机动车排污监控中心
Vehicle Emission Control Center

2021

中国重型车CO_2管理现状及规划
Current Status and Planning of CO_2 Management for Heavy Vehicles in China

机动车排污监控中心

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Vehicle Emission Control Centre

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中国温室气体管控现状
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《大气污染防治法》
“Atmospheric Pollution Prevention and Control Law”

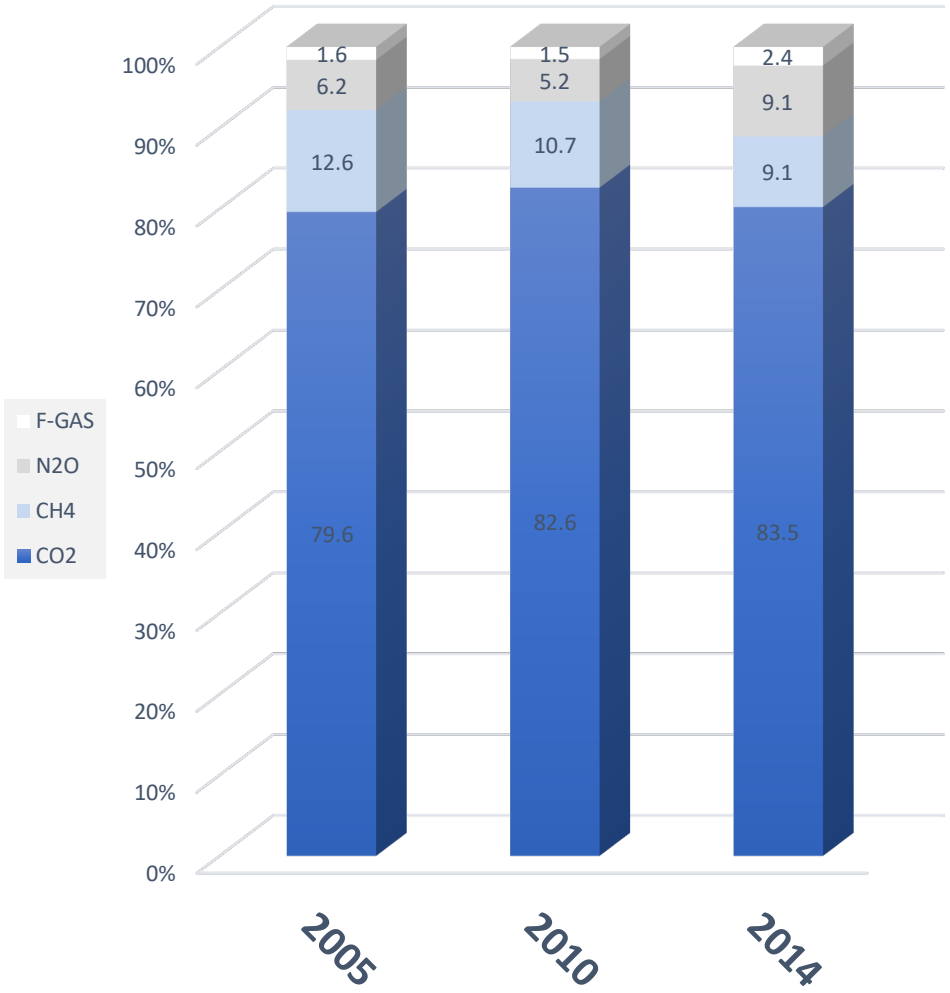
第二条　防治大气污染，应当以改善大气环境质量为目标，坚持源头治理，规划先行，转变经济发展方式，优化产业结构和布局，调整能源结构。

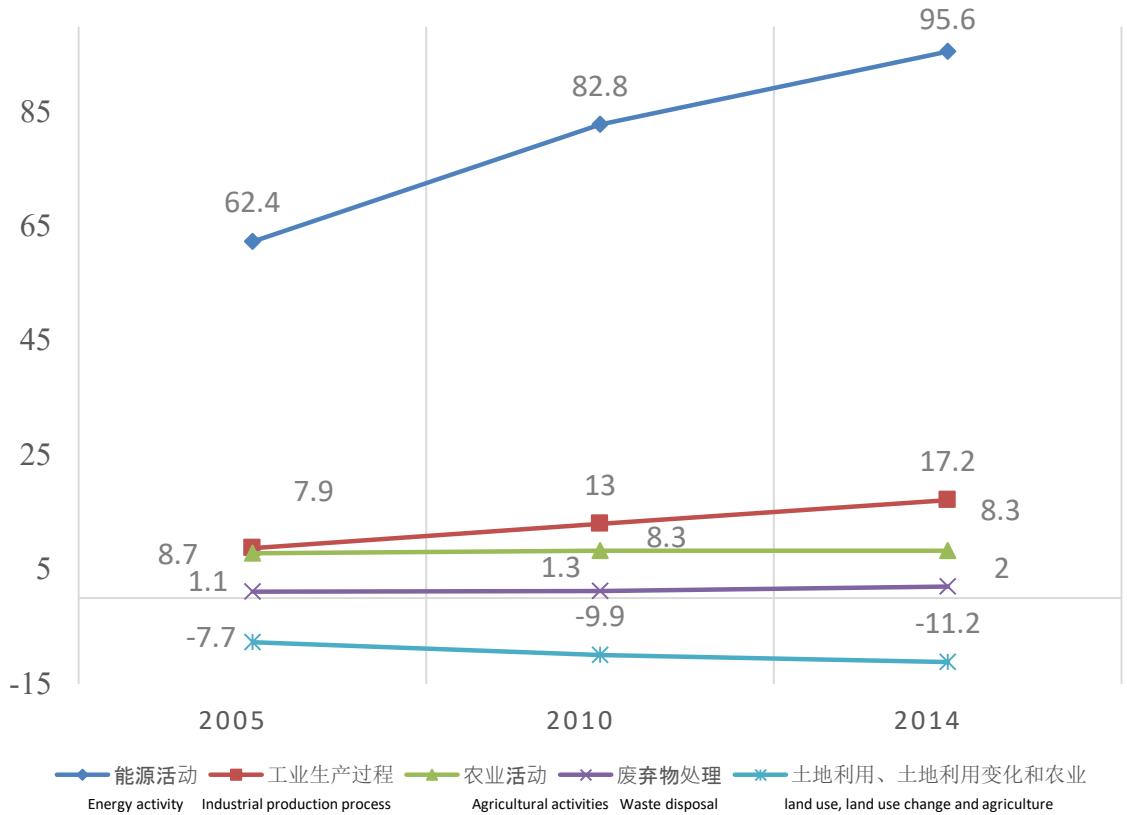
Article 2 Atmospheric pollution prevention and control shall aim at improving the quality of the atmospheric environment, adhere to regulation from the source, make plans first, transform the economic development mode, optimize industry structure and layout, and adjust the energy structure.

防治大气污染，应当加强对燃煤、工业、机动车船、扬尘、农业等大气污染的综合防治，推行区域大气污染联合防治，对颗粒物、二氧化硫、氮氧化物、挥发性有机物、氨等大气污染物和温室气体实施协同控制。

To prevent and control atmospheric pollution, it is necessary to strengthen overall prevention and control of air pollution from coal burning, industry, motor vehicles and ships, dust, etc., promote regional joint prevention and control for coordinated control of atmospheric pollutants and greenhouse gases such as particulate matter, sulfur dioxide, nitrogen oxide, volatile organic compounds, and ammonia.

温室气体构成
Greenhouse gas’ composition



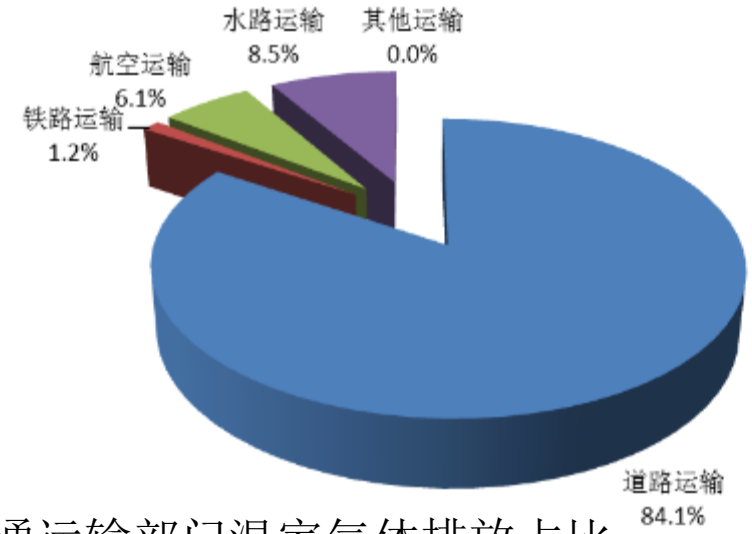


从**气体类型**看，二氧化碳排放102.75亿吨，是我国最主要的温室气体，占温室气体排放总量的83.5%；
In terms of gas type, **the most important greenhouse gas in China is carbon dioxide emissions, at 10.275 billion tons, accounting for 83.5% of total greenhouse gas emissions;**

从**排放领域**看，能源活动温室气体排放95.59亿吨二氧化碳当量，是我国温室气体最大的排放来源，占温室气体排放总量的77.7%。
In terms of emissions, **greenhouse gas emissions from energy activities are 9.559 billion tons of carbon dioxide equivalent and are the largest source of greenhouse gas emissions in China, accounting for 77.7% of the total.**

数据来源：2014国家温室气体清单 Data source: 2014 National Greenhouse Gas Inventory

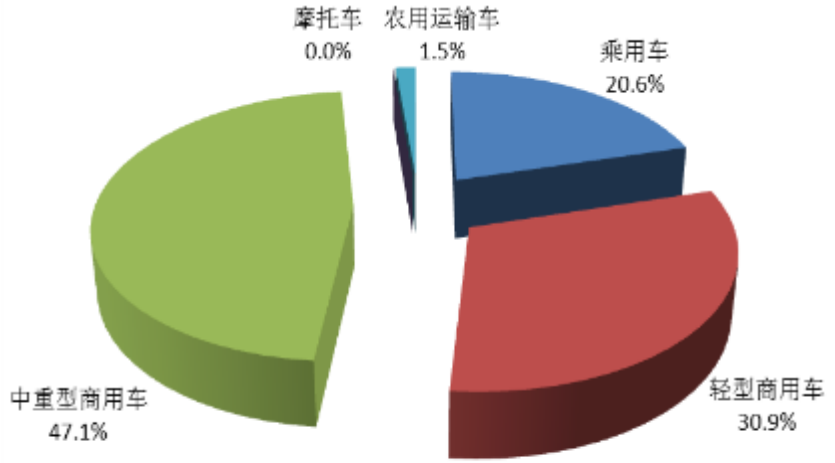
温室气体排放占比
Percentages of greenhouse gas emissions



不同交通运输部门温室气体排放占比
Percentage of greenhouse gas emissions

交通运输温室气体排放8.2亿吨二氧化碳当量，占能源活动温室气体排放的8.6%，占全国温室气体排放总量的6.7%。
2014年道路运输、铁路运输、航空运输、水路运输和其他运输温室气体排放分别为6.9、0.1、0.5、0.7、0.0亿吨二氧化碳当量，分别占交通运输温室气体排放的84.1%、1.2%、6.1%、8.5%、0.0% 。
Greenhouse gas emissions from transportation are 820 million tons of carbon dioxide equivalent, accounting for 8.6% of greenhouse gas emissions from energy and 6.7% of total national greenhouse gas emissions.
In 2014, greenhouse gas emissions from road transportation, railway transportation, air transportation, water transportation and other transportation were 6.9, 0.1, 0.5, 0.7, and 0.0 billion tons of carbon dioxide equivalent, respectively, accounting for 84.1%, 1.2%, 6.1%, 8.5%, and 0.0% of transportation greenhouse gas emissions,

2014年乘用车、轻型商用车、中重型商用车、农用运输车、摩托车温室气体排放分别为1.4亿吨二氧化碳当量、2.1亿吨二氧化碳当量、3.2亿吨二氧化碳当量、0.1亿吨二氧化碳当量、0.0亿吨二氧化碳当量，分别占道路运输温室气体排放的20.6%、30.9%、47.1%、1.5%、0.0%。
In 2014, greenhouse gas emissions from passenger cars, light commercial vehicles, medium and heavy commercial vehicles, agricultural transport vehicles, and motorcycles were 140 million tons of carbon dioxide equivalent, 210 million tons of carbon dioxide equivalent, 320 million tons of carbon dioxide equivalent, 10 million tons and 0.0 billion tons of carbon dioxide equivalent, respectively, accounting for 20.6%, 30.9%, 47.1%, 1.5%, and 0.0% of greenhouse gas emissions from road transportation, respectively.

