Progressing to cleaner air: Evaluating non-attainment areas

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Cover page:
In the Time Extension Notifications many measures implemented or to be implemented in order to reduce urban concentrations are related to transport. A number of frequently taken measures are illustrated here: the introduction of congestion charging in London, promotion of e-cars by free parking and free charging points in Rotterdam and three Dutch post stamps (issued in 2008) promoting hybrid cars, car sharing and the introduction of particle filters. These or similar measures are described in Chapter 4 and Annex I of this report presenting overviews of measures taken or planned in the Air Implementation Pilot cities.

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Summary and Conclusions

This ETC/ACM technical paper is prepared in order to track progress of air quality (AQ) in "non-attainment" areas. Following the AQ Directives[1], "non-attainment" areas are defined here as those areas in the European Union where the European AQ objectives (limit and/or target values) are not met during a longer period of time.

Several approaches can be used in the selection of the non-attainment areas. These approaches are described in Section 2 of this report. Method (i) derives the information on the AQ management zones as reported by means of the annual AQ Questionnaire (Commission Decision 2004/461/EC) for the year 2010. Method (ii) assesses attainment in zones on the basis of information on measurements as available in AirBase. Whereas the problem of method (i) is that the zones are not consistent over time (changes in zones definition); the advantage of this method is that also modelled information is available for the zones. Advantage of method (ii) is that all 2010 zones can be evaluated, but this method excludes modelled exceedances (because model data are as yet not included in AirBase).

The results presented in this ETC/ACM Technical Paper are based on method (i). Section 2 shows that with respect to the annual NO_2 limit value (LV), population and area of zones (both agglomerations as well as non-agglomerations) where the LV is exceeded, hardly changed throughout recent years (2006 – 2010). Meeting the LV remains a problem in about 65% of the agglomerations and in about 23% of the non-agglomerations. The hourly LV of NO_2 is less frequently exceeded (in 15-39 zones on a total of 442 zones). In non-agglomerations, compliance is nearly complete since 2007. In agglomerations there is a decreasing tendency, especially in the population living in non-compliance zones.

Compliance with the PM_{10} daily LV is improving in the urban agglomerations, as the percentage of agglomerations being in non-attainment has changed from 80% in 2006 to 40% in 2010. The only exception is found in the more rural non-agglomerations, where a strong improvement is observed in 2007 compared to 2006. In contrast to the situation in agglomerations, which shows a continuously downward tendency, no further improvement is observed in non-agglomeration zones during the more recent years. The situation with respect to the PM_{10} annual LV tends to improve over the years on all selected parameters. However, the downward trends seem to level off in the recent years, particular in non-agglomerations.

With a view to support the Air Implementation Pilot undertaken jointly by the Environment Directorate General (European Commission) and the European Environment Agency (EEA), in this study (section 3) following topics are considered:

- Are the monitoring networks adequate?
- Is there a trend in AQ concentration within the selected cities?
- Are the selected cities representative for the (larger) cities in the European Union? What are the persistent problems in the selected cities compared to the other cities?

[1] Framework Air Quality Directive 96/62/EC, developed by the 4 Daughter Directives (1999/30/EC, 2000/69/EC, 2002/3/EC and 2004/107/EC). The Framework Directive and its first three Daughter Directives have been replaced by Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

This study concludes that the monitoring networks fulfill the requirements on stations density. The other criteria set in the AQ Directives are not always fulfilled: e.g. the number of PM_{10} and $PM_{2.5}$ stations differ not always more than the required factor of two.

In all Air Pilot cities, the **PM_{10}** concentrations tend to decrease, but a significant trend is only observed at a limited number of stations. The observed trend (in $\mu g/m^3$ annual mean concentration) is even less significant. For **NO_2**, the assessment shows a different result. Although not significant, half of the stations show a tendency for increased concentrations. Malmö is the only city where all (two) stations (both urban background) show a small significant decrease. In Vienna one station shows a significant positive trend. In Dublin, there is no significant trend but a strong positive tendency that is mainly caused by one single traffic station (Coleraine Street). On three out of 40 stations the **ozone** concentrations show a significant trend; it is positive to mention that on those three the averaged slope is -1.5 $\mu g/m^3$ per year. Other stations, however, don't show a clear picture.

On the representativeness of the Air Pilot cities for cities in Europe, this study concludes that the current selection of 8 cities in the Air Pilot is representative mainly for the air quality situation in cities having more than one million inhabitants. As in most of the smaller size cities represented in the pilot no persistent air quality problems are noted, the generalization of the results to cities smaller than one million inhabitants is therefore difficult.

Final activity under this task, was to prepare an inventory of measures as described in the Plans and Programmes (P&Ps) of the Air Pilot cities. For this purpose, the P&P questionnaires and time extension applications (TEN) have been analysed. Section 4 provides an overview of the results of this analysis. The results are shown for 7 out of 8 Air Pilot cities: Malmö did not report any exceedances; so there was no need to apply for a Time Extension for achieving the AQ LVs; nor P&Ps have been prepared.

The LV for PM_{10}, as defined in the Directives 1999/30/EC and 2008/50/EC, has already been in force since the 1st of January 2005. Some of the cities have not been able to attain to the annual or daily PM_{10} LVs yet. The cities with PM_{10} exceedances (annual and/or daily LV) are Milan, Ploiesti, Prague, Berlin and Vienna. According to the European Directive 2008/50/EC, the annual and hourly LV due date for NO_2 was 1st of January 2010. Berlin, Dublin, Madrid, Milan, Prague nor Vienna were able to comply with the LV at that date.

Sources contributing to the exceedances for NO_2 and PM_{10} LVs are summarised in section 4.3. For NO_2, main contributions stem from road transport, the commercial and residential sector and industry. These are also the main sources for PM_{10}, though in a few cases the contributions stem from natural sources and other sources, too. Section 4.4, the Annexes I and II provide an overview of the measures applied according to the TENs and P&Ps. Measures are categorised in several groups: Industry; Buildings; Technology & Infrastructure; Traffic; and Campaigns. The number and characteristics of the applied measures vary between the cities. The analysis shows that not always the larger number of measures is related to the greater contribution to the problems. E.g. in the P&Ps submitted by the cities of Milan, Prague and Ploiesti, traffic is identified as the main contributor to the exceedances of the LV of both NO_2 and PM_{10}. However, in those cities the percentage of measures for limiting traffic emission is: 4% in Milan for NO_2; 32% and 18% in Prague for NO_2 and PM_{10}, respectively, and 9% in Ploiesti for PM_{10}.

From the analysis of the P&Ps and of the TENs, it is unfortunately not possible to identify which are the most efficient measures in each city. The analysis can only be based on the number of measures that have been applied for limiting emissions directly from the sources. It is very important that the cities themselves provide input on how they evaluate the effectiveness of the measures and how they analyse the output of the measures; together with a list of the key measures that have been implemented in the city (e.g. Milan and Madrid reported more than 100 measures). This issue will be addressed in further work in 2013.

Table of Content

1. Introduction

This ETC/ACM technical paper is prepared in order to track progress of air quality (AQ) in "non-attainment" areas. Following the AQ Directives[2], "non-attainment" areas are defined here as those areas in the European Union where the European AQ objectives (limit and/or target values) are not met during a longer period of time.

Original aim of this task was to assess/grade the status of AQ in the non-attainment areas by looking at the AQ trends at station level throughout Europe. The scope of the work has changed to some extent when the Air Implementation Pilot was started, in the first half of 2012. At that time, it was decided to conduct this study in parallel with the task on trend analyses and assessment of the management practices in the Air Implementation Pilot project. The objectives of this task are to detect statistically significant changes at the Air Pilot cities stations, to examine if these changes can be attributed to specific policies and measures and to identify effective policies and measures undertaken in these pilot cities. The pilot cities are (in alphabetical order): Berlin, Dublin, Madrid, Malmö, Milan, Ploiesti, Prague and Vienna.

This study focuses especially on the attainment/non-attainment related to PM_{10} and NO_2 LVs in the Air Pilot cities. Following issues are addressed successively:
(1) how is attainment/non-attainment in zones defined and assessed;
(2) monitoring and AQ trends in the Air Pilot cities;
(3) assessment of Plans and Programs and Time Extensions Notifications in Air Pilot cities and effectiveness of measures.

[2] Framework Air Quality Directive 96/62/EC, developed by the 4 Daughter Directives (1999/30/EC, 2000/69/EC, 2002/3/EC and 2004/107/EC). The Framework Directive and its first three Daughter Directives have been replaced by Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

2. How is attainment / non-attainment in zones defined and assessed

For the protection of human health and ecosystems, limit and target values for a number of air pollutants have been set in the Air Quality (AQ) Directives. Exceedances of limit and target values are still frequently observed, though the date by which they have to be met has passed. This is particularly the case for the limit values (LVs) of NO_2 and PM_{10} and for the target value (TV) of ozone.
There is a need to track AQ progress in non-attainment areas by reviewing changes in measured concentrations in the Member States with respect to these limit and target values. In the non-attainment areas an improvement in concentration levels is expected which might be evidenced by analyzing the trends.
For this study, a non-attainment area is defined as an area (either an AQ management zone as defined under the AQ Directives or an administrative unit like a city) where in the past 5 years (2006-2010) the limit or target value has been exceeded in at least three years. To ensure that the area is still in exceedance, it is further required that in 2009 and/or in 2010 an exceedance of a limit or target value is observed.

Several approaches can be used in the selection of the non-attainment areas. Method (i) starts with the information on the AQ management zones as reported by means of the annual AQ Questionnaire (Commission Decision 2004/461/EC) for the year 2010. The AQ status of the 2010 zones, is traced in the reporting questionnaire over the years 2006 until 2009. Advantage of this approach is that the selection is based on the official reports of the Member States (MS) and that for a number of MS the assessment is based on a combination of monitoring and modelling.
Disadvantage of this approach, is that countries are allowed to change the designation of zones over the years. Any change in the designation of a zone leads to inconsistencies, and makes it impossible to give a historical overview on all zones during the past five years.

