

Non-road mobile machinery (NRMM) engine exhaust emission legislation 非道路机动机械（NRMM）发动机废气排放法规

**4th Sino-EU Workshop on New Emissions Standards and
Regulations for Motor Vehicles, 04 March 2021
第四届中欧机动车辆新排放标准和法规研讨会，2021年3月4日**



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About EUROMOT

关于EUROMOT

- EUROMOT is the European Association of Internal Combustion Engine Manufacturers, seated in Brussels / Belgium

EUROMOT是指位于比利时布鲁塞尔的欧洲内燃机制造商协会

- Our scope | 我们的业务范围：
 - Interest representation for manufacturers of industrial combustion engines
工业内燃机制造商的利益代表
 - International environmental requirements and related legislation such as product safety, certification and testing, fuels, standards,...
国际环境要求和相关立法，例如：产品安全、认证和测试、燃料、标准...
- A non-governmental organization in consultative status at UN-ECE and UN-IMO
一个在联合国欧洲经济委员会和联合国国际海事组织具有咨商地位的非政府组织



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Broad scope | 范围宽广

Non-road Stage V engine emission Regulation (EU) 2016/1628 非道路欧V标准发动机排放法规 (EU) 2016/1628

- General non-road mobile machinery (NRMM) applications ⁽³⁾
- Agricultural tractors ⁽¹⁾⁽³⁾
- Mobile gensets ⁽³⁾
- SI Engines <56 kW ⁽³⁾
- Locomotives & railcars
- Inland waterway vessels
- All terrain vehicles (ATV) and side-by-side vehicles (SbS) ⁽³⁾
- Snowmobiles ⁽³⁾
- 一般非道路机动机械 (NRMM) 应用场景 ⁽³⁾
- 农用拖拉机 ⁽¹⁾⁽³⁾
- 移动发电机组 ⁽³⁾
- SI发动机 <56 kW ⁽³⁾
- 火车头和轨道车辆
- 内河船舶
- 全地形车辆 (ATV) 与并排式车辆 (SbS) ⁽³⁾
- 雪地摩托车 ⁽³⁾

Engine Category 发动机分类

NRE
NRE
NRE (NRG >560kW)
NRS/NRSh
RLL, RLR ⁽²⁾
IWP, IWA ⁽²⁾
ATS
SMB

Includes both CI and SI engines operated on any liquid or gaseous fuel (including diesel, petrol, LPG, natural gas)
包括使用任何液体或气体燃料的CI和SI发动机 (包括柴油、汽油、液化石油气、天然气)

Supplemented by Regulations (EU) 2017/654, 2017/655 & 2017/656
补充法规 (EU) 2017/654、2017/655和2017/656

⁽¹⁾ Via Regulation (EU) 167/2013 | 依据法规 (EU) 167/2013

⁽²⁾ Engines of category NRE < 560 kW may also be used in locomotives, railcars and inland waterway vessels | NRE < 560 kW类别的发动机也可能用于火车头、轨道车辆以及内河船舶

⁽³⁾ Also included in 05 series of UNECE Regulation R96 | 还可能包含于《联合国欧洲经济委员会法规R96》的05系列中

Stage V limit values (category NRE)

欧V标准限制数值 (NRE类别)

Table II-1: Stage V emission limits for engine category NRE defined in point (1) of Article 4(1)