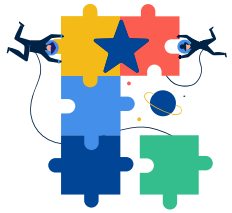


不同车辆类型温室气体排放占比
Percentage of greenhouse gas emissions of different vehicle types

数据来源：2014国家温室气体清单
Data source: 2014 National Greenhouse Gas Inventory

中国碳减排目标
China’s Carbon Reduction Target

在第七十五届联合国大会一般性辩论上提出，
“中国将提高国家自主贡献力度，采取更加有力的政策和措施，二氧化碳排放力争2030年前达到峰值，努力争取2060年前实现碳中和。”
At 75th United Nations General Assembly, China proposed in the general debate that,
“China will scale up its Intended Nationally Determined Contributions by adopting more vigorous policies and measures. We aim to have CO2 emissions peak before 2030 and achieve carbon neutrality before 2060. “



在“十四五”规划中提出，要加快推动绿色低碳发展。降低碳排放强度，支持有条件的地方率先达到碳排放峰值，制定二〇三〇年前碳排放达峰行动方案。
The “14th Five-Year Plan” proposed accelerating the promotion of green and low-carbon development and reducing the intensity of carbon emissions, by supporting locations where conditions permit taking the lead in reaching peak of carbon emissions, and formulating an action plan for peaking carbon emissions before 2030.

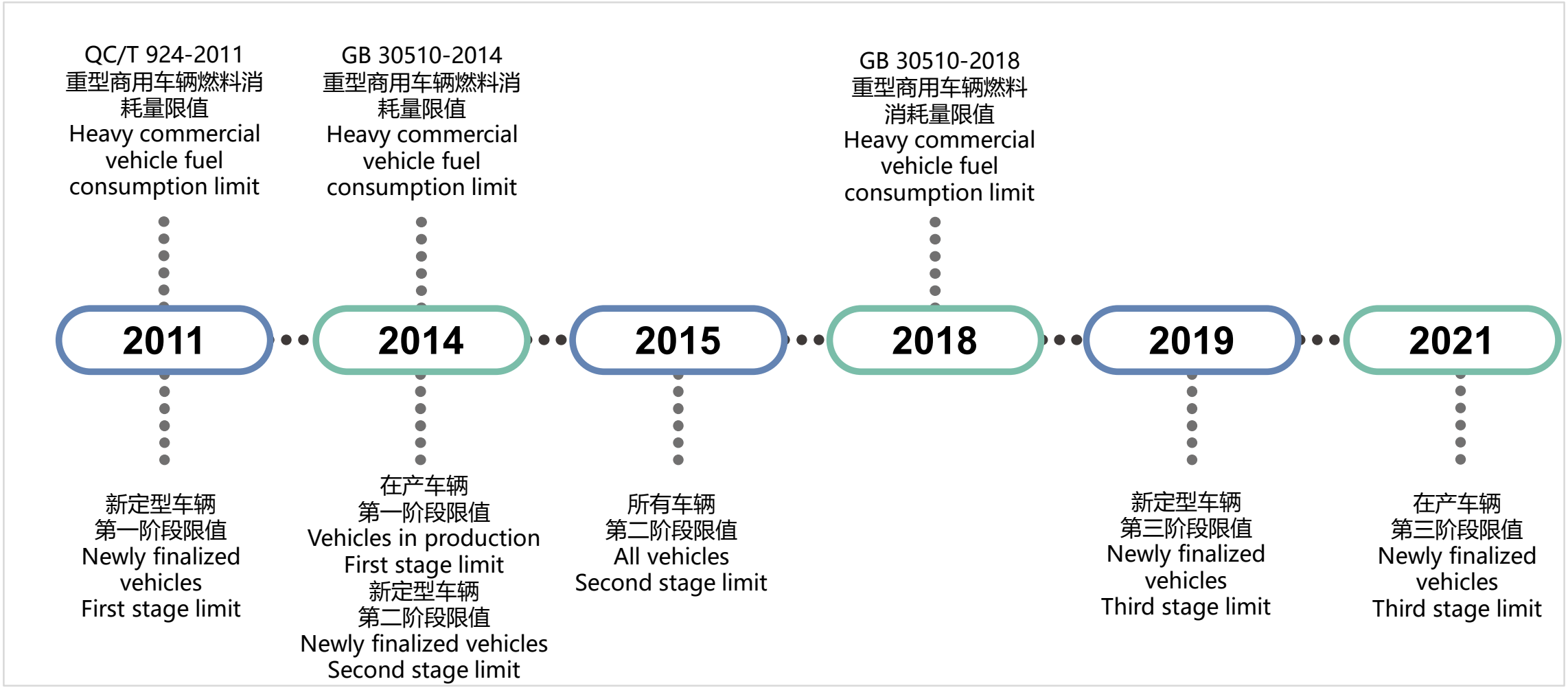
不同国家和地区机动车温室气体管理模式
Vehicle Greenhouse Gas Management Models in Different Countries and Regions

	美国	日本	欧盟	中国
类型	燃料经济性、CO_2	燃料经济性	CO_2	燃料消耗量
单位	mpg, g/mile	km/L	g/km	L/100km
限值基础	脚印面积	质量	质量	质量
评价方法	企业平均、单车	段内企业平均	企业平均	企业平均、单车
处罚方式	罚款	罚款	罚款	停止生产

中国现行油耗标准
China's Current Fuel Consumption Standards

	轻型车（GVW ≤ 3500kg） Light vehicles（GVW ≤ 3500kg）	重型车（GVW＞3500kg） Heavy vehicles（GVW＞3500kg）
限值标准 Limit standard	GB 19578-2014 乘用车燃料消耗量限值（下阶段修订中） Passenger car fuel consumption limit (Under revision in the next stage)	
	GB 27999-2019 乘用车燃料消耗量评价方法及指标 Evaluation method and index for passenger car fuel consumption	GB 30510-2018 重型商用车辆燃料消耗量限值（下阶段修订中） Heavy commercial vehicle fuel consumption limit (Under revision in the next stage)
	GB 20997-2015 轻型商用车辆燃料消耗量限值（下阶段修订中） Light commercial vehicle fuel consumption limit (Under revision in the next stage)	
试验方法 Experimental method	GB/T 19233-2020 轻型汽车燃料消耗量试验方法 Light vehicle fuel consumption test method	GB/T 27840-2011 重型商用车辆燃料消耗量测量方法（下阶段修订中） Method for measuring fuel consumption of heavy commercial vehicles (Under revision in the next stage)
	GB/T 19753-2013 轻型混合动力电动汽车能量消耗量试验方法（下阶段修订中） Light hybrid electric vehicle energy consumption test method (Under revision in the next stage)	GB/T 19754-2015 重型混合动力电动汽车能量消耗量试验方法（下阶段修订中） Heavy hybrid electric vehicle energy consumption test method(Under revision in the next stage)
	第四阶段 Fourth stage	第三阶段 Third stage

重型车辆燃料消耗量标准 | Fuel consumption standards for heavy vehicles



第一阶段 First stage	第二阶段 Second stage	第三阶段 Third stage
QC/T 924-2011	GB 30510-2014 较一阶段加严10.5%-14% 10.5%-14% stricter than the first stage	GB 30510-2018 较二阶段加严12.5%-16% 12.5%-16% stricter than the second stage