As an alternative, attainment in zones can be assessed based on information on measurements as available in AirBase (method (ii)). The reporting questionnaire lists operational stations in each of the zones (form 3 and 4 of the questionnaire). After retrieving the observed concentration from the AQ database AirBase, the status with respect to achieving the limit and target values can be assessed by comparing the highest concentration measured at any of the stations in the zones to the limit or target values. Advantage of this alternative approach is that all 2010 zones can be evaluated. Disadvantage of this method is that modelled exceedances are not included (because model data are as yet not included in AirBase). Section 2.1. and 2.2. provide an overview of the result of assessing attainment/non-attainment in zones on the basis of both approaches.

2.1 Method (i) Assessment of non-attainment zones using the AQ Questionnaire

The AQ Questionnaire reporting on the years 2006-2010 has been used to select the non-attainment areas by means of method (i). The results are summarized in Table 1. Note that a few zones (2-8) have been defined in form 2 of the questionnaire, but information on the AQ status has not been reported in the corresponding forms.

Table 1 indicates that for all three pollutants less than two-third of the zones designated in 2010 were already designated in 2006. By far the largest change occurred between 2009 and

2010. In 2010, both France and Poland have newly defined their zones (Jimmink et al, 2012); for none of these 2010-zones 'historical' information was available.

The figures of non-attainment zones for the five pollutant/protection target combinations given in Table 1 are as expected. The highest number of non-attainment zones is seen for NO_2 annual LV, for the health related TV of ozone and for the PM daily LV. Non-attainment situations for the PM_{10}-daily LV are observed in about 10% and for NO_2 hourly LV in about 4% of the zones. NO_2 and PM_{10} are an outspoken problem in agglomerations while ozone is of concern in less urbanized zones as well. With an estimate of an EU-27 population of 490 million inhabitants, 28% (for ozone) up to 40% (for NO_2) of the European population lives in non-attainment zones.

Table 1. Statistics on the number of non-attainment zones based on the annual AQ reporting questionnaire.

	NO_2 year	NO_2 hour	PM_{10} day	PM_{10} year	O_3 health
Number designated zones (2010)	684	684	686	686	623
With 2010 assessment	677	677	680	678	621
Number of zones retraced in period 2006-2009 [(a)]	446	446	437	437	376
Number of non-attainment zones (ag/nonag)	123 /68	18 / 1	99/82	28/15	49/138
Population in non-attainment zones (in M) (ag/nonag)	110 / 90	38 /1.8	89/79	36/16	48/92

[(a)] additional requirement is that assessment information is provided

There are a few shortcomings in defining the non-attainment zones by this procedure. Most important is that due to the reconstruction of zones in France and Poland in 2009, these two countries are excluded from the analysis. In countries where zones are relatively frequently changed (Spain, Germany) or countries having a lower reporting performance (like Italy) the number of non-attainment zones will be underestimated. A second shortcoming is – like in each assessment based on zone information – that no information is available on the degree of exceedance and on the area at risk within the zone. The AQ status of the whole zone depends on the highest concentration measured (or modelled) within the zone.

These shortcomings are illustrated on the basis of the NO_2 zones in Figure 1. The yellow areas correspond to areas where the zone boundaries have been changed in the period 2006-2010. It is clear that for large parts of the EU the attainment status can not be assessed on this basis. The green areas are zones that are – according to the definition given above – in attainment. The red areas are the non-attainment zones. When comparing this map with interpolated concentrations maps (de Smet et al, 2011) it is clear that the suggested exceedance areas in Figure 1 are too large. As an example: the exceedance situation in the non-attainment zone in Northern Sweden is limited to one urban traffic station in the medium-sized city of Umeå (108 000 inhabitants).

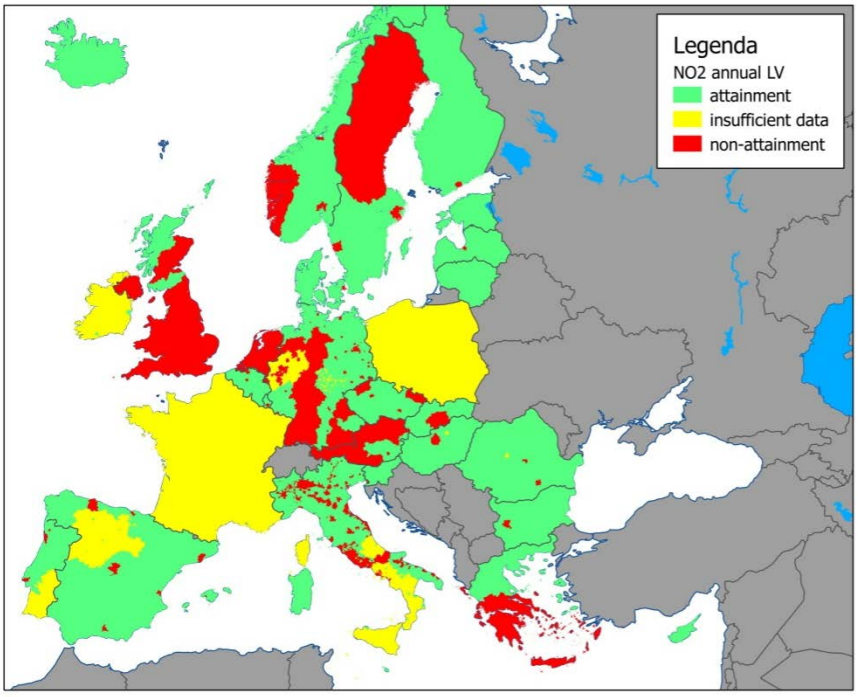

Figure 1. Attainment status of NO_2 air quality management zones, period 2006-2010.

2.2 Method (ii) Assessment of non-attainment areas using AirBase information

The information provided in the 2010-questionnaire in the forms 3 and 4 (in these forms the stations used for assessment are listed for each zone) has been combined with meta-information and concentration data from AirBase. In this way, a connectivity table is prepared which links each station with the zone code for NO_2, PM_{10} and ozone. Note that the zoning for these three pollutants may differ and one station might be located in one to three different zones.

This approach allows for following the changes in AQ in the 2010 zones over time. As indicated before, advantage of this approach is that (in contrast to method (i)) all 2010 zones can be evaluated. Disadvantage is that modelled exceedances are excluded.
However, method (ii) has two drawbacks:

(1) the method is based on the stations listed in the 2010 questionnaire. These stations have been officially assigned by the MS for compliance checking; additional information from other stations (e.g. stations not fulfilling the quality objective on data coverage), will not be used;
(2) the 2010 questionnaire lists only stations operational in 2010. Information from old stations (operational in the period 2006-2009 but no longer in 2010) can therefore not be included in the analysis.

The raw data in AirBase are used to collect a statistical indicator relevant to the limit or target value; only stations having data coverage of 75% or more are selected. As indicator the annual mean (NO_2 and PM_{10} annual LV) or a percentile value (NO_2 hourly LV: 99.79 percentile; PM_{10} daily LV: 90.4 percentile; O_3 TV: 93.2 percentile) can be used.

The short term limit and target values are defined as an allowable number of exceedances above a certain threshold level. The number of exceedances could be used as indicator for compliance assessment. However, we prefer here to use the percentile value corresponding to the maximum allowable number of exceedances as this indicator is from a statistical point of view more robust (de Leeuw, 2012). By this method we were able to assess the attainment status of (most) of the 2010-zones; a few zones are still missing due to lack of monitoring stations or of measurement data. When comparing the results of both methods, differences are found for the attainment situation in the United Kingdom and the Netherlands, in particular for NO_2 and to a lesser extent for PM_{10}. These two Member States apply models in combination with measurements in their compliance assessments. Some other Member States report also the use of models but only in cases to confirm that concentration levels are below the limit or target values.
A full analysis based on method (ii) will not be presented here; in this paper the method is limited to the Air Pilot cities. Further work is needed to refine the procedures for non-attainment analysis.

2.3. Observed trends in air quality status of zones based on AirBase

Figure 2 shows trends in the attainment and non-attainment zones as analysed by method (i). To assess changes in compliance with the limit or target values, a consistent set of zones reporting an assessment for each of the five years during the period 2006-2010 has been selected. Results are summarized in Table 2. No attempts have been made to extend the time period. In the years 2001-2003 reporting was mandatory for the EU15 Member States for the pollutants listed in the first and second daughter directive. In 2004 mandatory reporting on ozone (third daughter directive) was included in the Questionnaire and the new Member States (at that time EU-10) had to report on their AQ status. The first reporting year covering all EU27 Member States is the year 2006.

Table 2 presents the results, split up for agglomerations and non-agglomerations. With respect to the annual NO_2 LV, this table shows that the number, population and area of zones (both agglomerations as well as non-agglomerations) where the LV is exceeded, hardly changed throughout the years. Meeting the LV remains a problem in about 65% of the agglomerations and in about 23% of the non-agglomerations.
The hourly LV of NO_2 is less frequently exceeded (in 15-39 zones on a total of 442 zones). In non-agglomerations, compliance is nearly complete since 2007. In agglomerations there is a decreasing tendency, especially in the population living in non-compliance zones.

Compliance with the PM_{10} daily LV is improving in the urban agglomerations, as the percentage of agglomerations being in non-attainment has changed from 80% in 2006 to 40% in 2010. The only exception is found in the more rural non-agglomerations, where a strong improvement is observed in 2007 compared to 2006. In contrast to the situation in agglomerations, which shows a continuously downward tendency, no further improvement is observed in non-agglomeration zones during the more recent years.
The situation with respect to the PM_{10} annual LV tends to improve over the years on all selected parameters. However, the downward trends seem to level off in the recent years, particular in non-agglomerations.

Whereas NO_2 and PM_{10} form a problem typically in urban areas, ozone causes problems in rural areas. Since 2006 the situation is improving although in 2009 an increase in the area of

non-compliance agglomerations is noted. This increase is not reflected in the number of zones, nor in the population.

It should be stressed that the shortcomings discussed in the previous section (i.e. the selected set is not representative for the EU27 and the binary approach (compliance versus non-compliance in a zone) does not reflect the actual exposure of the population) also hamper the discussion on (possible) trends. In that respect, method (ii) would provide a more representative and reliable description of non-attainment areas.

