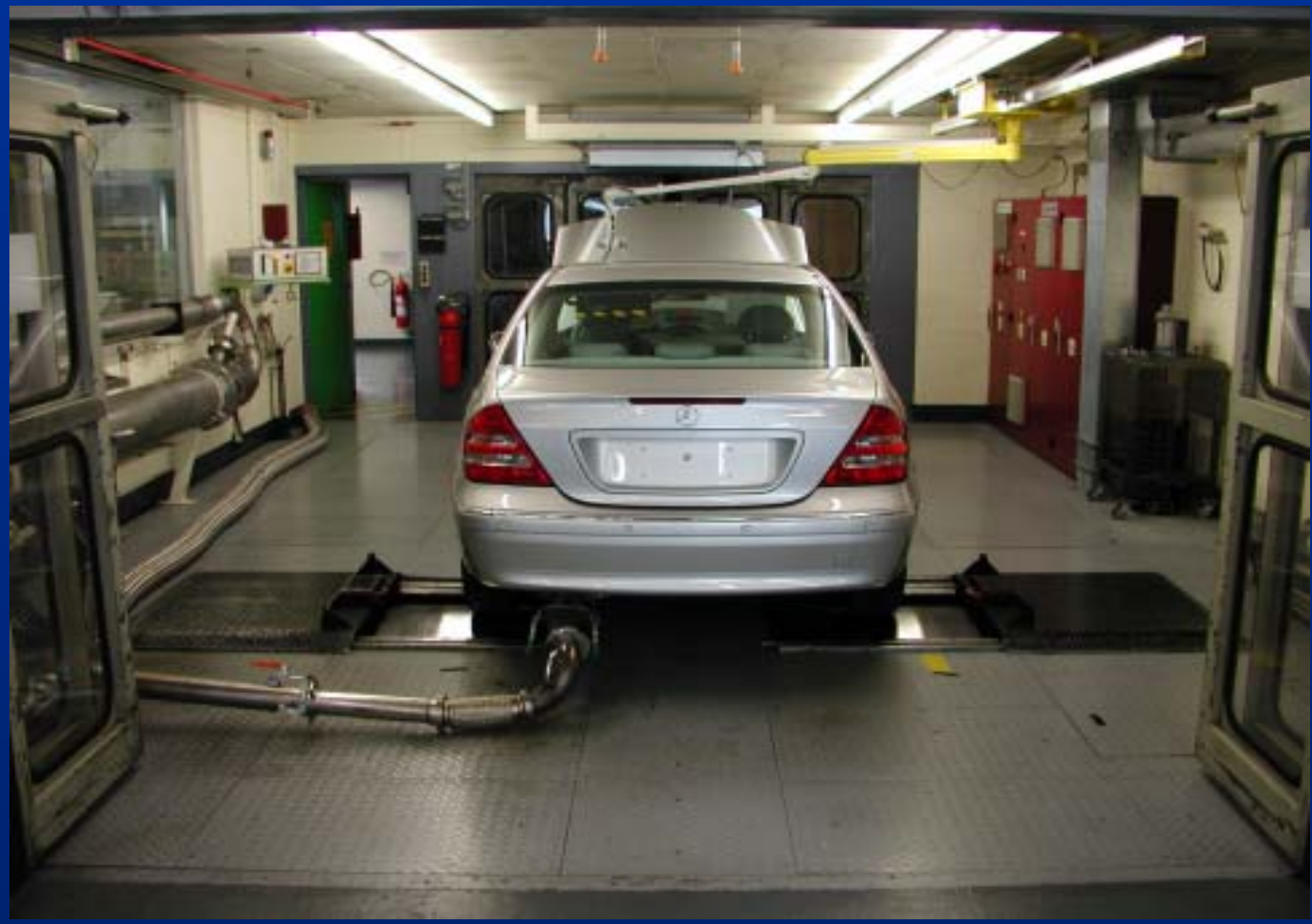
全国柴油车污染防治监督管理工作研讨会
National Diesel Vehicle Emission Control and Enforcement Management Seminar

