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Federal Department of the Environment,
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Federal Office for the Environment FOEN
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Analysis of Swiss vehicle database for ECE-R51/02 and proposals for noise limit values from EC, Ger, Jap

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Agenda

- Questions to be analyzed
- Available basic information
- Evaluation procedure
- Analysis ECE R51/02
- Analysis Proposals EC, Ger, Jap
  - number of vehicles, accumulated sound energy level
  - consequences of category shifts
  - Vehicle and accumulated sound level increase over the past 15 years
- Comparison phase 1 vs phase 3 for proposals

Questions

- Numbers of vehicles and accumulated noise levels in CH for vehicle categories (ECE R51/02) -> Dominant categories?
- Specific increases for vehicle categories from 1998 – 2012 ?
- Numbers of vehicles and accumulated noise levels in CH for vehicle categories (Proposals EC, Ger, Jap) -> Dominant categories?
- Consequences for proposed shifts (Cat M1a to M1b/c, Cat M3a to M3b/c, Cat N2a to N2b)?
- Reduction of accumulated sound levels step 1 and step 3 for proposals EC, Ger, Jap vs ECE R51/02)?

Available basic information

- FEDRO database: list of vehicles with date of first registration (1996-2012) and
  - number of seats
  - engine power
  - total weight
  - vehicle code (SWISS categories)
  - → proposal according to Chinese position could not be considered (length of vehicle not recorded)

Available basic information

- ECE R51/02 classification scheme with Limit values
- Classification schemes according to proposal of EC, Germany and Japan with Limit values
  - EC: Proposal COM(2011)0856, as referred to in inf doc GRB-55-16
  - Germany: inf doc GRB-54-03
  - Japan: inf doc GRB-56-05
- VENOLIVA report (Vehicle Noise Limit Values – comparison of two noise emission test methods – Final Report, MON-RPT-2010-02103, TNO Science and Industry, 2011.)
  - → conversion of existing Limit values (ECE-R 51/02) into estimated values obtained with the new measurement method

Evaluation procedure

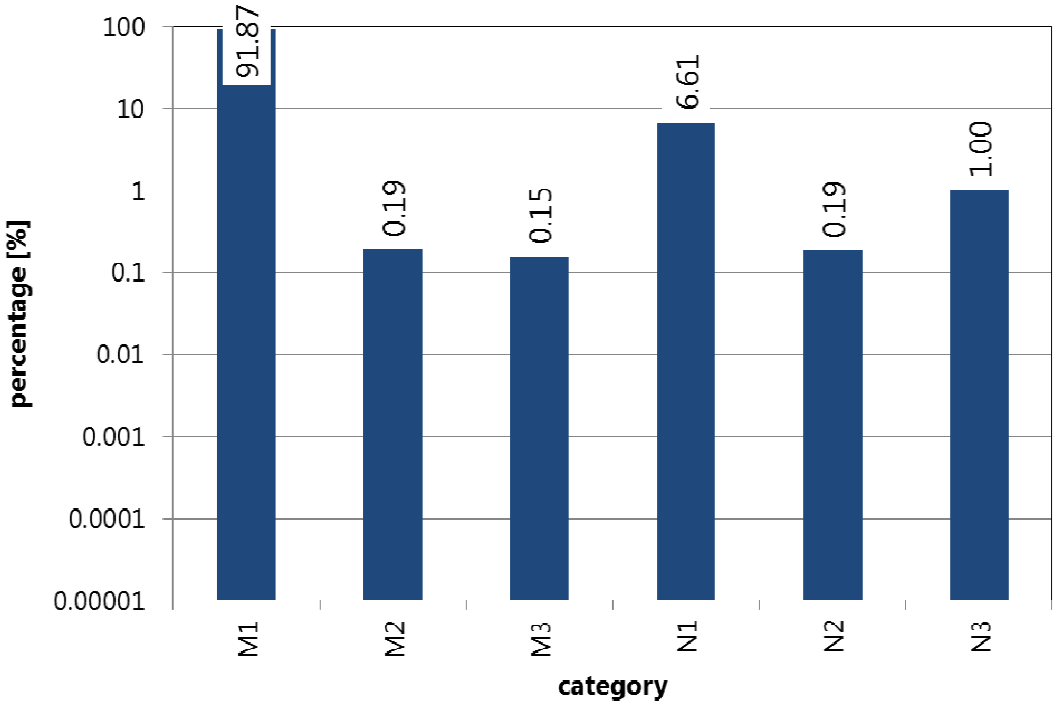
- check for plausibility of vehicle data:
  - 2 kW/t < power/mass-ratio PMR < 999 kW/t
  - 1.2% of vehicles rejected
  - 5’241’870 vehicles valid

Evaluation procedure

- mapping of each vehicle to specific classification scheme (ECE-R51/02) and proposals EC, Germany and Japan)
  - evaluation of number of vehicles
  - energetic accumulation of Limit values
  - evaluation of changes for time period 1998-2000 and 2010-2012
- Comparison of noise reduction of proposals by energetic accumulation of proposed limit values

