



Acoustic Signatures  
of Heat Pumps

IEA HPT

Annex **51**



IEA Heat pumping Technologies



**POLITECNICO**  
MILANO 1863

# EUROPEAN LEGISLATION AND STANDARDS

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# TASK 1: goals & deliverables



## Main goal

Identification, collection and analysis of:

- national legislations and regulations including limits on sound emissions of heat pumps based on their applications and location
- European standards used to determine them



$\leq \text{dB}$



# TASK 1: goals & deliverables



- brief introduction on Acoustics (physics and perception)
- overview of measurement techniques
- collection and comparison of:
  - international measurement standards
  - national laws
  - European certification schemes

# Data collection: participating countries



Participants:

AT, DE, DK, FR,  
IT, SE

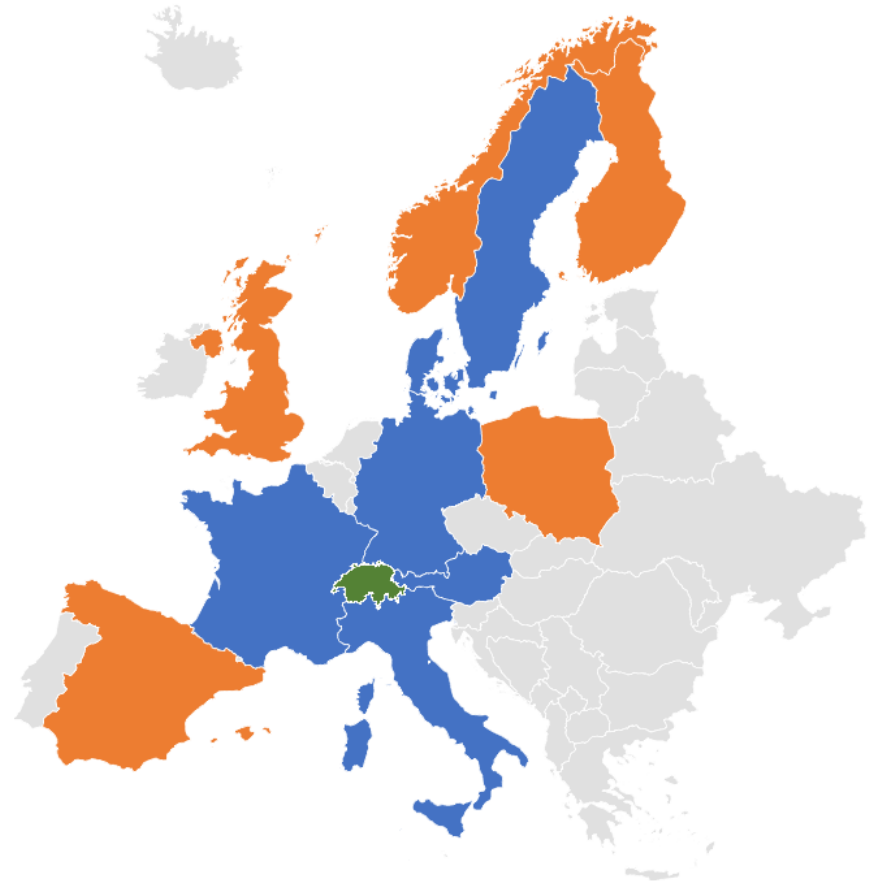
Other EU

Covered Nations:

ES, FI, NO, PL,  
UK

Some data on Extra

EU: CH, KO, JP,  
CN

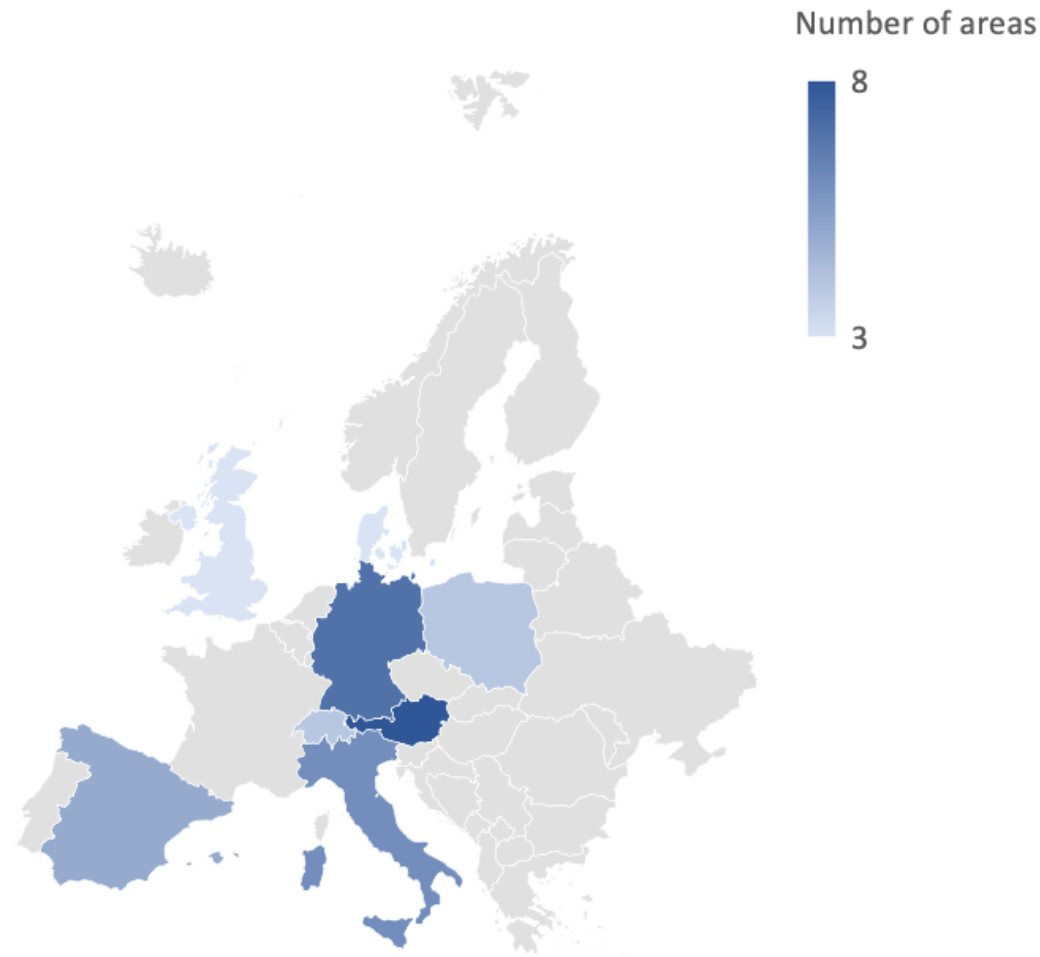


# NATIONAL LEGISLATIONS: Environmental noise



- **Noise Limits by area:**  
AT, CH, DE, DK, ES, IT,  
PL, UK
- Typical subdivision (DE):

Areas	dB(A) Limits	
	day	night
spa areas		
pure residential areas	45	35
general residential areas	50	35
central areas	55	40
urban areas	60	45
industrial estate	65	50
industrial areas	70	70



