



UGM Emission Reduction Technologies

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Caterpillar Emission Solutions for UGM Equipment

Ventilation Reduction
(VR)



Battery Electric
(in development)

Ventilation Reduction
(VR) + Flow Through
Filter (FTF)

EU Stage IV & V

Ventilation Reduction
(VR) + Wall Flow Filter
(WFF)

Selected
models only



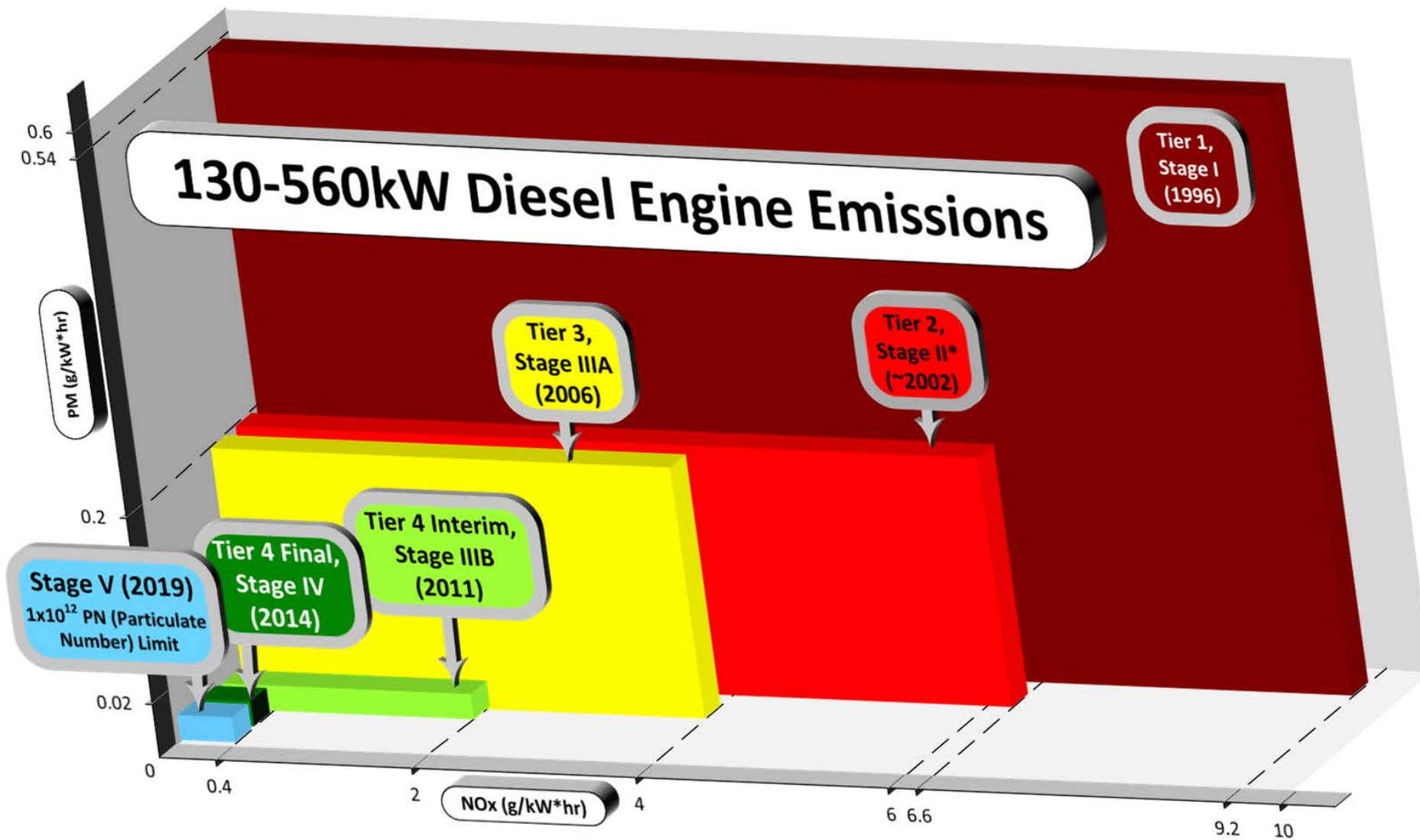
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DPM reductions for UGM

- Ventilation Reduction options available for many Cat M/NM products:
 - Lower PM engine calibrations
 - Flow Through Filter (DPM reduced 50%)
 - Wall Flow Filter (DPM reduced 98%)

(Surface) Nonroad Emissions Standards



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Stage V Emission Reduction for UGM

- Stage V technologies being implemented for M/NM mining:
Includes Wall Flow Filter and SCR/DEF.
(Coal has performance requirements that are incompatible with Stage V)
- Additional safety design requirements apply
(eg. engine shutdown)
- DEF storage may be an issue.
(Exceeding 32°C/90°F will result in accelerated decay)
- DEF/SCR systems may emit traces of ammonia

Stage V Aftertreatment Configurations

Engine Models	Power Category [kW]	Stage V NOx Limit [g/(kW*hr)]	Stage V PM Limit [g/(kW*hr)]	Aftertreatment		
C0.5 – C1.5	< 19	7.5 *	0.4	no aftertreatment		
C1.5 - C3.6	19 - 56	4.7 *	0.015	DOC	DPF	
C3.6 – C18	56 – 560	0.4	0.015	DOC	DPF	SCR
C18 – C32	> 560	3.5**	0.045**	DOC		
3500, C175						SCR

* NOx limit includes HC (hydrocarbons)

** Non-genset limit stated. Gensets >560kW have more stringent emission limits.

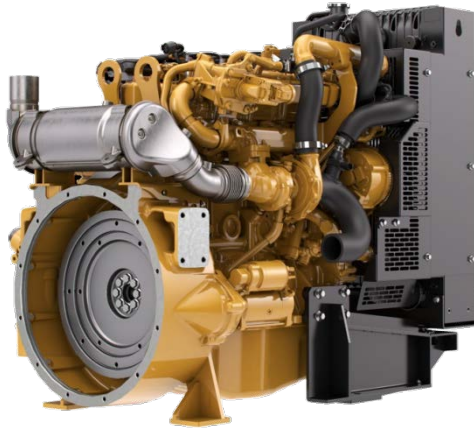
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Aftertreatment Configurations

Examples of engine + aftertreatment configurations:



C3.4
DOC+DPF



C4.4
DOC+DPF+SCR



C7.1
DOC+DPF+SCR

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Caterpillar R1700, available with Stage V engine.



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Other Stage V models in development

- AD45, AD60



- R2900 LHD



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Battery Electric machines are in development

- Stay tuned!



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