Evaluation procedure

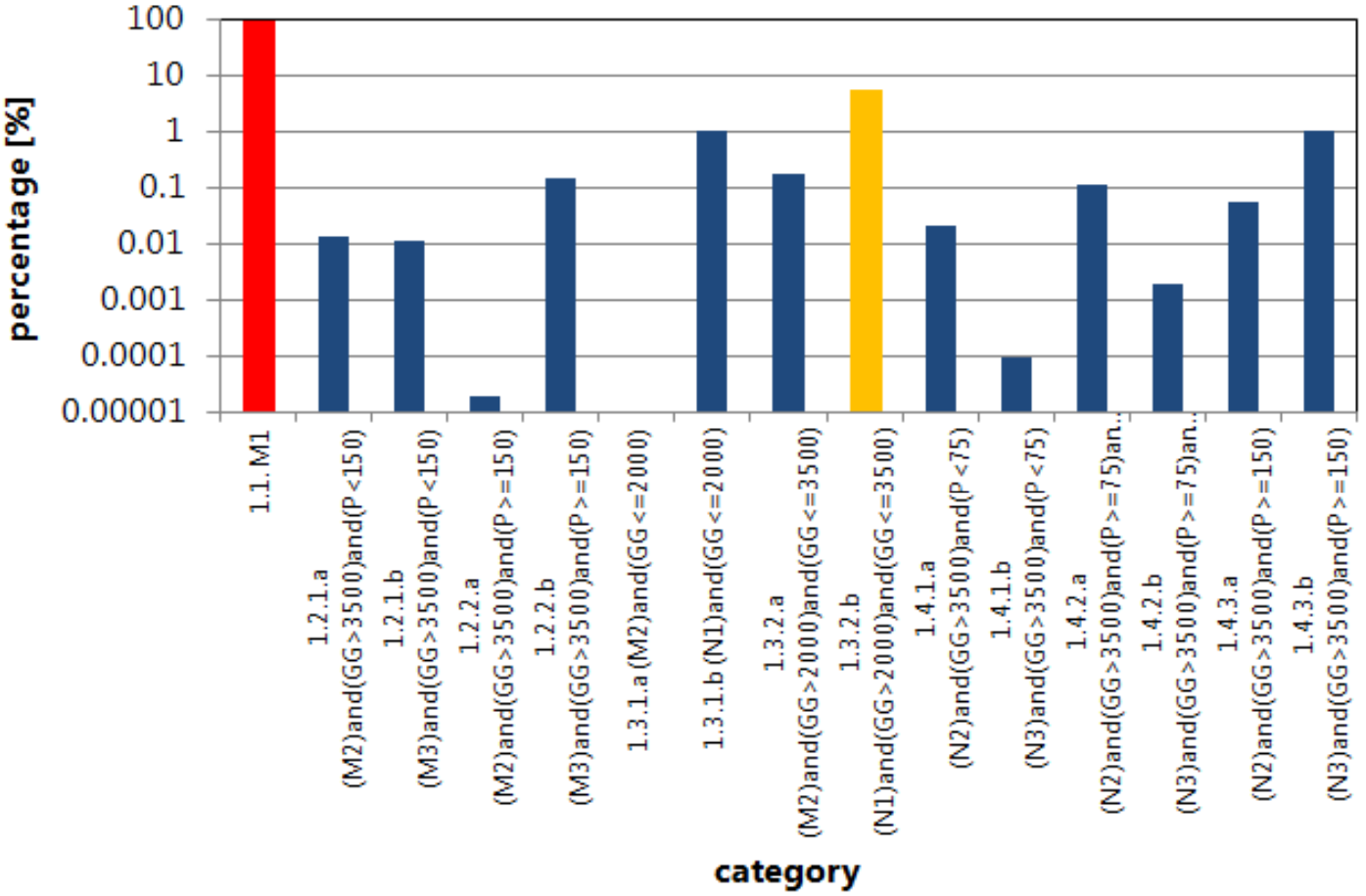
- mapping of each vehicle to M1..N3 class (including subdivisions):



M1	PMR ≤ 120 kW/t	M1 a
	120 < PMR ≤ 160 kW/t	M1 b
	PMR > 160 kW/t	M1 c
M2	GVW ≤ 2.5 to	M2 a
	2.5 to < GVW ≤ 3.5 to	….
	GVW > 3.5 to GVW	….
M3	P ≤ 180 kW	
	180 < P ≤ 250 kW	….
	P > 250 kW	….

