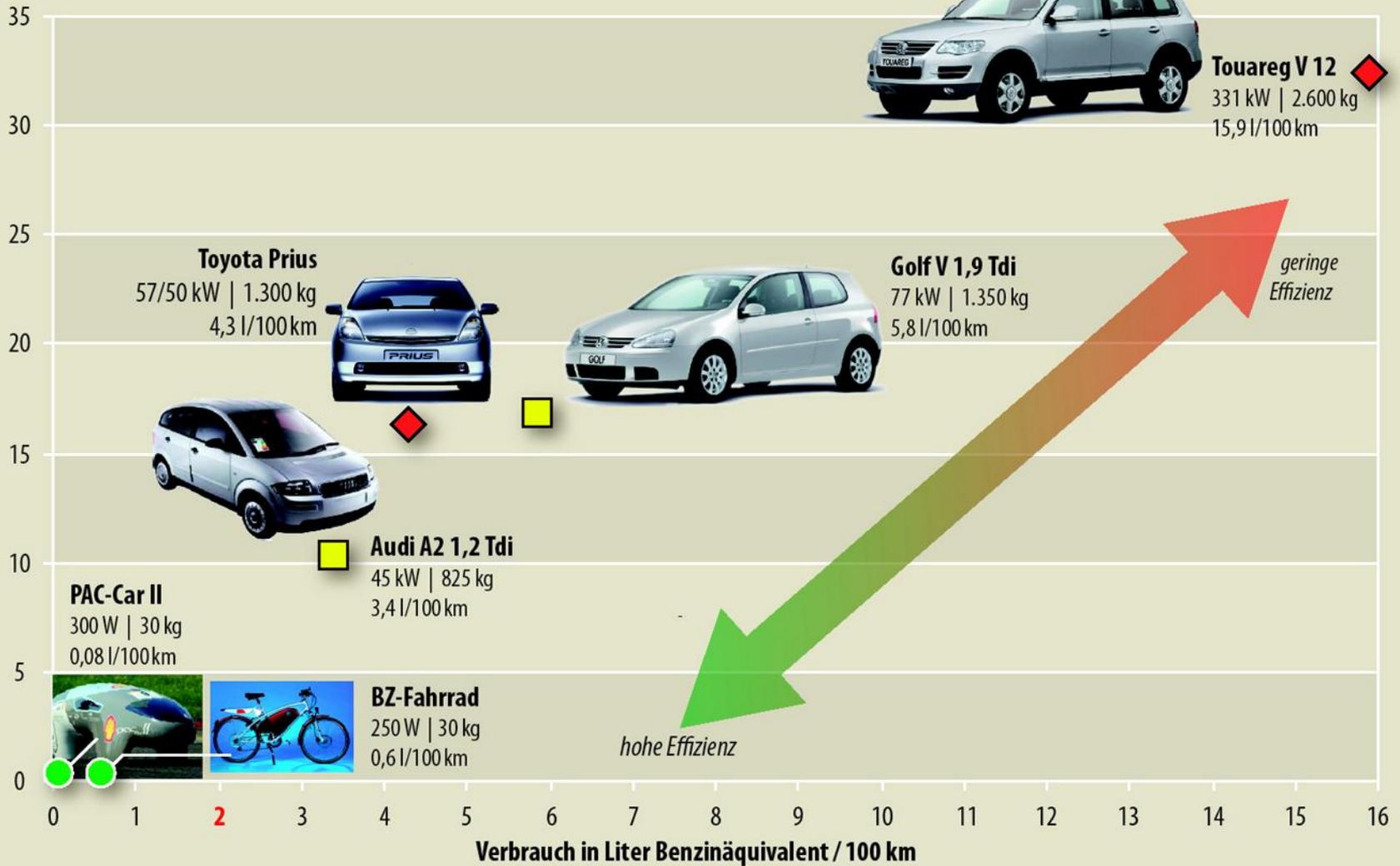# Less Toxic Emissions by …

- Better conventional engines (ICE)

- Better catalysts and filters for ICE

- Better conventional liquid fuels

- Gaseous fuels (- not all!)