重型车辆燃料消耗量标准
Fuel consumption standards for heavy vehicles

采用单车型限值管理
Adopting a single-vehicle model

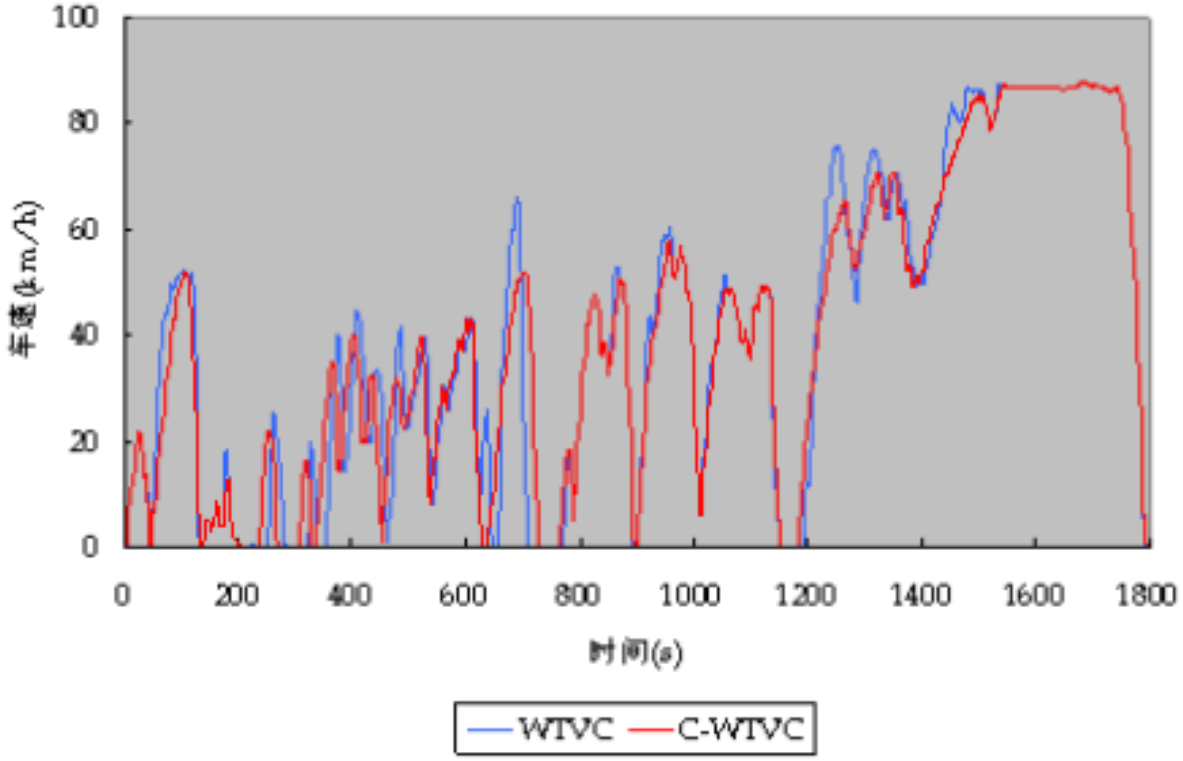
货车		半挂牵引车		客车		自卸汽车		城市客车	
最大设计总质量（GVW）kg	燃料消耗量限值 L/100km	最大设计总质量（GCW）kg	燃料消耗量限值 L/100km	最大设计总质量（GVW）kg	燃料消耗量限值 L/100km	最大设计总质量（GVW）kg	燃料消耗量限值 L/100km	最大设计总质量（GVW）kg	燃料消耗量限值 L/100km
3500 < GVW≤4500	11.5*	GCW≤18000	28.0	3500 < GVW≤4500	10.6*	3500 < GVW≤4500	13.0	3500 < GVW≤4500	11.5
4500 < GVW≤5500	12.2*	18000 < GCW≤27000	30.5	4500 < GVW≤5500	11.5*	4500 < GVW≤5500	13.5	4500 < GVW≤5500	13.0
5500 < GVW≤7000	13.8*	27000 < GCW≤35000	32.0	5500 < GVW≤7000	13.3*	5500 < GVW≤7000	15.0	5500 < GVW≤7000	14.7
7000 < GVW≤8500	16.3*	35000 < GCW≤40000	34.0	7000 < GVW≤8500	14.5	7000 < GVW≤8500	17.5	7000 < GVW≤8500	16.7
8500 < GVW≤10500	18.3*	40000 < GCW≤43000	35.5	8500 < GVW≤10500	16.0	8500 < GVW≤10500	19.5	8500 < GVW≤10500	19.4
10500 < GVW≤12500	21.3*	43000 < GCW≤46000	38.0	10500 < GVW≤12500	17.7	10500 < GVW≤12500	22.0	10500 < GVW≤12500	22.3
12500 < GVW≤16000	24.0	46000 < GCW≤49000	40.0	12500 < GVW≤14500	19.1	12500 < GVW≤16000	25.0	12500 < GVW≤14500	25.5
16000 < GVW≤20000	27.0	49000 < GCW	40.5	14500 < GVW≤16500	20.1	16000 < GVW≤20000	29.5	14500 < GVW≤16500	28.0
20000 < GVW≤25000	32.5			16500 < GVW≤18000	21.3	20000 < GVW≤25000	37.5	16500 < GVW≤18000	31.0
25000 < GVW≤31000	37.5			18000 < GVW≤22000	22.3	25000 < GVW≤31000	41.0	18000 < GVW≤22000	34.5
31000 < GVW	38.5			22000 < GVW≤25000	24.0	31000 < GVW	41.5	22000 < GVW≤25000	38.5
				25000 < GVW	25.0			25000 < GVW	41.5
*对于汽油车，其限值是表中相应限值乘以1.2，求得的数值圆整（四舍五入）至小数点后一位。				*对于汽油车，其限值是表中相应限值乘以1.2，求得的数值圆整（四舍五入）至小数点后一位。					

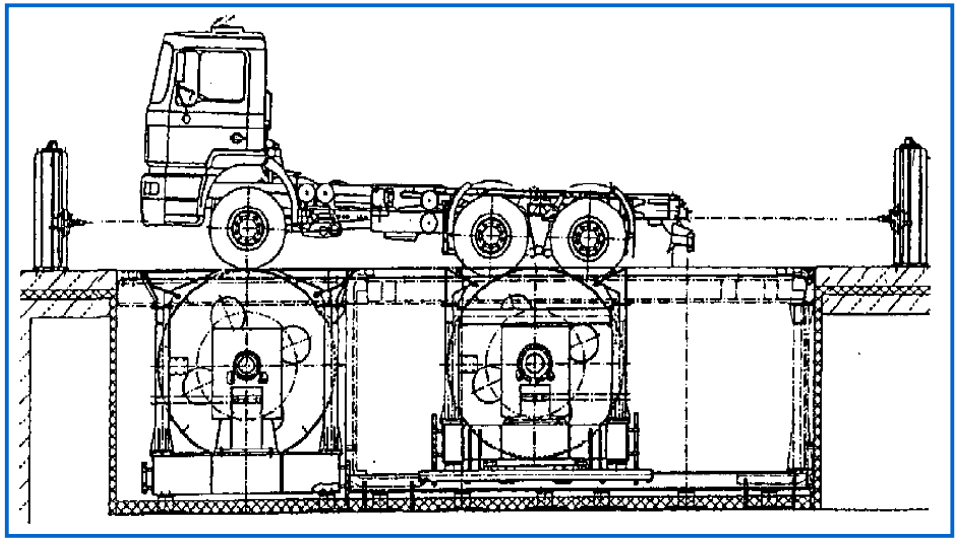




重型车辆燃料消耗量标准
Fuel consumption standards for heavy vehicles

测试方法
Test method





测试循环采用C-WTVC循环。

碳平衡法、质量法、容积法对测量数据进行计算后按各种车型的特征分配里程比例系数进行加权。

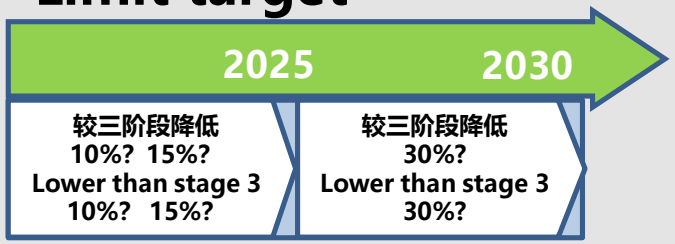
Testing cycle uses a C-CWT cycle.

The carbon balance method, quality method, and volume method are used to calculate the measured data and then weighted according to the characteristics of various vehicle models.

重型车下阶段油耗标准规划
Fuel consumption standard planning for the next stage of heavy vehicles

01

限值目标
Limit target



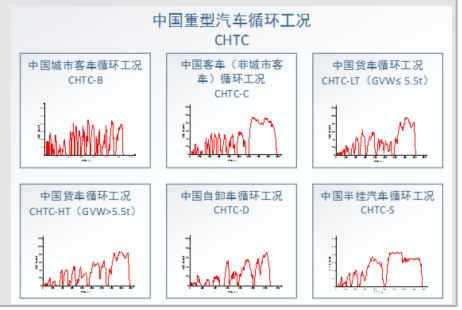
02

工况 | Working conditions

C-WTVC

↓

CHTC



2020年正式启动第四阶段标准修订

The fourth phase of standard revision will be officially launched in 2020

03

车型指标
Model target

指标设定时考虑不同车型达标难度的差异
从阶梯式要求改为线性?

When setting indicators, consider the difference in difficulty for different models

Change from stepped requirements to linear?

04

管理方式
Management method

单车型管理 Single model management

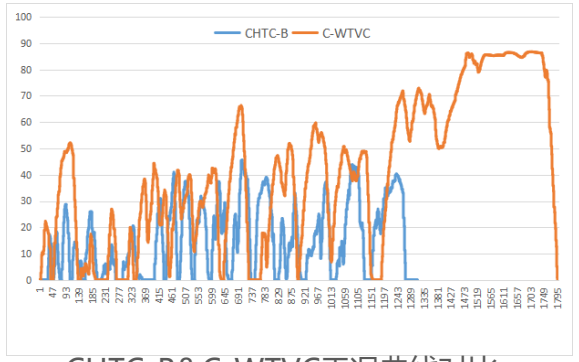
↓

单车&企业平均? Bicycling & corporate average?

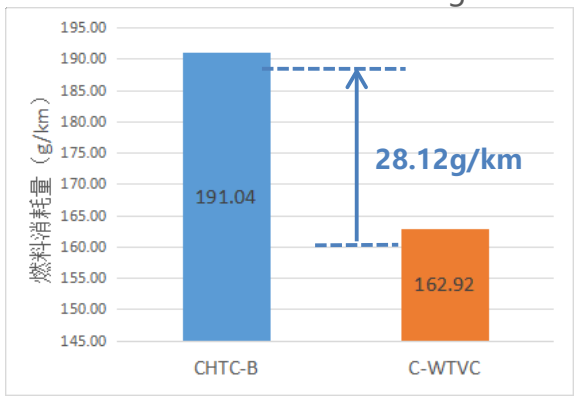
重型车下阶段油耗标准规划
Fuel consumption standard planning for the next stage of heavy vehicles

基于VECTO软件计算CHTC和C-WTVC曲线的燃油消耗量对比分析
Comparison and analysis of fuel consumption based on VECTO software used to calculate CHTC and C-WTVC curves