Table 2. Changes in air quality status: number of zones, population and total area of zones where the limit valure or target value has been exceeded in the period 2006-2010; a consistent set of zones has been considered (those with assessment reported in the period 2006-2010) *(source: Jimmink et al, 2012).*

Type		2006	2007	2008	2009	2010	total set
NO2 annual limit value							
ag	number of zones	116	123	117	117	115	182
	Population (in M)	97.1	102.6	99.8	100.1	101.5	126.9
	Area (km^2)	63091	66352	59931	61413	84942	210633
nonag	number of zones	67	65	55	60	59	260
	Population (in M)	75.7	75.2	69.2	72.1	70.4	166.6
	Area (km^2)	724410	746866	666097	693706	735895	2382574
PM10 daily limit value							
ag	number of zones	137	104	83	75	71	172
	Population (in M)	106.5	88.0	73.2	76.6	66.9	124.6
	Area (km^2)	176567	164273	159419	154293	150396	207648
nonag	number of zones	125	86	75	57	70	259
	Population (in M)	99.8	59.2	53.9	47.9	59.0	168.3
	Area (km^2)	907188	619211	611562	504665	709838	2406189
O3 health target value							
ag	number of zones	57	51	43	38	34	166
	Population (in M)	40.4	41.9	37.1	38.4	35.2	123.5
	Area (km^2)	72891	71253	67855	87317	86209	205981
nonag	number of zones	121	127	112	108	98	208
	Population (in M)	74.4	82.4	81.9	68.4	64.6	169.6
	Area (km^2)	862595	902157	801403	737068	744574	2387777

ag: agglomerations nonag: non-agglomerations

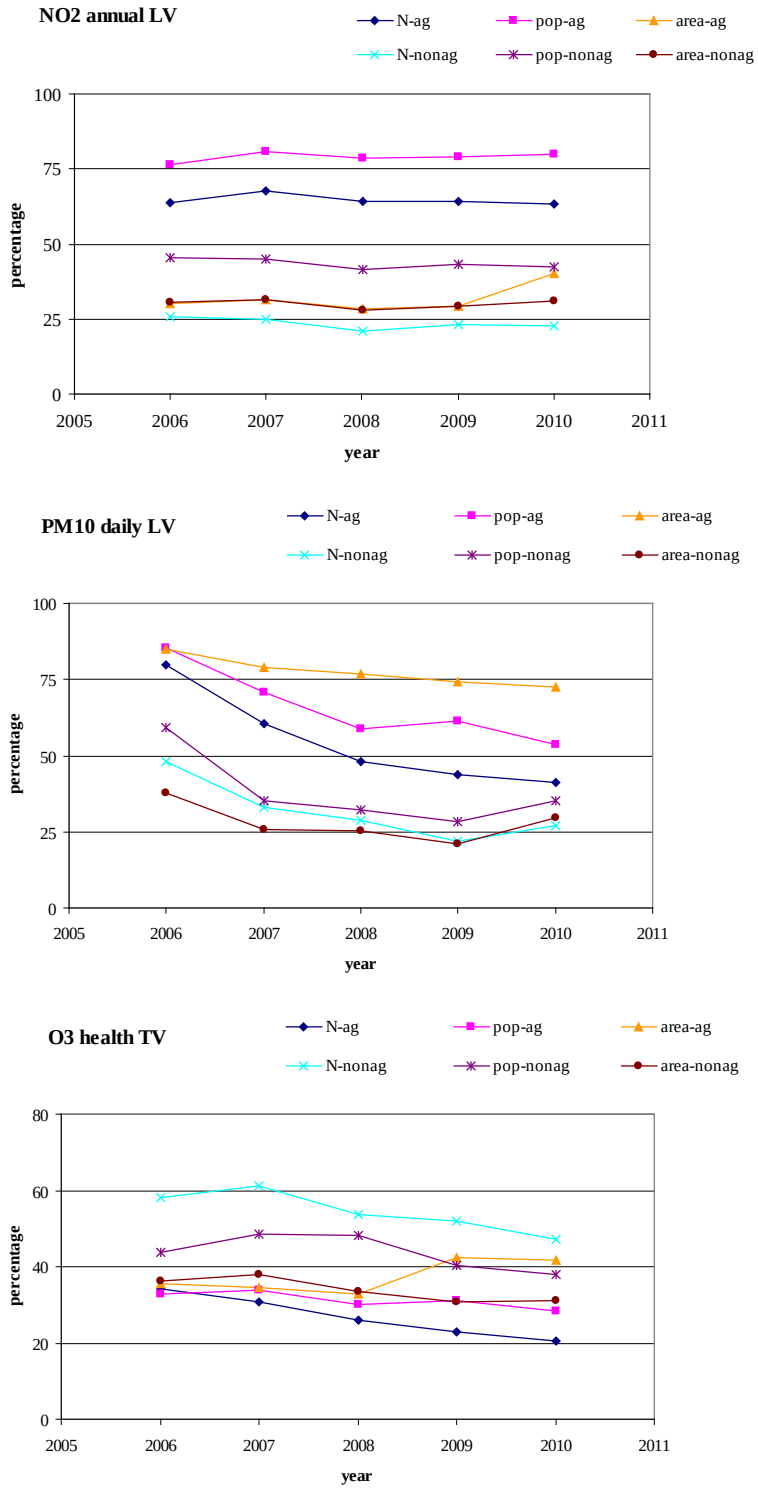

Figure 2. Relative changes in number, population and area of zones where the NO_2 annual limit value (LV), PM_{10} daily limit value (LV) and the O_3 target value (TV) for health protection is exceeded. As reference the total set (Table 2, right column) is taken.

3. Monitoring and Air Quality trends in the Air Pilot cities

In this section, some aspects in relation to the Air Implementation Pilot project are addressed. The results are obtained from a quick screening of the available information (data up to 2010 available from AirBase v6 and the 2010 Air Quality (AQ) reporting questionnaire, with the exception of Milan, where the AQ zone was changed in 2011 to IT0306 and data from the 2011 data submission have been used).

The following topics are considered:

- Are the monitoring networks adequate ?
- Is there a trend in AQ concentration within the selected cities?
- Are the selected cities representative for the (larger) cities in the European Union? What are the persistent problems in the selected cities compared to the other cities?

The first question depends on the objective. Different requirements on siting and density will be required, depending on the objective:

- Legislative point of view: is the assessment of the urban AQ in compliance with the requirements as set in the AQ Directive?
- Effect-oriented point of view: will the network provide exposure estimates representative for the urban population?

For this assessment, the legislative point of view has been taken. In the AQ Directives requirements on networks have been set at the level of AQ management zones. Therefore the first question is addressed at the zone level which not in all cases coincides with the city level. The two other questions focus on the situation in the cities itself; here the assessment will be based on the municipal networks.

For 4 cities (Berlin, Madrid, Prague and Vienna,) the administrative limits of the city are the same as the corresponding AQ zone.
Dublin City forms together with South Dublin County Council, Fingal County Council and Dun Laoghaire Rathdown Council, the AQ zone IE0001 (Zone A). In the analysis of the monitoring network the AQ zone IE0001 will be used, but in the trend analysis, we will consider only Dublin City, which corresponds to the urban audit[3] core city.
Malmö forms, together with Burlöv, Lomma, Lund, Staffanstorp and Vellinge, the AQ zone SW6 (Malmö). In the analysis of the monitoring network the AQ zone SW6 will be used, but in the trend analysis only the Municipality of Malmö will be considered.
Milan was, until 2010, part of the AQ zone IT0301 (Agglomerati Urbani (A1)), which was formed by the agglomerations of Milan, Bergamo and Brescia. From 2011 on, Milan City forms part of the AQ zone IT0306 (Milan Agglomerate). For the purposes of the pilot project, this new AQ zone will be considered instead of the core city, since the zone is homogeneous and continuum and densely populated.
Ploiesti forms, together with the villages of Blejoi, Bucov, Păuleşti, Bărcăneşti, Brazi, Berceni, Ariceştii Rahtivani and Târgşoru Vechi the AQ zone RO0302 Ploiesti, which will be considered for the purposes of the pilot.

[3] http://www.urbanaudit.org/

3.1 Monitoring networks

AirBase information together with information from the AQ reporting questionnaire has been combined to select all the monitoring stations located within the AQ zones. Table 3 lists the number of stations per pollutant that were operational during 2010.
An "operational station" is defined here as a station delivering at least one valid measurement during the year 2010; this does not necessarily imply that the station fulfills the data quality objectives as listed in the AQ Directive.

Table 3. Number of operational monitoring stations in the cities selected for the Air Implementation Pilot, reference period 2010. *Source*: *Data extracted from AirBase and AQ reporting questionnaire***.**

City (a)	Zone code (b)	Pollutant											
		SO_2	NO_2	O_3	PM 10	PM 2.5	CO	Lead	bnz	As	Cd	Ni	BaP
Vienna	AT_09C	9	17	5	13	2	5	1	2	1	1	1	2
Prague	CZ010	10	15	9	15	4	4	8	4	8	8	8	2
Berlin	DEZBXX0 001A	2	16	7	14	4	2	3	4	3	3	3	4
Madrid	ES1301	10	24	14	12	9	10	2	6	2	2	2	1
Dublin	IE0001	6	7	3	7	3	3	2	1	2	2	2	2
Milan	IT0306 (c)	5	14	5	11	4	8	3	2	3	3	3	3
Ploiesti	RO0302	5	5	4	3	1	4	3	4	3	3	3	
Malmö	SW6	2	3	3	4	3	1		1				

(a) Note that in the tables 3-5 the name of city, not the name of the air quality zone, is given.
(b) For the analysis of the monitoring networks density, the AQ zone will be used in all the cases.
(c) Milan was part of AQ zone IT0301 until 2010. In 2011 it became the AQZ IT0306, which will be used for the purposes of the pilot project, so the reference period for the list of stations in Milan is 2011.

According to the AQ Directives, the minimum number of stations depends on population size and assessment regime (see Annex V and IX in the Directive 2008/50/EC and Annex III in Directive 2004/107/EC). When the information from the fixed measurement stations is supplemented by information from modeling and/or indicative measurements, the number of stations might be reduced when specific conditions as described in articles 7.3 and 10.3 of the Directive 2008/50/EC and 4.11 in Directive 2004/107/EC are met.
For simplicity issues, the minimum numbers as listed in the Annexes of the AQ Directives are used as a benchmark.

Information on the assessment regimes in the corresponding AQ zones is – on a voluntary basis – available from the annual AQ Questionnaire (Form 10). When the assessment regime is not available from the questionnaire, it has been estimated from AirBase data. Results are summarized in Table 4. By combining this information and the population numbers the required minimum number of stations is given in Table 5. Note that for particulate matter the sum of PM_{10} and $PM_{2.5}$ sampling points is given.