- Electric Vehicles EV (- depending on source)

- Future technologies, eg Fuel Cells FC
  - EV and FC not yet ready for various reasons

Less Fossil Fuel Consumption and Less GHG Emissions

- Reduced energy demand for driving

- Better engine efficiency

- Alternative fuels
  - Liquid biofuels and biogas
    - For Gasoline: Ethanol, Methanol, biogas
    - For Diesel: Seed oils for diesel
  - Natural Gas as CNG or LNG, LPG

- Plug-in electric with storage by battery

kg Fahrzeug / kg Mensch

35

Touareg V 12
331 kW | 2.600 kg
15,9 l/100 km

30

25

Toyota Prius
57/50 kW | 1.300 kg
4,3 l/100 km

Golf V 1,9 Tdi
77 kW | 1.350 kg
5,8 l/100 km

geringe Effizienz

20

15

Audi A2 1,2 Tdi
45 kW | 825 kg
3,4 l/100 km

10

PAC-Car II
300 W | 30 kg
0,08 l/100 km

5

BZ-Fahrrad
250 W | 30 kg
0,6 l/100 km

hohe Effizienz

0

0   1   **2**   3   4   5   6   7   8   9   10   11   12   13   14   15   16

Verbrauch in Liter Benzinäquivalent / 100 km

Dieselfahrzeuge: *inkl. 12 %-Aufschlag für höheren Energie-inhalt von einem Liter Diesel gegenüber einem Liter Benzin.*

H₂-Fahrzeuge: *inkl. Verluste bei der Herstellung von Wasserstoff aus Strom des deutschen Kraftwerksmixes (Primärenergiefaktor 4).*

Well-to-Wheel Report 2007 – EU / JCR

Figure 8.2 **Estimated incremental vehicle retail price**
(Expressed in percentage relative to a 2010 gasoline PISI vehicle)
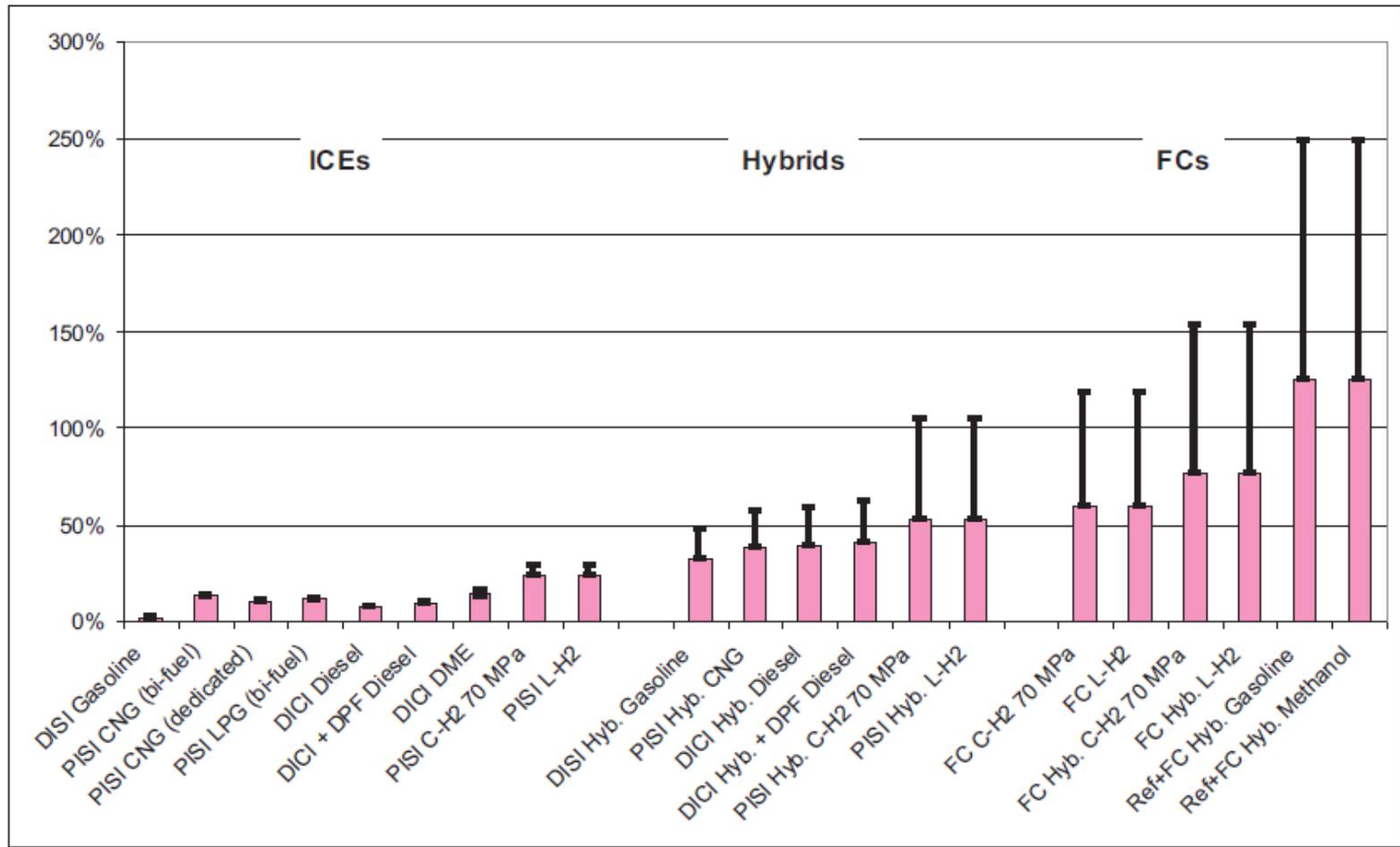
Useful Applications for Electric Drive in Passenger Cars