CHTC-B&C-WTVC

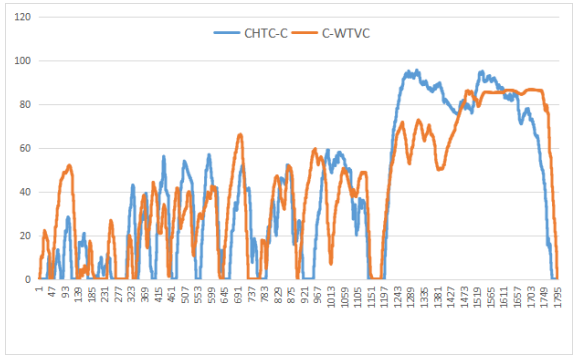


CHTC-B&C-WTVC工况曲线对比
CHTC-B&C-WTVC working

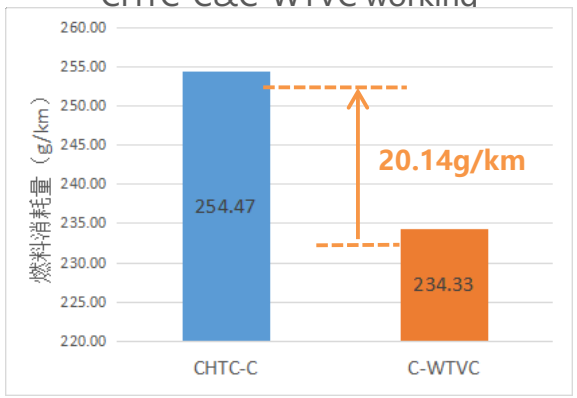


CHTC-B比C-WTVC消耗量增加**17%**
CHTC-B consumes **17% more than C-WTVC**

CHTC-C&C-WTVC

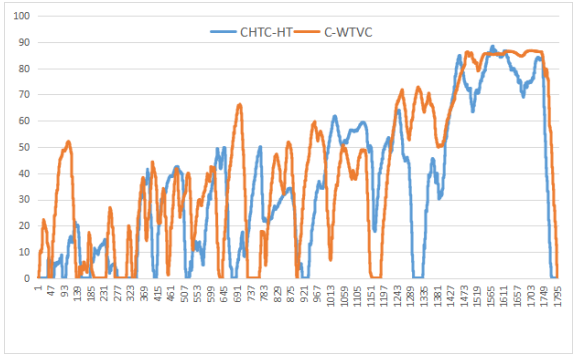


CHTC-C&C-WTVC工况曲线对比
CHTC-C&C-WTVC working

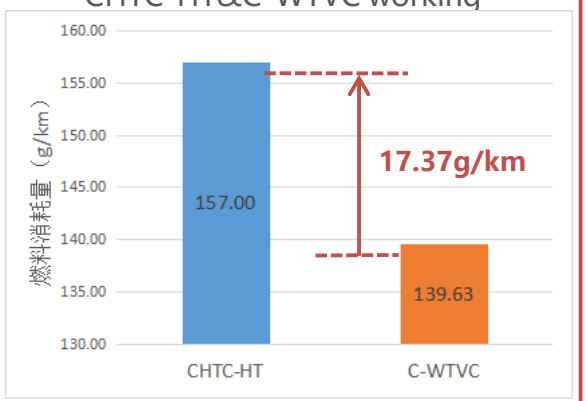


CHTC-C比C-WTVC消耗量增加**8.6%**
CHTC-C consumes **8.6% more than C-WTVC**

CHTC-HT&C-WTVC

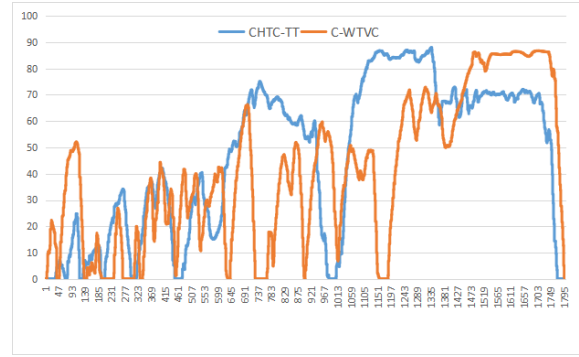


CHTC-HT&C-WTVC工况曲线对比
CHTC-HT&C-WTVC working

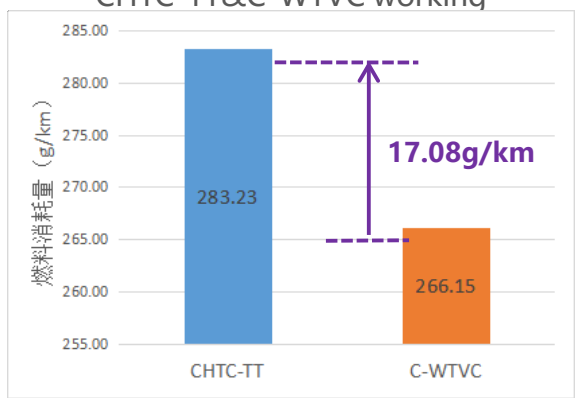


CHTC-HT比C-WTVC消耗量增加**12.4%**
CHTC-HT consumes **12.4% more than C-WTVC**

CHTC-TT&C-WTVC



CHTC-TT&C-WTVC工况曲线对比
CHTC-TT&C-WTVC working



CHTC-TT比C-WTVC消耗量增加**6.4%**
CHTC-TT consumes **6.4% more than C-WTVC**

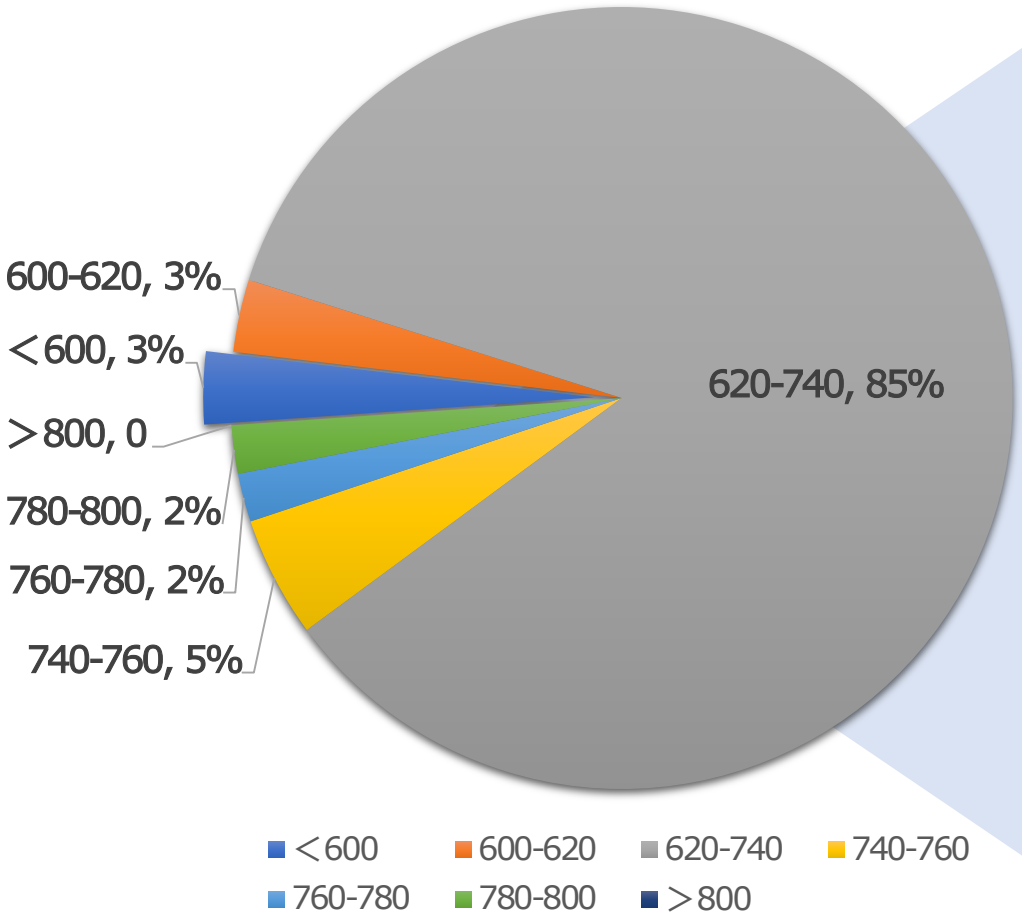
CHTC工况的燃油消耗量比C-WTVC工况的燃油消耗量高约**6.4%~17%**
Fuel consumption of the CHTC working condition is about **6.4%–17% higher than that of the C-WTVC working condition**

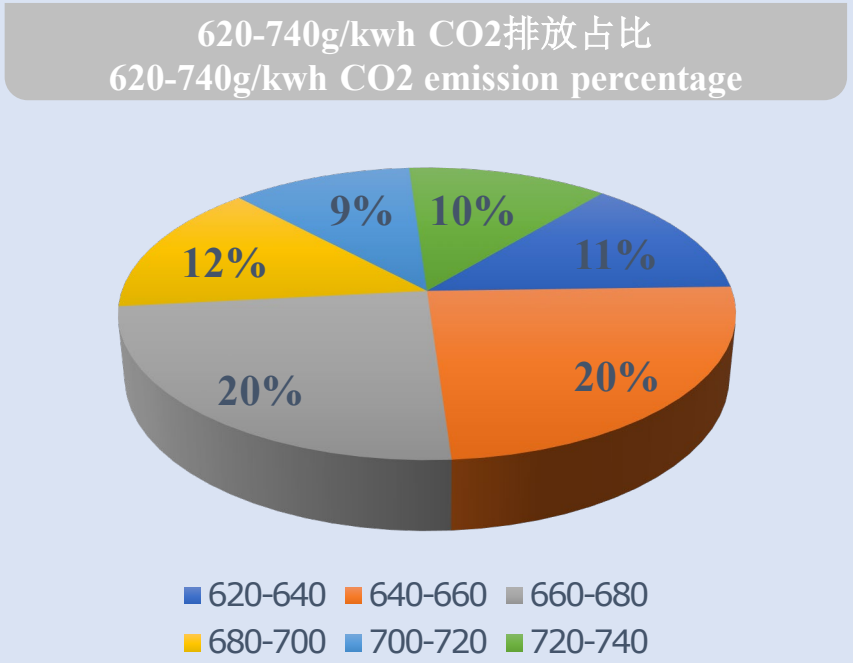
第N 2 部分 | Section

国六重型车CO2排放水平研究

China VI heavy vehicle CO2emission level research

国六柴油机 CO_2排放分析 WHTC
China VI diesel engine CO_2 emission analysis WHTC





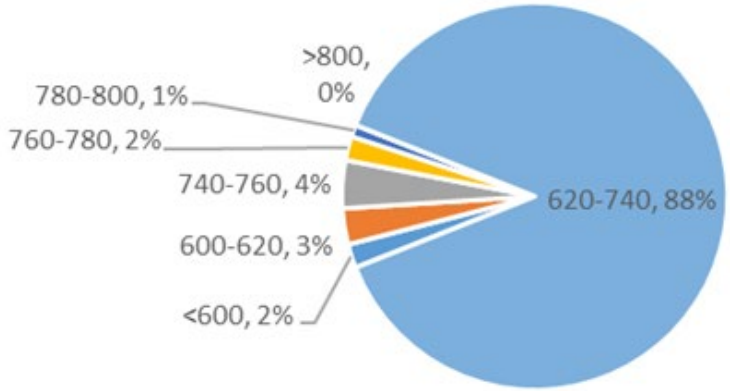
国六柴油机 WHTC 循环CO2排放
China VI diesel engine WHTC cycle CO2 emission

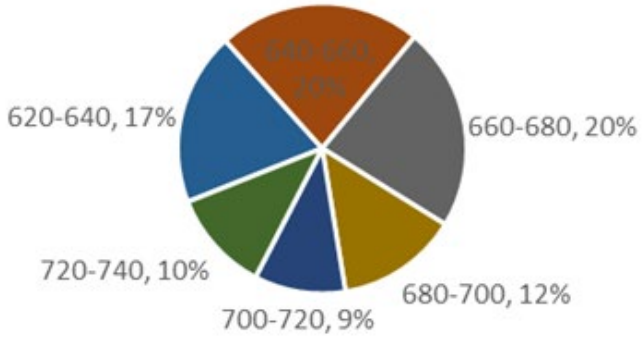
620-740g/kwh 占比 88%， 小于620g/kwh占比 5%， 大于740g/kwh 占比 7%
620-740g/kwh percentage 88%， less than 620g/kwhpercentage 5%， greater than 740g/kwh percentage 7%

约280台国六柴油发动机
Approximately 280 China VI diesel engines

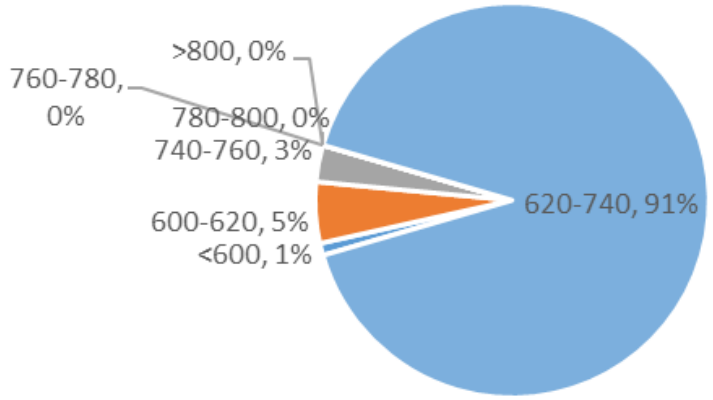
国六柴油机 CO_2排放分析 WHTC
China VI diesel engine CO_2 emission analysis WHTC