# NATIONAL LEGISLATIONS: Environmental noise



- **Noise Limits by period of the day:**

AT, CH, DE, DK, ES,  
FR, FI, IT, PL, SE, UK

- **Division:**

**Day/Night:**

06-22 / 22-06\*

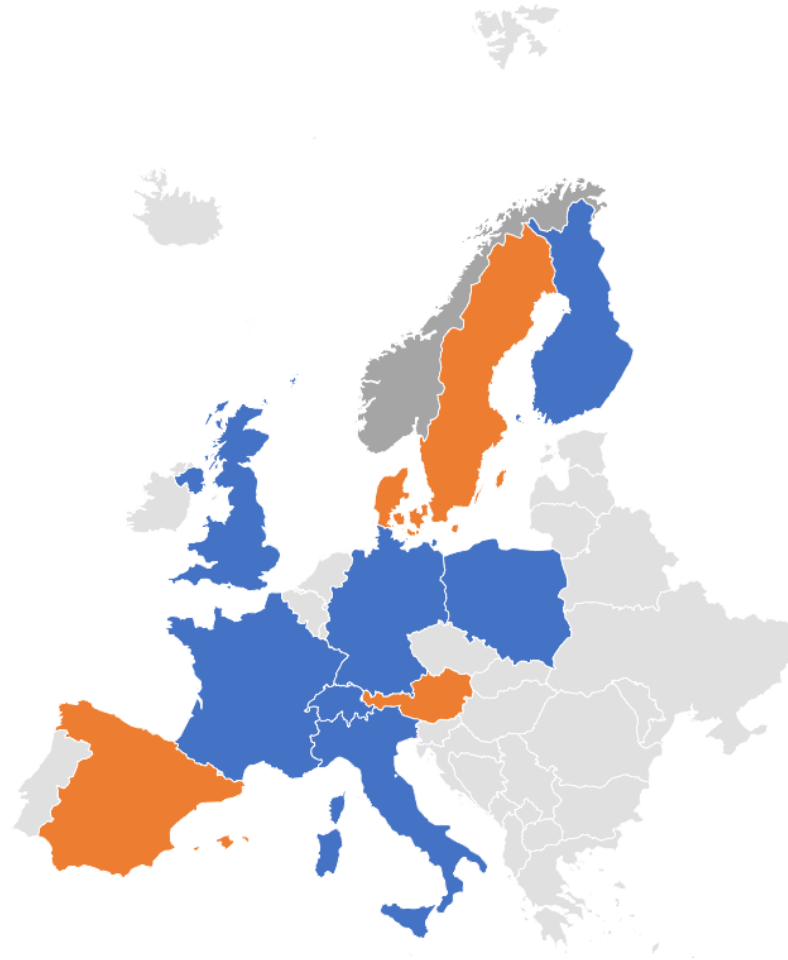
**Day/Evening/Night\*\*:**

7-19 / 19-22 / 22-7\*

■ D/N

■ D/E/N

■ no data



\*Typically, not always

\*\*see 2002/49/EC

# NATIONAL LEGISLATIONS: Environmental noise



- Noise Limits by period of day:**

AT, CH, DE, DK, ES,  
FR, FI, IT, PL, SE, UK

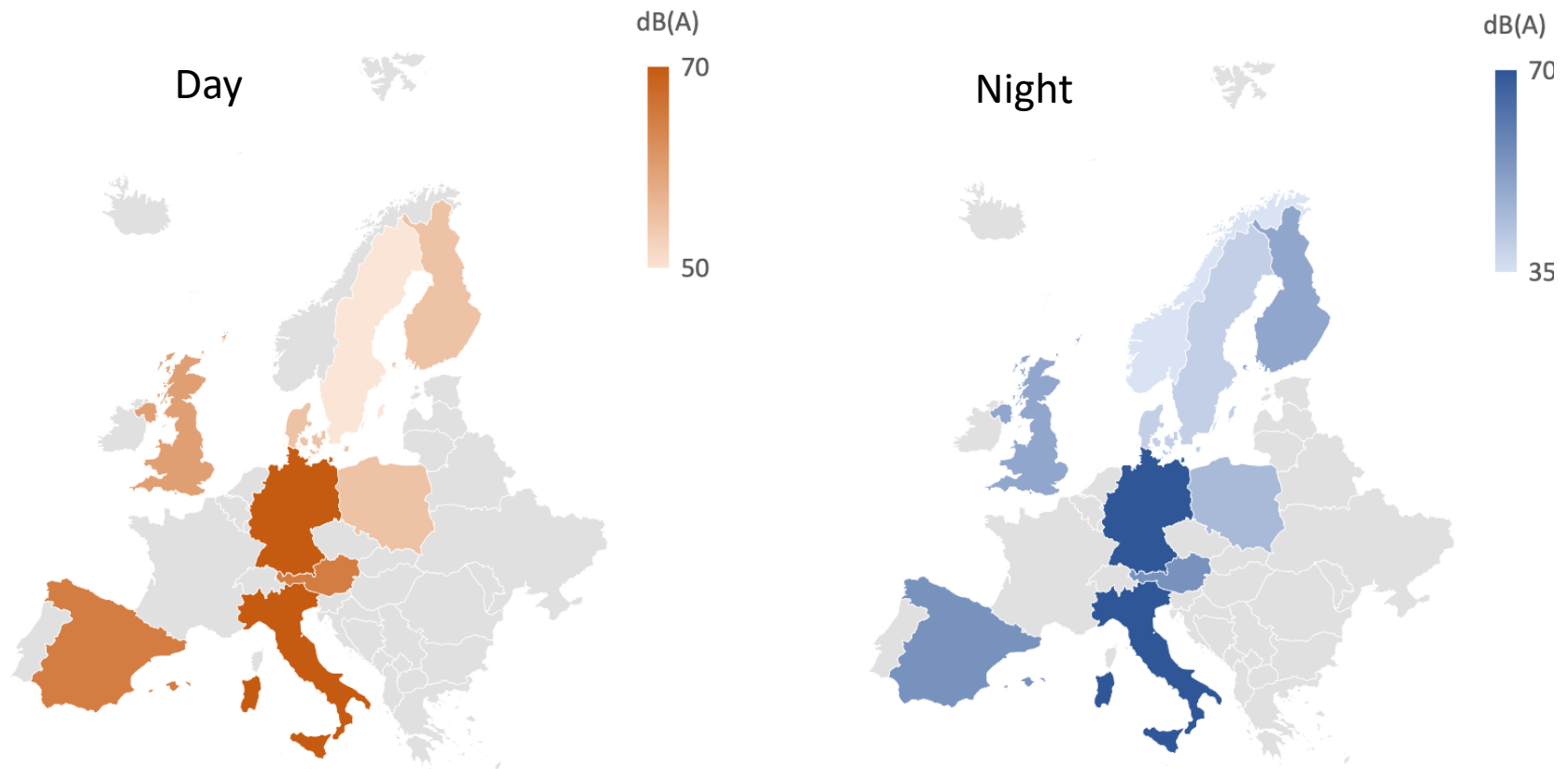
TOPIC	EU Country											Other Country			
	FR	UK	AT	IT	ES	DE	PL	DK	SE	FI	NO	CH	KO	JP	CN
Different limits for Day/Night Day/evening/Night	D/N	D/N	D/E/N	D/N	D/E/N	D/N	D/N	D/E/N	D/E/N	D/N	no data	D/N		4 period	
Day period interval	7-22	7-22 8-22 (Sunday)	7-19	6-22	7-19	6-22	6-22	7-18	6-18	7-22		7-19		8-19	
Evening period interval	-	-	19-22	-	19-23	-	-	18-22	18-22	-		-		19-23	
Night period interval	22-7	22-7 22-8 (Sunday)	22-7	22-6	23-7	22-6	22-6	22-7	22-6	22-7		19-7		23-6	

# NATIONAL LEGISLATIONS: Environmental noise



- **Noise Limits approach by area and D/N or D/E/N**

MAX LEVEL LIMITS (outdoor)