Regarding ozone, in AQ questionnaires forms 13c reported exceedances of the long term objective for ozone in the last year for all AQ zones, except in Dublin, with the only exceedance took place in 2006. In any case, in all towns measurements of ozone are required.

Focusing on PM, NO_2 and ozone, following can be stated:

- For NO_2 the number of operational stations is higher than the required minimum. The distribution over background and traffic-oriented stations fall within the requested factor of 2. The reference method (chemiluminescence) is used in all the stations;
- For ozone the number of operational stations equals or exceeds the required number. The criterion that in agglomerations at least 50% of the stations is located in suburban areas (Annex IX) is generally not met. The reference method (ultraviolet photometry) has been used at all stations.
- For particulate matter, the required or a larger number of stations is operational in all zones. In six of the Air Pilot zones, an imbalance in the number of PM_{10} and $PM_{2.5}$ stations is found. The requirement that the number of PM_{10} and $PM_{2.5}$ stations should not differ by more than a factor of two is fulfilled in the zones of Madrid and Malmö. Note that this requirement should be met at a national level, not necessarily in each zone.

Table 4. Assessment regimes in the selected AQ zones; information extracted from the AQ Questionnaire (2010 data, except Milan, 2011 data).

city	zone	Pollutant (a)										
		SO_2	NO_2	PM 10	PM 2.5	CO	lead	bnz	As	Cd	Ni	BaP
Vienna	AT_09	<LAT	>UAT	>UAT	>UAT	<LAT	<LAT	<LAT	<LAT	<LAT	<LAT	>UAT
Prague	CZ010	<LAT	>UAT	>UAT	>UAT	<LAT	<LAT	<LAT	>UAT	<LAT	<LAT	>UAT
Berlin	DEZBXX 0001A	*<LAT*	*>UAT*	*>UAT*	*>UAT*	*<LAT*	*<LAT*	*L-UAT*	*<LAT*	*<LAT*	*<LAT*	*>UAT*
Madrid	ES1301	<LAT	>UAT	>UAT	L-UAT	<LAT	<LAT	<LAT	<LAT	<LAT	<LAT	<LAT
Dublin	IE0001	<LAT	>UAT (b)	>UAT	<LAT	<LAT	<LAT	<LAT	L-UAT	<LAT	<LAT	>UAT
Milan	IT0306	<LAT	>UAT	>UAT	>UAT	<LAT	<LAT	L-UAT	<LAT	<LAT	<LAT	>UAT
Ploiesti	RO0302	<LAT	>UAT	>UAT	*?*	<LAT	<LAT	>UAT	<LAT	<LAT	<LAT	*?*
Malmö	SW6 (c)	<LAT	L-UAT	L-UAT	L-UAT	<LAT	<LAT	L-UAT	<LAT	<LAT	<LAT	<LAT

(a) Information given in italics has been estimated from AirBase data. "?" indicates that insufficient information is available to estimate the assessment regime. <LAT: below the lower assessment threshold; L-UAT: between the upper and lower assessment thresholds; >UAT: above the upper assessment threshold.

(b) for SO_2, NO_2 and PM_{10} for both the long-term as well for the short-term limit value (LV) assessment thresholds have been defined. In general, the assessment regime is similar for both LVs. TheNO2 assessment in zone IE0001 (Zone A, Dublin) forms an exception; the worst situation (for NO_2 hourly LV) is given. With respect to the NO2 annual LV, current concentrations are in the range lower-to-upper assessment threshold.

(c). according to the 2011 report concentration for As, Cd, Ni and BaP are below the lower assessment threshold.

Table 5. Required minimum number of stations when assessment is based on fixed measurements only.

city	Population (a)	pollutant										
		SO_2	NO_2	O_3	PM	CO	lead	C_6H_6	As	Cd	Ni	BaP
Vienna	1.731.444	-	5	3	7	-	-	-	-	-	-	2
Prague	1.257.158	-	4	3	6	-	-	-	2	-	-	2
Berlin	3.442.675	-	7	5	10	-	-	3	-	-	-	1
Madrid	3.237.937	-	7	5	10	-	-	-	-	-	-	-
Dublin	1.270.603	-	4	3	6	-	-	-	1	-	-	2
Milan	3.593.025	-	7	5	10	-	-	3	-	-	-	3
Ploiesti	271972	-	2	1	3	-	-	2	-	-	-	*?*
Malmö	503273	-	1	2	2	-	-	1	-	-	-	-

(a) Note that the population numbers refer to the population in the corresponding air quality zone and not to the city.

Conclusion is that the monitoring networks in the corresponding zones fulfill the requirements on stations density. The other criteria set in the AQ Directives are not always fulfilled: e.g. the number of PM_{10} and $PM_{2.5}$ stations differ in most zones by more than the required factor of two.

3.2 Observed trends in air quality in Air Pilot cities based on AirBase

To evaluate the trend in AQ, a consistent set of stations has been selected according to the following criteria:

- for each year in the period 2001-2010 the data coverage should be 75% or more;
- the station should be available during at least 8 years in the ten year period 2001-2010.

The Mann-Kendal test (see, for example, de Leeuw (2012) for a short description of the method) has been applied. The trend is called significant when $\alpha < 0.10$. Calculations have been done for the following indicators:

- 90.4 percentile of PM10 daily mean; when this indicator is below 50 $\mu g/m^3$ there is compliance with the short term LV. For a data coverage of 100% the 90.4 percentile is equal to the 36th highest value;
- PM_{10} annual mean;
- NO_2 annual mean;
- 93.2 percentile of the maximum daily 8-hour means of ozone. When this indicator is below 120 $\mu g/m^3$ there is compliance with the ozone TV.

The measured time series, averaged over all stations (all station types, with/without a significant trend) in an Air Pilot city are presented in Figure 3 and Table 6. Ploiesti is not presented because the available series were not long enough.

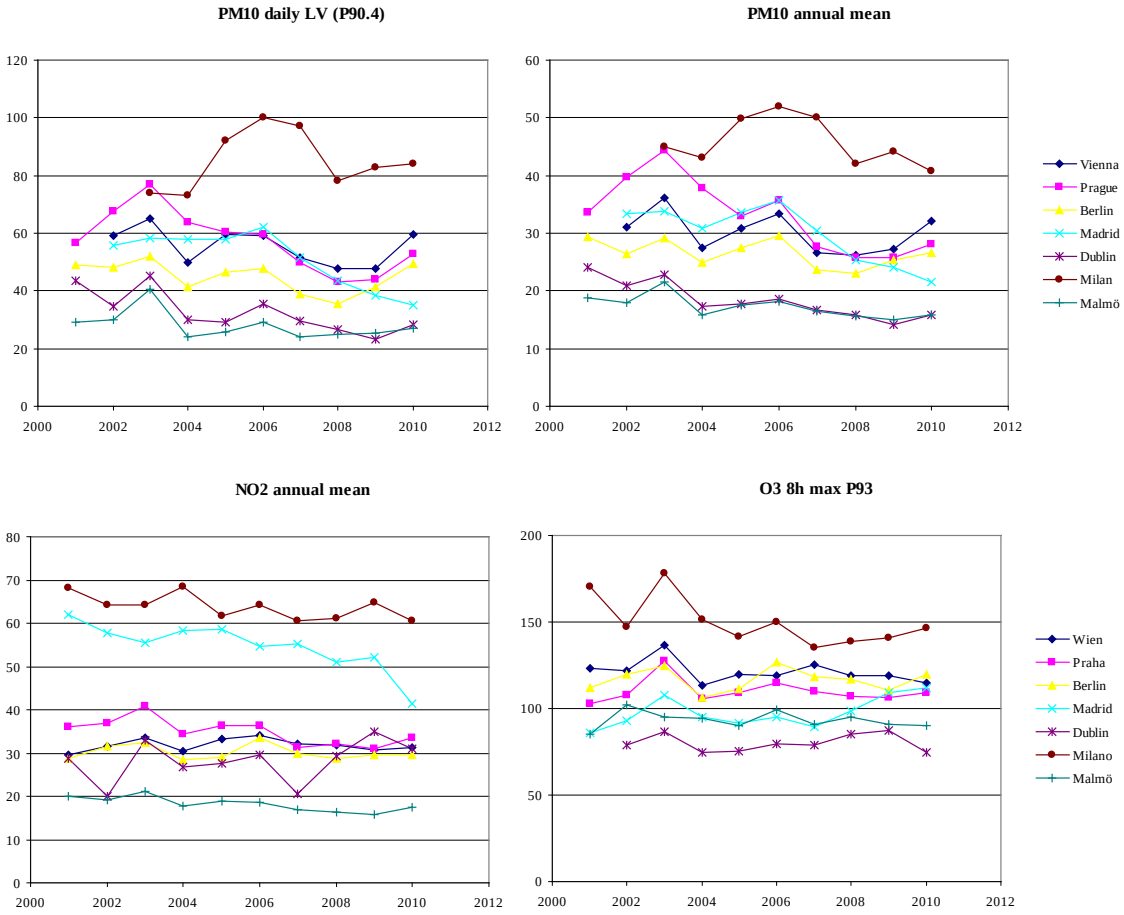

Figure 3. Estimated trend in selected cities, averaged over all available stations within the consistent set. *Source: AirBase v6*

Table 6. Trend analysis: number of operational stations, in parenthesis the number of stations having a significant trend. *Source: AirBase.*

city	PM_{10} day		PM_{10} year		NO_2		ozone	
	number	slope	number	slope	number	slope	number	slope
Vienna	5 (0)	-1.0	5 (0)	-0.5	17 (1)	0.0	5 (1)	-0.87
Prague	9 (4)	-2.3	9 (7)	-1.6	9 (4)	-0.6	5 (1)	-0.03
Berlin	9 (0)	-0.5	9 (0)	-0.2	13 (0)	-0.1	6 (0)	0.16
Madrid	4 (3)	-2.8	4 (3)	-1.3	9 (4)	-0.9	21 (0)	0.84
Dublin	4 (3)	-1.4	4 (2)	-0.7	3 (0)	0.6	1 (0)	0.09
Milan	1 (0)	1.3	1 (0)	-0.6	4 (1)	-0.7	1 (1)	-2.43
Ploiesti	0		0		0		0	
Malmö	1 (0)	-0.4	1 (1)	-0.4	2 (2)	-0.5	1 (0)	-0.68

The slope (in µg/m3 per year) is averaged over all operational stations, consistent set 2001-2010.