Example of subdivisions from proposal Germany (exerpt from inf doc GRB-54-03)

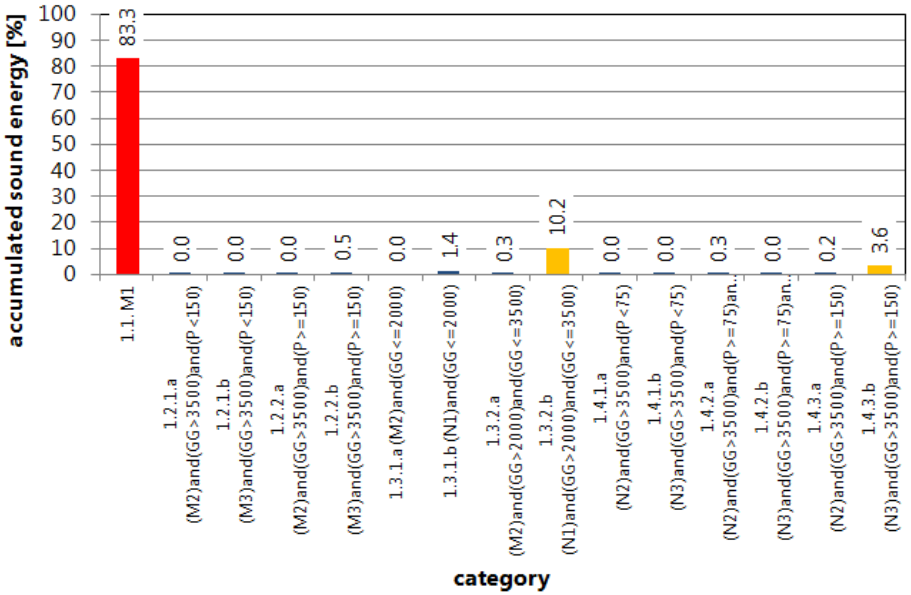
Enrolled vehicles per categorie (ECE-R51/02)

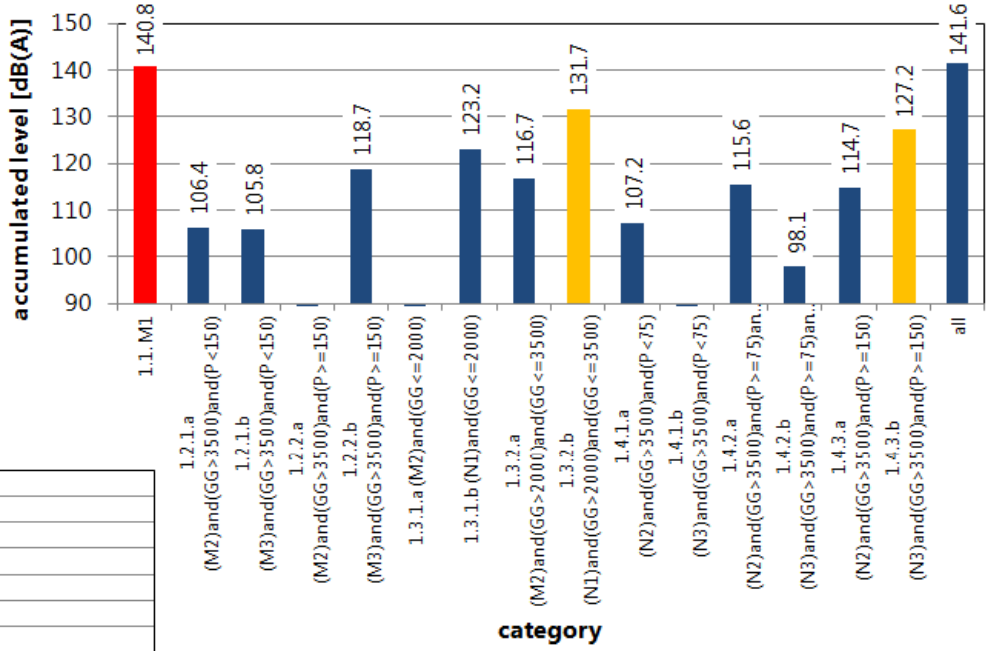


- Vehicle categories M1 (91.9%) and N1 with 2000 t < GW ≤ 3500 t (5.6%) of total enrolled vehicles CH 1996 - 2012