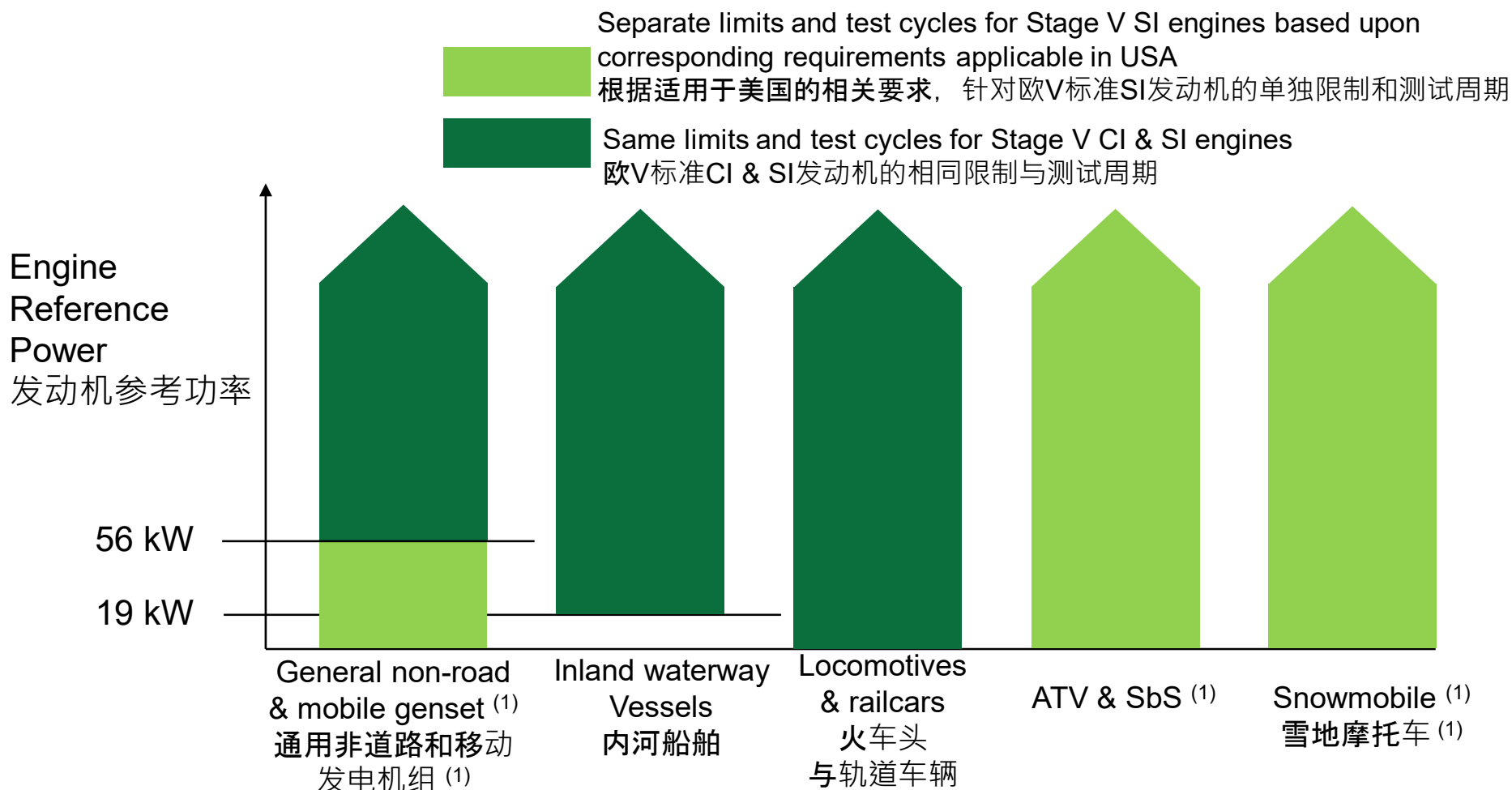
Emission stage	Engine sub-category	Power range	Ignition type	CO	HC	NO _x	PM mass	PN	A
		kW		g/kWh	g/kWh	g/kWh	g/kWh	#/kWh	
Stage V	NRE-v-1 NRE-c-1	0 < P < 8	CI	8,00	(HC + NO _x ≤ 7,50)		0,40 ⁽¹⁾	—	1,10
Stage V	NRE-v-2 NRE-c-2	8 ≤ P < 19	CI	6,60	(HC + NO _x ≤ 7,50)		0,40	—	1,10
Stage V	NRE-v-3 NRE-c-3	19 ≤ P < 37	CI	5,00	(HC + NO _x ≤ 4,70)		0,015	1 × 10 ¹²	1,10
Stage V	NRE-v-4 NRE-c-4	37 ≤ P < 56	CI	5,00	(HC + NO _x ≤ 4,70)		0,015	1 × 10 ¹²	1,10
Stage V	NRE-v-5 NRE-c-5	56 ≤ P < 130	all	5,00	0,19	0,40	0,015	1 × 10 ¹²	1,10
Stage V	NRE-v-6 NRE-c-6	130 ≤ P ≤ 560	all	3,50	0,19	0,40	0,015	1 × 10 ¹²	1,10
Stage V	NRE-v-7 NRE-c-7	P > 560	all	3,50	0,19	3,50	0,045	—	6,00

⁽¹⁾ 0,60 for hand-startable, air-cooled direct injection engines.