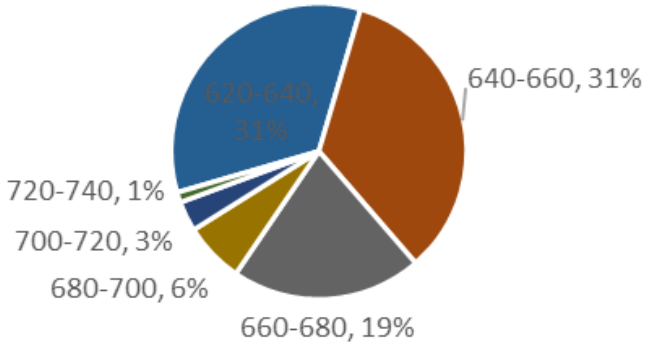
EGR





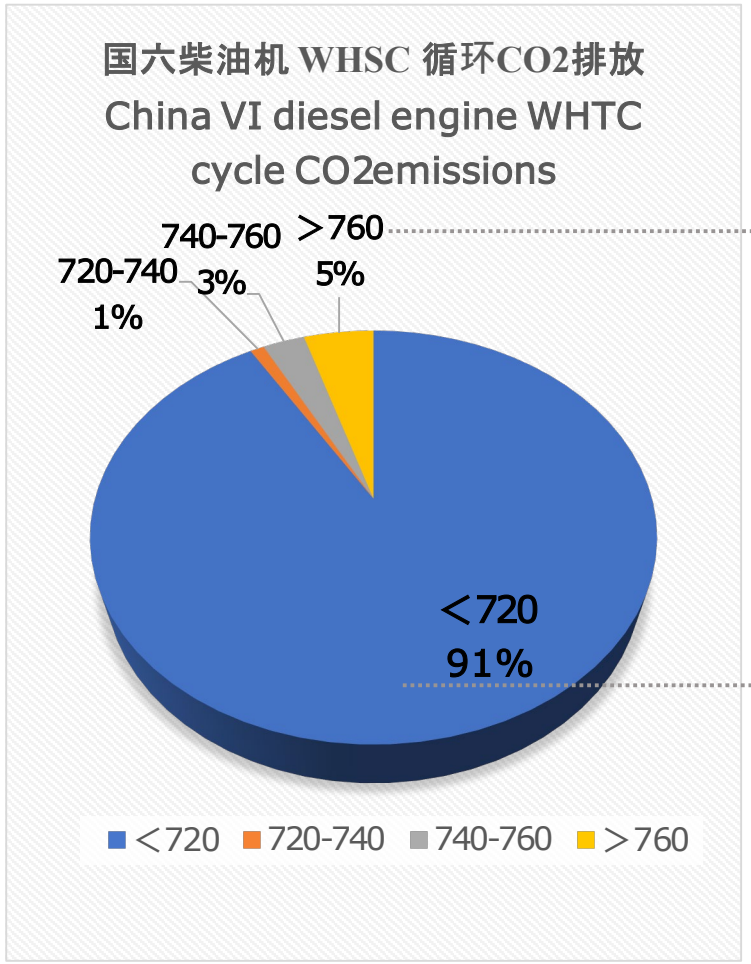
非EGR
NON-EGR



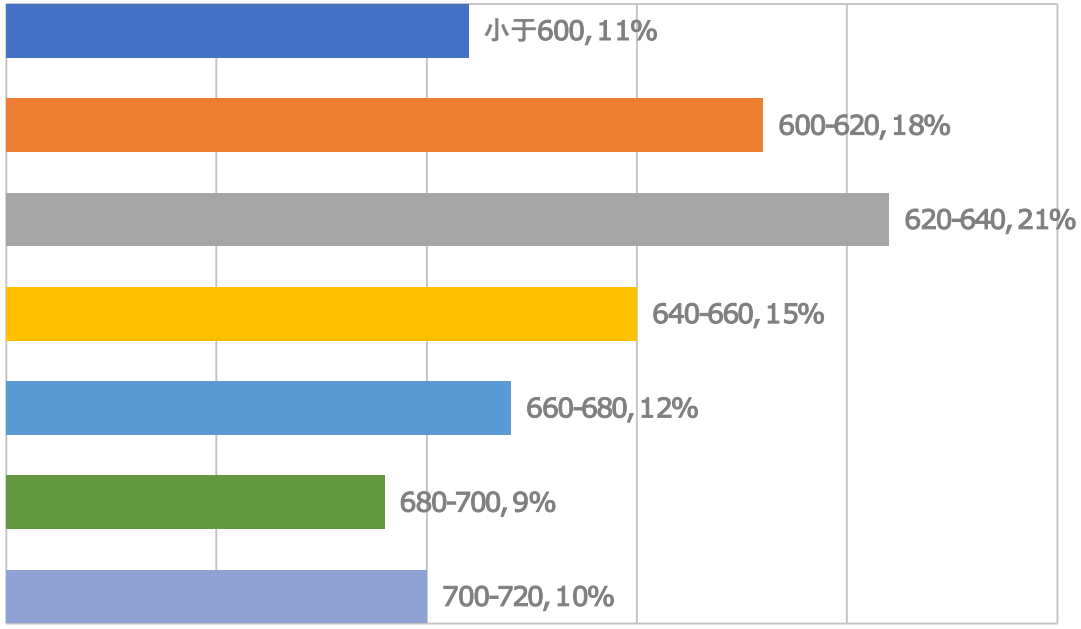


约280台国六柴油发动机(EGR 190+,非EGR 80+)
Approximately 280 National VI diesel engines (EGR 190+, non-EGR 80+)

国六柴油机 CO_2排放分析 WHSC
China VI diesel engine CO_2 emission analysis WHSC



620-740g/kwh CO2排放占比
620-740emission percentageg/kwh CO2

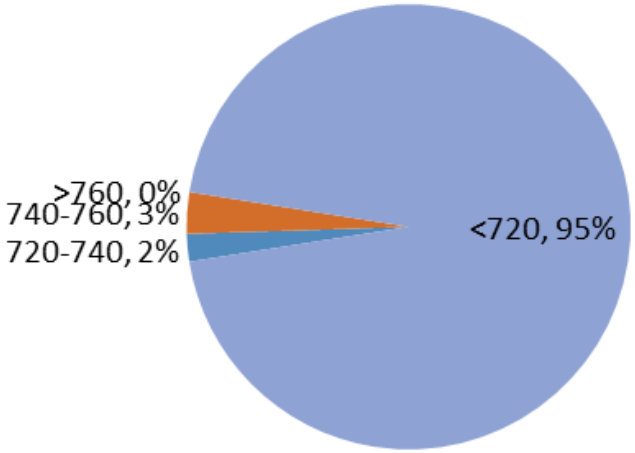


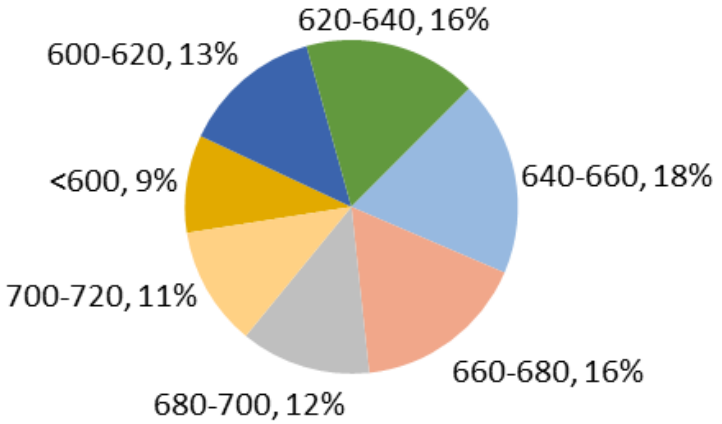
	620-740g/kwh CO2排放占比 Emissions percentage
小于600 Less than	11%
600-620	18%
620-640	21%
640-660	15%
660-680	12%
680-700	9%
700-720	10%

约280台国六柴油发动机
Approximately 280 China VI diesel engines

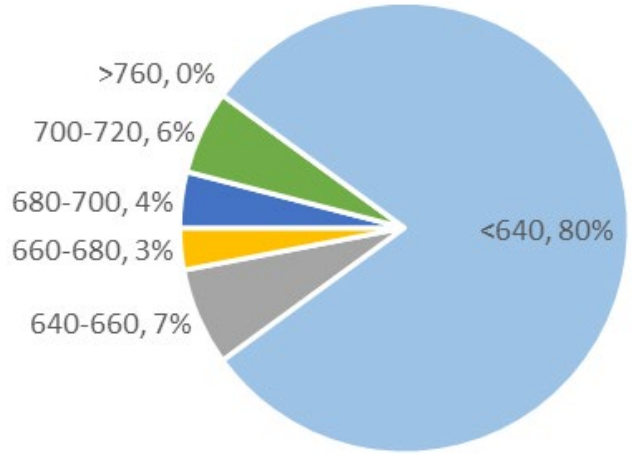
国六柴油机 CO_2排放分析 WHSC
China VI diesel engine CO_2 emission analysis WHSC