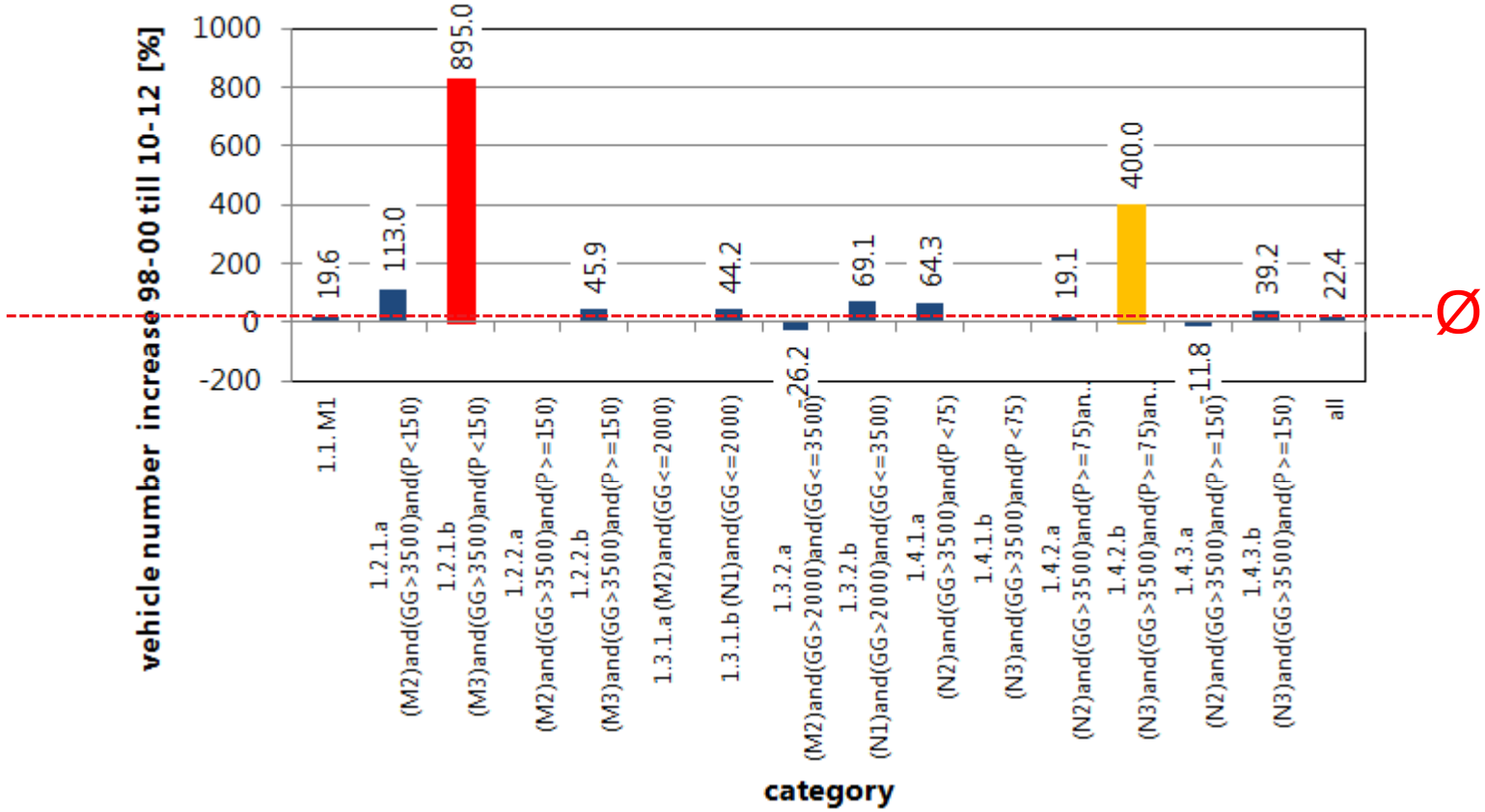
Enrolled vehicles vs accumulated sound energy (ECE-R51/02)

Vehicle categorie	# Vehicles [%]	Acc. sound energy [%]
M1	91.9	83.3
N1 with 2000 t < GW ≤ 3500 t	5.6	10.2
N3 with P ≥ 150 kW	1	3.6





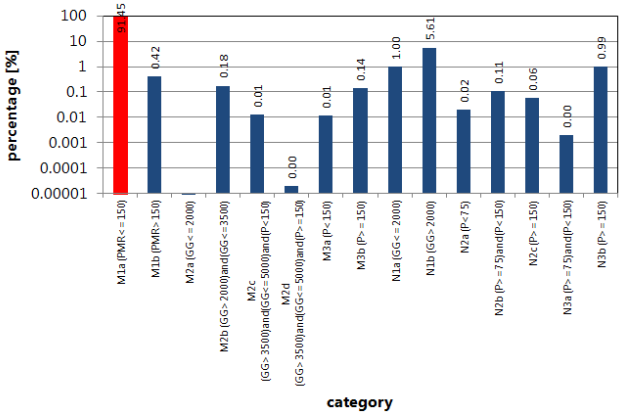
Vehicle increase per categorie (ECE-R51/2)



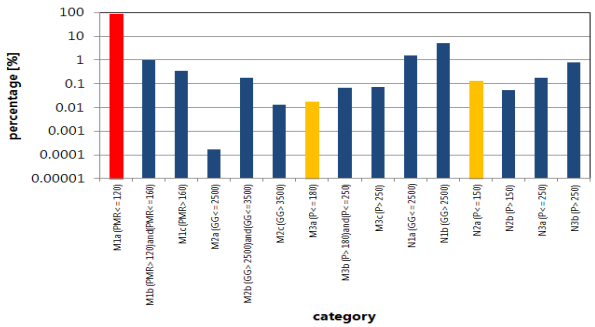
- Disproportionate increase for categories:
  - M3 with P<150 kW
  - N3 with 75 kW ≤ P < 150 kW

