



With the contribution of
the LIFE programme of the European Union



LIFE MONZA

Methodologies for Noise Low Emission Zones introduction and management

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Study Trip to Italy of the Hungarian LIFE Environment Team

Meeting with representatives of Italian LIFE Projects

Rome, 23rd April 2018

Partner:



SCOPE

The introduction of **Low Emission Zones**, urban areas subject to road traffic restrictions in order to **ensure compliance with the air pollutants limit values**, set by the European Directive on ambient air quality (2008/50/EC), is a common and well-established action in the administrative government of the cities and the impacts on air quality improvement are widely analyzed, whereas the **effects and benefits concerning the noise have not been addressed in a comprehensive manner.**

The definition, the criteria for analysis and the management methods of a **Noise Low Emission Zone** are not yet clearly expressed and shared.

LIFE MONZA project (Methodologies for Noise low emission Zones introduction And management - LIFE15 ENV/ IT/000586) addresses these issues.

SCOPE

NOISE

EEA Report “Noise in Europe 2014”:

- noise pollution is a major environmental health problem in Europe;
- road traffic is the most dominant source of environmental noise with an estimated 125 million people affected by noise levels higher than 55 dB *Lden*.

LIFE Environment and Resource Efficiency 2015

Thematic priorities of LIFE programme, for Environment and Health, including chemical and noise:

*“projects aimed at the introduction of permanent **noise Low Emission Zones (LEZ)** schemes in urban areas, by allowing only electrically powered vehicles or applying other equally effective noise LEZ approaches.”*

*“projects inside densely populated **urban areas aimed at reducing noise from roads and other transport infrastructures by means of using low noise surfaces having life cycle costs comparable to those of standard surfaces while achieving a substantial noise reduction.**”*

First OBJECTIVE

1°

The main objective of the project is to **introduce an easy-replicable method**, and related guidelines, for the **identification and the management of the Noise Low Emission Zone**, an urban area subject to traffic restrictions, whose **impacts and benefits regarding noise issues** will be analyzed and tested in the pilot area of the city of Monza, located in Northern Italy

Further OBJECTIVES

2°

The second objective regards specific *top-down measures*, adopted by the municipality and able to turn up the urban area in a permanent Noise LEZ, concerning infrastructural interventions

3°

The third objective is to **reduce the average noise levels** in the pilot area of Libertà district, with positive complementary effects also on the **air quality** and benefits on **the quality of life** of the inhabitants

4°

The fourth objective is to involve the population in an active management system (*bottom-up measures*) of lifestyle choices

Dialogue between citizens and public bodies

top-down measures adopted by the municipality and able to turn up the area in a permanent Noise LEZ, concerning:

- **traffic management** (limitation of the vehicles speed and prohibition access to trucks);
- **road paving substitution;**
- **introduction of two pedestrian crossings**

bottom-up measures: people will be involved in an active management system of a more sustainable lifestyle choices, related to the reduction of noise and the improvement of air quality and wellbeing conditions, in their living and working environment. In order to encourage the local community involvement and to strengthen the dialogue between citizens and public bodies, many activities will be carried out, as:

- **meetings** in primary and high schools, in order to raise awareness about noise effects;
- **ideas contests** for Noise LEZ picture and logo;
- **questionnaires** on perceptions of specific noise impacts; on the quality of life, air quality and social aspects;
- use of the **mobile App**, developed during the course of the project, devoted to manage voluntary and sustainable actions carried out by citizens.

Project location and beneficiaries

PROJECT LOCATION: Pilot area is located in MONZA Municipality
Northern ITALY- Lombardia

The project started on 1st September 2016 and the completion date is scheduled for 06.30.2020