内容 Content

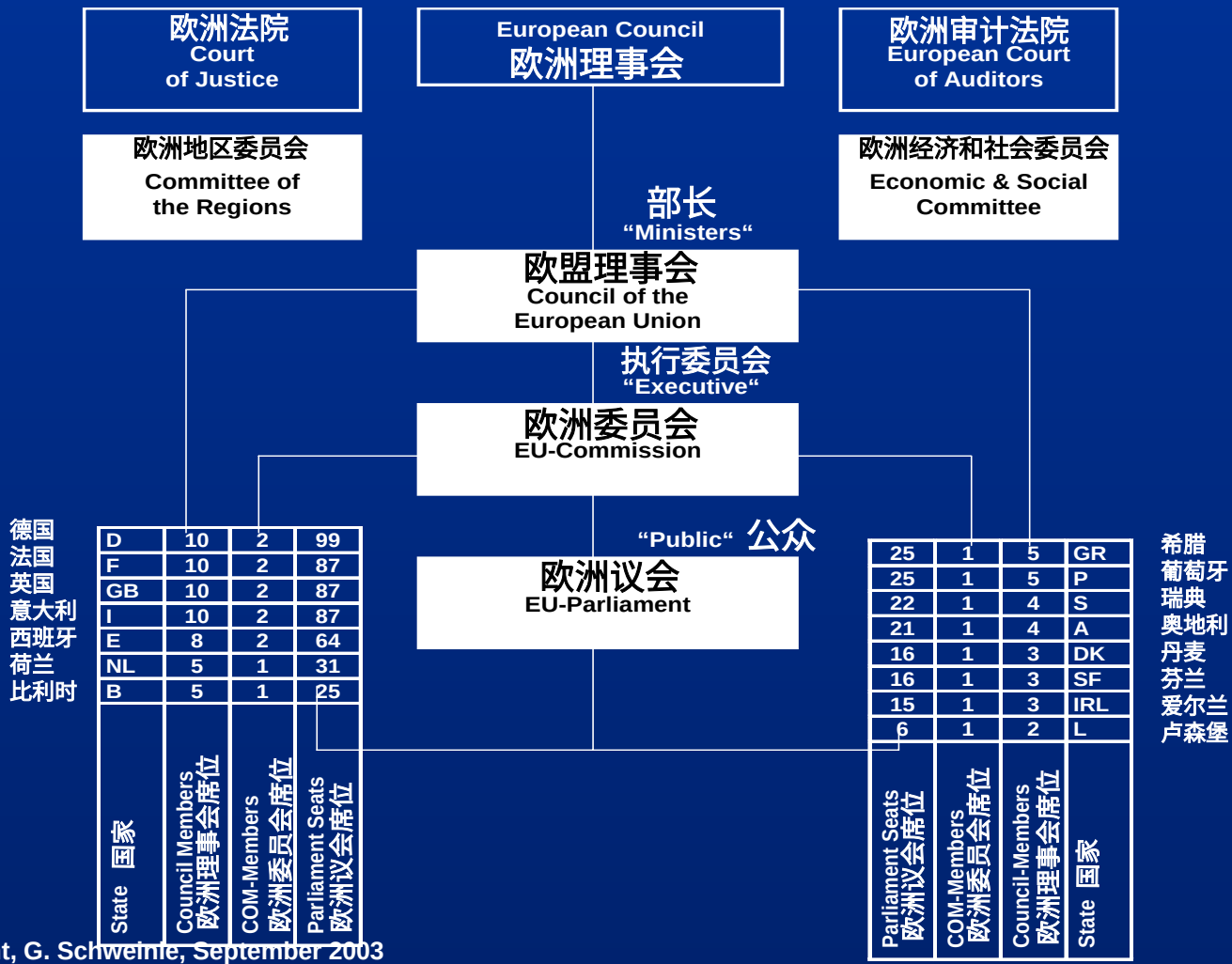
车辆排放检测

Exhaust Emission Measurement

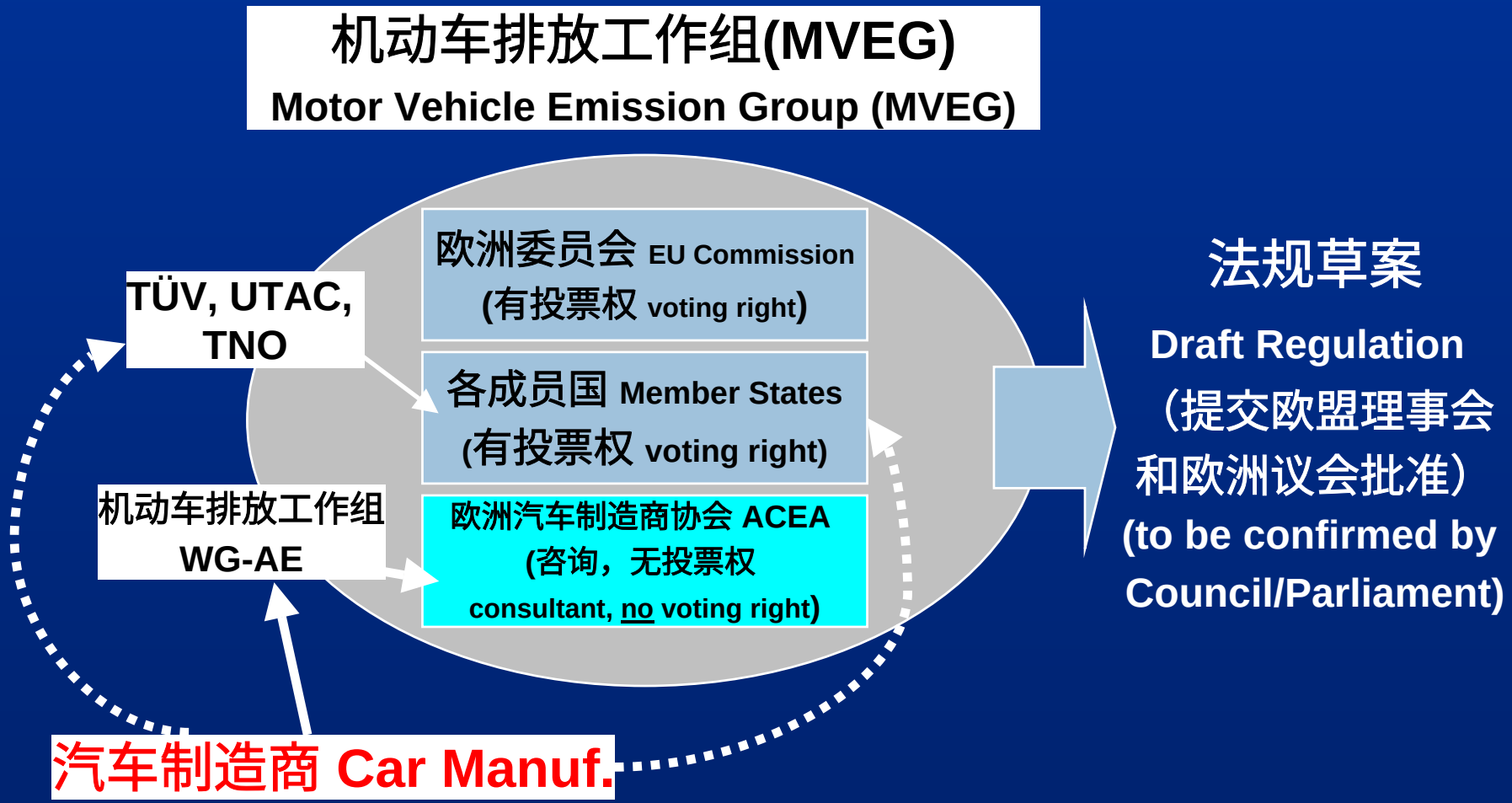


欧洲排放法规的制定程序

The EU-Basis for Rule Making Procedure



汽车制造商参与排放法规的制定
Car Manufacturers Involvement in EU Emission Regulations



欧洲排放法规的制定过程
The EU-Basis for Rule Making Procedure according to Environmental Aspects

欧盟在制订排放控制法规时，需要考虑车辆排放控制技术的发展
The community must take into account the latest scientific advances in combating atmospheric pollution caused by gases emitted from motor vehicles.

法规制定过程的第一阶段 First step of rule making procedure

- 欧盟理事会委托欧洲委员会起草排放法规
  Commission gets a mandate from the Council to offer the COM - draft (with MVEG)

法规制定过程的第二阶段 Second step of rule making procedure

- 欧洲委员会向欧盟理事会和欧洲议会提交排放法规草案
  Commission issues the COM - draft for comment by Council and EP

法规制定过程的第三阶段Third step of rule making procedure

- 欧洲议会讨论排放法规草案 EP comments the COM - draft with
  - 通过 acceptance
  - 否决 rejection
  - 提出修改建议/修正案 recommendation of changes / proposed amendments

排放法规的实施进程
Time Schedule of Implementation

确保法规顺利实施的有利因素
Positive influencial factors for smooth implementation

- 机动车排放小组（MVEG）的参与及欧洲委员会法规草案
  working group (MVEG) and the COM - draft
- 采用了切实可行的排放控制技术和合理的时间框架
  realistic technical compromize within realistic time frame
- 每个排放法规都包括三个实施日期three different implementation dates

影响法规顺利实施的不利因素
Negative influencial factors for smooth implementation

- 排放法规草案颁布日期较晚，技术开发和型式认证的时间较为仓促
  late issue of COM - draft shortens time for development and certification
- 由于排放标准已经颁布实施，不可能对法规进行否决和弃权
  standards as issued are fixed and cannot be rejected any more and no waiver procedure exist
- 没有一个逐步引入的过程 no phase - in procedure
- 在法规正式颁布实施前，要将文件、法规和草案的内容翻译成11种不同的文字
  translation into 11 different languages before issuing documents / regulations / drafts etc.

欧盟的排放控制法规
Description of Council Directives

欧盟排放控制法规 Description of Council Directives

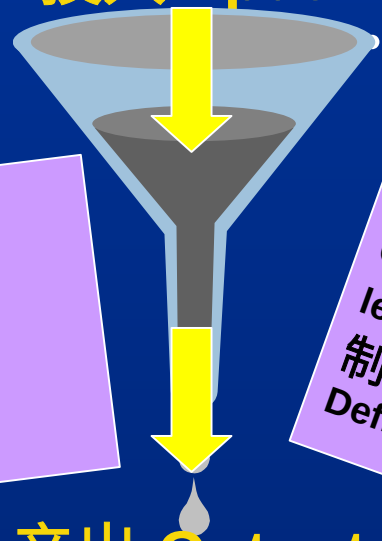
标准号 Reference	简称 Abbreviation	车辆类型 Type of Vehicle
91/441/EEC	欧 1 Euro 1	总重量小于 2.5 吨的 6 座或 6 座以下轿车 Passenger cars ≤ 6 persons and ≤ 2,5 t gross vehicle weight
93/59/EEC	欧 1 Euro 1	总重量在 2.5 吨到 3.5 吨之间的 7-9 座轿车以及总重量小于 3.5 吨的货车 Passenger cars 7-9 persons and/or > 2,5 t ≤ 3,5 t and trucks ≤ 3,5 t gross vehicle weight
94/12/EC	欧 2 Euro 2	总重量小于 2.5 吨的 6 座或 6 座以下轿车 Passenger cars ≤ 6 persons and ≤ 2,5 t gross vehicle weight
96/69/EC	欧 2 Euro 2	总重量在 2.5 吨到 3.5 吨之间的 7-9 座轿车以及总重量小于 3.5 吨的货车 Passenger cars 7-9 persons and/or > 2,5 t ≤ 3,5 t and trucks ≤ 3,5 t gross vehicle weight
98/69/EC	欧 3+欧 4 Euro 3 + Euro 4	总重量小于 2.5 吨的 6 座或 6 座以下轿车，总重量在 2.5 吨到 3.5 吨之间的 7-9 座轿车以及总重量小于 3.5 吨的货车 Passenger cars ≤ 2,5 t gross vehicle weight and passenger cars > 2,5 t ≤ 3,5 t

排放检测项目
Application of Tests

型式认证检测项目 Type-approval test	检测内容 Description	标准号 Reference
I 型试验 Type I	检测车辆冷起动后排气管的排放量 Verifying the average emission of tailpipe emissions after a cold start	附件 III Annex III
II 型试验 Type II	检测怠速工况下的一氧化碳排放量 Carbon monoxide emission test at idling speed	附件 IV Annex IV
III 型试验 Type III	检测曲轴箱燃油蒸发排放量 Verifying emissions of crankcase gases	附件 V Annex V
IV 型试验 Type IV	检测安装点燃式发动机的车辆的燃油蒸发排放量 Determination of evaporative emissions from vehicles with spark-ignition engines	附件 VI Annex VI
V 型试验 Type V	进行耐久性试验，检测车辆排放控制系统的耐久性 Ageing test for verifying the durability of anti-pollution devices	附件 VII Annex VII

EPEFE项目 The EPEFE Program

EPEFE = 欧洲的排放、燃油及发动机技术项目
EPEFE = European Program on Emssions, Fuels and Engine Technologies



投入Input
- 更高的燃油质量 Advanced fuel properties
- 先进的发动机技术 Advanced vehicle engine technologies

欧洲 EUROPE

有关各方相互合作，包括
Realised teamwork between
- 汽车制造商 Car Manufacturers
- 石油行业 Oil industry
- 欧洲政府 European Government

中国 CHINA

有关各方应当借鉴欧洲的经验
Comparable partners in China should learn from this European experience:
制定统一的排放控制目标
Define common targets for China

产出 Output
- 排放降低 Exhaust emissions
- 燃油消耗减少 Fuel consumption

通过研究排放对空气质量的影响
Impact of vehicle emissions on air quality
对不同排放控制策略的成本效益进行评价
Evaluation of the cost effectiveness of different strategies
欧洲委员会制定了2000年以后欧洲车辆和燃油的发展战略
Enable EU-COM to propose a strategy for vehicles and fuels beyond 2000

税收激励政策
Taxes and Incentives

	奥地利 A	比利时 B	德国 D	丹麦 DK	法国 F	英国 GB	希腊 GR	意大利 I	卢森堡 L	荷兰 NL	瑞典 S
基于排放的税收 Emission based tax	●		●				●				●
对达到欧 4 标准的车辆的税收激励政策 Incentive Euro 4		●	●*)								●
基于 CO_2 排放的税收 CO_2based tax	●		●	●	●	●			●	●	

*) 详见下页 Details on next page

税收激励政策
Incentives

德国的税收激励政策 Tax incentives in Germany

根据欧盟法规，对已达到下一阶段排放标准的车辆，各成员国可以自行制定相应的税收激励政策。

According to the EU law, each member state may set tax incentives for vehicles which already comply with the next step of emission regulation (in case the next step regulation is already published).