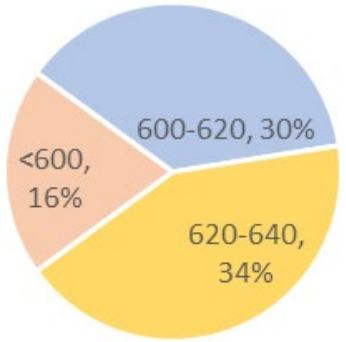
EGR





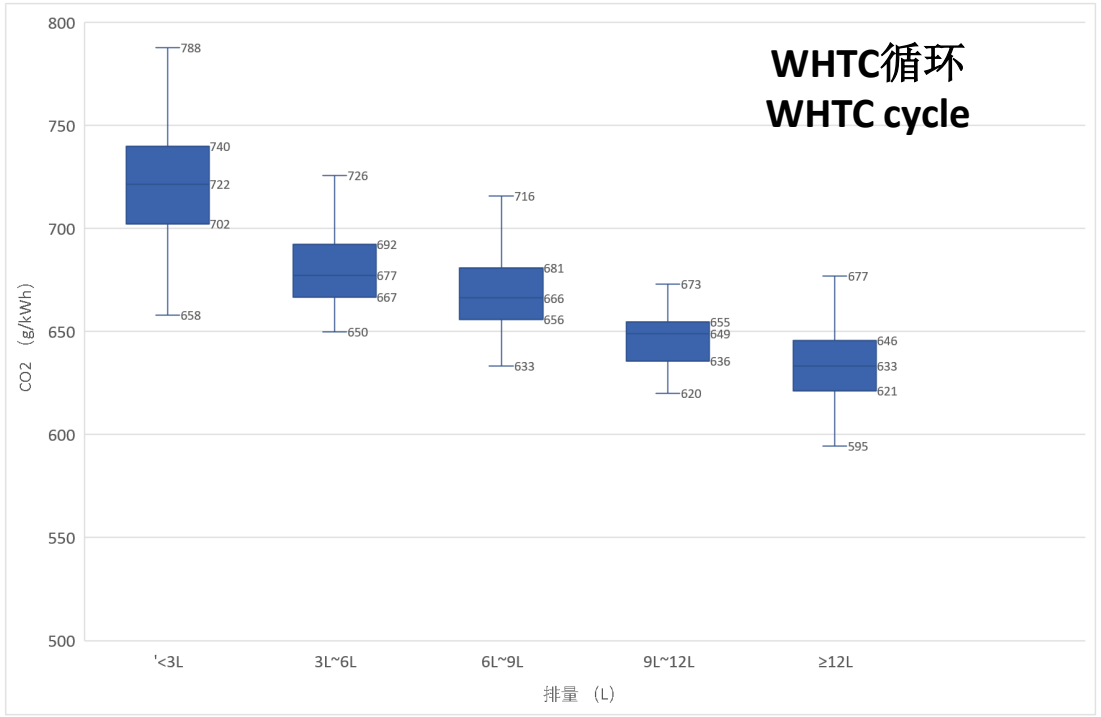
非EGR
NON-EGR

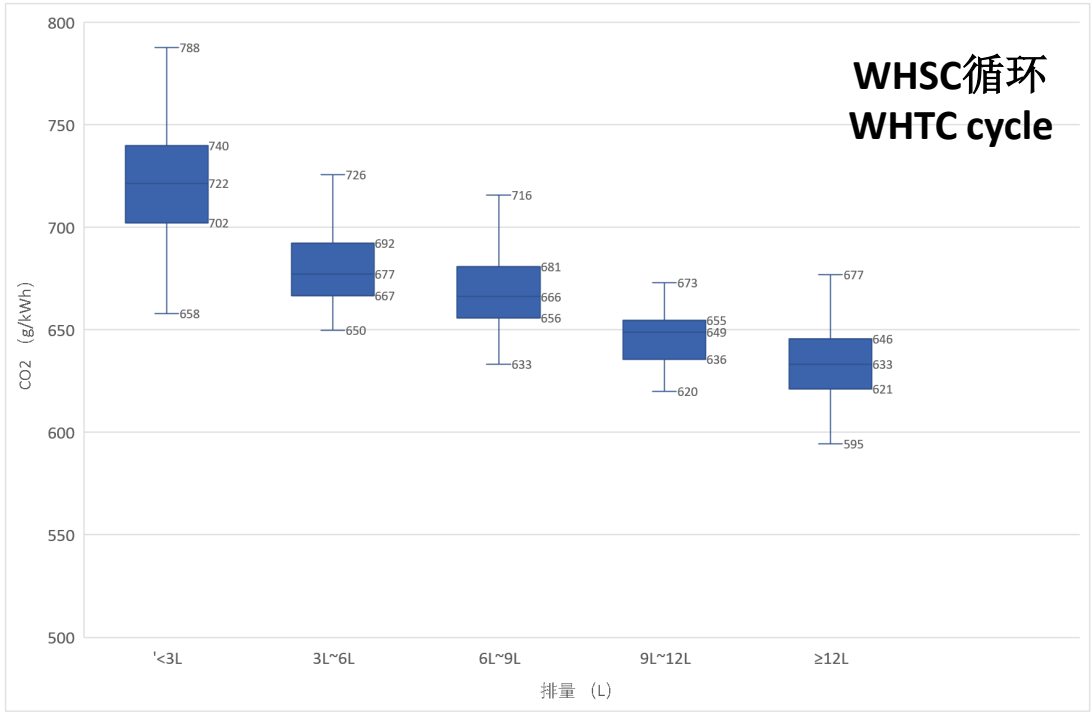




约280台国六柴油发动机(EGR 190+,非EGR 80+)
Approximately 280 National VI diesel engines (EGR 190+, non-EGR 80+)

国六柴油机 CO_2排放分析
China VI diesel engine CO_2 emission analysis



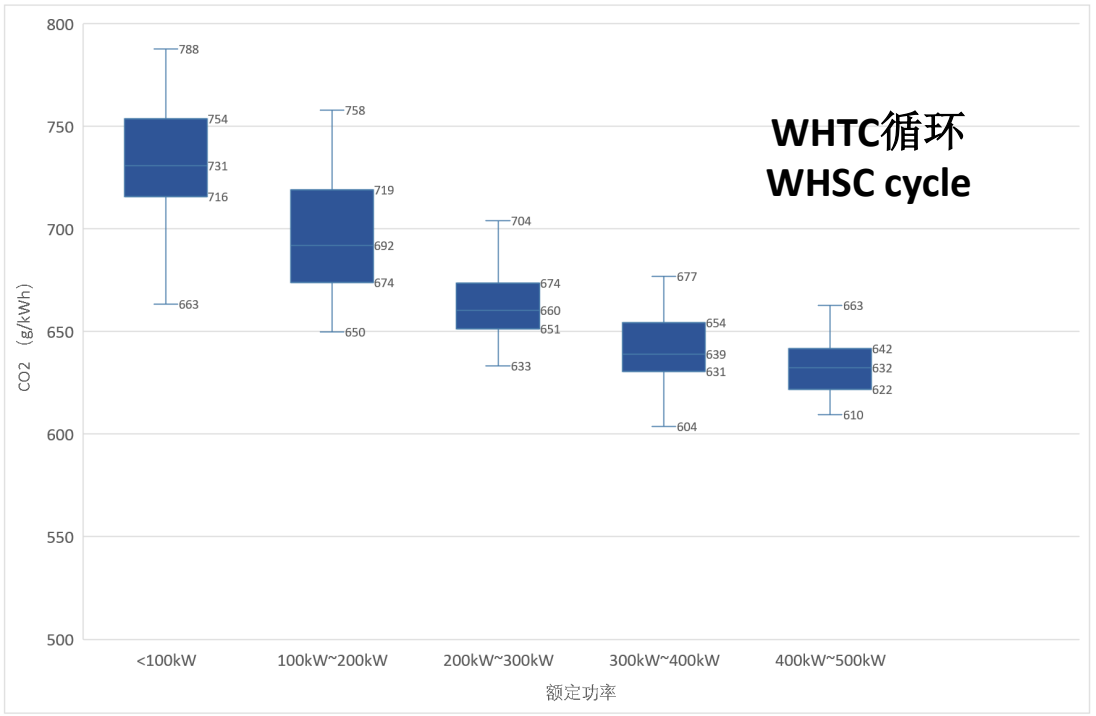


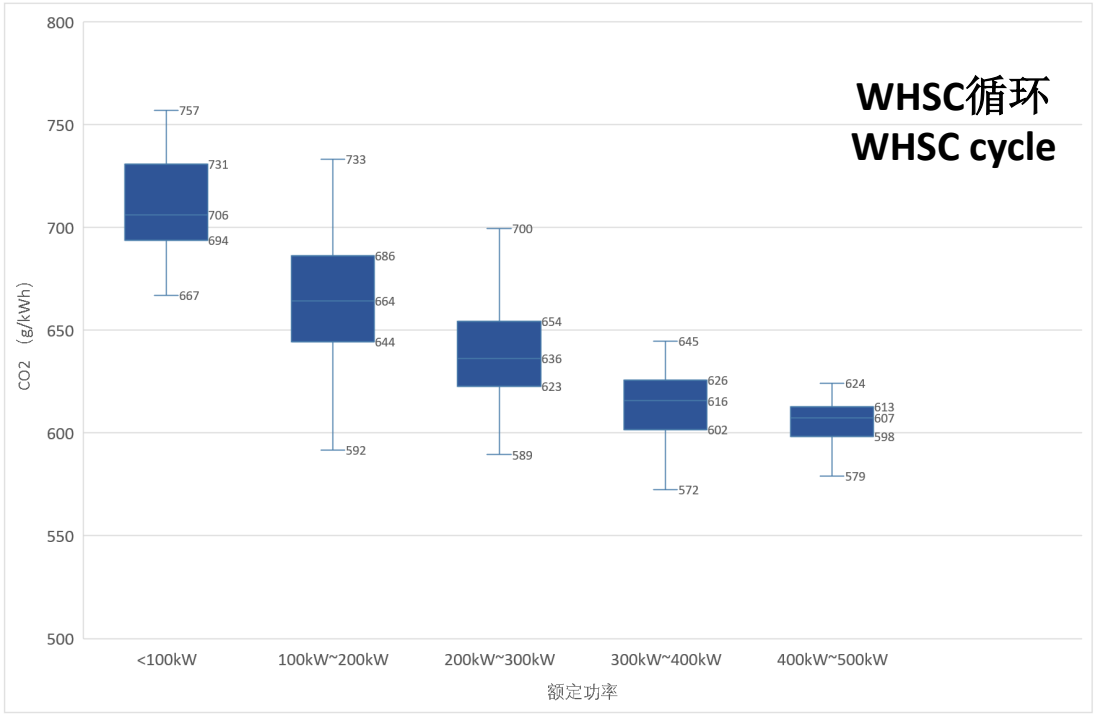
- 不同排量发动机——排量由小到大WHTC/WHSC循环CO2水平呈下降趋势，最大差异约90g/kwh

  Engines with different displacements—the CO2 level of the WHTC/WHSC cycle shows a downward trend from small to large displacement, the maximum difference is about 90g/kwh

约280台国六柴油发动机(EGR 190+,非EGR 80+)
Approximately 280 National VI diesel engines (EGR 190+, non-EGR 80+)