PROJECT Beneficiaries

Coordinating Beneficiary: ISPRA

Italian National Institute for Environmental Protection
and Research

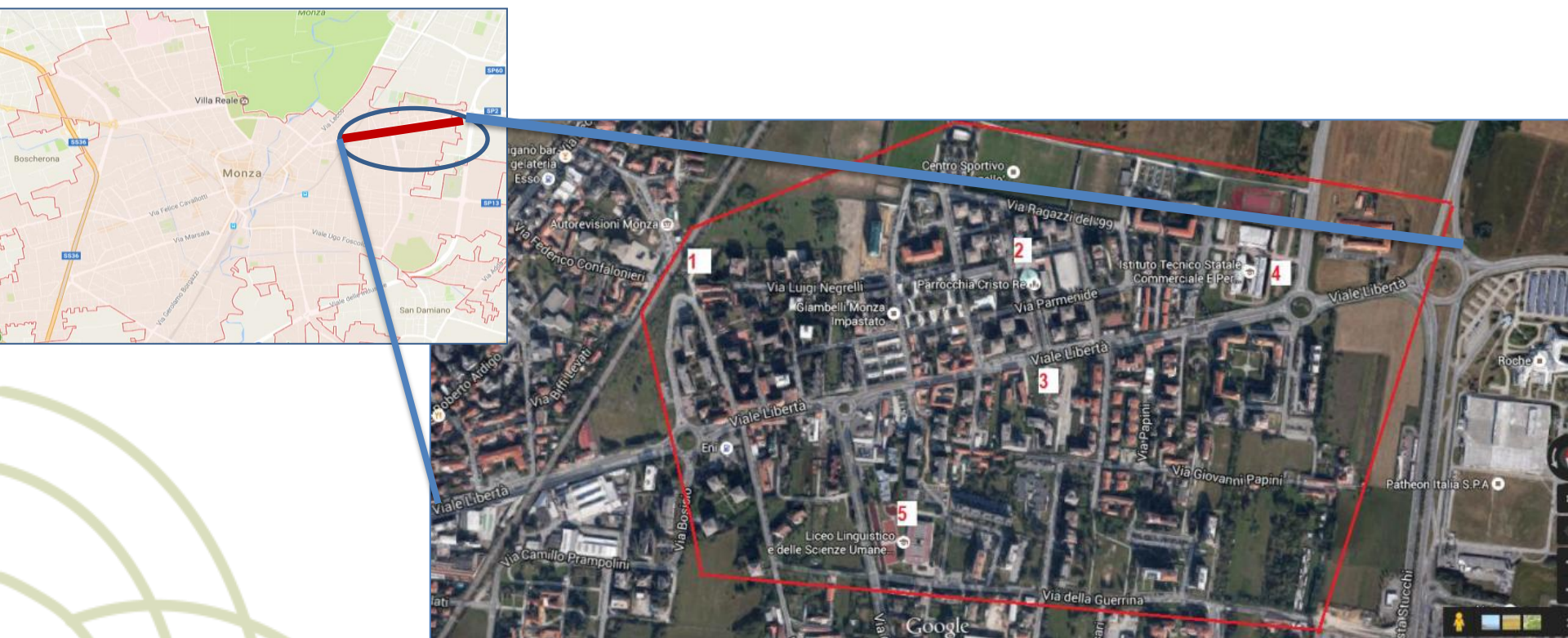
Associated Beneficiaries: MONZA Municipality

UNIVERSITY of FLORENCE

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Pilot area in Monza Municipality



Significant average levels of noise pollution affect a large number of citizens so that Libertà district is identified as a **hotspot in the Action Plan of the city of Monza**.

Noise strategic map of the city of Monza, dated 2012, highlights that in a range of 30 m from the Viale Libertà almost the 100% of the receivers is exposed to levels higher than 65 dB(A) during the day and 55 dB(A) during the night.

Method to be developed and tested in pilot area

The Life MONZA has the character of pilot project, since it is developing and testing **a new method for the introduction and management of LEZ**, based on both traditional and innovative techniques, such as a noise smart monitoring system, and air quality monitoring system, already applied in other contexts, though distinctly.

The method proposed consists in the **evaluation of LEZ measures implementation** (viability restrictions, replacement of road pavement, pedestrians crossing) in order to assess the reduction of noise, the complimentary effects on air quality and how these measures reflect on well-being conditions and quality of life for citizens living around the pilot area.

A set of **indicators**, distinguished in different topics, have been identified. Noise indicators, such as percentage of people exposed to defined values of *Lden* and *Lnight*, air pollution indicators, as particular matter, and socio-economics indicators, as commercial activities and people employed, will be analyzed during the project. Health indexes will be introduced and evaluated after the ante and the post-operam phases of the NLEZ introduction and also combined with indicators of noise and air quality in a **global index for noise LEZ**.