In all Air Pilot cities, the PM_{10} concentrations tend to decrease, but a significant trend is only observed at a limited number of stations. The observed trend (in $\mu g/m^3$ annual mean concentration) is even less significant.
For NO_2, the assessment shows a different result. Although not significant, half of the stations show a tendency for increased concentrations. Malmö is the only city where all (two) stations (both urban background) show a small significant decrease. In Vienna one station shows a significant positive trend. In Dublin situation seems even worse: no significant trend but a strong positive tendency, that is mainly caused by one single traffic station (Coleraine Street). On three out of 40 stations the ozone concentrations show a significant trend; it is positive to mention that on those three the averaged slope is -1.5 $\mu g/m^3$ per year. On the other stations, however, no clear picture is noticed.

3.3 Are the selected cities representative for the (larger) cities in the European Union

The Urban Audit (UA) data has been used to evaluate the persistency of non-attainment of the PM_{10} daily LV and the NO_2 annual LV. A persistent non-attainment situation is defined as a station having an exceedance of the LV during four or five years in the period 2006-2010. As usual, only stations having a data coverage of 75% or more are included in the analysis. All station types (including industrial stations) have been taken into account, as long as they are located within an UA city. The results given as function of the city size, are presented in Table 7. Not all UA cities have been included but only a subset limited to the 27 EU member States.

Table 7 Number of cities having persistent problems in meeting the NO_2 and PM_{10} limit values (exceedances) as function of city size (population). *Source: AirBase*

	all UA cities (UA)			air pilot selection		
pop size	N city	NO_2 yr	PM_{10} day	Ncity	NO_2 yr	PM_{10} day
<50k	9					
50-250k	469	60	60			
250-500k	109	31	17	2	0	0
500k-1M	39	26	15	1	0	0
1-2M	13	13	10	2	2	2
>2M	5	5	2	3	3	2
Total number	644	135	104	8	5	4

To get an impression of the representativeness of the air pilot selection, a comparison is presented in Table 7. The Air Pilot selection includes five out of the 8 cities having more than one million inhabitants and may be seen as representative for these size classes. In most of the "million-cities" a persistent NO_2-problem is observed both in the UA selection as in the Air Pilot selection. The Air Pilot city selection is less representative when looking at PM_{10} non-attainment areas. The Air Pilot selection may underestimate this problem.

For the cities smaller than one million inhabitants the Air Pilot selection is not representative; only three smaller cities (Dublin, Malmö and Ploiesti) are included and in three cities no persistent problems are noted. This is in sharp contrast to the overall set of UA cities: NO_2 forms a persistent problem in 13%, 28% and 67% of the cities in the size classes 50-250k, 250-500k, and 500k – 1M, respectively. PM_{10} gives long-lasting problem in 13%, 16% and 38% of the cities in the above mentioned size classes

Conclusion is that the selected cities in the Air Pilot are representative for AQ situations in cities having more than one million inhabitants. None of the selected cities is representative for the situation in smaller size cities which are confronted with persistent AQ problems. The generalization of the results to cities smaller than one million inhabitants may therefore be difficult.

4. Assessment of Plans and Programs and Time Extensions Notifications in Air Pilot cities

In this section, an inventory of measures reported by the Air Pilot cities is presented. For this purpose, the Plans and Programmes (P&P) questionnaires and time extension applications (TEN) have been analysed (see table 8).
The analysis presented in this document is based on the information that the cities reported to the European Commission, undertaken with the assistance of cities. In the next revision of this document in 2013 we will also take into account the feedback from the cities focusing on the management process (e.g. method/process leading to the choice of measures; estimation of the expected effect and/or achieved effect of a measure, evaluation of the costs, faced problems in the implementation, measures out of city control, effects outside the city, further guidance, etc.).

Table 8: Summary of cities that take part in the Air Pilot project and overview of the sent Plans and Programmes (P&Ps) and time extensions notifications (TEN) *Source: TEN and P&Ps*

City	AQZ name (code)	P&P (year)		Time Extension	
		NO_2	PM10	NO_2	PM10
Berlin	Ballungsraum Berlin (DEZBXX001A)	YES (2002)	YES (2002)	YES (2009)	NO
Dublin	Zone A (IE001)	YES (2009)	(-)	NO	NO
Madrid	Madrid (ES1301)	NO	NO	YES (2010)	NO
Malmö	Malmö (SW6)	NO	NO	NO	NO
Milan	Agglomerati urbani (A1) (IT0301)(a)	YES (2009)	YES (2009)	YES (2008-2009)	YES (2005)
Ploiesti	Ploiesti (RO0302)	(-)	YES (2009)	NO	YES(2007)
Prague	Praha (CZ010)	YES (2004)	YES (2004)	YES (2010)	YES (2006)
Vienna	Wien (AT_09)	NO	NO	YES (2010)	YES (2005)

(year): the reference year.
(-): the city has not reported exceedances for that pollutant.
(a) changed to IT0306 in 2011

4.1 Plans and Programs and Time extensions

Article 11 of the old Framework Directive (96/62/EC) and article 23 of the current Air Quality Directive (AQD) 2008/50/EC, require Member States to submit their P&Ps to the European Commission. While the P&Ps would be drafted according to the specific administrative requirements in each Member State, the information submitted to the Commission should be harmonised. The reporting of P&Ps to the Commission is given as an excel form that includes:
(1) General information;
(2) Description of the exceedance situation addressed by the P&Ps;
(3) Analysis of the causes of exceedance;
(4) Summary descriptions of individual measures.

Article 22 of the AQD 2008/50/EC allows the Member States to postpone the attainment deadline for the limit values (LVs) for nitrogen dioxide and benzene and to be exempt from the obligation to apply the LV for PM_{10} if certain conditions are met. Member States have to notify to the Commission where these postponements and exemptions apply using the Time Extension Notification (TEN) format, as defined in the "Commission Staff Working Paper concerning guidance on preparing a notification of a postponement of the deadline for attaining the LVs for NO_2 under Directive 2008/50/EC on ambient air quality and cleaner air for Europe" (SEC(2011) 300 final). Furthermore, according to the "Communication from the Commission on notifications of postponements of attainment deadlines and exemptions from the obligation to apply certain LVs pursuant to Article 22 of Directive 2008/50/EC on ambient air quality and cleaner air for Europe" (COM/2008/0403 final), notifications must be accompanied by an air quality (AQ) plan for the zone or agglomeration concerned.

Time extensions have been applied for Berlin, Madrid, Milan, Ploiesti, Prague and Vienna (Table 8). The applications for time extension include similar information than that in the

P&Ps, such as the summary of the measures implemented or to be implemented for compliance purposes. In addition, the applications include information concerning expectation in the year of extension of the deadline of compliance.

Five out of the eight cities taking part in the Air Pilot project have sent the P&Ps to the European Commission (i.e. Berlin, Dublin, Milan, Ploiesti and Prague; Table 8).

As far as known, Madrid and Malmö have not provided information to the EC on neither on exceedance situations nor the P&Ps in the city (reports on exceedances in the corresponding AQ zone has been included in the national reporting questionnaires). Malmö has not registered exceedances in the last five years, what explains the lack of reporting. The city of Madrid provided upon request the Time Extension Notification with the description of the measures separately for this assessment. The information concerning compliance with LVs, reasons for exceedances and proposed measures is directly comparable between the cities if they have submitted the P&Ps or have applied for a time extension. Therefore, the evaluation in this ETC/ACM technical paper is performed for the seven cities together.

4.2 Exceedances of the limit values reported in the P&P and TEN

Table 9 shows the exceedances reported in the P&P and TEN of the limit values (LVs) for protecting human health for the eight cities. Table 9 only consider those exceedances reported in the P&P or TEN for the reference year; note also that the reference year is not the same for each city (see Table 8).
The LV for $PM_{10,}$ as defined in the Directives 1999/30/EC and 2008/50/EC, has already been in force since the 1st of January 2005, but some of the cities did not attain the annual or daily PM_{10} LVs in the reference year. For instance, the cities of Milan, Ploiesti, Prague, Berlin and Vienna reported exceedances of the PM10 LV for the reference year in the P&P or TEN. According to the AQD, the annual and hourly LV due date for NO_2 was 1st of January 2010. Berlin, Dublin, Madrid, Milan, Prague and Vienna reported exceedances of the LV for NO_2 in the reference year (Table 9).

Table 9: Summary of compliance of the LV ($\mu g/m^3$) for protection of human health by the cities in the reference year (Table 8). *Source: Time Extension Notifications and Plans and Programmes*

LV	LV	Berlin	Dublin	Madrid	Malmö	Milan	Ploiesti	Prague	Vienna
A. NO_2	40	NO	NO	NO		NO		NO	NO
H. NO_2	200 (<18 t/y)			NO		NO			NO
A. PM10	40					NO		NO	NO
D. PM10	50 (<35 t/y)	NO				NO	NO	NO	NO

t/y stands for times per year. Empty cells means that the city has not reported exceedances of the LV. A: annual; H: hourly; D: daily.

Table 10 shows the exceedances reported by the cities in the P&P and TEN, the concentrations above the annual LV for NO_2 and PM_{10}, and the number of exceedances for the hourly and daily LVs of NO_2 and PM_{10}, respectively. The cities reported the expected concentration or number of exceedances by the date when the LV has to be met according to the new extended deadline (see table 10).
Dublin and Madrid are the only cities that do not need additionally measures to comply with the LVs stipulated by the European Directive. The other cities have indicated that it will be

necessary to adopt additional measures beyond those in the current legislation to meet the LV for NO_2 or PM_{10}.
Berlin has estimated an annual NO_2 concentration between 36 and 42 µg/m^3 by the extended deadline, meaning that some of the stations will still present exceedances of the annual LV for NO_2. The city of Madrid expects to comply with both the annual LV and the hourly LV for NO_2 by the year 2014 based on modelling estimations.
Ploiesti has not reported the expected concentration or number of exceedances estimated in the years when the LV has to be met (extended deadline), taking the additional measures for PM_{10} into account. However, it has been indicated that additional measures will be necessary in order to meet the LV. Milan has reported the estimated values for NO_2 indicating that the annual concentrations are expected in the range between 28 and 55 µg/m^3, meaning that some of the stations will register exceedances by the extended deadline; but the expected number of exceedances of the hourly LV for NO_2 is below 10, taking into account the additional measures. For PM_{10} Milan indicated in the TEN that compliance of the LV is expected through the integration of regional measures and the national measures.
Prague has reported that, with additional measures, the estimated level for the NO_2 annual concentration will be lower than the LV. The expected values for PM_{10} are also below the hourly and annual LV according to the estimated values by the city of Prague. Vienna has reported that the expected value for the annual LV of NO_2 will still be higher than the LV in some of the stations by the year 2015. However for the daily LV of PM_{10} Vienna expects that with the additional measures the concentrations will be below 50 µg/m^3, and therefore no exceedances are expected by the extended deadline year.