例如：德国对达到欧4标准的车辆的税收优惠为：Example Germany for Euro 4:
汽油车：最高可达306.78欧元 For Gasoline vehicles: max 306.78 €
柴油车：最高可达613.55欧元 For Diesel vehicles: max 613.55€

这些优惠的数额将从车辆的年度税收中抵扣
the amount will be subtracted from the annual vehicle tax

税收激励政策
Incentives

德国的税收激励政策 Tax incentives in Germany

例如 Example

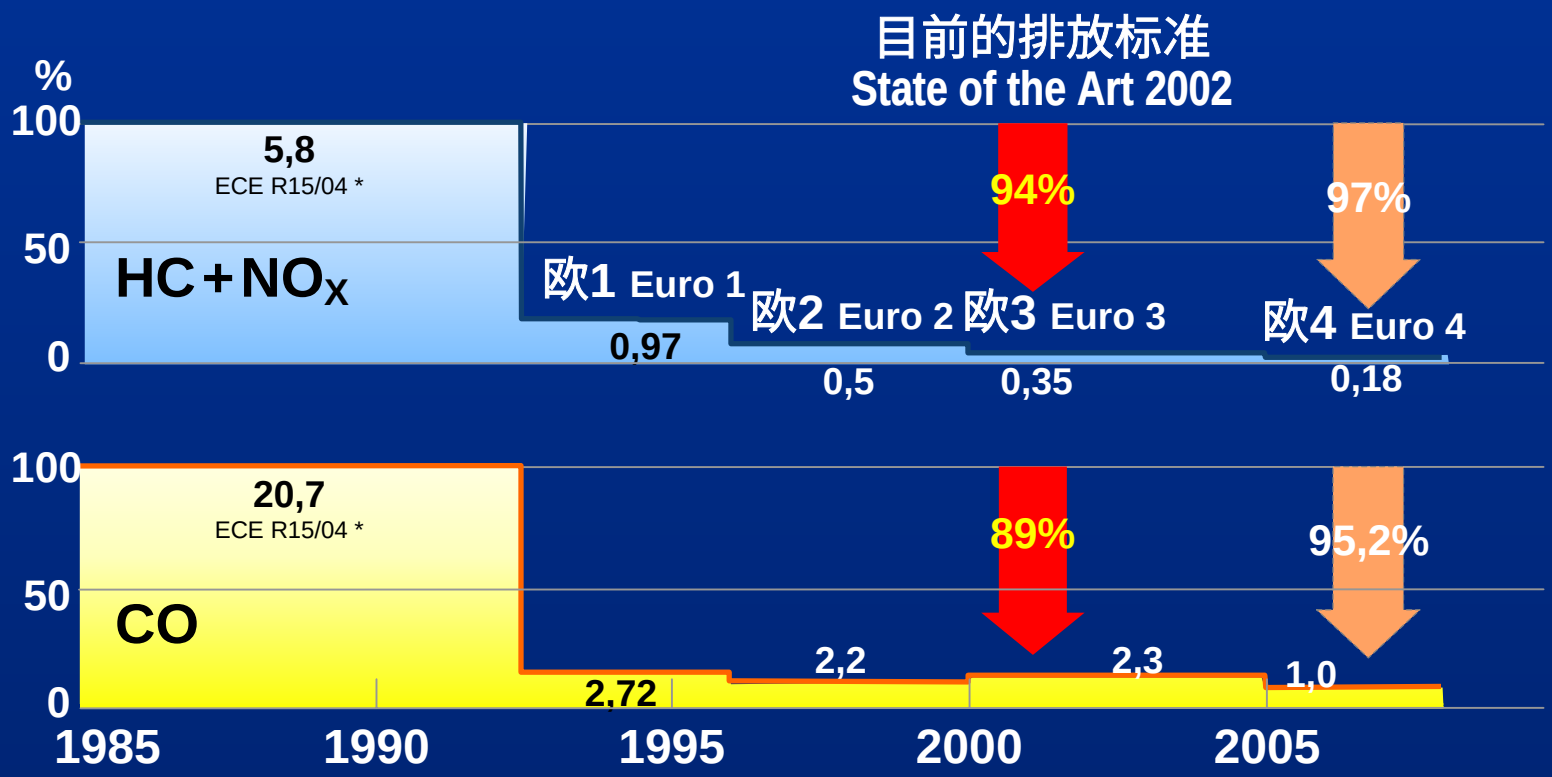
- 在德国，一辆排量为2升的满足欧3排放标准的汽油车每年应交税102.20欧元。
  A 2000 cc gasoline Euro 3 and upwards vehicle has to pay in Germany an annual road tax of 102.20 €.

- 如果这辆车达到了欧4标准，将会得到306.78欧元的税收优惠。
  If the vehicle already complies with the Euro 4 standards, tax incentive will be granted with an amount of max. 306.78 €.

这样，差不多三年都不用交税了！
No tax has to be paid for almost 3 years!

欧洲汽油轿车的排放标准

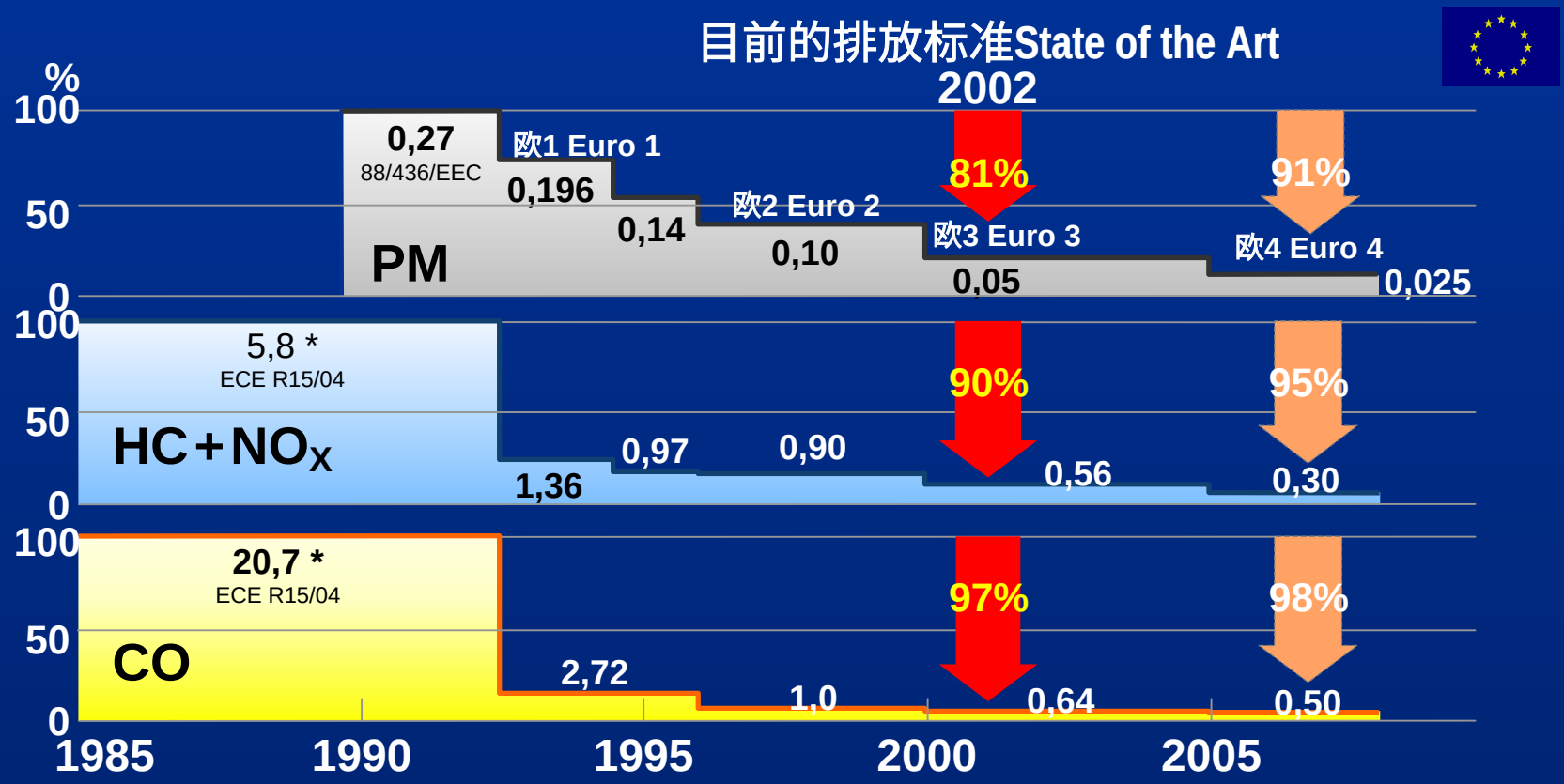
Exhaust Emission Regulations in the EU Today and in the Future for Gasoline Passenger Cars



* ECE R15/04: 该标准中车辆的当量惯量为1590千克
* ECE R15/04: Standards for the Equivalent Inertia Weight Class = 1590 kg

欧洲柴油轿车的排放标准

Exhaust Emission Regulations in the EU Today and in the Future for Diesel Passenger Cars



单位：克/公里 Standards in g/km

* ECE R15/04: 该标准中车辆的当量惯量为1590千克

* ECE R15/04: Standards for the Equivalent Inertia Weight Class = 1590 kg

从欧2标准到欧3标准燃油成分限值的变化
Change of Fuel Specifications from Euro 2 to Euro 3

柴油Diesel

- 十六烷值的变化范围从49-53变为52-54
  Cetane no. changed from 49-53 to 52-54
- 密度减小，允许变化范围缩小
  Density reduced and tolerance tightened
- 蒸发特性有变化
  Evaporation characteristic changed
- 含硫量从3000ppm降低到300ppm
  Sulfur reduced from 3000 ppm to 300 ppm