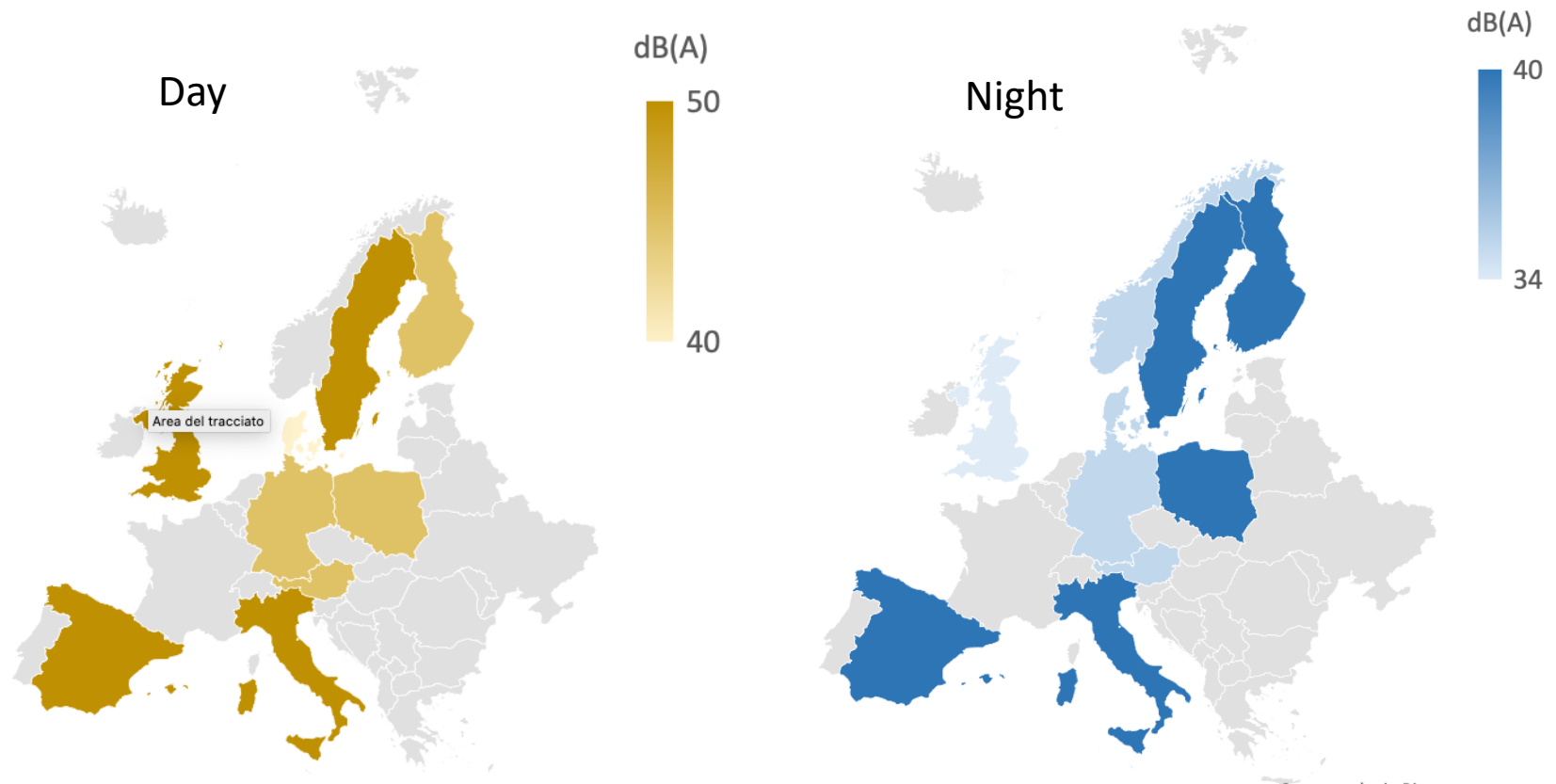


# NATIONAL LEGISLATIONS: Environmental noise



- **Noise Limits approach by area and D/N or D/E/N**

MIN LEVEL LIMITS (outdoor)



# NATIONAL LEGISLATIONS: Environmental noise



Other limits criteria

- **by day of the week;**
- **regional or municipal limits;**
- **differential criterion on background noise**

TOPIC	EU Country											Other Country			
	FR	UK	AT	IT	ES	DE	PL	DK	SE	FI	NO	CH	KO	JP	CN
Max limit (day)		60	65	70	65	70	55	55	50	55				70/55	70/60
Max limit (night)		50	55	70	55	70	45	40	40	50	35				
Minimum limit (day)		50	45	50	50	45	45	40	50	45				45/40	50/40
Minimum limit (night)		34	35	40	40	35	40	35	40	40	35				
Absolute criterion for max noise low frequency									31,5-200 Hz						
Different Regional or municipal limits	No	No	No	No	Yes	No								Yes	Yes
Different limit for Saturday and/or Sunday	No	Yes		-	-			Yes							
Differential criterion on background noise Day/Night	5/3 dB			5/3 dB					10/5 dB						