Analysis M Cat for proposals EC, Ger, Jap

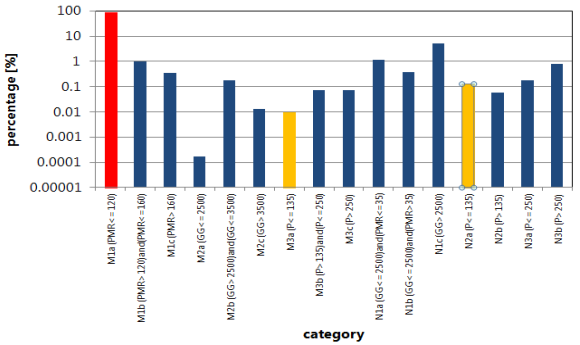
EC (COM(2011)0856



Germany



Japan



% Total Vehicles per Category	Subcategory	% Total Vehicles proposal EU	% Total Vehicles proposal Ger	% Total Vehicles proposal Jap
M1 91.9 %	M1a	91.45	90.57	90.57
	M1b	0.42	0.96	0.96
	M1c	-	0.34	0.34
M2 0.19 %	M2 a	0.0	<< 0.0	<< 0.0
	M2 b	0.18	0.18	0.18
	M2 c	0.01	0.01	0.01
	M2 d	<< 0.0	-	-
M3 0.15 %	M3 a	0.01	0.01728	0.00984
	M3 b	0.14	0.06505	0.07249
	M3 c	-	0.07057	0.07057

- Shift Cat M1 a from 150 kW/t (EC) to 120 kW/t (Ger, Jap): 0.88 % of vehicles (46'000 vehicles) in Cat M1 a to higher Cats M1 b/c
- Shift Cat M3 a from 180 kW (Ger) to 135 kW (Jap): 57% of vehicles (390 vehicles) in Cat M3 a to higher Cat M3 b

Analysis N Cat for proposals EC, Ger, Jap

% Total Vehicles per Categorie	Subcat.	% Total Vehicles proposal EU	% Total Vehicles proposal Ger	% Total Vehicles proposal Jap
N 1 6.6 %	N1 a	1.00	1.56	1.18
	N1 b	5.61	5.04	0.38
	N1 c	-	-	5.04
N2 0.19 %	N2 a	0.020088	0.13114	0.12778
	N2 b	0.110877	0.05586	0.05922
	N2 c	0.056030	-	-
N3 0.99 %	N3 a	0.002	0.18	0.18
	N3 b	1.00	0.81	0.81

- Shift Cat N2 a from 150 kW (Ger) to 135 kW (Jap): 2.5 % of vehicles (176 vehicles) in Cat N2 a to higher Cat N2 b

Analysis M Cat sound energy EC, Ger, Jap

% Total Vehicles per Category	Subcategory	% Total Vehicles proposal EU	% Total sound energy EU	% Total Vehicles proposal Ger	% Total sound energy Ger	% Total Vehicles proposal Jap	% Total sound energy Jap
M1 91.9 %	M1a	91.45	80.2	90.57	76.7	90.57	77.9
	M1b	0.42	0.5	0.96	1.3	0.96	1.3
	M1c	-	-	0.34	0.9	0.34	0.7
M2 0.19 %	M2 a	0.0	0.0	<< 0.0	0.0	<< 0.0	0.0
	M2 b	0.18	0.3	0.18	0.3	0.18	0.3
	M2 c	0.01	0.0	0.01	0.0	0.01	0.0
	M2 d	<< 0.0	0.0	-	-	-	-
M3 0.15 %	M3 a	0.01	0.0	0.01728	0.0	0.00984	0.0
	M3 b	0.14	0.6	0.06505	0.3	0.07249	0.4
	M3 c	-	-	0.07057	0.4	0.07057	0.4

- Shift of 0.88% total vehicles (EU vs Ger/Jap) from Cat M1 a to Cat M1b/c leads to a shift of 3.5% (Ger) resp. 2.3% (Jap) for accumulated sound energy -> louder cars allowed in proposals Ger, Jap have an increased impact on total noise level

Analysis N Cat sound engery EC, Ger, Jap

% Total Vehicles per Categorie	Subcat.	% Total Vehicles proposal EU	% Total sound energy EU	% Total Vehicles proposal Ger	% Total sound energy Ger	% Total Vehicles proposal Jap	% Total sound energy Jap
N 1 6.6 %	N1 a	1.00	1.1	1.56	1.3	1.18	1.6
	N1 b	5.61	7.8	5.04	8.4	0.38	0.3
	N1 c	-	-	-	-	5.04	8.5
N2 0.19 %	N2 a	0.020088	0.0	0.13114	0.3	0.12778	0.3
	N2 b	0.110877	0.3	0.05586	0.2	0.05922	0.3
	N2 c	0.056030	0.2	-	-	-	-
N3 0.99 %	N3 a	0.002	0.0	0.18	1.2	0.18	1.0
	N3 b	1.00	8.8	0.81	8.6	0.81	6.9