Table 10: Description of the LV exceedances for NO2 and PM10 and expected concentrations when the LV comes into force (new extended deadline). *Source: Time Extension Notifications and Plans and Programmes*

LV	**Berlin** (TEN)			**Dublin** (P&Ps)			**Madrid** (TEN)			**Malmö**		
	Ref.	*Exp.*	*M*	*Ref.*	*Exp.*	*M*	*Ref.*	*Exp.*	*M*	*Ref.*	*Exp.*	*M*
Annual NO_2	44-62	36-42	Y	40	NA	N	41-68	20-37	N			
Hourly NO_2							*33-76*	*0*	N			
Annual PM10												
Daily PM10												
LV	**Milan** (NO_2:TEN; PM10:P&Ps and TEN)			**Ploiesti** (A:TEN, D: P&Ps)			**Prague** (TEN)			**Vienna** (TEN)		
	Ref.	*Exp.*	*M*	*Ref.*	*Exp.*	*M*	*Ref.*	*Exp.*	*M*	*Ref.*	*Exp.*	*M*
Annual NO_2	45-56	28-55	Y				41-67	<40	Y	42-58	37-52	Y
Hourly NO_2	*19-86*	*<10*	Y									
Annual PM10	41-48	compl iance	Y	60	NA	NA	40-61	40	Y			
Daily PM10	*45-130*	compl iance	Y	*38*	NA	Y	*36-164*	*35*	Y	*46-92*	*0*	Y

Ref.: is the concentration (µg/m3) or the number of exceedances of the LV in the reference year.
Exp.: is the concentration (µg/m3) or the number of exceedances (in italic) estimated in the years when the LV has to be met (extended deadline), taking the additional measures into account.

M: Yes (Y) if there are any measures beyond those resulting from existing legislation needed to ensure that the limit value will be met by the compliance date.
TEN: information from the application for time extension, P&Ps: information from plans and programmes. NA: not available

4.3. Causes of exceedance of the limit values reported in the P&P

Table 11 and table 12 show the sequential level of contribution of local sources to exceedances of the LVs of NO_2 and PM_{10}, respectively, as reported in the P&Ps. The cities identify traffic as the primary source for both NO_2 and PM_{10} levels. The three cities with NO_2 exceedances that have identified contribution sources place them in the same order: traffic, commercial and residential and industrial sources, and all of them identify NO_2 as an urban problem.
Regarding PM_{10} there are differences in the level of contribution between the four cities that have reported contribution of sources to PM_{10} exceedances. All of them place traffic as the main source, but for instance, Ploiesti identifies industry as the second source, while Prague identifies industry as the lowest contributor to PM_{10} levels and Milan also considers natural sources.

Table 11 Contribution of local sources to exceedances of the limit value of NO_2 as reported in the P&Ps. The level of contribution is the same for hourly, daily and annual limit value**.**

Local sources NO_2	**Berlin**	**Dublin**	**Madrid**	**Malmö**	**Milan**	**Ploiesti**	**Prague**	**Vienna**
Traffic	1	NA	NA	n.r.	1	n.r.	1	NA
Industry	3	NA	NA	n.r.	3	n.r.	3	NA
Agriculture	-	NA	NA	n.r.	-	n.r.	-	NA
Commercial and residential	2	NA	NA	n.r.	2	n.r.	2	NA
Natural	-	NA	NA	n.r.	-	n.r.	-	NA
Other	-		NA	n.r.	-	n.r.	-	NA

NA: not available (the information is not available in the TEN; n.r.: not relevant (not exceedances reported)

Dublin sent P&Ps for NO_2 as exceedances of the annual LV (40 µg/m^3) in an urban traffic station have been reported. There is no information about the contribution of local sources to the exceedances. Milan included in the AQ Zone of Agglomerati urbani (A1) submitted the P&Ps for the exceedance of the annual LV for NO_2 and PM10. The contributions of local sources to the exceedance of the LV of NO_2 are in order of relevance traffic, commercial and residential sources, and industry including heat and power production. Berlin and Prague list the sources in the same order as Milan. For the exceedances of PM_{10}, traffic, agriculture and commercial and residential sources, industry and finally natural sources are the contributors in Milan. Also here Berlin reports the same order, except agriculture and natural contributions (Table 11 and 12)

Table 12: Contribution of local sources to exceedances of the limit value of PM_{10} as reported in the P&Ps.

Local sources PM10	Berlin	Dublin	Madrid	Malmö	Milan	Ploiesti	Prague	Vienna
Traffic	1	NA	NA	n.r.	1	1	1	NA
Industry	3	NA	NA	n.r.	3	2	4	NA
Agriculture		NA	NA	n.r.	2		-	NA
Commercial and residential	2	NA	NA	n.r.	2		3	NA
Natural		NA	NA	n.r.	4		-	NA
Other				n.r.			2	NA

The level of contribution is the same for hourly, daily and annual limit value. NA: not available (the information is not available in the TEN; n.r.: not relevant (not exceedances reported)

Ploiesti presented the P&Ps and applied for time extension concerning the exceedances of PM_{10} LV. The local sources appointed as contributors are traffic in the first place and industry in second place (Table 12). Prague has provided the P&Ps in relation to the annual exceedances of NO_2 and daily and annual exceedances of PM_{10}, along with the time extension. The contribution of local sources to the NO_2 exceedance of the LV follows this order: traffic, commercial and residential and industrial (Table 11), whereas the contributions to the PM_{10} exceedances are ranked as traffic, other (not described), commercial and residential, and industry (Table 12).

4.4 Overview of the measures reported to the EC

This section shows an overview of the measures proposed by the different cities (a more extensive overview of measures is included as Annex 1). The overview of the measures is presented on the basis of information provided by the cities concerning:

- the administrative level at which the measure could be taken (i.e. local, regional and national);
- the type of measures (i.e. economical/fiscal, technical, education/information, other);
- the time scale of the concentration reduction achieved by the measure (i.e. short term, medium term, long term);
- the source sector affected by the measure (i.e. transport, industry heat and power production, agriculture, commercial and residential sources, others);
- the spatial scale of the sources affected by the measure (i.e. local sources, urban area, region, country, more than one country).

This information is evaluated and presented in the form of tables. It is important to highlight that some of the measures are classified under several subcategories of the same type. For instance, a measure may be economical and technical at the same time.
In addition, the measures have been divided according to six different groups: I: Industry; II: Buildings: Commercial and residential sources; III: Traffic: Technological and Infrastructure; IV: Traffic: Limiting traffic emissions; V: Campaigns; VI: Agriculture. Every measure has been assigned to a unique group and the percentage of measures classified in every group are presented in pie charts.

Detailed information is presented in Annex I. The six groups are as follows:

(I) Industry: this category includes measures that are directly related (or apply exclusively) to the industry sector. Examples of these measures are the increase of efficiency of power plant, the voluntary reduction of emission at specific refineries and industries (e.g. Schwechat), both in Vienna and implemented in 1999 and 2007, respectively.

(II) Buildings: Similarly the measures taken by the cities concerning energy efficiency of buildings and the use of environmentally friendly fuels for heating are included in this category. Examples are the ban of coal heating and the reinforced measures for heat insulation of old buildings both implemented in Vienna.

(III) Traffic: Technological and Infrastructure: this group is composed of measures which address reduction of traffic emissions via technological improvement of the means of transports, improvement of infrastructures and/or extension of public transport network. Examples of the measures included in this category are the establishment of tighter EU emission standards for vehicles and funding (e.g. Euro 5/6 funding in Vienna), emission improvements in bus fleet, taxis and school vehicles (e.g. Berlin), support for testing retrofit buses, reorganization and extension of bus network, expansion of bike path (e.g. Vienna), among others.

(IV) Traffic: Limiting traffic emissions: this category includes all measures implemented to reduce emission from traffic at the source via reduction of traffic volume or activity, i.e. it does not include technological and infrastructure measures. Examples are the establishment of low emission zones (LEZ), ban of higher emitters or the management of new parking schemes, specific examples are those measures implemented to directly reduce the traffic in the inner city, the establishment of environmental zone levels (e.g. Berlin), the establishment of low speed limit on urban motorways (80 km/h) and in the city (50 km/h; e.g. Vienna), toll increase, etc.

(V) Campaigns: This category includes soft measures such as those implemented to create awareness, to encourage the population towards practise that help to reduce emissions and promotion of low emission activities. Some of the measures taken along those lines are the promotion of car sharing, cycling or electric vehicles, information campaigns, or training campaigns in defensive driving.

(VI) Agriculture: This category includes measures related to the agricultural sector aiming at reducing the impact of agriculture on air pollution. Examples of measures include bans in the burning of waste or the implementation of technological measures to eliminate agricultural waste (eg. Madrid).

4.5. Summary of measures

All the cities, with the exception of Malmö, have reported the measures implemented in the city to reduce the concentrations of NO_2 and/or PM_{10} and comply with the LVs to the European Commission. The number and characteristics of the measures applied vary from city to city, and not always the larger number of measures is correlated with the greater effectiveness. E.g. in the P&Ps submitted by the cities of Milan, Prague and Ploiesti, traffic is

identified as the main contributor to the exceedances of the LV of both NO_2 and PM_{10}. In those cities the percentage of measures for limiting traffic emission is: 40% in Milan for NO_2; 74% and 72% in Prague for NO_2 and PM_{10}, respectively, and 55% in Ploiesti for PM_{10}. Regarding to the number of measures the city of Milan has reported 109 measures for NO_2, Prague 19 and 22 measures for NO_2 and PM_{10}, and Ploiesti has reported 11 measures to comply with the LV for PM_{10}.