# NATIONAL LEGISLATIONS: Environmental noise



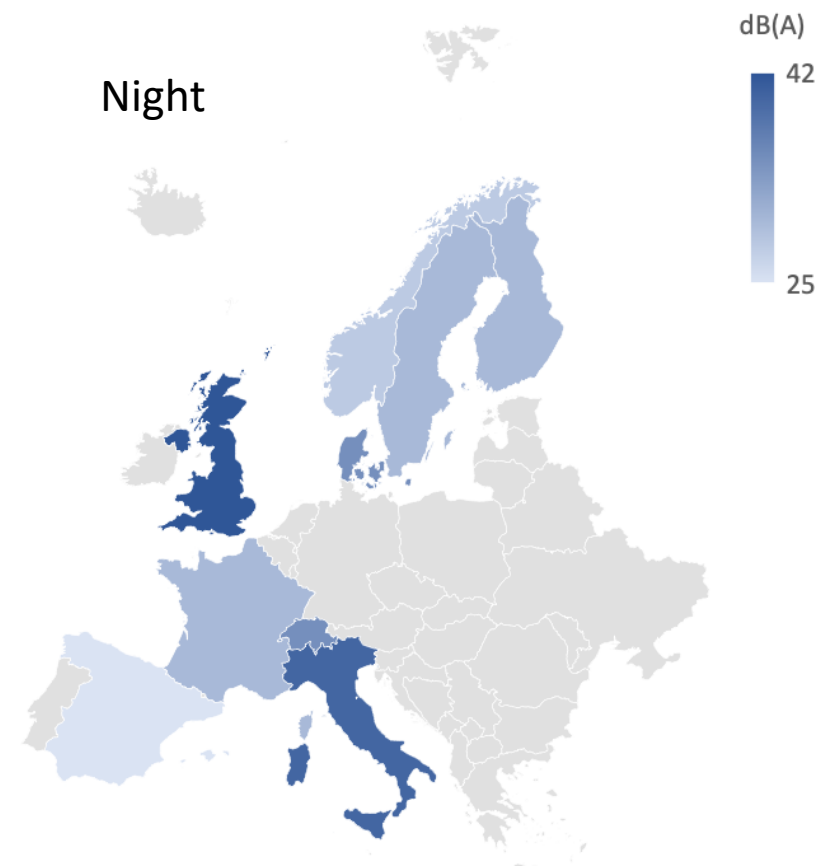
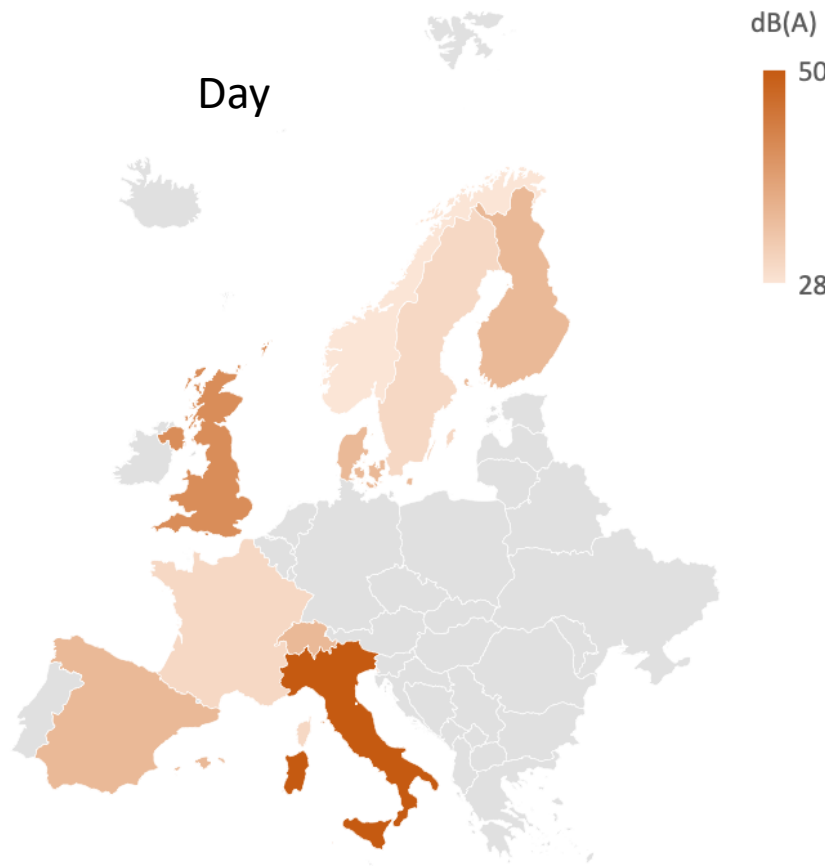
## Different ways to describe/measure the noise