Results expected from the LIFE MONZA project, concerning the pilot area, in terms of noise reduction, air quality and well-being conditions in the Libertà district, are potentially able to guarantee a better environmental state.

Monitoring activities and methods tested in pilot area

Objective: reduction of **the average noise levels** in the pilot area of Libertà district, with positive complementary effects also on the **air quality** and benefits on **well-being conditions** of inhabitants.

Priority will be given to actions for noise reduction, but attention will be also focused on the improvement of the air quality and citizens' quality of life.

Noise Monitoring

- Traditional equipment
- Smart low-cost sensors

Air Quality Monitoring

- EU Directive requirements
- Passive sampling

Quality of life

- Questionnaire

Noise Monitoring in pilot area

Noise Monitoring

- Traditional equipment
- Smart low-cost sensors

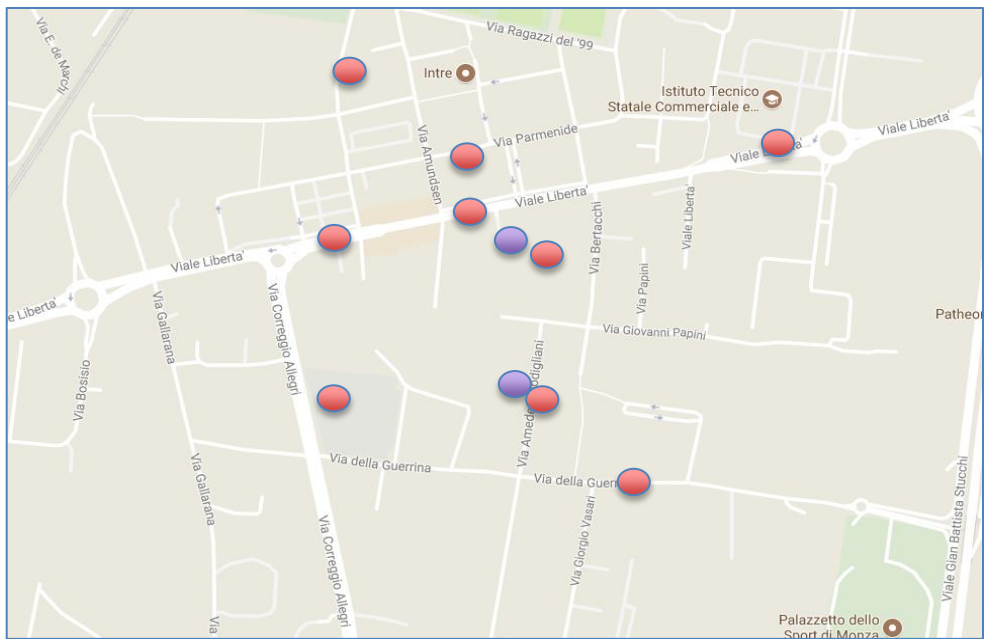
Regarding the noise monitoring phases planned in pilot area, the activities will be carried out referring to the **standard methods, using sound level meters of class I precision**, and also by developing and using a **smart low-cost monitoring system**.

Monitoring campaigns for both measurement methods are planned for 1 year in the ante-operam scenario and 1 year in the post-operam scenario.

The **prototype system for smart monitoring activity of noise** has been designed and implemented, in order to be used as a continuous monitoring unit in the ex ante and ex post scenarios.

After the end of LIFE MONZA project, the prototype will be given for free to Municipality of Monza that will take care of using it for monitoring activities in the three years after the project end.

Noise Monitoring in pilot area, using Class I sound level meters



- **Long-term period noise monitoring campaign:** noise level meter Class I, counting of traffic flows.
- **Noise monitoring campaign – SPOT measurements:** noise level meter Class I, counting of traffic flows



Smart low-cost noise monitoring systems experiences and procedures

Deliverable Action A1.
Abacus on Operational Contexts related to legislation; smart noise low-cost monitoring networks; air quality monitoring systems; health indicators; interventions and expected effects on air quality, noise and health