- Hybrid :
  – Drive with small combustion engine, support at acceleration with E-engine

- Braking recuperation
  – Possible up to 50%, today all heat losses

- *Perspective:*

Use of the techniques for e-drive:

drive slowly and smooth. Save energy.

Regenerative Braking Process
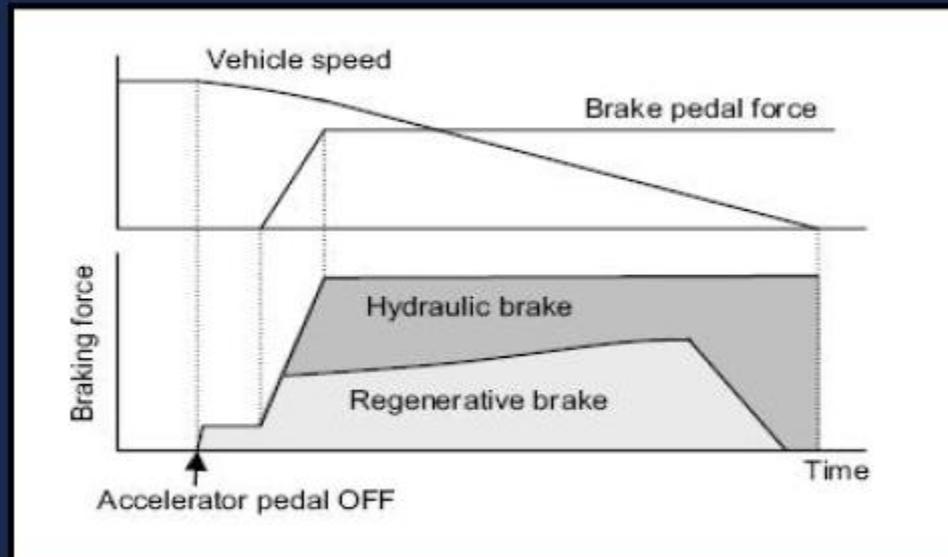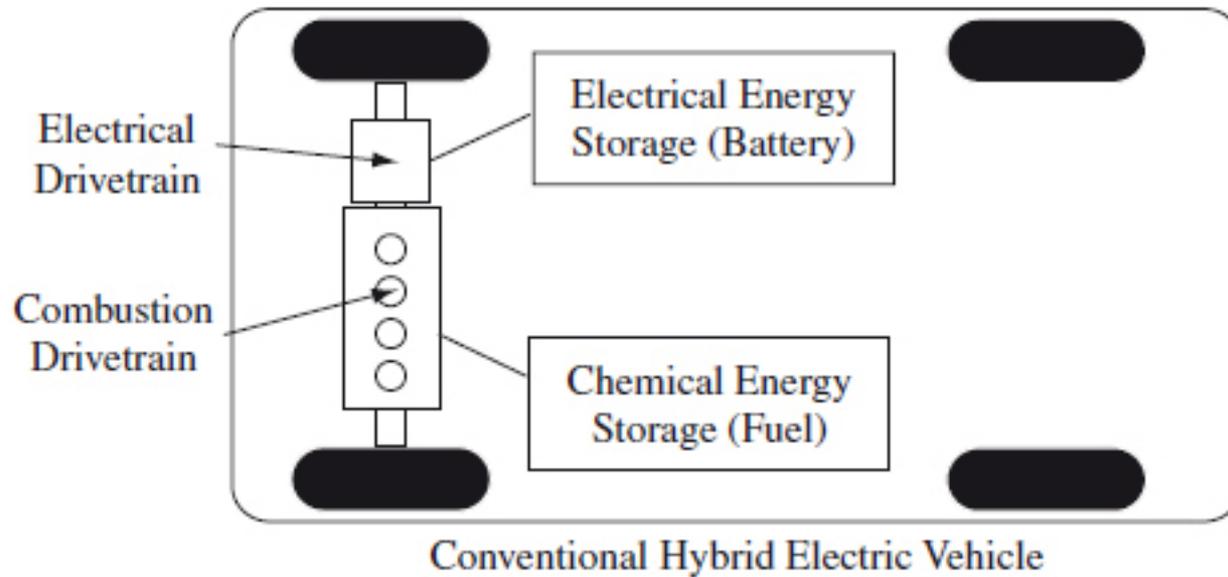
Cooperative control of regenerative and hydraulic brakes provide a Pedal Force response that give the driver the same feel as normal brake system
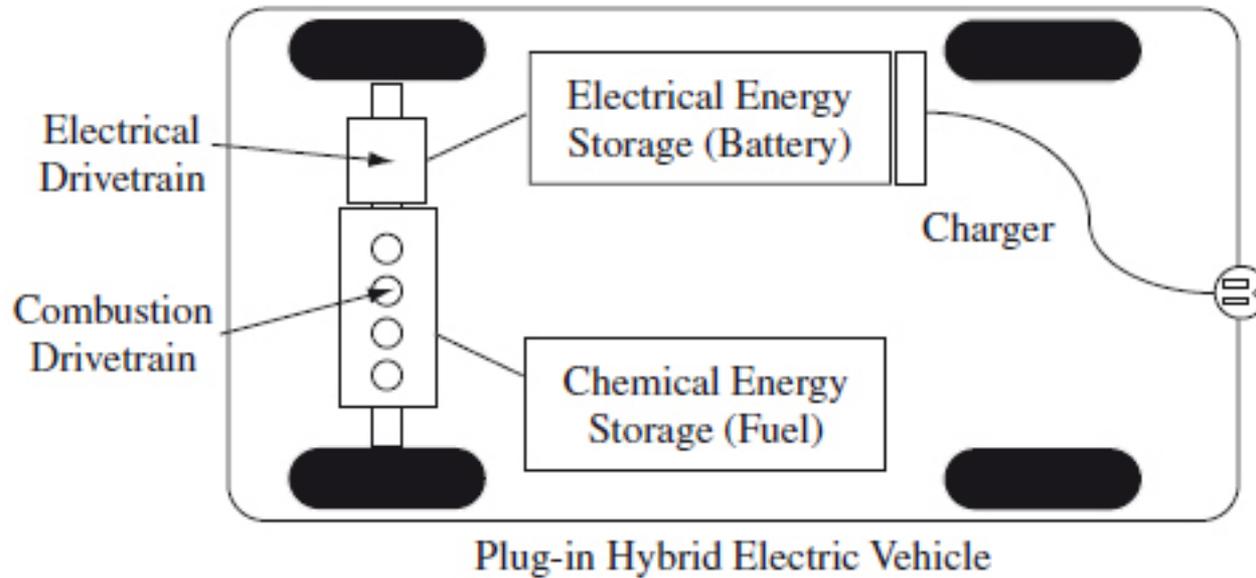
Electrical Drivetrain