汽油Gasoline

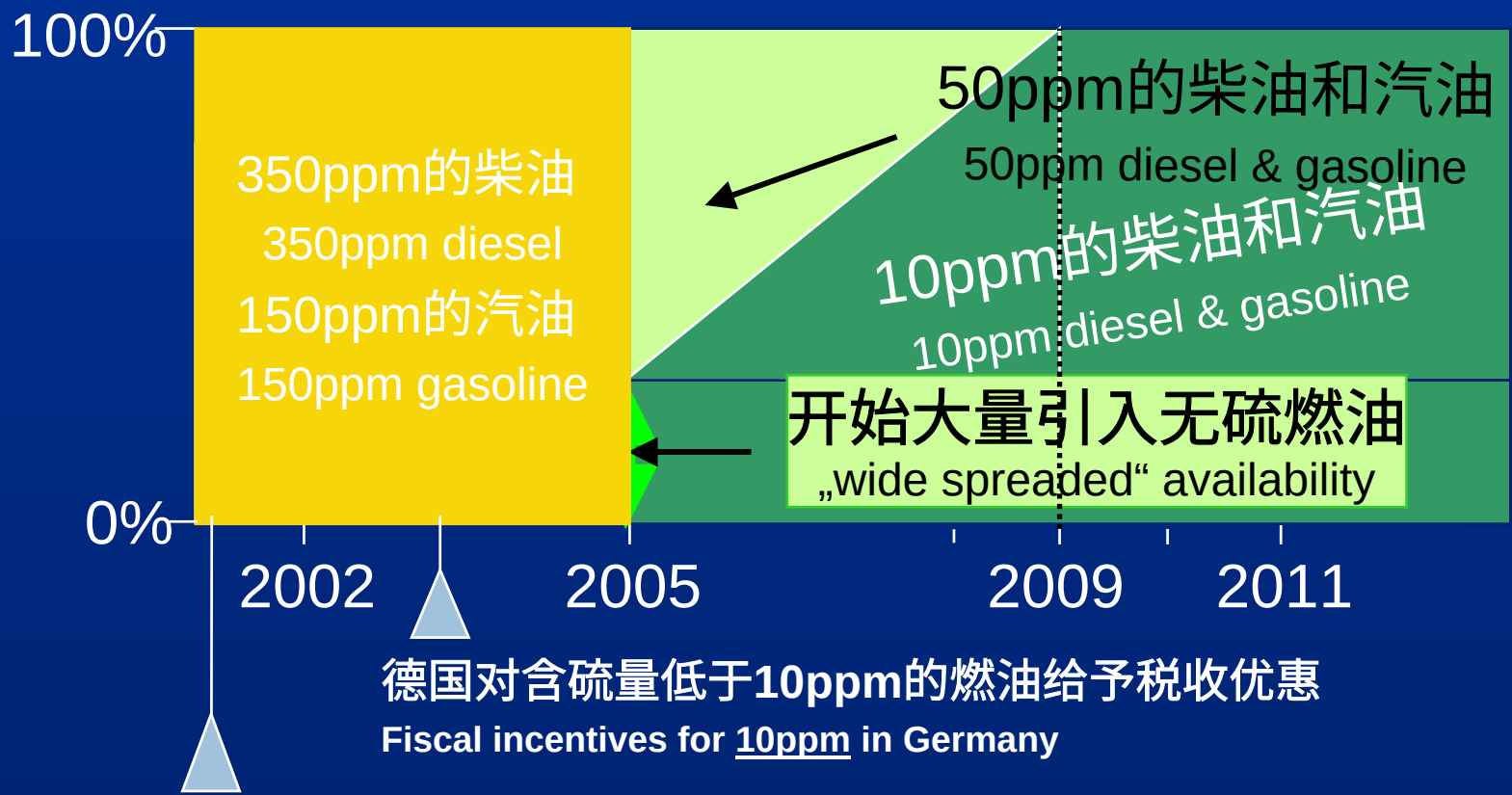
- 最高蒸气压力从64kPa降低到60kPa
  RVP: max. 64 kPa changed to max. 60 kPa
- 蒸发特性有变化
  Evaporation characteristic changed
- 芳烃含量由45%降至28%-40%
  Aromatics reduced from max. 45% to 28-40%
- 烯烃含量由20%降至10%
  Olefins reduced from 20% to 10%
- 对氧含量有限制
  Oxygen content limited
- 含硫量从400ppm降低到100ppm
  Sulfur reduced from 400 ppm to 100 ppm

欧2 Euro 2　　欧3 Euro 3　　世界燃油规范第4类燃油 WWFC Cat. 4

更清洁的燃油 Cleaner conventional fuel

欧盟引入无硫燃油的时间进程

Introduction of Sulfur-free Fuels in the EU



燃油特性对轻型柴油车排放的影响
Influence of Fuel Properties on Light-Duty Diesel Emissions

	HC	CO	NOx	PM
采用无硫燃油 Sulfur-free fuel	0	0	0	⇩⇩
提高十六烷值 Increased Cetane Number	⇩⇩	⇩⇩	0	⇩
减小密度和芳烃含量 Reduced Density and Polyaromatics*	⇩	⇩	0	⇩⇩
降低 T95 温度 Reduced T95	⇩	⇩	⇩	⇩

* - 这些参数也会相互影响 influence of these parameters was not decoupled

图例：Legend:

⇩⇩	⇩	⇩	0
影响较大 (10-20%) large positive effect (10-20%)	有一定影响 (2-10%) positive effect (2-10%)	影响较小 (<2%) very small effect (<2%)	没有影响 no effect

欧2标准和欧3标准的排放检测项目比较

Comparison Euro 2 and Euro 3

		欧2标准 Euro 2	欧3标准 Euro 3
测试循环 Testcycle		40秒后开始检测 NEDC with 40 sec Withour measurement	NEDC循环，发动机起动后即开始检测 NEDC with Measurement from engine start
排放限值 Limits [克 公里][g/km] *(轿车 PCs)*		汽油机 / 柴油机	汽油机 / 柴油机
	CO	2,2 / 1,0	2,3 / 0,64
	HC+NOx	0,5 / 0,7/ 0,9*	- / 0,56 **
	HC		0,2 / -
	NOx		0,15 / 0,5
	PM	- / 0,08/ 0,10*	- / 0,05**
燃油蒸发排放 Evaporation *(只用于汽油车only gasoline)*		1小时昼间换气损失 1h diurnal 1小时热浸损失 1h hot soak	24小时昼间换气损失 24 h diurnal 1小时热浸损失 1 h hot soak
低温排放 Cold Emissions *(只用于汽油车 only gasoline)*			在–7°C 和市区运转循环工况下的HC/CO排放 HC/CO at –7°C in City cycle
车载诊断系统 On-board Diagnosis			电控车载诊断系统EOBD
耐久性要求 Durability requirement		80000公里 80.000 km	80000公里 80.000 km
在用车排放检测 In-use surveillance			行驶里程超过15000公里，低于80000公里的车辆 Min. 15.000 km Below 80.000 km

* 用于直喷式柴油机 for DI engines

** 没有专门用于直喷式柴油机的排放限值 no separate limit for DI engines!

欧3排放标准（98/69/EC法规）的生效日期
Effective dates of Directive 98/69/EC, so-called Euro 3

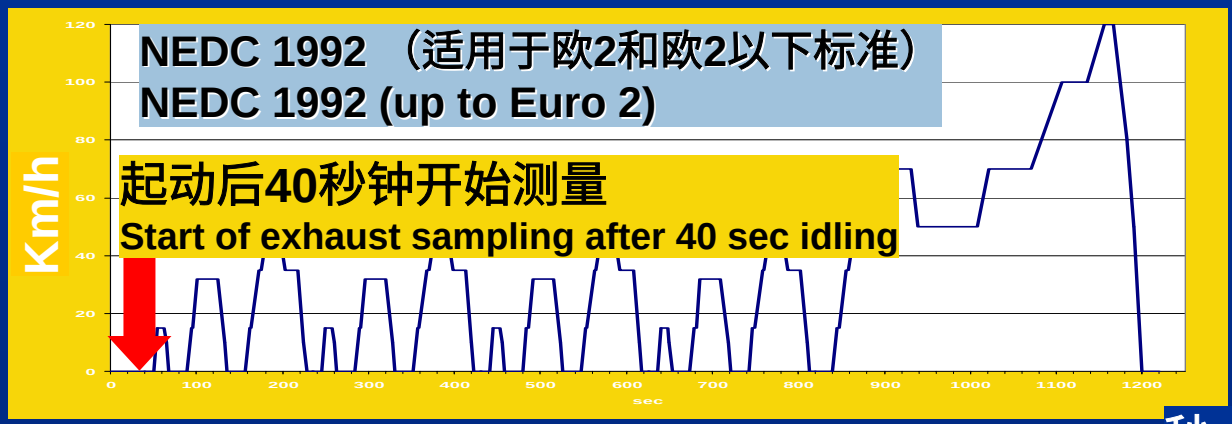


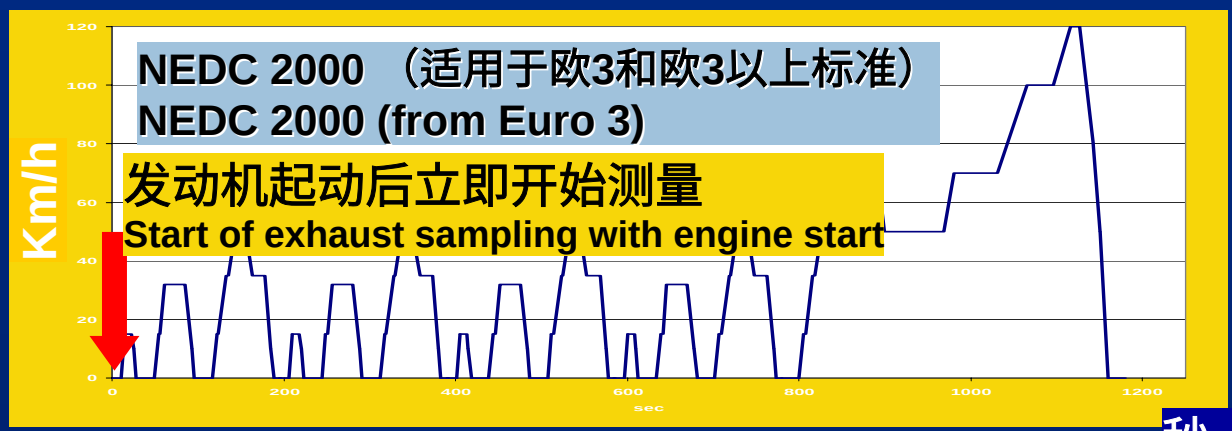

新车型 For new types	所有车型 For all types	检测内容的变化 Modification	M1 < 2500kg	N1 Gr. I	N1 Gr. II/III	M1 > 2500kg
1.1.2000	1.1.2001	欧3标准排放限值 EURO 3-Limits	●	●		
		燃油蒸发排放 Evap 车载诊断系统OBD	● (汽油车Gasoline)	● (汽油车Gasoline)		
1.1.2001	1.1.2002	欧3标准排放限值 EURO 3-Limits			●	●
		燃油蒸发排放Evap 车载诊断系统OBD			● (汽油车Gasoline)	● (汽油车Gasoline)
1.1.2002	1.1.2003	低温HC/CO排放 Cold HC/CO	● (汽油车Gasoline)	● (汽油车Gasoline)		
1.1.2003	1.1.2004	低温HC/CO排放 Cold HC/CO			● (汽油车Gasoline)	
		车载诊断系统 OBD	● (柴油车Diesel)			
1.1.2005	1.1.2006	车载诊断系统 OBD		● (柴油车Diesel)		● (柴油车Diesel)
1.1.2006	1.1.2007	车载诊断系统 OBD			● (柴油车Diesel)	