Environmental noise - Parameters and corrections (penalties and bonus)												
TOPIC	EU Country											Other Country
	FR	UK	AT	IT	ES	DE	PL	DK	SE	FI	NO	CH
parameters used	L <sub>Aeq</sub>		L <sub>r</sub> ; L <sub>r,den</sub>	L <sub>Aeq</sub> , L <sub>c</sub>	L <sub>K,x</sub> ; L <sub>d</sub> ; L <sub>e</sub> ; L <sub>n</sub> ; L <sub>den</sub>	L <sub>r</sub> ; L <sub>AFm</sub> ax	L <sub>r</sub> (L <sub>Aeq</sub> , T)	L <sub>r</sub>	L <sub>Aeq</sub> , T; L <sub>A,ma</sub> x	L <sub>Aeq</sub> , T	L <sub>Aeq</sub> , T	
time period of evaluation of the parameters			1 Year	minutes, hours, days								1 Year
Adjustment for type of source	-	-	Train -5; road 0; plants +5	-	-							HP: +5dB day, +10dB night
Penalty for Impulsive noise				3dB	3dB	Yes	Yes	5dB	5dB	5dB	5dB	2,4,6 dB
Penalty for tonal noise				3dB	3dB	Yes	Yes	5dB	5dB	5dB	5dB	2,4,6 dB
Penalty for tonal noise in low frequency	No Penalty but taken into account			3dB	3dB							
Bonus for noise emissions in partial time period	from 1 to 6 dB			3 o 5 dB		Yes?						

# NATIONAL LEGISLATIONS: Building / Indoor noise



- **Limits of Max indoor noise**



# NATIONAL LEGISLATIONS: Building / Indoor noise



Building												
TOPIC	EU Country											Other Country
	FR	UK	AT	IT	ES	DE	PL	DK	SE	FI	NO	CH
There are Buildings acoustic insulation Laws?	Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes
passive acoustic requirements of buildings	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes
Parameter used (insulation)	DnTw+C; L'nTw	DnTw+C; L'nTw	DnTw; L'nTw	R'w; L'nw; D2m,n T,w	DnTw +C; L'nTw	R'w; L'nw	R'w+C; L'nw	R'w; L'nw	R'w+C ; L'nw+ C		R'w; L'nw	DnTw+C; L'nTw+C
Different requirement for terraced house and apartment			Yes			Yes						Yes (rent/prop erty)
Specific limit for HP or tecthnological services/installations in general				25 dB(A) or 35 dB(A)								
Parameters for services/installations				LAeq; LASmax								
Different limit for different indoor ambient				Yes								
Minimum indoor limit (day) in dB(A)	30	42		50	35			35	30	35	28	35
Minimum indoor limit (night) in dB(A)	30	42		40	25			35	30	30	28	35
(Where)	in the Rooms	at window		at windo w				At property edge				at window