- Selective Catalytic Reduction (SCR) generally required 56 – 560 kW (same as Stage IV)
通常需要选择性催化还原 (SCR) 的发动机: 56-560 kW (与欧IV标准相同)
- Diesel Particulate Filter (DPF) required 19 – 560 kW due to PN limit
需要柴油微粒过滤器 (DPF) 的发动机: 19-560 kW (由于PN限制)
- Different limits apply for other engine categories
适用于其他发动机类别的不同限制数值

SI engines in Stage V Regulation (EU) 2016/1628

欧V标准法规（EU）2016/1628中的SI发动机



(1) Also included in 05 series of UNECE Regulation R96
还可能包含于《联合国欧洲经济委员会法规R96》的05系列中

Stage V NRS 19 – 56 kW, ATS & SMB emission limits

欧V标准NRS发动机（19-56 kW）、ATS & SMB发动机排放限制

Emission stage	Engine sub-category	Power range	Ignition type	CO	HC + NO _x
		kW		g/kWh	g/kWh
Stage V	NRS-v-2b NRS-v-3	19 ≤ P < 56	SI	4,40 (*)	2,70 (*)

(*) Optionally, as an alternative, any combination of values satisfying the equation $(HC + NO_x) \times CO^{0.784} \leq 8,57$ as well as the following conditions: $CO \leq 20,6$ g/kWh and $(HC + NO_x) \leq 2,7$ g/kWh

Emission stage	Engine sub-category	Power range	Ignition type	CO	HC + NO _x
		kW		g/kWh	g/kWh
Stage V	ATS-v-1	P > 0	SI	400	8

Emission stage	Engine sub-category	Power range	Ignition type	CO	NO _x	HC
		kW		g/kWh	g/kWh	g/kWh
Stage V	SMB-v-1	P > 0	SI	275	—	75

- For engines $19 \leq P < 30$ kW only applies if swept volume is > 1000 cm³
对于 $19 \leq P < 30$ kW 的发动机，仅适用于排量 > 1000 cm³ 的发动机
- Test cycle C2
测试周期C2
- Additional test cycle LSI-NRTC for engines with maximum test speed ≤ 3400 rpm
额外测试周期LSI-NRTC（如果发动机最大测试速度 ≤ 3400 rpm）
- Test cycle G1
测试周期G1
- Test cycle H
测试周期H

Stage V SI engine categories < 19 kW and $19 \leq P < 30$ kW with swept volume is ≤ 1000 cm³ not covered in these slides
本幻灯片不包括以下欧V标准SI发动机类别：< 19 kW的发动机、 $19 \leq P < 30$ kW且排量 ≤ 1000 cm³的发动机

In-use testing

使用过程测试

- In-use testing is now well established for on-highway vehicles and becoming applicable for non-road mobile machinery in some regions

目前，对于公路车辆的使用过程测试已经非常成熟；在某些地区，使用过程测试也开始适用于非道路机动机械

- Challenge for non-road mobile machinery is much higher than for road vehicles due to wide variety of applications; challenge increases as emissions limit decreases

由于广泛且各异的应用场景，非道路机动机械所面临的挑战远大于公路车辆；随着排放限制数值降低，挑战逐步增加

- EU Stage V in-service monitoring (ISM) programme is a mandated large-scale data-collection research exercise (no pass-fail criteria)

欧盟的欧V标准在线监控 (ISM) 计划一项强制性大规模数据收集研究活动 (没有通过或不通过标准)