排放检测项目
Test requirements

	欧 2Euro 2	欧 3Euro 3
1 型试验:在 NEDC 测试循环下的排放检测 NEDC：新的欧洲标准测试循环 Type 1 test : Exhaust emission at NEDC NEDC = New European Driving Cycle	●	● 有变化 modified
2 型试验:怠速工况下一氧化碳排放检测 Type 2 test : Idle CO	●	●
3 型试验:曲轴箱排放检测 Type 3 test : Crankcase emission	●	●
4 型试验:燃油蒸发排放检测 Type 4 test : Evaporative emission	●	● 有变化 modified
5 型试验:耐久性检测 Type 5 test : Durability test	●	●
6 型试验:低温 HC/CO 排放检测 Type 6 test : Low temperature HC/CO		● 新项目New item
车载诊断系统检测 OBD		● 新项目New item
在用车排放检测 In-use		● 新项目New item

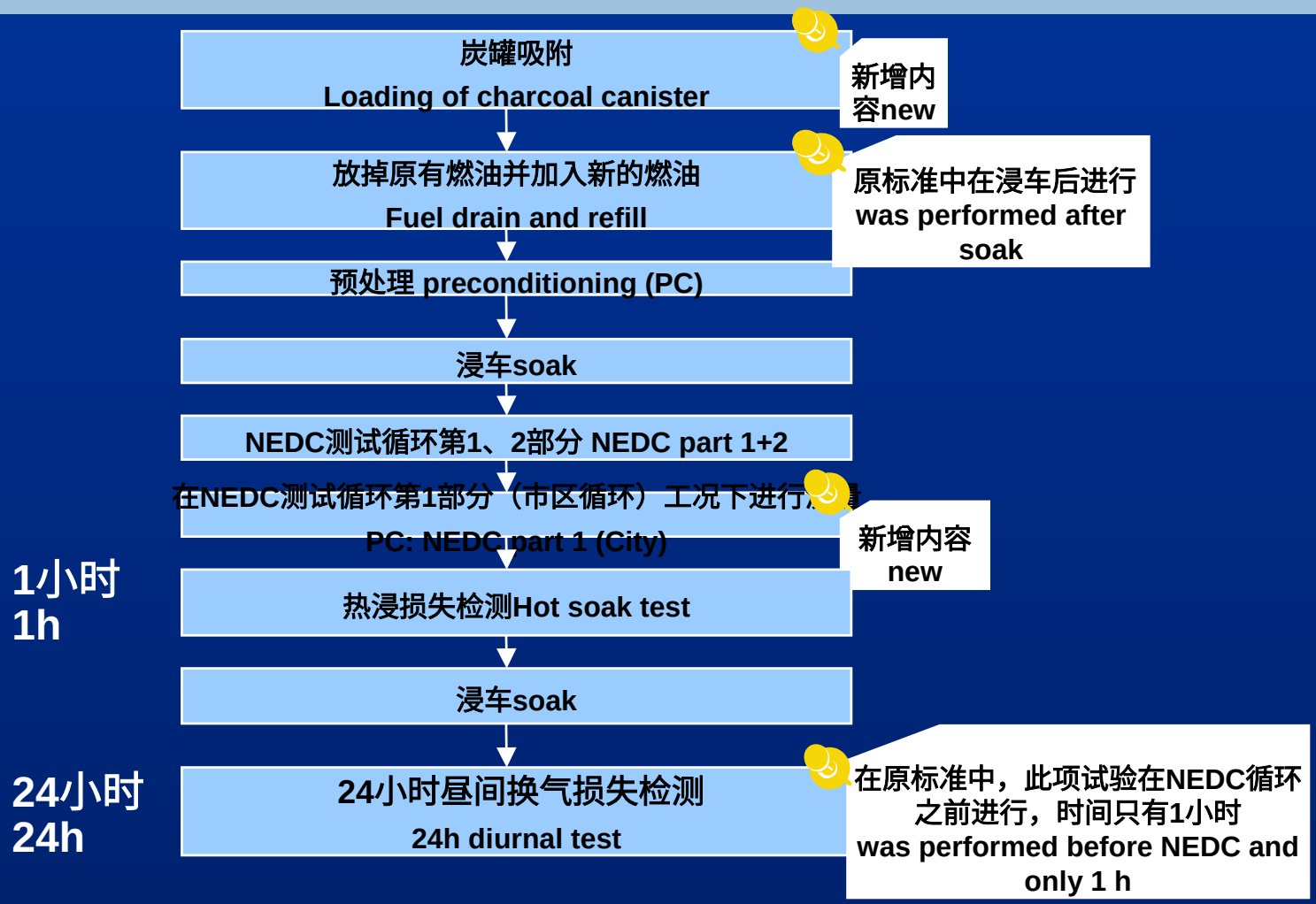
车辆测试循环的变化
The Modification of the Test Cycle





要求改善车辆的冷起动排放
Improvements on cold-start emissions required

燃油蒸发排放检测过程的变化
Modified Evaporative Emission Test



低温排放检测
Low Temperature Emission Test

- 在-7 °C 下浸车12-36小时
  soak 12-36 h at -7 °C
- 在NEDC测试循环的第1和第2部分工况下进行预处理
  preconditioning with NEDC part 1+2
- 在NEDC测试循环第1部分（市区循环）工况下进行排放检测
  emission testing at NEDC part 1 (city cycle)
- 试验中环境温度应保持在-7 °C
  ambient temperature at test cell -7 °C
- 对于总重低于2500千克的M1类车辆和I级N1类车辆来说，排放限值为：
  一氧化碳：15 克/公里；碳氢化合物：1.8 克/公里
  limit values for vehicles of category M1 < 2500 kg and N1 Gr. I :
  CO = 15 g/km and HC = 1,8 g/km

轿车的车载排放诊断系统（OBD）

On-board Diagnosis (OBD) for Passenger Cars

监测与排放有关的车辆系统和零部件
Systems and Components to be monitored with Euro 3

- 排气催化转化器的工作效能（利用前、后端的λ 传感器）
  Efficiency of the catalyst (λ-sensor before and after cat.)
- λ传感器的失效或输出信号减小
  Failure or reduced output of the λ-sensor
- 点火系统故障
  Ignition faults
- 燃油蒸发排放控制系统的控制电路
  Electric circuit of evaporative emissioin control system
- 燃油喷射系统的控制电路
  Electric circuit of injection system
- 其它与排放有关的车辆部件的 other emission related components redarding to
  - 损坏或失效（排放超出限值）情况 fault or misfunction (exceeding emission limits)
  - 控制电路故障 electric circuit

燃油的含硫量
Fuel sulphur !

欧洲车辆排放控制系统的道路适应性检测
Roadworthiness-Tests in Europe

(各成员国可以采用更严格的规定) (Member states may apply stricter rules)

99/52/EC	检测周期 Periodicity	限值 Control Value
汽油车 Gasoline	*在德国为3年时间* *In Germany: 3 years* 首次检测时间：新车注册后4年，此后每两年一次 first time: 4 years after first registration then every 2 years	怠速工况 normal idle CO的排放浓度： 3.5 % CO=3.5 % Vol (车辆未安装催化转化器 vehicles w/o catalyst) CO的排放浓度： 0.5 % CO=0.5 % Vol 或制造商设定的参数值 or manuf. Spec. 稳态工况 accel. Idle 发动机转速：2000rpm (2000 rpm) CO的排放浓度： 0.3 % CO=0.3 % Vol λ=1±0.03 或制造商设定的参数值 or manuf. Spec. (车辆安装了催化转化器 vehicles with catalyst)
柴油车 Diesel		在自由加速工况下：at free acceleration: 烟度值opacity = 2.5 m-1 (自然吸气机型natural aspirated) 烟度值opacity = 3.0 m-1 (涡轮增压机型turbo charged) 或制造商设定的参数值 or manuf. Spec.

欧3标准和欧4标准排放检测项目比较
Comparison Euro 3 and Euro 4

		欧3标准 Euro 3		欧4标准 Euro 4	
测试循环 Testcycle		NEDC测试循环，在发动机起动后立即开始测量 NEDC with measurement from engine start		相同 Same	
排放限值 Limits [克/公里][g/km] *(轿车 PCs)*		汽油机 Gasoline	柴油机 Diesel	汽油机 Gasoline	柴油机 Diesel
	CO	2,3	0,64	1,0	0,50
	HC+NOx	-	0,56	-	0,30
	HC	0,2	-	0,1	-
	NOx	0,15	0,50	0,08	0,25
	PM	-	0,05	-	0,025
燃油蒸发排放 Evaporation *(只用于汽油车 only gasoline)*		24小时昼间换气损失 24 h diurnal 1小时热浸损失 1h hot soak		相同 Same	
低温排放 Cold Emissions *(只用于汽油车only gasoline)*		在–7°C 和城市标准测试循环工况下的HC/CO排放 HC/CO at –7°C in City Cycle		相同 Same	
车载诊断系统 On-board Diagnosis		EOBD		相同 Same	
耐久性要求 Durability requirement		80000公里 80.000 km		100000公里 100.000 km	
在用车排放检测 In-use surveillance		行驶里程超过15000公里，低于80000公里的车辆 Min. 15.000 km Below 80.000 km		行驶里程超过15000公里，低于100000公里的车辆 Min. 15.000 km Below 100.000 km	