Combustion Drivetrain

Electrical Energy Storage (Battery)

Chemical Energy Storage (Fuel)

Conventional Hybrid Electric Vehicle

Plug-in Hybrid Electric Vehicle

This is not a

„Zero-

Emission Vehicle"

(ZEV)

but an

„Elsewhere–

Emission Vehicle"

(EEV)

Which technology will dominate East-Asia in 2050?

Transport, Low carbon scenario

		2005	2010	2020	2030	2040	2050
Family car ownership, per 100HH	Urban	3.37	14	36	65	77	78
	Rural	0.08	0.2	8	38	70	90
Family car annual travel distance, km		9500	9500	9300	8635	8300	7480
Average engin size of family cars, litter		1.7	1.6	1.6	1.6	1.5	1.4
Fuel efficiency of car, L/100km		9.2	8.9	7.1	5.9	4.8	4.1
Share of MRT in total traffic volume, %		0.011	0.016	0.025	0.046	0.1	0.21
Share of Biofuel, %		1.10%	1.30%	4.1%	7.70%	12%	13%
Share of electric car, %		0%	0.12%	3.2%	6.80%	12.5%	19.8%
Share of fuel cell car, %		0%	0%	0.80%	1.60%	4.70%	7.90%

Low Energy Future: Transport in China
Jiang Kejun, Energy Research Institute
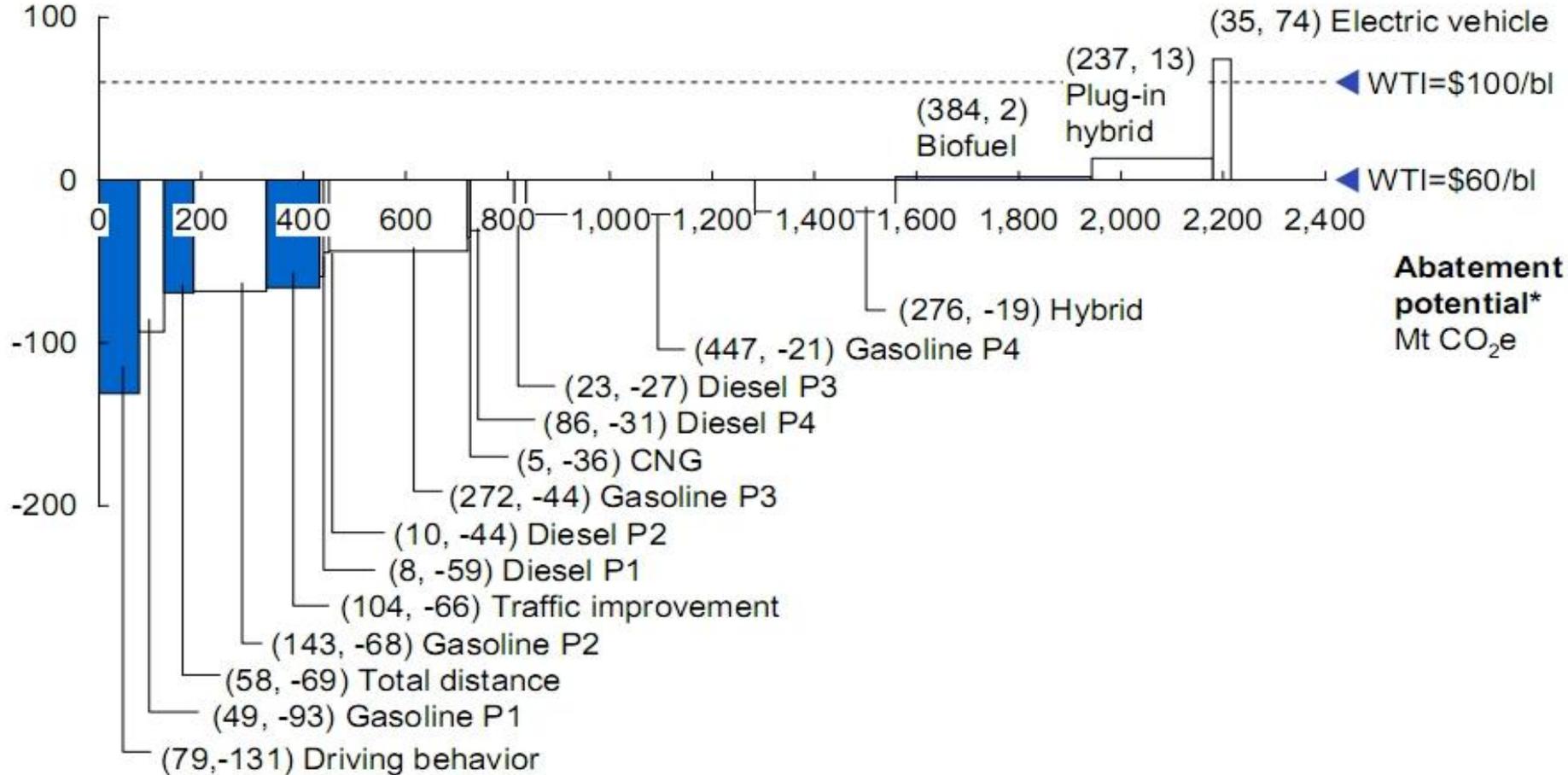„Bridging the Gap" Workshop 1. bis 10. Juni 2010 Bonn

Some considerations about alternative fuels and engines

- Cost and prices must meet the consumers demand