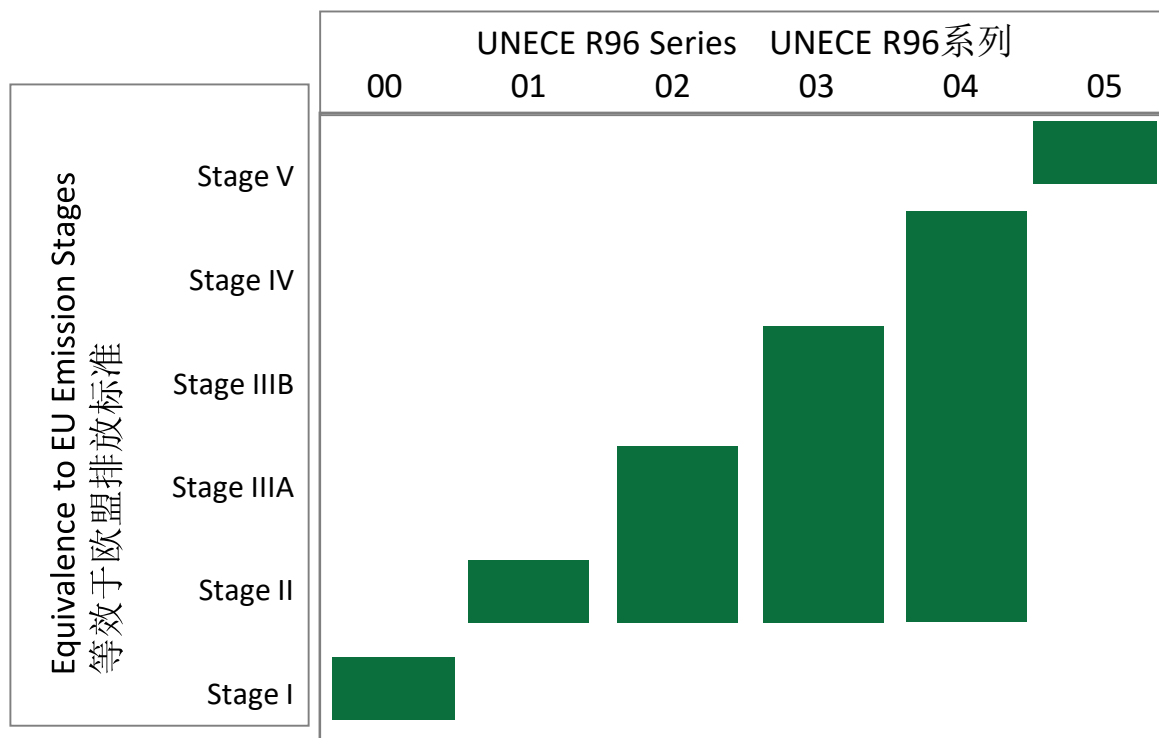
- European Commission expected to evaluate the data in 2025 and report results

欧盟委员会预计将在2025年对数据进行评估并报告结果



Equivalence: EU emission stages and UNECE R96

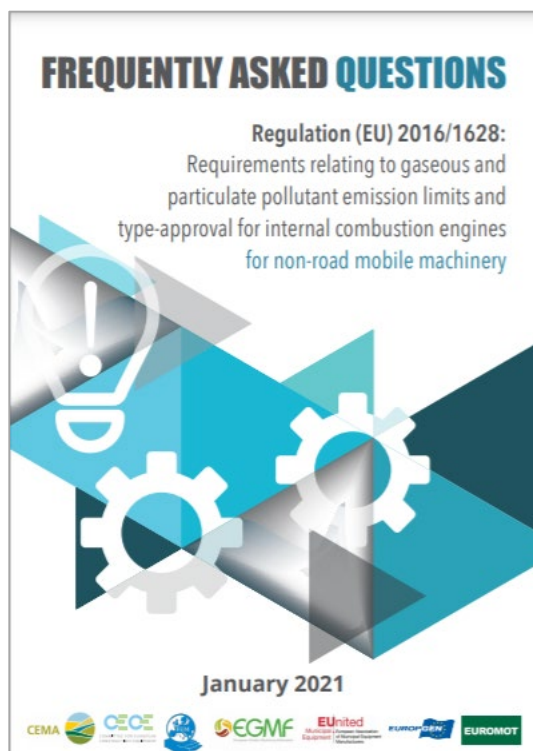
等效性：欧盟排放标准以及 UNECE R96



- UNECE R96 05 series published Feb 2019
发布于2019年的 UNECE R96 05系列
(<http://www.unece.org/fileadmin/DAM/transport/main/wp29/wp29regs/2018/R096r3am2e.pdf>)
- UNECE R96 type-approvals may still be granted to prior series
UNECE R96型批准还可授予之前的各个系列