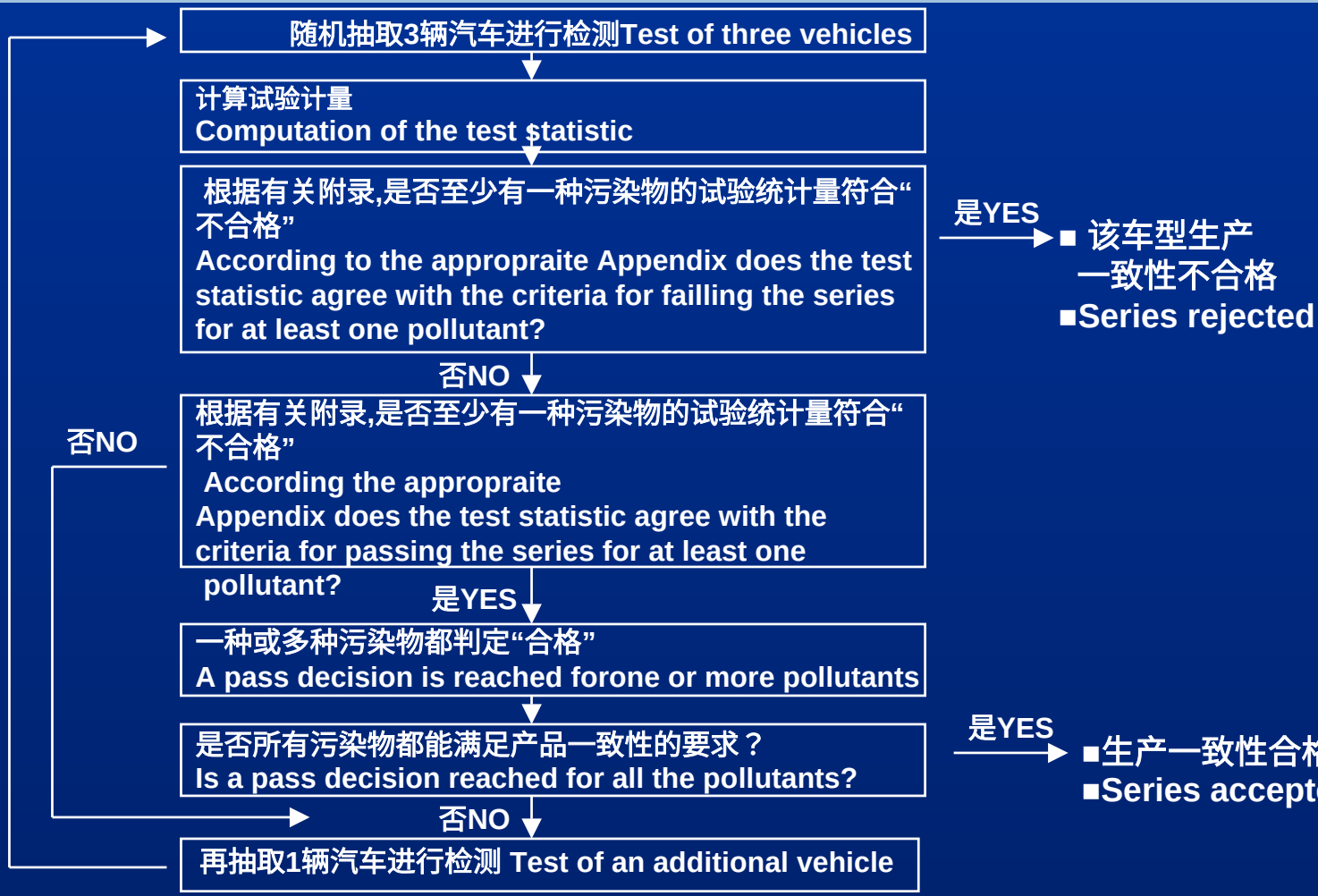
为确保达到欧1-欧4排放标准，汽油轿车应采用的排放控制技术
Emission Control Technologies necessary to meet Euro 1 - 4 Emission Limits with Gasoline Passenger Cars

欧1Euro 1	欧2Euro 2	欧3Euro 3	欧4Euro 4
三元催化转化器 Three-way catalyst	三元催化转化器 Three-way catalyst 发动机改进 engine measures	三元催化转化器 Three-way catalyst 发动机改进 engine measures 改进的催化转化器涂层 improved catalyst coating 催化剂加热 catalyst heating 催化转化器靠近发动机 calalyst close to engine 二次空气喷射 secondary air injection	三元催化转化器 Three-way catalyst 发动机改进 engine measures 改进的催化转化器涂层 improved catalyst coating 催化剂加热 catalyst heating 催化转化器靠近发动机 calalyst close to engine 二次空气喷射 secondary air injection 进一步改进的催化转化器涂层 further improved catalyst coating 排气再循环系统 exhaust gas recirculation

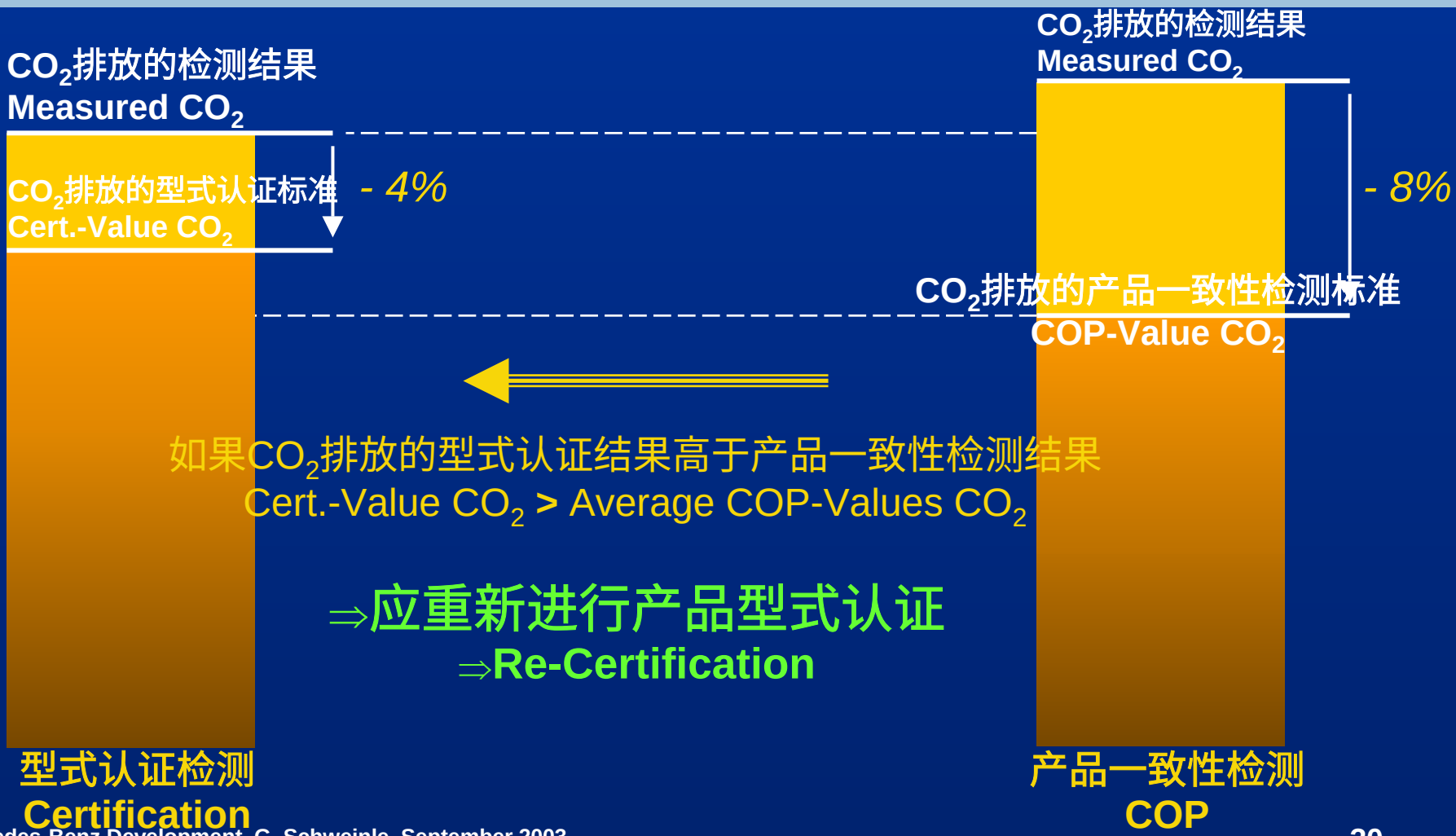
为确保达到欧1-欧4排放标准，柴油轿车应采用的排放控制技术
Emission Control Technologies necessary to meet Euro 1 - 4 Emission Limits with Diesel Passenger Cars

欧1Euro 1	欧2Euro 2	欧3Euro 3	欧4Euro 4
发动机改进 engine measures 排气再循环系统 EGR	氧化催化转化器 oxidation catalyst 发动机改进 engine measures 排气再循环系统 EGR	氧化催化转化器 oxidation catalyst 发动机改进 engine measures 带有冷却装置的排气再循环系统 cooled EGR 优化的燃烧室涡流形成 optimized swirl formation 氮氧化物吸附性催化转化器 NOx absorption catalyst	燃油后喷射 post-injection 发动机节流 throtteling 提高燃油喷射压力 increased injection press 压电式喷油阀 piezo injection valves