The city of Prague represents a good example of measures implemented to address specifically the main source of NO_2 and PM_{10} exceedances. 74% of the measures implemented or to be implemented for compliance with the NO_2 LV are related to traffic, well limiting directly the traffic emissions (32%), well addressed to reduce traffic emissions via technological improvement of the means of transport, improvement of infrastructures or extension of public transport. In relation to the measures for reducing PM_{10} levels, also traffic related measures constitute the largest group, with 72% of measures.

The city of Berlin also has the biggest group of measures dedicated to reduce emissions from traffic in order to comply with the LV for NO_2. Berlin includes 37 measures, and 68% of these measures deal with limiting traffic emissions (30%) and at improving the technology and infrastructure (38%). Another city with a large number of measures orientated to limit the traffic emissions is Vienna, with 25% and 37% for reducing NO_2 and PM_{10} concentrations, respectively.

The cities of Milan, Madrid and Ploiesti have only 4%, 5% and 9% of the measures oriented at reducing traffic emissions via reduction of traffic volume or reduction of activities, and the emphasis is allocated on traffic measures that involve technological development and changes in infrastructures, a percentage of 36%, 46% and 46% for reducing NO_2 emissions have been implemented or will be implemented in these cities, respectively. In the city of Dublin none of the measures can be classified as limiting traffic emissions. The measures for reducing traffic emissions in those cities are mainly related with technology and infrastructure.

Some of the measures related to road traffic that have been applied by the cities (usually a combination of different measures is applied) to reduce the concentrations of NO_2 and PM_{10} are:
1) Creation of Low Emission Zone (LEZ);
2) Improvement of public transport;
3) Promotion of cycling;
4) Management of traffic flow;
5) Change of speed limits;
6) Investment in technology to reduce emissions from public transport.

The commercial and residential sector has been identified as the second largest contributor to NO_2 exceedances in the cities of Milan and Prague (Table 11), and this sector is also an important contributor to PM_{10} exceedances in both cities. The city of Ploiesti has not identified this sector as a contributing to PM_{10} exceedances (Table 12).

Milan and Prague have implemented or are going to implement an important number of measures dealing with energy efficiency of buildings and environmentally friendly fuels for heating with the aim to comply with the LV for NO_2 (24% and 21%, respectively).

The city of Ploiesti identified industry as the second largest contributor to PM_{10} exceedances, but from the 11 measures reported, only one relates directly to limiting the emissions from industry.

All cities have implemented or plan to implement campaigns to create awareness, to encourage the population towards behaviours that help to reduce emissions promoting low emission activities. Those measures are important to make sure that the AQ problems are well understood among the population of the city to promote the adoption of the initiatives.

Agriculture is not as present as other sectors in the measures described in the P&P and TEN submitted by the cities. The most probable reason behind that is that measures concerning agriculture are usually undertaken at regional or national level, and although emissions from agriculture can impact on AQ in the cities, these emissions generally are emitted outside the legal boundaries of the cities and thus outside the city authority's jurisdiction. However, it does not mean that there are not agricultural measures considered at national level. From the 8 cities considered in the study only Milan has identified agriculture as one of the sectors contributing to PM10 exceedances, but the cities of Vienna and Madrid also reported measures dedicated to reduce emissions from agriculture, although they only represent 1% of the total reported measures.

From the analysis of the Plans and Programmes and of the Time Extension Notifications, it is unfortunately not possible to identify which are the most efficient measures in each city. The analysis can only be based on the number of measures that have been applied for limiting emissions directly from the sources.
It is very important that the cities provide input themselves on how they evaluate the effectiveness of the measures and how they analyse it, together with a list of the key measures that have been implemented in the city (e.g. Milan and Madrid reported more than 100 measures). This analysis will be undertaken in 2013 and will also be extended with four other European cities.

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Annex I: Overview of measures in Time Extension Notifications and Plans and Programmes of Air Pilot cities

BERLIN (GERMANY)

Berlin has included 37 measures in the time extension to comply with the limit value (LV) of NO_2. Most of the measures are taken at local administrative level (i.e. 95%; Table 1) and they affect local sources (i.e. 95%; Table 1). The expected time for the concentration reduction for each measure varies from short term to long term (Table 1).

Table 1: Summary of number of measures implemented or to be implemented in Berlin and reported in the application of time extension to comply with the limit value for NO_2.

	A	B	C	D	E
Administrative level	35	2	7		
Type of measure	12	31	17	1	
Time scale of the concentration reduction	17	31	20		
Source sector affected	35	4	0	4	0
Spatial scale of the sources affected	7	26	5	5	2

Administrative level at which the measure could be taken: A: local; B: regional; C: national.
Type of measure: A: economic/fiscal; B: technical; C: education/information; D: other.
Time scale of the concentration reduction achieved by the measure: A.: short term; B: medium term (about a year); C: long term.
Source sector affected by the measure: A: transport; B: industry including heat and power production; C: agriculture; D: commercial and residential sources; E: other.
Spatial scale of the sources affected by the measure: A: local source(s) only; B: sources in the urban area concerned; C: sources in the region concerned; D: sources in the country; E: sources in more than one country.

The measures implemented or to be implemented in Berlin in order to comply with the LVs for NO_2 are mainly related to technological improvement or associated with infrastructures (38%; Figure 1) addressed to reduce traffic emissions. For instance some of the measures are 1) emission side improvements of the municipal vehicle fleet, trucks, taxis and driving school vehicles; 2) reorganization of the bus traffic network; 3) conversion of the bus fleet to Euro 5 or 6; 4) testing of hydrogen/electric buses in regular services or retrofit buses; and 5) tighter EU emission standards for vehicles.

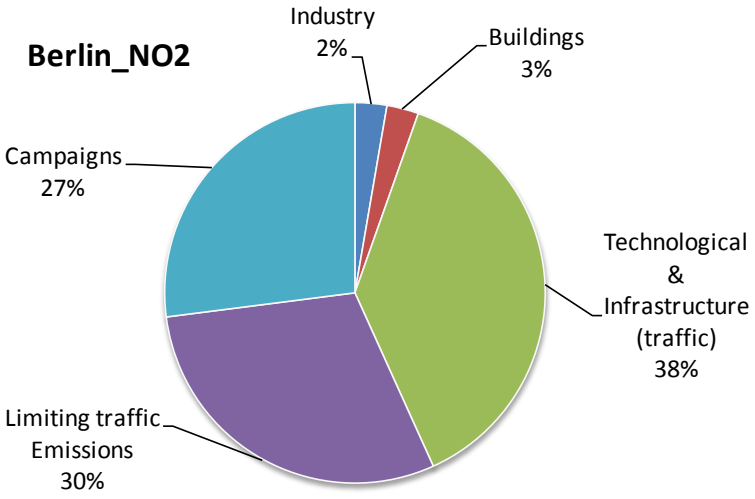

Figure 1: Overview of the types of measures implemented or to be implemented by Berlin in order to comply with the limit value established for NO_2. Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

The second biggest group of measures is the one dealing at limiting traffic emissions (30%; Figure 1), via reduction of traffic volume or reduction of activities, followed by measures promoting environmentally friendly means of transports and/or activities (i.e. campaigns: 27%; Figure 1) such as cycling, Euro 6 vehicles, natural gas vehicles, pedestrian traffic and car sharing. The measures implemented to limit traffic emissions are mainly those defining environmental zone levels, reduce traffic congestion, parking management and reduction of speed limit to reduce harmful emissions from the traffic sector. Only 2 and 3% of the 37 measures implemented in Berlin are related with the industry and building sector, respectively. Most of the measures (68%) implemented in Berlin are not regulatory.

Berlin also reported P&Ps in the year 2002 for NO_2 and PM_{10}, including 21 measures for both NO_2 and PM_{10}. 19 of these measures were also reported in the TEN for NO_2 and have been analyzed above. However, the P&P included two measures specific to decrease PM_{10} levels: i) enhanced wet cleaning of roads to reduce the resuspension of road dust during dry weather periods and ii) reduce dust emission caused by construction activity. The wet cleaning of the roads is expected to have a short term impact on PM_{10} reduction, while for the second measure the expected impact it was considered to be ineffective and was not implemented at the end. Measure (i) can be classified as reduction of traffic emissions via technological and infrastructure improvement.

VIENNA (AUSTRIA)

Vienna has implemented 65 and 76 measures to comply with the exceedances of the LV for NO_2 (Table 2) and PM (Table 3), respectively. Most of the measures for both NO_2 and PM_{10} compliance are taken at local level and the expected time for concentration reduction for most of the measures (about 70%) is about a year (Table 2 and Table 3). The sector mainly affected by these measures is transport for both NO_2 and PM_{10} compliances (63%; Table 2), followed closely by industry (including heat and power production) in the case of the group of measures implemented to comply with PM_{10} LV (29%; Table 3).

Table 2: Summary of the number of measures implemented or to be implemented in Vienna and reported in the application of time extension to comply with the limit value for NO_2. For A, B, C, D and E in each category see Table 1.

	A	B	C	D	E
Administrative level	48	3	17		
Type of measure	14	33	26	6	
Time scale of the concentration reduction	19	46	43		
Source sector affected	41	15	1	14	5
Spatial scale of the sources affected	47	1	1	16	0

Table 3: Summary of the number of measures implemented or to be implemented in Vienna and reported in the application of time extension to comply with the limit value for PM10. For A, B, C, D and E in each category see Table 1.

	A	B	C	D	E
Administrative level	61	3	15		
Type of measure	10	51	27	2	
Time scale of the concentration reduction	23	53	42		
Source sector affected	45	22	3	19	6
Spatial scale of the sources affected	57	62	9	17	0

The evaluation of the measures and their classification in groups indicate that most of the measures can be classified as related with technological improvement or modification of the infrastructures aiming to reduce traffic emissions (Figure 2). Some of the measures included in this group are those related with public transport and cycling, involving the extension of the public transport network in Vienna and the extension of the bike path, in addition change of the bus fleet to pure LPG and modernization of the fleet have been carried out, and the relocation of traffic along the Danube River, among other measures.