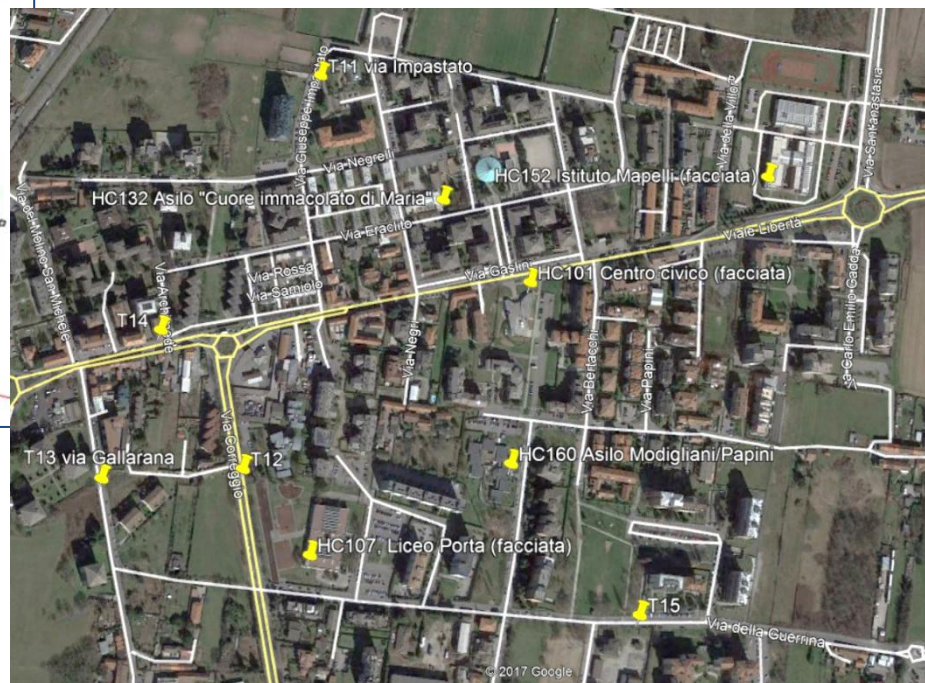
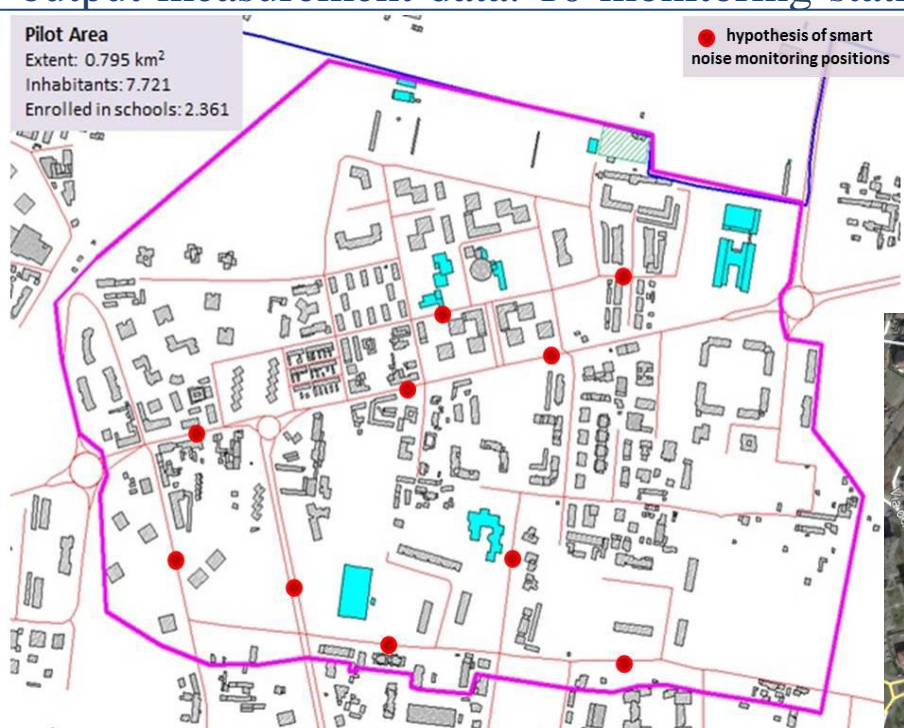
Sub-Action A1.2 - Operational Contexts on smart low-cost noise monitoring systems