欧2标准的生产一致性检测
Conformity of Production Euro 2

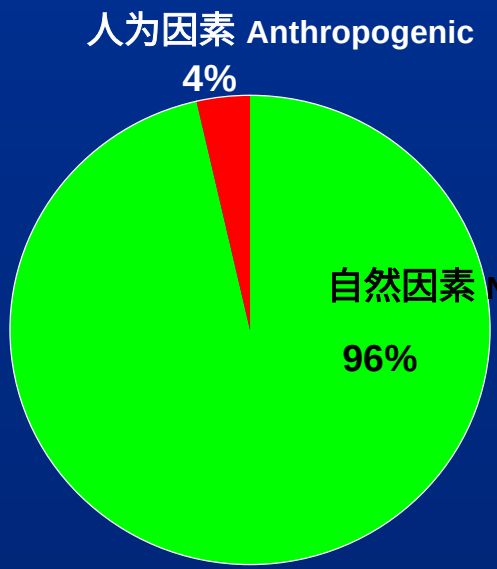


产品一致性检测与型式认证检测的对比
COP-Comparison with Certification

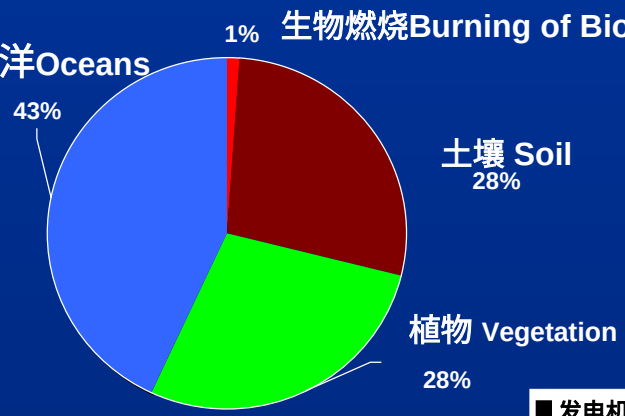


全球二氧化碳排放量的组成
Contribution of Various Sources to Global Yearly CO_2-Emissions

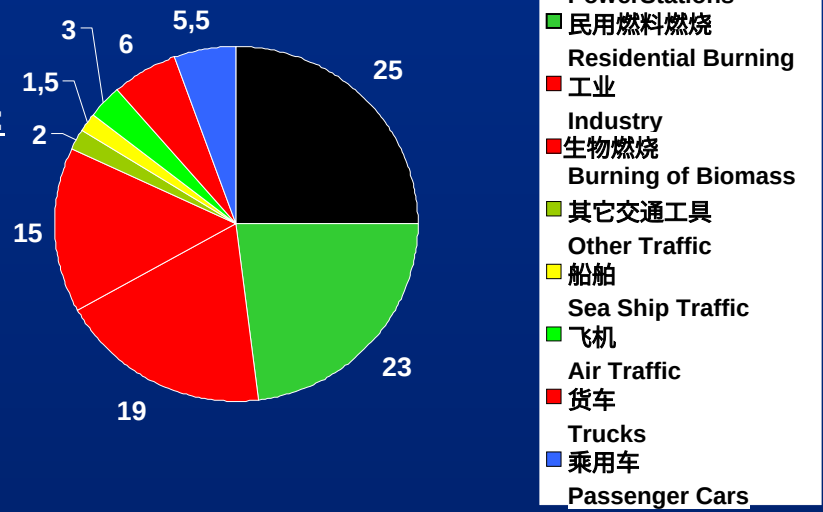
总计 Total:



自然因素 Natural:

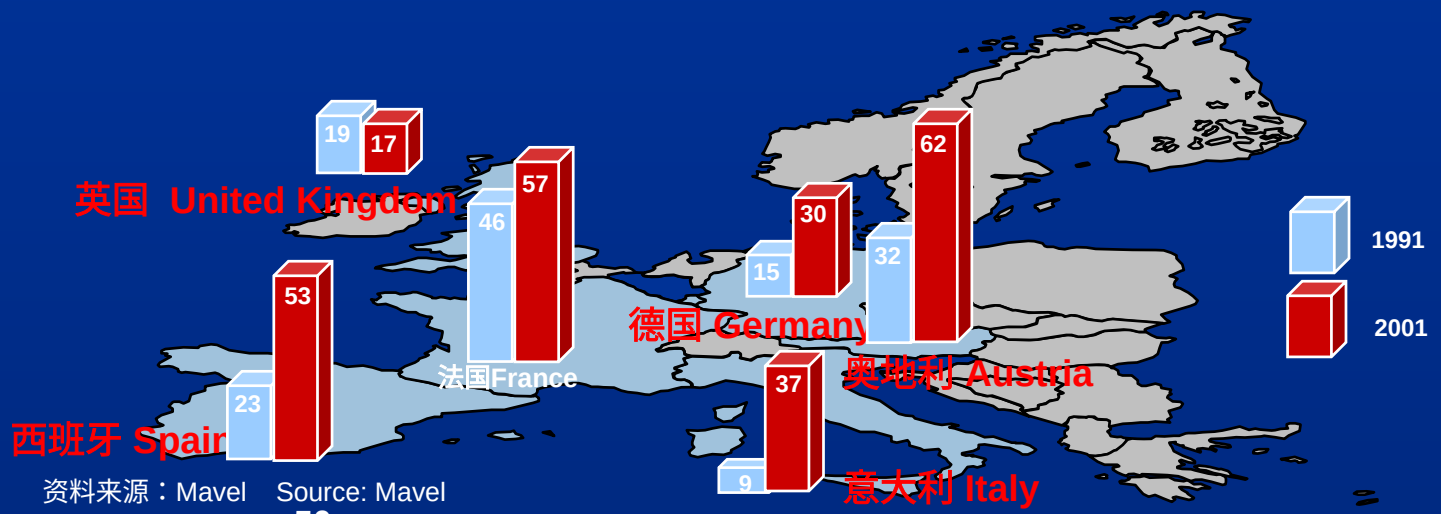


人为因素 Anthropogenic:

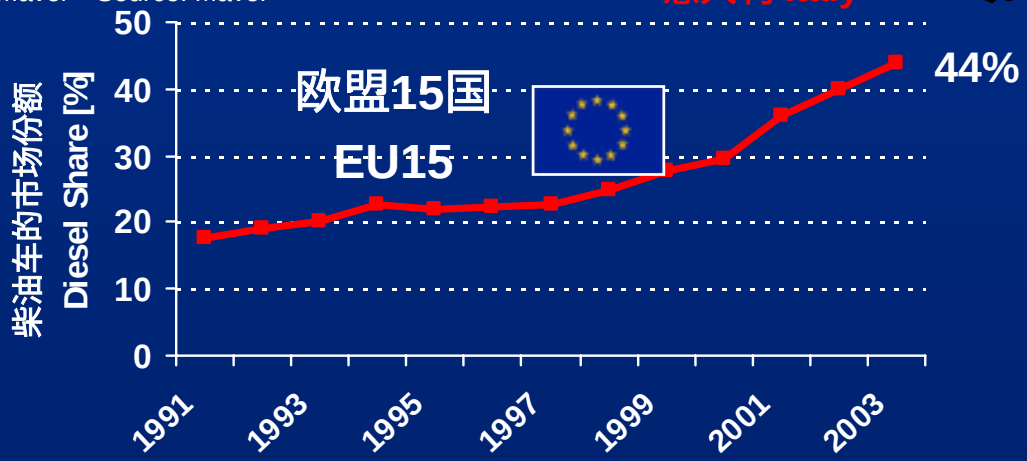


年份：1996 Year 1996
(Source: Lenz, Cozzarini, TU Wien)

1991年到2003年之间欧盟国家柴油车市场份额
Market Share of Diesel in the EU 1991 until 2003 (all Manufacturers)