Industry Stage V Guidance documents

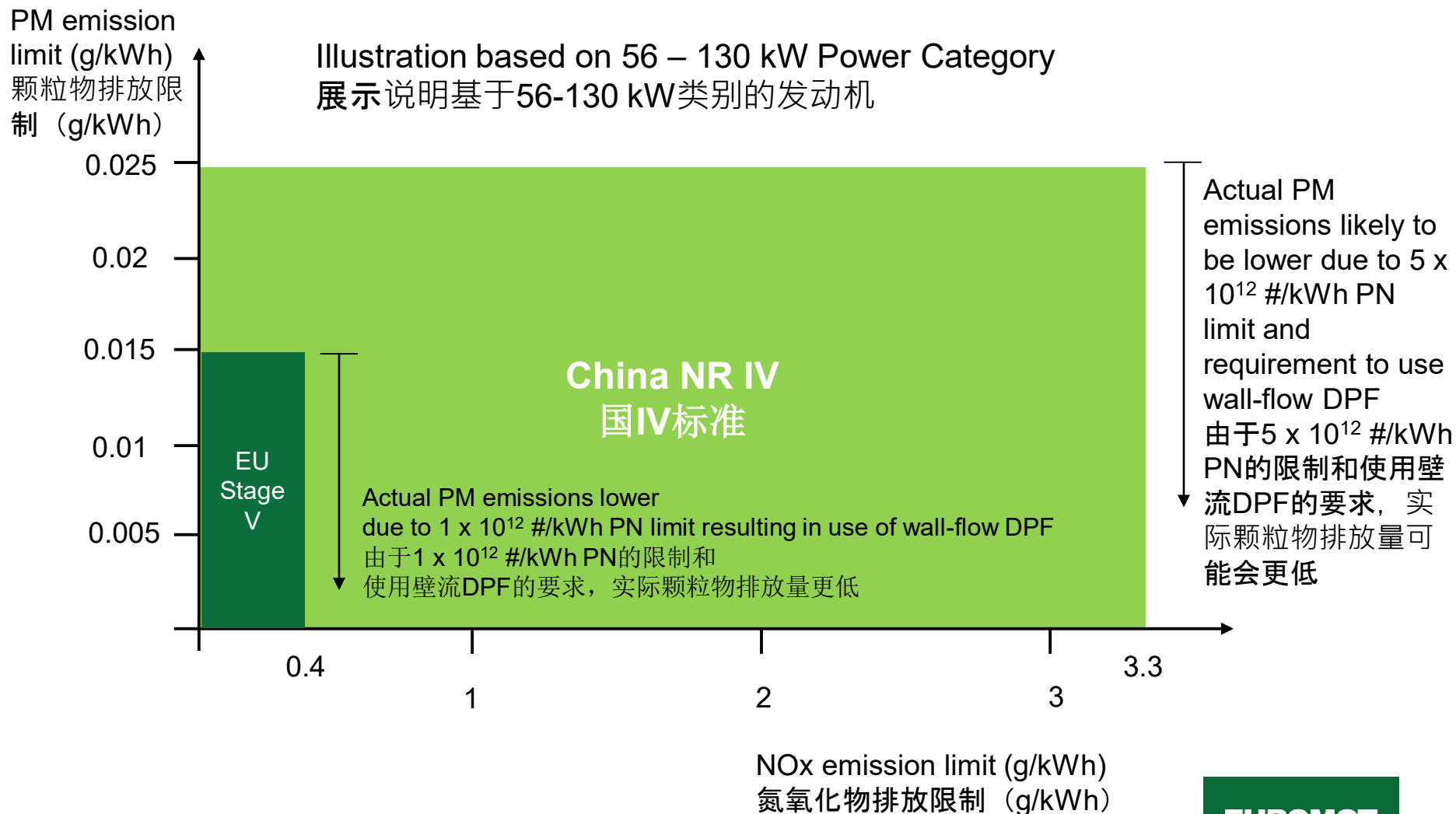
工业欧V标准指南文件



- Industry FAQ guidance documents available from EUROMOT's webpage
工业常见问答指南文件可从EUROMOT网页获取
- Chinese language version of diagnostics guidance
诊断指南的中文版本
- Download from/下载网址
<https://www.euromot.eu/publication-and-events/publications/>
- Unofficial Chinese language version of UNECE R96.05 also available
此外, 还可提供UNECE R96.05的非官方中文版本