DREAMsys
 Smart monitoring networks – Ghent University
 SENSEable Pisa
 LIFE DYNAMAP
 Barcellona Noise Monitoring network
 Low-cost monitoring systems based on smartphone devices –
 Regional Environmental Agency of Piedmont
 Participatory monitoring projects

Smart low cost noise monitoring systems	
main characteristics arising from analyzed projects	
Short /long term noise measurement	long term noise measurement
Embedded pc monitoring system /Units with microcontroller and digital signal processor	Embedded pc monitoring system
Type of microphones	MEMS microphones ¼ - inch condenser low cost microphone
Time basis acquisition	Different values. In most frequent cases =1 sec;
Acoustic dynamic range	70 dB
Acoustic Measure range	Different ranges. 30 (40)-100 (110) dB(A)
Acoustic frequency range	20 Hz-20 kHz
Floor noise value	30-35 dB(A)
Tolerance	$L_{Aeq} \pm 2$ dB(A)
Acoustic indicators	In all cases studies: L_{Aeq} , L_{A10} , L_{A50} , L_{A90} ; In some cases studies: L_{A01} , L_{Ceq} , M_{60} , M_{70} , N_{cn}
Spectral data	1/3 octave
Calibration	Periodic calibration
additional characteristics	
weatherproof	Applied in all case studies
connectivity	Wifi/3G/4G
possibility of audio recording	Applied in some case studies
other properties	Extensible with temperature/humidity sensors, air pollution monitoring sensors, GPS logging etc; battery for energy storage.
Size of PCB assembly	10mm < x < 10 mm
Shape of PCB	Optimized to avoid diffraction effects
pilot area of implementation	
Urban/Suburban	Urban and sub-urban areas
Territorial scales	Different dimensions, from medium to large scale; (most frequent dimension in urban area: $\approx 1,00$ km ²)
Number of stations	Different situations. For areas of medium spatial dimensions, in most cases, from 5 to 20 units

Smart low-cost noise monitoring system – LIFE MONZA

Smart low-cost noise monitoring systems, allowing an extensive and long-term noise monitoring, in medium sized territorial scale as urban area, seem to be able to ensure an appreciated quality output measurement data. 10 monitoring stations have been installed in the pilot area of Libertà



Smart low-cost noise monitoring system – LIFE MONZA

Acoustic parameters

overall A-weighted continuous equivalent sound pressure level, LAeq,1s and continuous equivalent sound pressure level, Leq,1s, as 1/3 octave band spectrum data; timing for data recording: data will be registered 1 second based to permit the recognition of unusual events, which will be advisable in the post analysis phase;

Data transmission

- timing for data transmission: data will be sent every hour
- connectivity 3G

Mechanical characteristics of sensors

- 1/2 or 1/4 - inch condenser low cost microphone
- weather protection.

Acoustic characteristics of sensors

- electric floor noise < 35 dB(A) and THD < 1% at 105 dB(A) SPL
- frequency response to pure tones 31.5, 40, 50, ..., 8000 Hz with respect of requirements provided by the class I (± 1 dB)

Procedures for **in situ calibration check and verification of the noise monitoring system performance** have been performed



Smart low-cost noise monitoring system – LIFE MONZA



Monitoring stations located on streetlight or on façade, height 4 m;
power supply: solar panel and energy network.

Monitoring methods and activities tested in pilot area: Air Quality

Air Quality Monitoring

- EU Directive requirements
- Passive sampling

Air Quality monitoring within the pilot area is in progress, according to requirements provided by Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

Also, the low cost and easy operation of the diffusive sampling technique will be used for a large scale air pollution surveys with a high spatial resolution.

In order to compare the spatial variability of air pollution before and after the NLEZ implementation, NO₂ and benzene land use regression models in a defined urban area of Monza of about 4 km², including the noise LEZ, will be developed.

The objectives of monitoring will be to assess whether the implementation of the noise low emission zone contributes, as an ancillary effect, to reduce air pollution levels in the pilot area.

Monitoring methods and activities tested in pilot area: questionnaire

Quality of life

- questionnaire

A survey about the perception of the life conditions, noise and air quality has been planned in ante and post-operam phases, in order to analyze and evaluate changes in perceptions and judgments of different groups of citizens in the pilot area.

The analysis of the effects of the project actions (infrastructural, management and public involvement) on local social system will be conducted, in order to detect and evaluate the opinions, the perceptions and the attitudes of the population concerned the aspects related to the livability of the district and to the conditions of environmental and social well-being.