- > 90% of Vehicles in Cat N1 b (EU, Ger) shift to higher Cat N1 c (Jap), new Cat N1 c in Jap proposal has 8.5% of total accumulated sound energy of all vehicles (M+N)
- Cat N3 b: 0.8% of Vehicles have > 8% of total accumulated sound energy of all vehicles (M+N)

Vehicle and total sound level increase per category M (proposals EC, Ger, Jap)

Category	% Vehicle increase EU	Acc. sound level increase EU [dB]	% Vehicle increase Ger	Acc. sound level increase Ger [dB]	% Vehicle increase Jap	Acc. sound level increase Jap [dB]
All Cat (M+N)	22.4	1.0	22.4	1.0	22.4	1.0
M1 a	18.9	0.8	18.1	0.7	18.1	0.7
M1 b	625.1	8.6	201.1	4.8	201.1	4.8
M1 c	-	-	498.1	7.8	498.1	7.8
M2 a	0.0	0.0	- 66.7	- 4.8	- 66.7	- 4.8
M2 b	- 26.2	-1.3	- 26.1	- 1.3	- 26.1	- 1.3
M2 c	113.0	3.3	113.0	3.3	113.0	3.3
M2 d	0.0	0.0	-	-	-	-
M3 a	895.0	10	170.1	4.3	495.0	7.8
M3 b	45.9	1.6	- 0.4	0.0	8.3	0.3
M3 c	-	-	118.9	3.4	118.9	3.4

Increase for time period 1998-2000 and 2010-2012

- Disproportionate increase for categories:
  - M1 b (EU) and especially M1 b / M1 c (Ger, Jap) -> high powered cars became more dominant
  - M3 a and M3 b / M3c

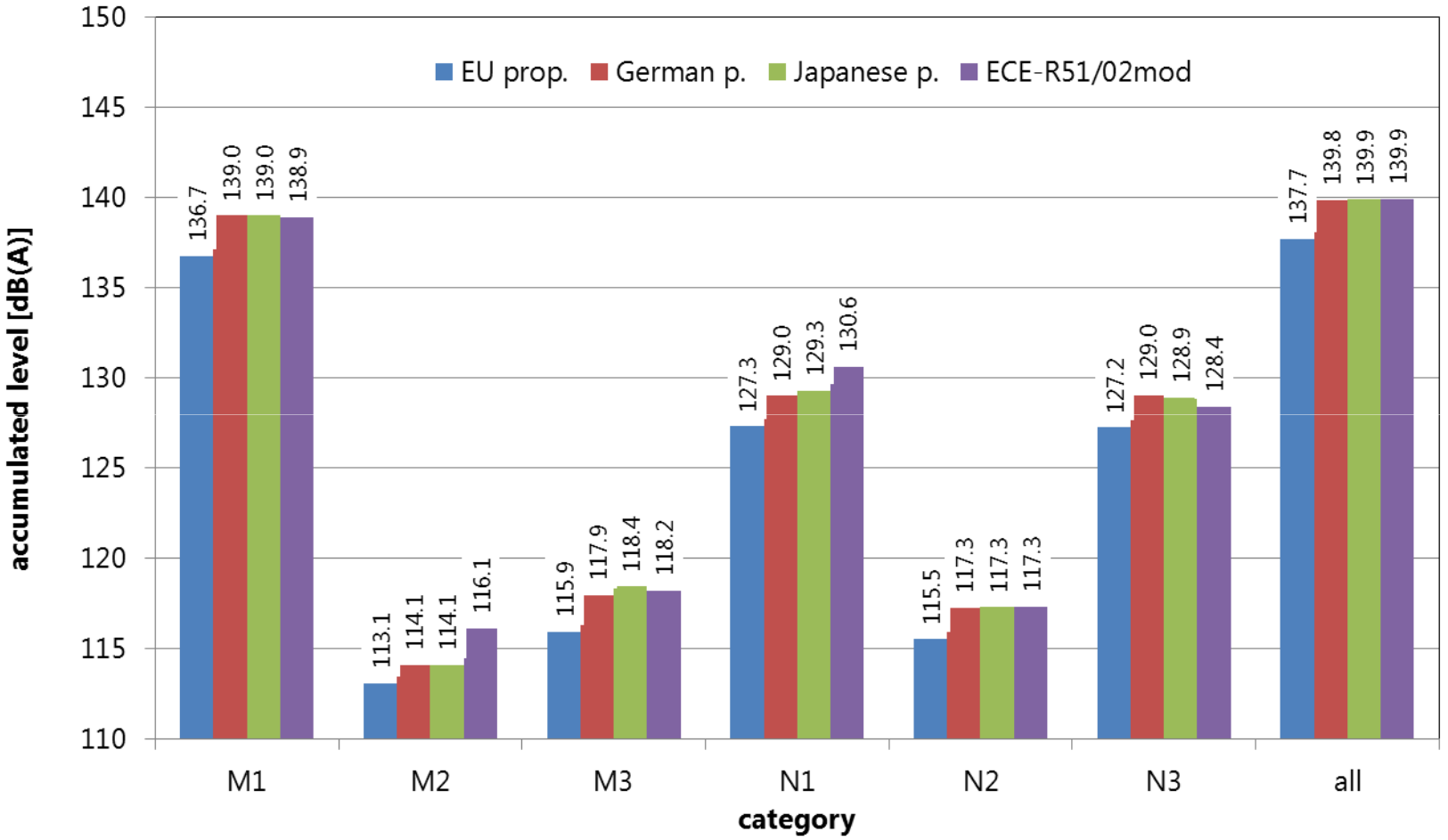
Vehicle and total sound level increase per category N (proposals EC, Ger, Jap)