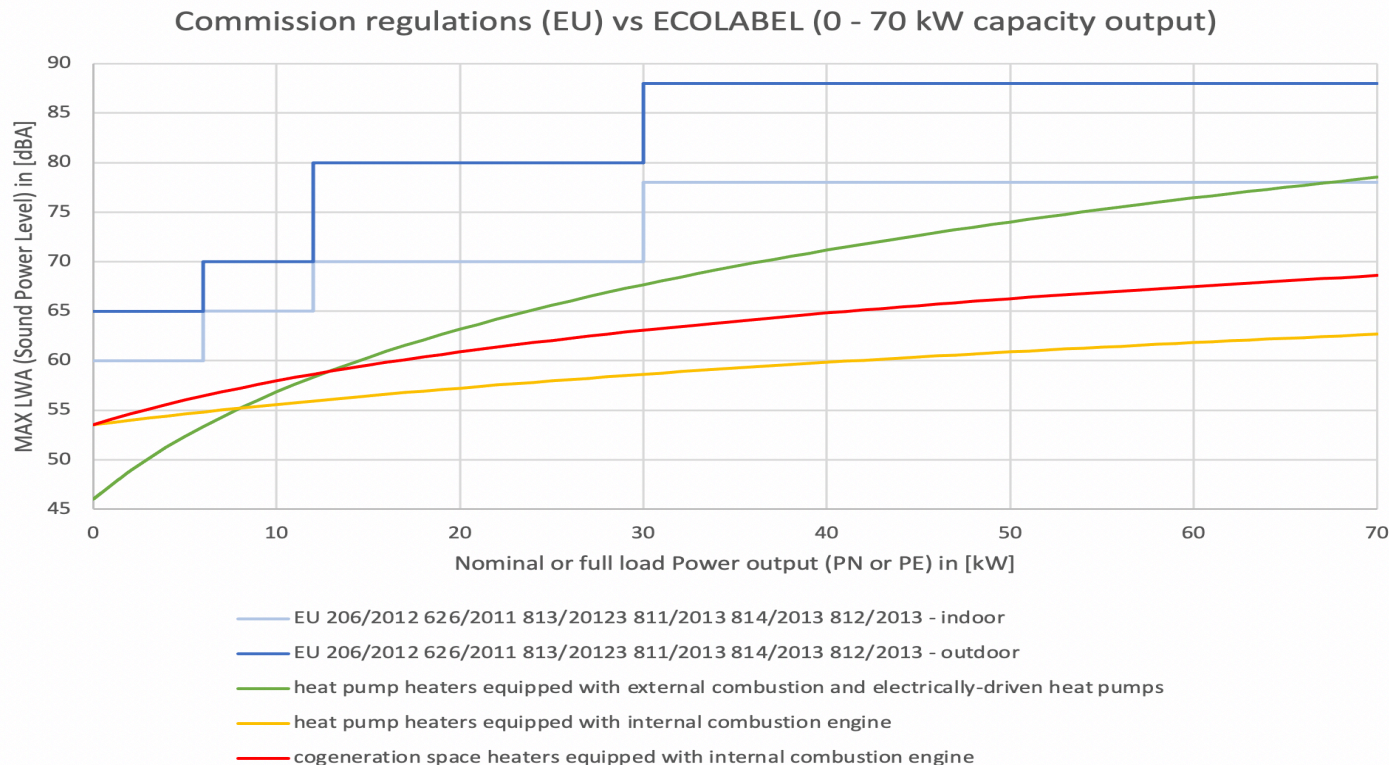


- **ISO 374X + ISO 9614** to determine sound power levels
- **EN 12102-1** establishes requirements for determining the sound power level emitted into the surrounding air by air conditioners, heat pumps, and liquid chilling packages with electrically driven compressors when used for space heating and/or cooling, including water cooled multisplit systems
- **EN 12102-2** concerns the determination of the sound power level of heat pump water heaters
- **European regulations on noise:**
  - Regulation n°206/2012 (air conditioners below 12 kW rated capacity )
  - Regulation n°626/2011 (regulation for energy labelling for previous products)
  - Regulation n°813/2013 (air-to-water and water(brine)-to- water HP below 400 kW)
  - Regulation n°811/2013 (energy labelling of products covered by regulation n° 813/2013 but limited to 70 kW)
  - Regulation n°814/2013 (air-to-water and water(brine)-to-water HP below 400 kW)
  - Regulation n°812/2013 (energy labelling of products covered by regulation n° 814/2013 but limited to 70 kW)

# EUROPEAN STANDARDS AND REGULATIONS



- Comparison between the limits defined in European regulations on noise and the ones defined in the ECOLABEL





- **National Regulations**

1. different countries have different approaches on noise regulation. they are based on maximum disturbance, on time length of measure, on homogenous acoustic zones, or on different days of the week
2. different countries have also different acoustic descriptors to quantify noise in outdoor and indoor environment. They are based on different measurement methods, different time of measurement

- **Harmonization of noise laws** is hardly conceivable at country level (even at European level. The same 2002/49/EC refers only to environmental noise without fixing limits since it is designed only for medical and epidemiological purposes)

- **European regulations and certification schemes**

All are based on EN 12102 for Sound Power Level determination





- 1.0-Introduction-V01
- 1.1-Measurement-Techniques-V01
- 1.2-Regulations-V03
- 1.3-Regulations-Synthesis V03



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# THANK YOU FOR YOUR ATTENTION!

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