Monitoring methods and activities tested in pilot area: survey

Structure of the questionnaire

- socio-demographic data
- building (location, noise exposure, time spent at home)
- quality of life in the district (opinion on social, economic and environmental aspects)
- perception about air quality
- perception about noise
- health and life quality
- transport mobility situation
- potential effects of LIFE MONZA project on local system aspects

A second section of the questionnaire follows with a "short" test on the **quality of life** concerning the **WHO Quality of Life-BREF** (WHOQOL-Bref) questionnaire, that has a specific environmental domain, it can be self-administered and it is already validated in Italian language.

Currently the questionnaires filled in are 100, equal to about 17.5% of the sample (570 expected)

Further actions about the questionnaire administration are in progress, in order to guarantee the expected number of compiled copies.

Bottom –up activities: people involvement

The challenge is to discover and to build together the “*genius loci*” of the area, defining a territorial identity of the noise LEZ area, through initiatives able to design a part of the city and to share new lifestyle choices.

- **Schools** located in the pilot area of LIFE MONZA (primary and high schools) – **Students**
- **Schools** located in the pilot area of LIFE MONZA (primary and high schools) – **Parents and Teachers**
- **Inhabitants of pilot areas and Monza municipality citizens**
- **Associations** of Monza municipality
- **Consult neighborhood**
- **NLEZ users** (companies, transport companies, owners of private vehicles)

Bottom –up activities: people involvement

- meetings have been organized in the primary and high schools located in Libertà district to raise awareness in students about noise and a sustainable home – school mobility system, particularly during the INAD – International Noise Awareness day and these activities will be continued.
- ideas contests in the high schools, about a new logo, and in primary schools about a symbolic picture for identifying noise LEZ have been launched and they will be completed during the next May
- use of a mobile App, developed during the course of the project, dedicated to the management of sustainable actions, voluntarily undertaken by citizens, to “measure” benefits and concrete changes in people lifestyle, to be transposed in a bonus for citizens.



Contribution of the project to policy implications at different levels

European Level

The EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe considers the establishment of LEZ a measure to be adopted in air quality action plans.

LEZs have been implemented in many cities in Europe and they are the most common measures adopted in EU, considering traffic planning.

The EU 2002/49/EC Environmental Noise Directive (END) does not provide a definition of LEZ in relation to noise and it is not considered as an action to take into account in noise action plan drafting.

In order to contribute to the implementation of the European directives, avoiding duplications and overlaps, potential synergies existing between the issues related to noise pollution and air quality will be investigated during the project.

LIFE MONZA project, aiming at providing harmonized and tested procedure to identify and manage NLEZ, will contribute to the implementation of noise action plans set out in Annex V of the END Directive

Contribution of the project to policy implications at different levels

European Level

EU Seventh Environmental Action Programme declares among its objectives to:

- *safeguard the Union's citizens from environment-related pressures and risks to health and well-being (objective 3)*

LIFE MONZA tests its actions in Libertà district that is a hotspot in the Noise Action Plan of Monza since an average levels of noise pollution exists, affecting a large number of citizens. The aim is to turn the Libertà district in a permanent noise LEZ, reducing environmental impacts and improving well-being conditions.

- *maximize the benefits of the Union's environment legislation by improving its implementation (objective 4).*

LIFE MONZA can support and validate the choice of LEZ adoption in the frame of the noise action plans, required by Directive 2002/49/EC, which could ensure a percentage reduction of exposed population and noise levels.

- *make the Union's cities more sustainable (objective 8)*

LIFE MONZA, defining and testing method for the implementation of urban areas subject to road traffic restrictions, can support the sustainability of the cities.

Contribution of the project to policy implications at different levels

National Level

Harmonization and simplification process among transposition decrees of EU Directives concerning noise and air pollution.

Development of a common method for the establishment and management of NLEZ, and related guidelines, as a proposal to be adopted by a national decree.

Local Level

Availability of a common procedure for Noise LEZ able to make the cities more sustainable, from local to European levels.

More knowledge about impacts and benefits due to NLEZ introduction.

Implementation of EU Directives at local level.

Enforcement of the dialogue between public institutions and citizens.

Thank you for your kind attention

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