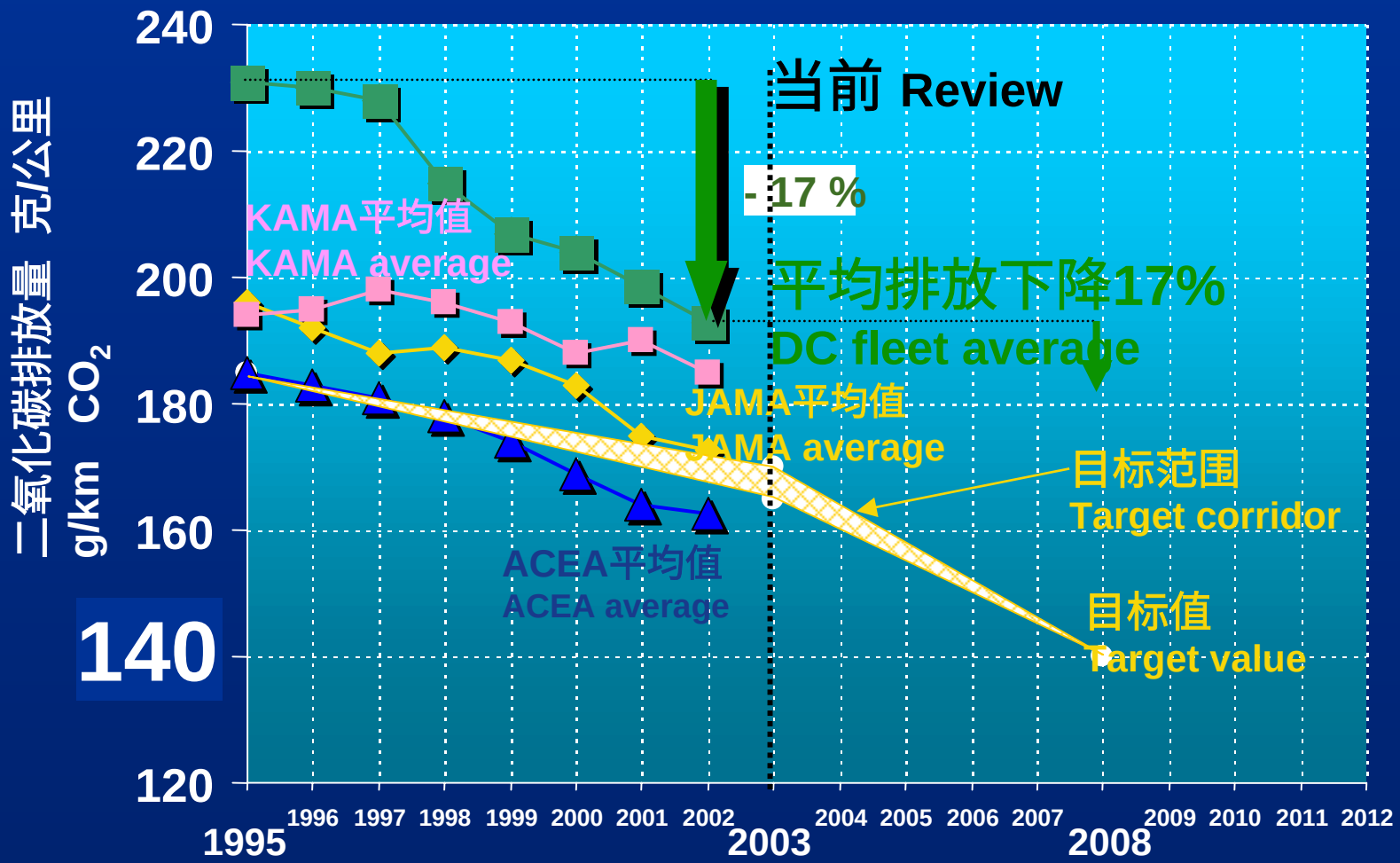
资料来源：Mavel Source: Mavel



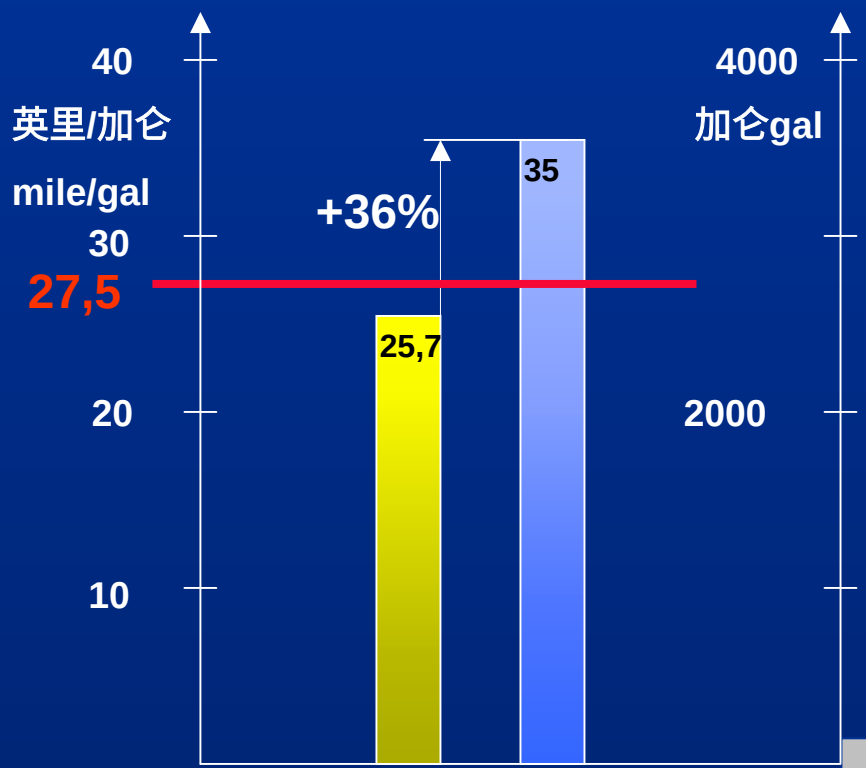
ACEA承诺的二氧化碳排放控制目标

Status of the ACEA Commitment on CO_2

ACEA：欧洲汽车制造商协会 ACEA = European Car Manufacturer Association

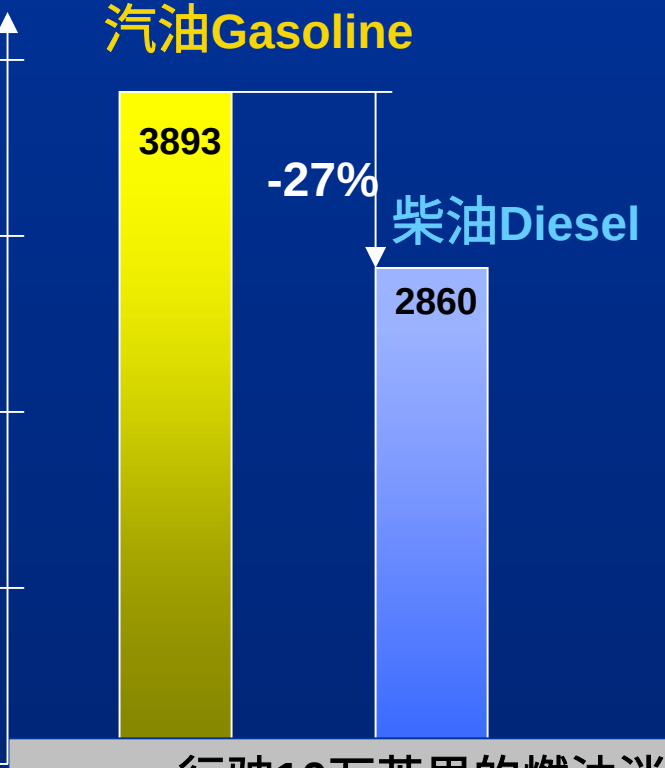


柴油车和汽油车燃油消耗量比较
Fuel Cosumption Comparison Diesel vs. Gasoline



燃油经济性 Fuel Economy

美国汽车公司平均燃油经济性标准
CAFE-Standard in USA



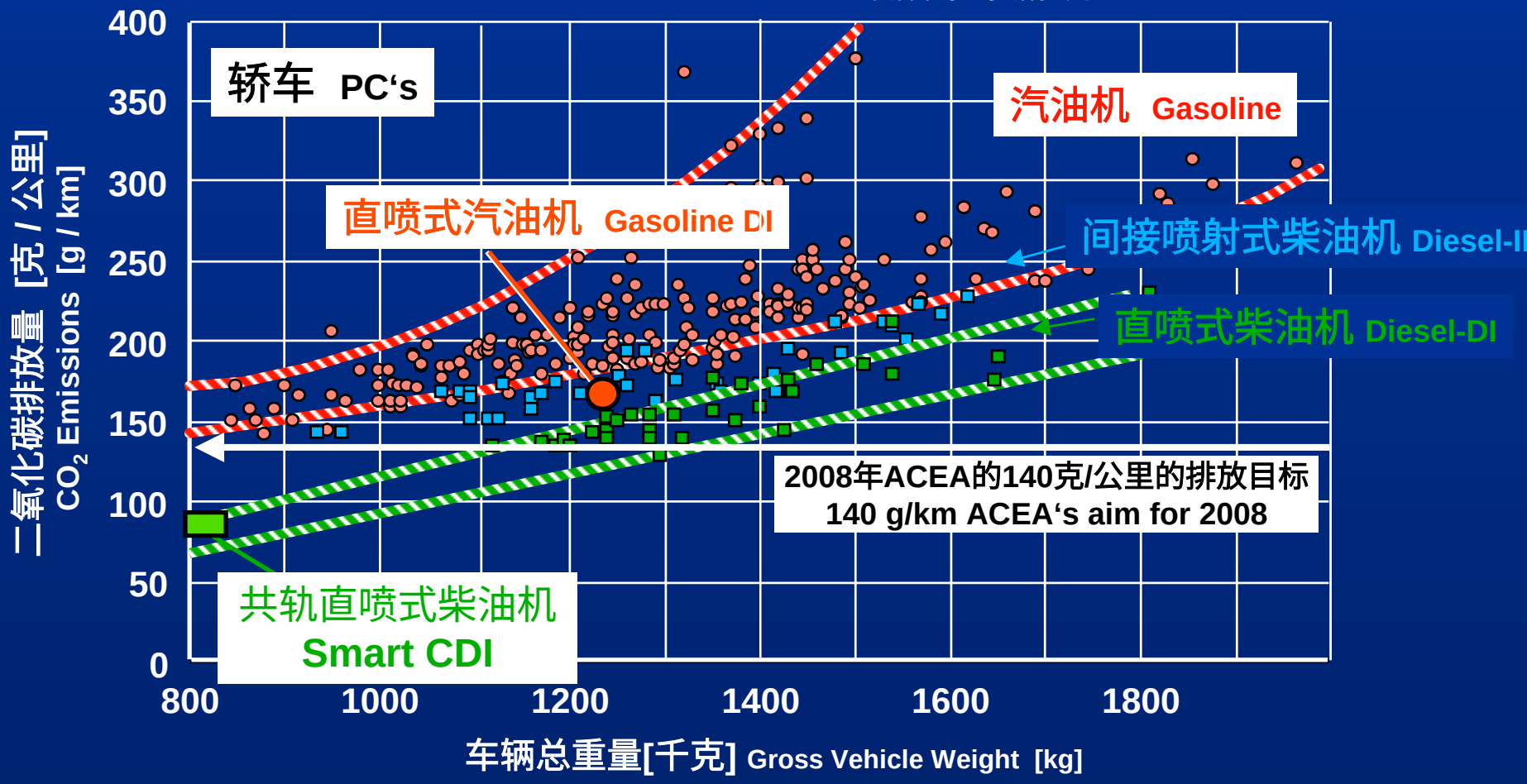
行驶10万英里的燃油消耗量
Fuel Consumption over 100 000 miles

奔驰E320汽油车
E320

奔驰E320 CDI柴油车
E320 CDI

不同发动机技术的燃油经济性
Fuel Economy of Different Engine Technologies

资料来源：李斯特公司Source: AVL List GmbH



建议（1）
Recommendations (1)

全面引入欧3排放标准，同时进行
Introduction of Euro 3 emission limits including the requirements of
- 低温HC/CO排放检测 low temperature HC/CO testing
- 燃油蒸发排放检测 evaporative emission testing
- 耐久性检测 durability testing

由于中国的燃油质量是一个关键性限制因素，只有当燃油质量达到标准后，再进行
Since the fuel quality is a limiting factor, the following items should be subject for introduction only if the requested fuel quality is available:
- 车载诊断系统检测 No on-board diagnosis (OBD)
- 在用车检测，现阶段应同欧盟一样进行道路适应性检测
  No in-use vehicle testing ; instead follow roadworthiness testing same as in the EU

清洁燃油对于各种车辆的排放控制效果都有着极为重要的影响
The availability of cleaner fuels is of extreme importance and impacts the whole vehicle population

建议（2）
Recommendations (2)

如果燃油质量得到改善，对于中国的轿车(汽油或柴油)和货车来说，一氧化碳、碳氢化合物和颗粒物的排放将会减少20%以上。

道理很简单：投入决定产出。

An immediate reduction of CO, HC, and PM by 20% or even more can be achieved by improved fuel qualities, which affects all passenger cars (gasoline and diesel) and all trucks in China.

It is very simple: *What goes in, will come out.*

以欧洲的排放标准为依据，分阶段实施排放法规。
To follow the European path of exhaust emission regulation allows the Chinese authorities a step by step approach.

目前中国已签署了“1998年协定书”，应当考虑进一步签署加入“1958年协定书”。

China should join the „1958 Agreement“ since already the „1998 Agreement“ was signed by China

建议（3）
Recommendations (3)

- 全面接受欧洲的排放证书，不在中国进行排放试验.

  Fully acceptance of existing EU emission certificates without further testing in China for Homologation. Harmonized Homologation requirements between SEPA and Provincial EPA‘s

- 成立由中国和欧洲排放控制专家组成的项目组，更充分地吸收和借鉴欧洲的排放控制经验。

  Establish a project team between Chinese and European Emission Experts to participate in the European experience

谢谢！

Thank you for your attention