  - Fuel tax differentiation required?
  - Why should the alternative fuel be subsidized?
- Energy must be available in all markets
  - Technical progress and efficiency need globalized markets.
  - Regional solutions are not sustainable.

Global CO$_2$ abatement curve for passenger vehicles: Mixed-technology scenario – 2030

Legend:
- ■ Traffic, driving behavior and total distance
- ■ Biofuels
- □ Fuel efficiency

Abatement cost
€ per tonne CO$_2$e

(35, 74) Electric vehicle

(237, 13) Plug-in hybrid

(384, 2) Biofuel

◄ WTI=$100/bl

◄ WTI=$60/bl

Abatement potential*
Mt CO$_2$e

(276, -19) Hybrid

(447, -21) Gasoline P4

(23, -27) Diesel P3

(86, -31) Diesel P4

(5, -36) CNG

(272, -44) Gasoline P3

(10, -44) Diesel P2

(8, -59) Diesel P1

(104, -66) Traffic improvement

(143, -68) Gasoline P2

(58, -69) Total distance

(49, -93) Gasoline P1

(79, -131) Driving behavior

* Calculated on a well-to-wheel basis

Source: McKinsey analysis

Thank you!

Rudolf M. Petersen <rudolf.petersen@rudolf-m-petersen.de**>**

Contacts for the gtz-project:
Roland Haas / Napaporn Yuberk
roland.haas@gtz.de / napaporn.yuberk@gtz.de