国六柴油机 CO_2排放分析
China VI diesel engine CO_2 emission analysis



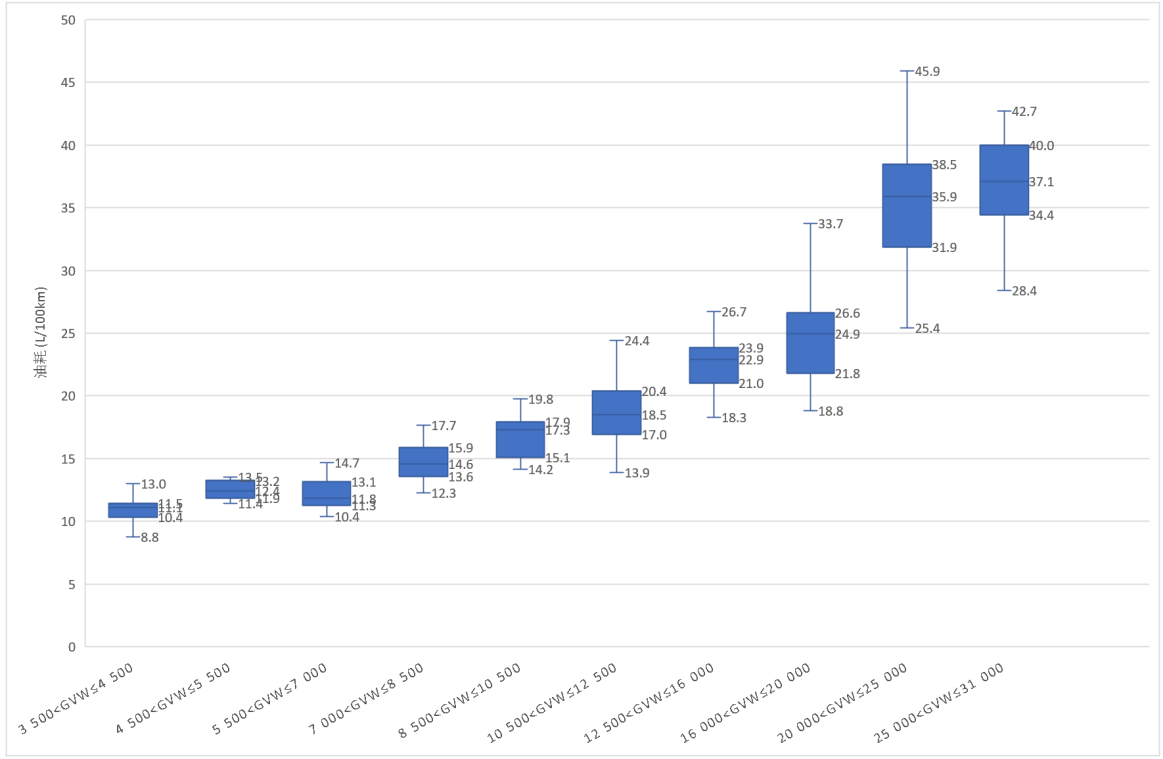


- 不同功率发动机——功率由小到大WHTC/WHSC循环CO_2水平呈下降趋势，最大差异约100g/kwh

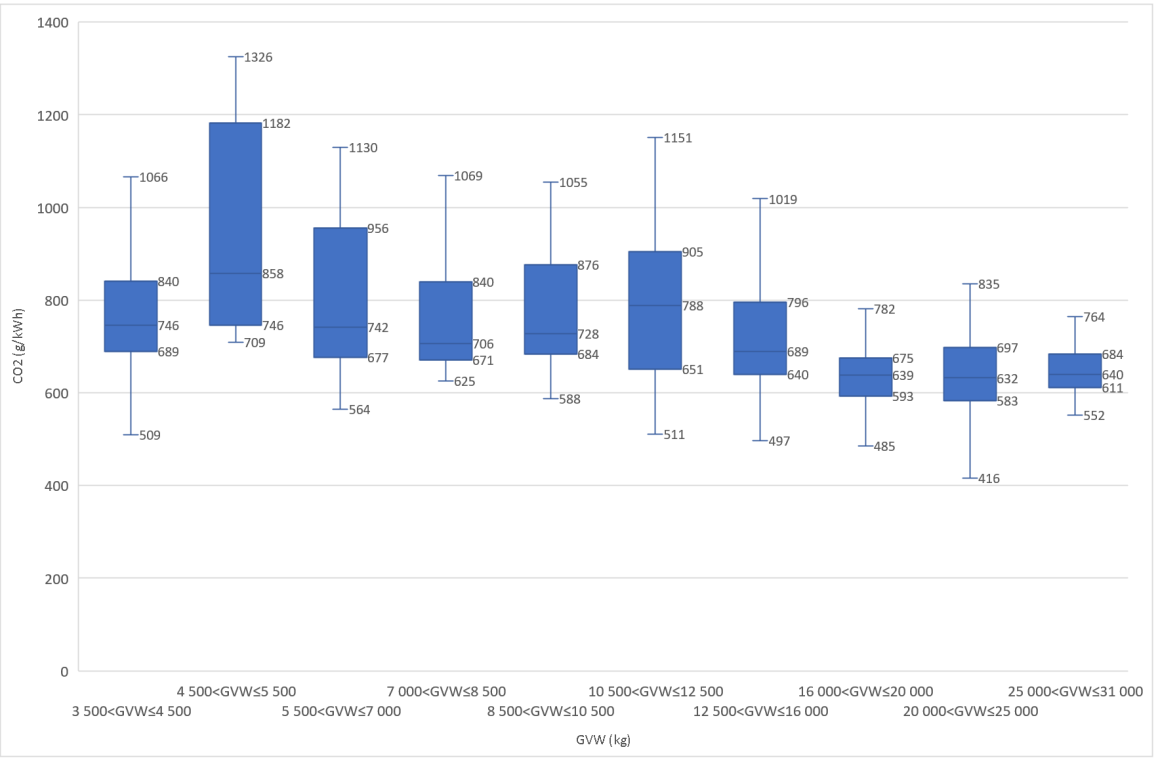
  Engines of different powers—from small to large power, the WHTC/WHSC cycle CO_2 level shows a downward trend, the maximum difference is about 100g/kwh

约280台国六柴油发动机(EGR 190+,非EGR 80+)
Approximately 280 National VI diesel engines (EGR 190+, non-EGR 80+)

国六柴油车油耗及CO2分析
China VI diesel vehicle fuel consumption and CO2 analysis



不同GVW车型油耗水平（C-WTVC）
Fuel consumption levels of different GVW models (C-WTVC)

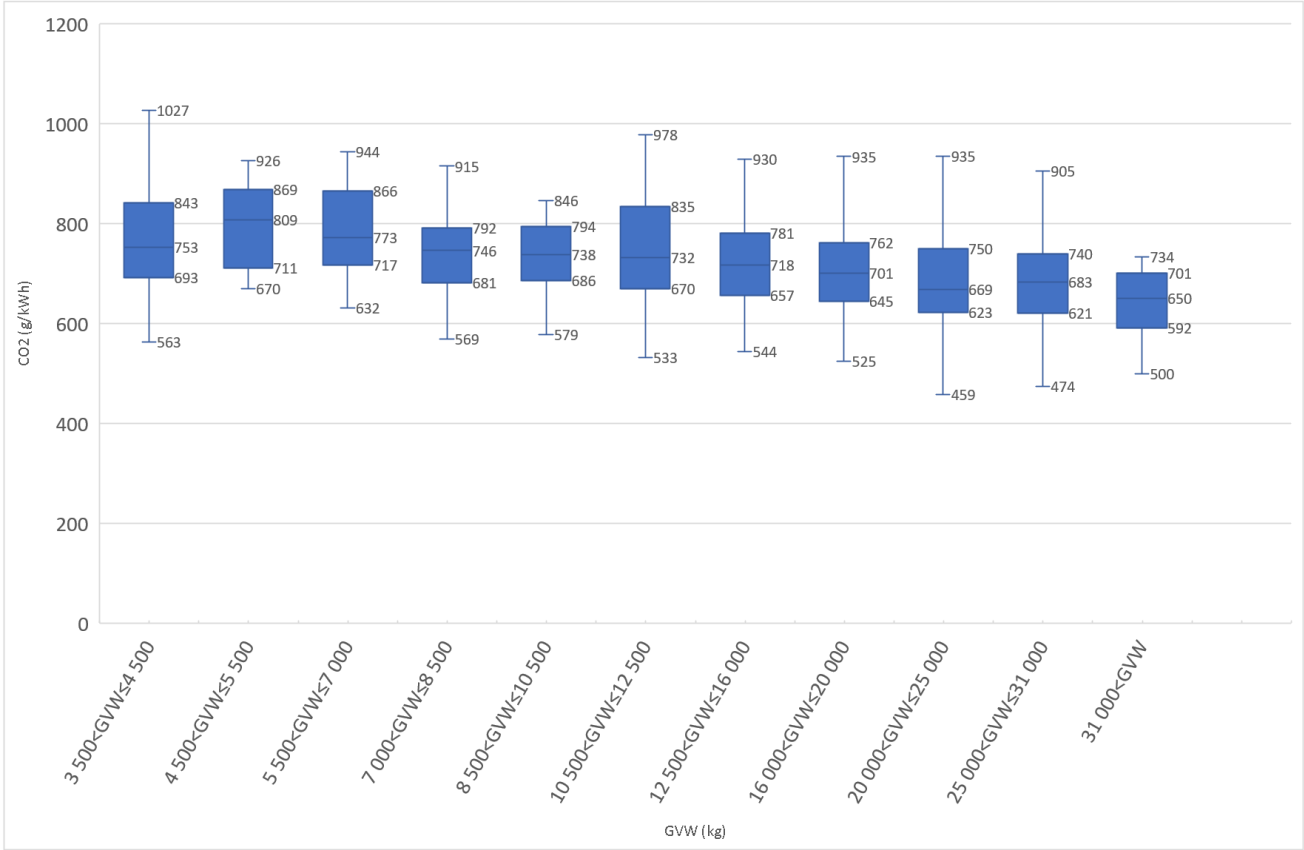


不同GVW车型CO2比排放（C-WTVC）
CO2 percentage of emissions of different GVW models (C-WTVC)

随着GVW 增加， 油耗随之呈增加趋势，CO2比排放随之有下降趋势，但是有波动
With the increase of GVW, fuel consumption will increase, and CO2 emissions will decrease, but fluctuate

435辆国六柴油车， 采用C-WTVC循环，同时采用PEMS设备测量CO2比排放
435 China VI diesel vehicles, using C-WTVC cycle, and simultaneously using POMS equipment to measure CO2 specific emissions

国六柴油车油耗及CO_2分析
China VI diesel vehicle fuel consumption and CO_2 analysis



不同GVW柴油车实际道路测试（PEMS）CO2比排放

Actual road test (PEMS) CO2 emissions of different GVW diesel vehicles

主要由于测试车辆载荷及路线不同导致，随着GVW增加 CO2的比排放趋势有波动

Mainly due to the different loads and routes of the test vehicles, as the GVW increases, the CO2 specific emission trend fluctuates.

约630辆国六柴油车实际道路测试CO2比排放结果

CO2 ratio emission results of about 630 China VI diesel vehicles in actual road tests