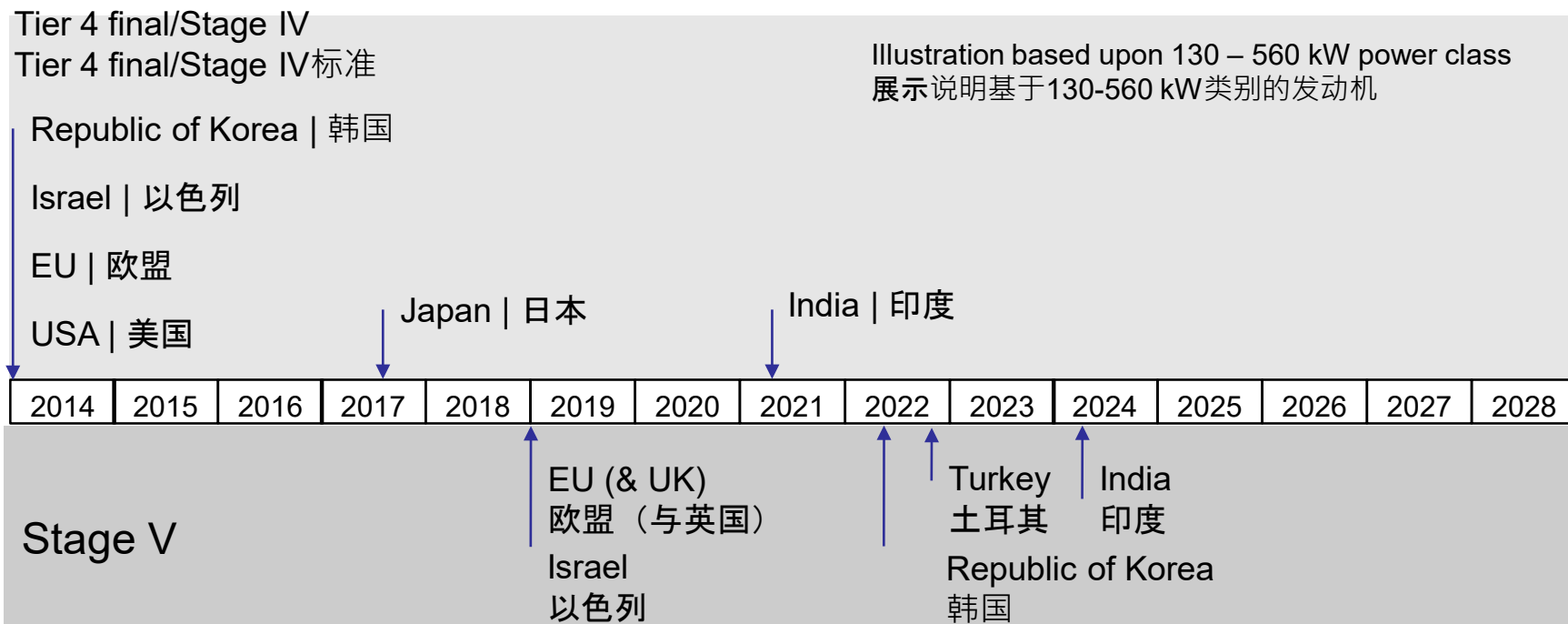
EU Stage V versus China NR IV

欧V标准 vs 国IV标准



Legislation with similar stringency to US EPA Tier 4 final & EU/UNECE Stage IV or V

与美国EPA Tier 4 final和EU/UNECE欧IV或V标准同样严格的法规



- Global alignment key for NRMM engine emissions
- 非道路机动机械发动机排放的全球统一关键
- Not necessary to repeat EU ISM research programme in multiple regions
- 没有必要在多个地区重复欧盟的ISM研究计划

Key elements for development of future regulation

制定未来法规的关键因素

GLOBAL VIEW 全球视野

Seek global alignment through international forums and avoid regional requirements
通过国际论坛寻求全球统一，避免地区性要求

FOLLOW (NOT LEAD) ON-HIGHWAY 遵循（而非领导）公路用途发动机标准

On-highway provides a higher production volume platform to evaluate new technical content
公路应用场景可提供一个更高产量的平台，用于评价新的技术内容

ROBUST TECHNICAL ASSESSMENT 稳健的技术评估

Evaluate technical feasibility of any content that is new or adapted from on-highway
评估任何全新或取自公路应用场景的内容之技术可行性

ROBUST IMPACT ASSESSMENT 稳健的影响评估

Evaluate cost versus benefit of any new content
评估任何新内容的成本与收益

ROBUST TEST PROCEDURES 稳健的测试程序

Use proven internationally developed procedures appropriate to the specified emission level
使用经过国际验证、适用于规定排放水平的程序

SUFFICIENT STABILITY BETWEEN STAGES 保持各阶段间的充分稳定性

Ensure time is long enough to recover investment
确保时间足够长，能够收回投资

SUFFICIENT LEAD-TIME AFTER OFFICIAL PUBLICATION 在官方发布之后确保足够的前置时间

Ensure enough time to develop products
确保有足够的时间来开发产品

Thank you for your attention
谢谢！



EUROMOT aisbl

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