Category	% Vehicle increase EU	Acc. sound level increase EU [dB]	% Vehicle increase Ger	Acc. sound level increase Ger [dB]	% Vehicle increase Jap	Acc. sound level increase Jap [dB]
All Cat (M+N)	22.4	1.0	22.4	1.0	22.4	1.0
N1 a	44.2	1.6	72.3	2.3	45.6	1.7
N1 b	69.1	2.2	63.5	2.2	242.8	5.3
N1 c	-	-	-	-	63.5	2.2
N2 a	64.3	2.1	26.6	1.0	17.0	-0.6
N2 b	19.6	0.8	- 13.3	- 0.6	4.0	0.2
N2 c	- 11.8	- 0.5	-	-	-	-
N3 a	400.0	7.0	- 21.9	- 1.1	- 21.9	- 1.1
N3 b	39.2	1.5	61.7	2.1	61.7	2.1

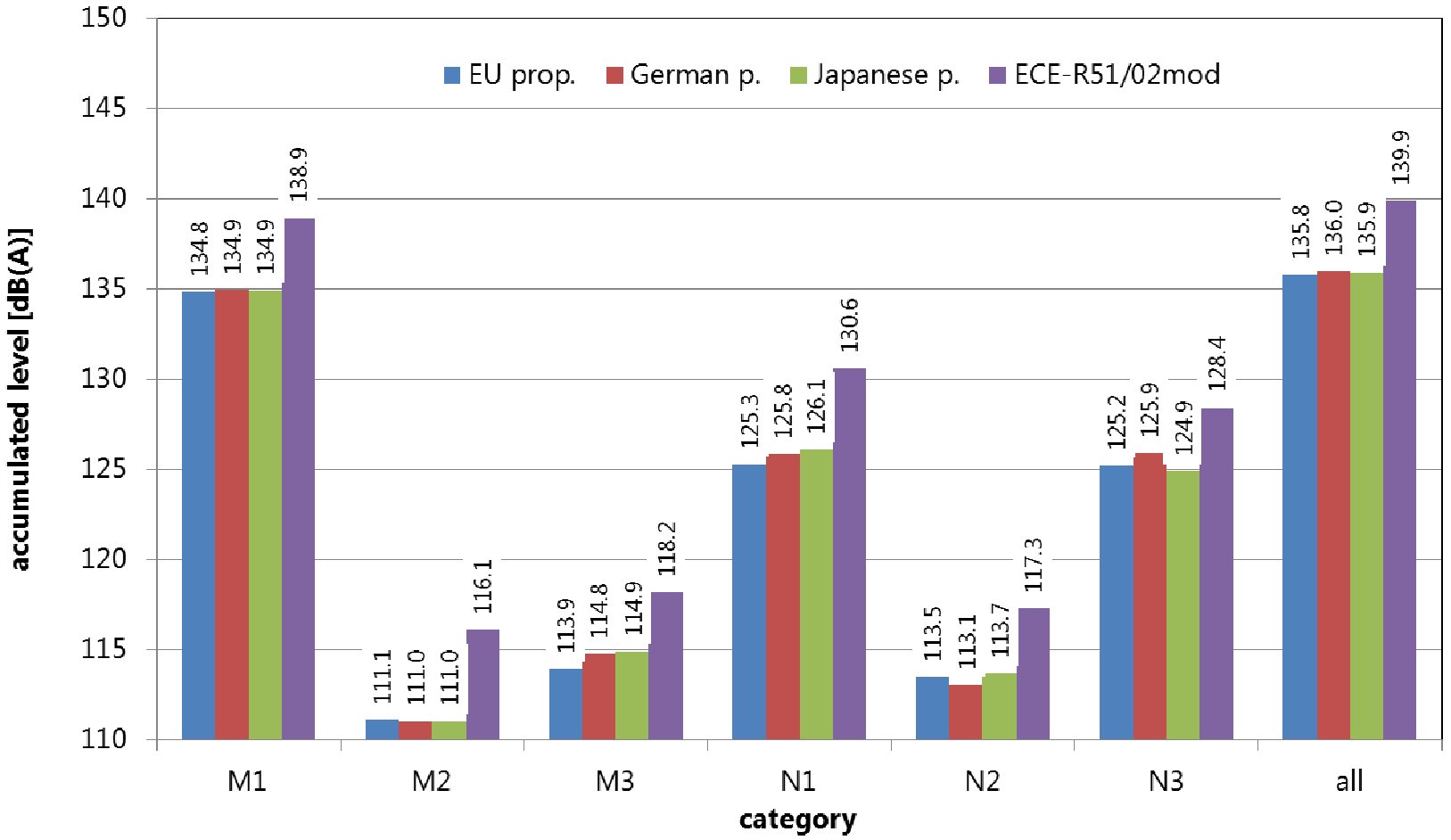
Increase for time period 98-00 till 10-12