第 N 3 部分 | Section

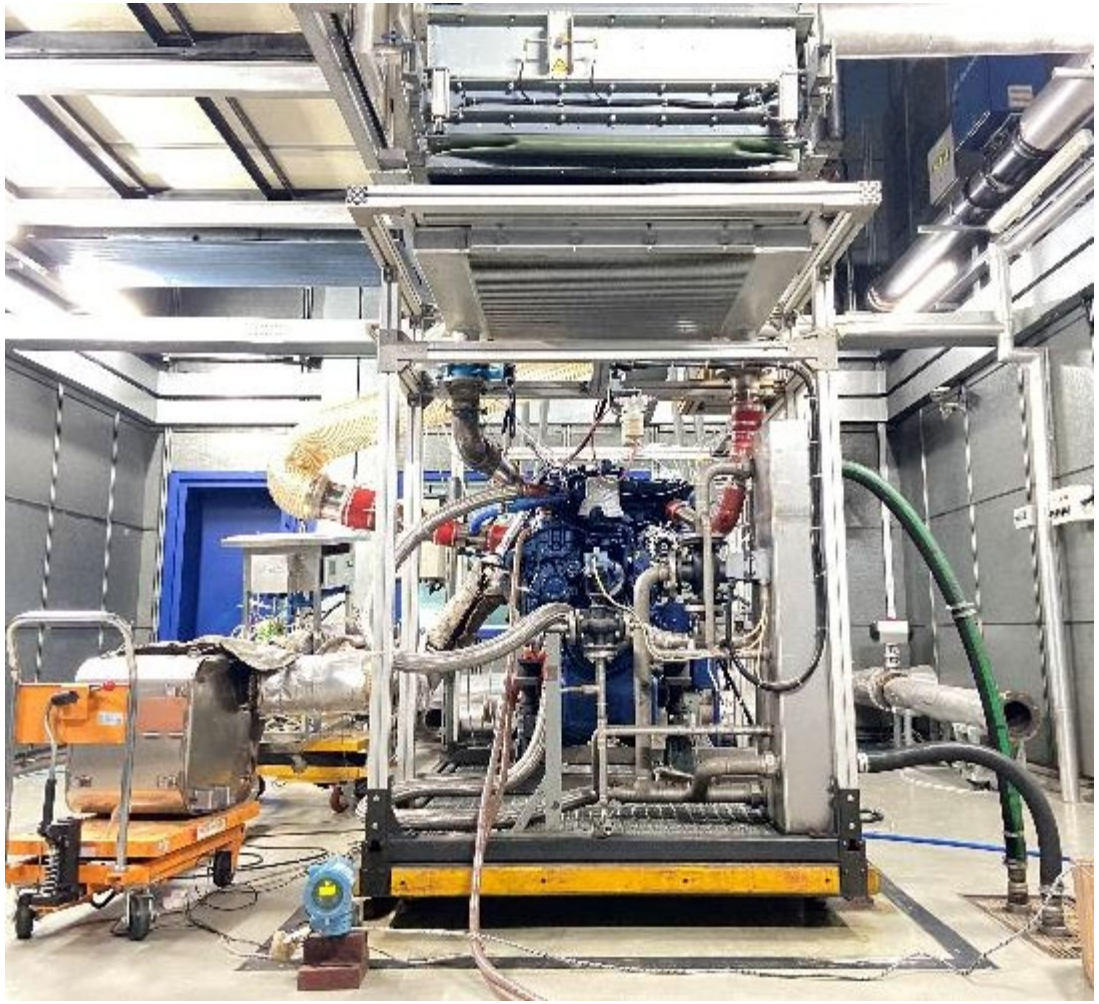
重型车温室气体排放研究计划

Greenhouse Gas Emission Research Plan for Heavy Vehicles

重型车温室气体监管体系对比及规划
Comparison and planning of greenhouse gas monitoring systems for heavy vehicles

内容 Details		欧洲 Europe	美国 US	中国 (计划/研究) China (Planning/Research)
温室气体范围 Range of greenhouse gas		CO2	CO2, CH4, N2O	CO2, CH4, N2O
与其他法规适应性 Compliance with other regulations		CO2 （油耗无限值） CO2 (Unlimited fuel consumption value)	温室气体， 油耗 Greenhouse gas, fuel consumption	CO2与油耗联合管控 CO2 with fuel consumption joint control
限值设置 Limit set		发动机/整车 无限值 Engine/vehicle Unlimited value	发动机限值： Engine limits: • CO2: 按车型分为5小类（牵引车2，专业车辆3） CO2: Divided into 5 sub-categories based on vehicle type (towing vehicle 2, professional vehicle 3)) • CH4, N2O：统一限值 CH4, N2O: Consolidated limit 整车限值： Model limit: CO2：按车型和整车配置分类 • CO2: Classified by model and vehicle configuration	发动机限值：待定 Engine limits: To be determined （统一限值？） (Consolidated limit?) 整车限值：待定 Vehicle limits: To be determined （按照车型及GVW分类？） (Based on model and GVW classification)
监管车辆范围 Range of controlled vehicles		部分（N2、N3车型中的4种） Partial (4 types in N2, N3 models)	全部 Entire	全部？ Entire?
发动机 Engine	测试循环	同排放测试循环（WHTC/WHSC） Same emission test cycle (WHTC/WHSC)	同排放测试循环 Same emission test cycle 牵引车： SET Tractor: SET 专业车辆： FTP Professional vehicle: FTP	同排放测试循环（WHTC/WHSC） Same emission test cycle (WHTC/WHSC)
	单位	g/kwh	g/hp-h	g/kwh
整车 Entire vehicle	测试循环	VECTO 软件模拟 VECTO software simulation	GEM 软件模拟 GEM software simulation	待定 （转鼓 vs 软件模拟 vs PEMS？） To be determined (Rotating drum vs software simulation vs PEMS?)
	单位	g/(ton.km)	g/(ton-mile)	g/(ton.km)
监管方法 Control method	排放控制	企业平均 Company average	单车&发动机限值+ABT交易 Bicycle & engine limit + ABT transaction	单车&发动机限值 （企业平均？） Bicycle & engine limits (Company average?)
	在用符合性	无 None	无 None	?

重型车温室气体排放研究
Greenhouse Gas Emission Research for Heavy Vehicles



发动机——温室气体排放影响因素及评价方法研究
Engines—Study of Influencing Factors and Evaluation Methods of Greenhouse Gas Emissions

- 国六发动机数据分析
  （CO2、CH4、N2O）
  China VI engine data analysis
  (CO2, CH4, N2O)
- 台架试验（WHTC、WHSC）
  温室气体减排能力及影响因素研究
  Bench test (WHTC, WHSC)
  Research on Greenhouse Gas Emission Reduction Capability and Influencing Factors
- 减排技术可行性方案及成本分析
  Emission reduction technology feasibility plan and cost analysis
- 结合国六发动机数据
  探索温室气体排放推荐限值
  Combining China VI engine data
  Explore recommended limits for greenhouse gas emissions

重型车温室气体排放研究
Greenhouse Gas Emission Research for Heavy Vehicles

整车——CO2排放影响因素及评价方法研究
Entire vehicle—CO2study of factors influencing emissions and evaluation methods

1. 国六车辆油耗试验CO2数据分析
   CO2 data analysis of China VI vehicle fuel consumption testing
2. 与油耗标准协同
   coordination with fuel consumption standards
   油耗与CO2排放相关性研究
   Fuel consumption and CO2emission interdependency studies
3. 整车转鼓试验（CWTVC/CHTC）
   Vehicle drum test（CWTVC/CHTC）
   温室气体减排能力及影响因素研究
   Research on Greenhouse Gas Emission
4. 减排技术可行性方案及成本分析
   Feasibility plan and cost analysis of emission reduction technology
5. 探索整车温室气体排放推荐限值
   Explore recommended limits for entire vehicle greenhouse gas emissions

重型车温室气体排放研究
Greenhouse Gas Emission Research for Heavy Vehicles

实际道路—CO2排放影响因素及评价方法
Actual road—CO2study of factors influencing emissions and evaluation methods

国六车辆实际道路测试CO_2数据分析

CO_2 data analysis of actual road test of China VI vehicles

实际道路敏感性和试验结果可重复性分析和验证

Analysis and verification of actual road sensitivity and repeatability of test results

系统劣化对CO_2排放的影响

Impact of system degradation on CO_2 emissions

重型车温室气体排放研究
Greenhouse Gas Emission Research for Heavy Vehicles

基于软件模拟计算的整车CO_2排放评价方法
Evaluation method of vehicle CO_2 emission based on software simulation calculations

1. 现有国际通用软件的适应性（欧洲VECTO，美国GEM2.0等）
Applicability of existing international software (European VECTO, US GEM2.0, etc.)

2. 适用中国车型配置、道路工况的模拟软件方法
A simulation software method suitable for Chinese vehicle configuration and road conditions

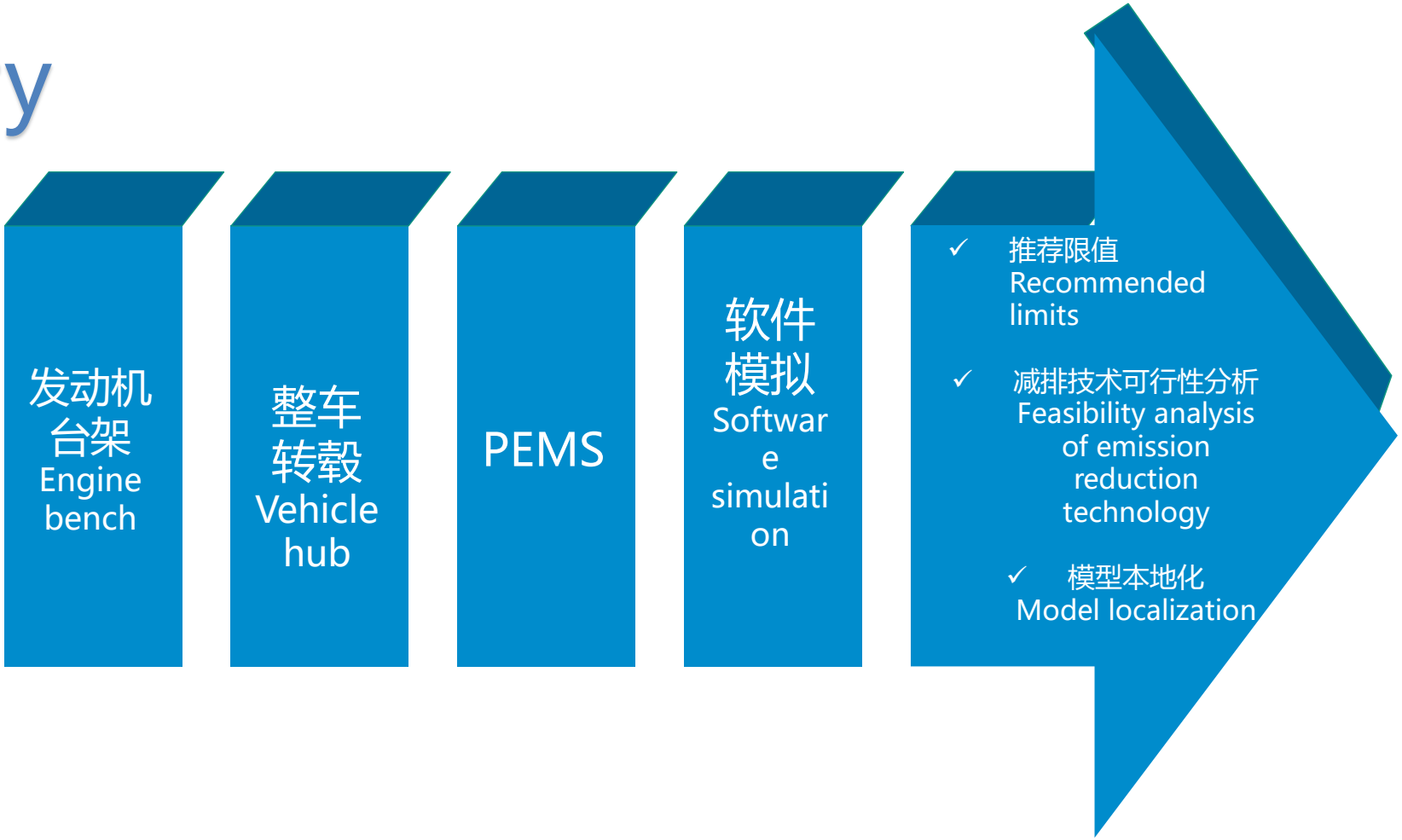
3. 发动机及整车关键参数识别
Identification of key parameters of engine and vehicle

4. 车型分类原则探讨及边界条件
Investigation of the principles of vehicle classification and boundary conditions

5. 软件模拟与实测结果一致性验证
Verification of consistency between software simulation and actual measurement results

重型车温室气体排放研究
Greenhouse Gas Emission Research for Heavy Vehicles

小结
Summary



感谢聆听
Thank you for your attention!