- Disproportionate increase for categories:
  - N1 b (especially proposal Japan)
  - N3 a (proposal EU)

Comparison Phase 1



Comparison Phase 3



Annex I: Proposal EC COM(2011)0856

as referred to in inf doc GRB-55-16

Kategorie	Bedingung	L Phase 3 [dB(A)]
M1a	M1 und (PMR <= 150 kW/t)	68
M1b	M1 und (PMR > 150 kW/t)	69
M2a	M2 und (GG <= 2000 kg)	70
M2b	M2 und (GG > 2000 kg) und (GG <= 3500 kg)	71
M2c	M2 und (GG > 3500 kg) und (GG <= 5000 kg) und (P < 150 kW)	72
M2d	M2 und (GG > 3500 kg) und (GG <= 5000 kg) und (P >= 150 kW)	74
M3a	M3 und (P < 150 kW)	73
M3b	M3 und (P >= 150 kW)	75
N1a	N1 und (GG <= 2000 kg)	69
N1b	N1 und (GG > 2000 kg)	70
N2a	N2 und (P < 75 kW)	72
N2b	N2 und (P >= 75 kW) und (P < 150 kW)	73
N2c	N2 und (P >= 150 kW)	75
N3a	N3 und (P >= 75 kW) und (P < 150 kW)	75
N3b	N3 und (P >= 150 kW)	78

Annex II: Proposal Germany

- inf doc GRB-54-03

Kategorie	Bedingung	L Phase 3 [dB(A)]
M1a	M1 und (PMR <= 120 kW/t)	68
M1b	M1 und (PMR > 120 kW/t) und (PMR <= 160 kW/t)	70
M1c	M1 und (PMR > 160 kW/t)	73
M2a	M2 und (GG <= 2500 kg)	69
M2b	M2 und (GG > 2500 kg) und (GG <= 3500 kg)	71
M2c	M2 und (GG > 3500 kg)	71
M3a	M3 und (P <= 180 kW)	73
M3b	M3 und (P > 180 kW) und (P <= 250 kW)	76
M3c	M3 und (P > 250 kW)	76
N1a	N1 und (GG <= 2500 kg)	68
N1b	N1 und (GG > 2500 kg)	71
N2a	N2 und (P <= 150 kW)	72
N2b	N2 und (P > 150 kW)	75
N3a	N3 und (P <= 250 kW)	77
N3b	N3 und (P > 250 kW)	79

Annex III: Proposal Japan

- inf doc GRB-56-05

Kategorie	Bedingung	L Phase 3 [dB(A)]
M1a	M1 und (PMR <= 120 kW/t)	68
M1b	M1 und (PMR > 120 kW/t) und (PMR <= 160 kW/t)	70
M1c	M1 und (PMR > 160 kW/t)	72
M2a	M2 und (GG <= 2500 kg)	69
M2b	M2 und (GG > 2500 kg) und (GG <= 3500 kg)	71
M2c	M2 und (GG > 3500 kg)	71
M3a	M3 und (P <= 135 kW)	73
M3b	M3 und (P > 135 kW) und (P <= 250 kW)	76
M3c	M3 und (P > 250 kW)	76
N1a	N1 und (GG <= 2500 kg) und (PMR <= 35 kW/t)	70
N1b	N1 und (GG <= 2500 kg) und (PMR > 35 kW/t)	68
N1c	N1 und (GG > 2500 kg)	71
N2a	N2 und (P <= 135 kW)	73
N2b	N2 und (P > 135 kW)	75
N3a	N3 und (P <= 250 kW)	76
N3b	N3 und (P > 250 kW)	78

Annex IV: Conversion of existing Limit values for comparison with proposals

- VENOLIVA – final report:

class	transformation
M1	$L_{new} = L_{old} – 2.1$ dB(A)
M2	$L_{new} = L_{old} – 1.0$ dB(A)
M3	$L_{new} = L_{old} – 0.7$ dB(A)
N1	$L_{new} = L_{old} – 1.7$ dB(A)
N2	$L_{new} = L_{old} – 1.2$ dB(A)
N3	$L_{new} = L_{old} +1.2$ dB(A)