Most of the measures have been implemented to comply with both LVs, NO_2 and PM10. The main difference is observed in the number of measures that affect the industry sector, as 17% of measures are implemented to comply with PM10 versus 9% of measures to comply with NO_2 LV (Figure 2). The city of Vienna has implemented one measure related with the agricultural sector named Nitrates Action Programme.

Most of the measures taken to reduce traffic volume in specific areas, and therefore limiting traffic emissions, involve speed limit reduction, extension of calm traffic zones, increase of toll, ban to high emitter vehicles (e.g. Euro 0+1 trucks). These measures constitute 25% and 37% of the measures implemented to comply with the value limit for NO_2 and PM10, respectively.

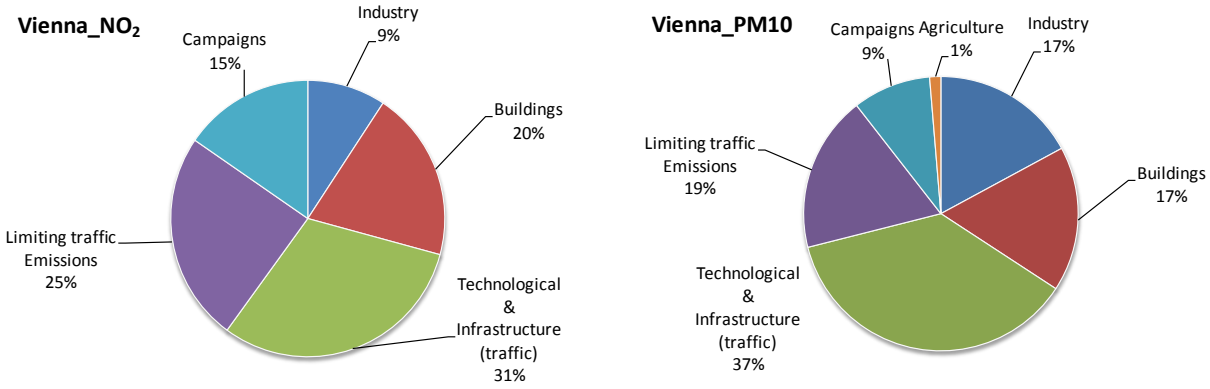

Figure 2: Overview of the types of measures implemented or to be implemented in Vienna to comply with the limit value established for NO_2 (left) and PM10 (right). Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

MILAN (ITALY)

Milan reported 109 measures implemented or to be implemented to comply with the LV for NO_2 in the TEN (Table 9). Most of the measures are taken at regional level (i.e. 94%), have a technical character (i.e. 75%;), a long term concentration reduction is expected for 75% of the measures and traffic and industry are the sector most affected.

Table 4: Summary of the number of measures implemented or to be implemented in Milan and reported in the application of time extension to comply with the limit value for NO_2. For A, B, C, D and E in each category see Table 1.

	A	B	C	D	E
Administrative level	10	103	4		
Type of measure	60	82	4	9	
Time scale of the concentration reduction	19	67	81		
Source sector affected	48	38	12	26	16
Spatial scale of the sources affected	11	19	89	1	1

Most of the implemented measures in Milan are technological or involve an improvement of the infrastructures of the city (i.e. 36%; Figure 3). Some of the measures are the establishment of bicycle paths, intervention programs of urban transports, the development of emission inventories or actions for planning the urban traffic. The second biggest group of measures are those affecting buildings (24%; Figure 3), followed by the measures affecting the industry sector (23%; Figure 3). Some examples of the measures affecting the building sectors involve establishing district heating plants, plans for energy saving in hospitals and schools or the use of energy performance certificate of buildings. Whereas examples of measures affecting the industry sector are measures for limiting the emissions in power plants and energy production facilities. In the city of Milan, 8% of the measures are related with the agriculture sector, an example of those measures is the implementation of the nitrates directive via economic, administrative and technological aspects or the nitrogen load reduction in manure.

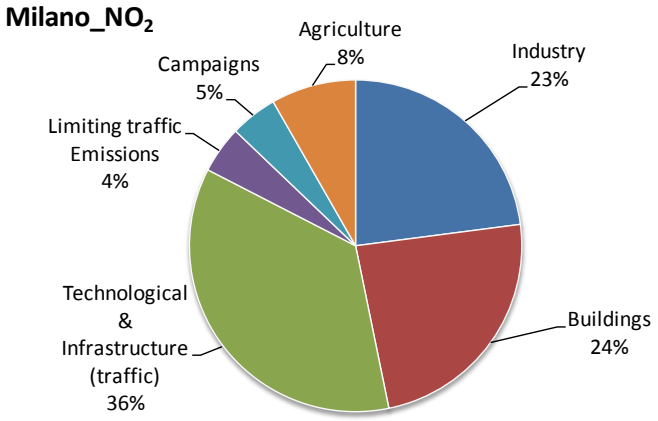

Figure 3: Overview of the types of measures implemented or to be implemented in Milan in order to comply with the limit value established for NO_2. Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

One of the most interesting results obtained in the evaluation of measures implemented in Milan is that only 4% of the measures are related to limiting traffic emissions (Figure 3) even though traffic was identified as the primary source for both NO_2 and PM_{10} (Table 4). As it was indicated previously, the category "limiting traffic emissions" in this report includes measures such as LEZ, low speed limits, toll increase, etc. In the case of Milan, the measures taken to limit traffic emissions involve pricing and access restriction of vehicles to specific areas or opening a call for funding projects aim at reducing emissions from the distribution of goods in urban areas. As mentioned above, in Milan the reduction of emissions from the traffic sector is mainly addressed by technological and infrastructure measures.

PRAGUE (CZECH REPUBLIC)

Prague has reported 19 and 22 measures to comply with the LVs for NO_2 and PM_{10} levels, respectively. All measures were taken at both local and regional administrative level (Table 5 and Table 6). The sources affected by the measures are mainly located in urban areas in the case of measures to comply with LV for NO_2 (Table 5), whereas local, urban and regional sources would be affected by the measures to comply with LV of PM_{10} (Table 6). Most of the measures are classified as technical (i.e. 63%; Table 5 and Table 6), and in addition as education/information in the case of compliance with PM_{10} levels. The time expectancy of concentration reduction varies slightly between measures for NO_2 and PM_{10} reductions; short/medium term time scale of concentration reduction is mainly expected for NO_2 whereas medium term is mainly expected for PM10 reduction.

Table 5: Summary of the number of measures implemented or to be implemented in Prague and reported in the application of time extension to comply with the limit value for NO_2. For A, B, C, D and E in each category see Table 1.

	A	B	C	D	E
Administrative level	19	19	0		
Type of measure	3	12	0	12	
Time scale of the concentration reduction	8	8	3		
Source sector affected	15	0	0	4	0
Spatial scale of the sources affected	5	15	0	0	0

Table 6: Summary of the number of measures implemented or to be implemented in Prague and reported in the application of time extension to comply with the limit value for PM10. For A, B, C, D and E in each category see Table 1.

	A	B	C	D	E
Administrative level	22	22	0		
Type of measure	7	19	11	0	
Time scale of the concentration reduction	0	22	1		
Source sector affected	18	4	2	7	5
Spatial scale of the sources affected	22	22	22	0	0

Figure 4 shows a detailed subdivision of the type of measures taken to reduce NO_2 and PM_{10} levels. Most of the measures, 42% for NO_2 reduction and 54% for PM_{10} reduction, are classified as technological and affecting traffic infrastructures. Some of these measures involve the operational control of emission parameters of vehicles, the development of an integrated transport system, the support of alternative fuels for transport or the construction/improvement of public transport routes.
The second most prominent group of measures includes those limiting traffic emissions, about 32% and 18% of the measures for NO_2 and PM_{10} reduction, respectively. The introduction of toll systems, the definition of low emission zones and the restriction to heavy vehicles in the city are some of the main measures in this group. Measures to increase the attractiveness of public transport and promote it have also been taken in Prague (campaigns; Figure 4). The measures affecting the building sector constitute about 21% and 14% for reduction of NO_2 and PM_{10}, respectively (Figure 4). Some examples of measures affecting the building sectors are support to renovate the heating systems in homes and the efficient use of energy.

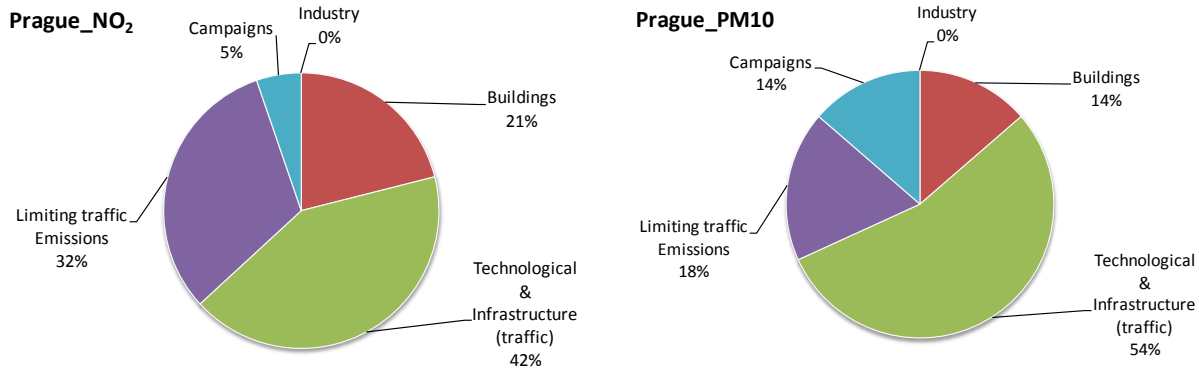

Figure 4: Overview of the types of measures implemented or to be implemented in Prague to comply with the limit value established for NO_2 (left) and PM_{10} (right). Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

MADRID (SPAIN)

Madrid has reported 121 measures to comply with the LV for NO_2. Most of the measures are taken at regional level (74%), and correspond to technical type of measures (84%) affecting mainly local sources. The expected time for the concentration reduction is mostly from medium term to long term, although some of the measures (35%) are expected to have a short term impact (Table 7).

Table 7: Summary of the number of measures implemented or to be implemented in Madrid and reported in the application of time extension to comply with the limit value for NO2. For A, B, C, D and E in each category see Table 1

	A	B	C	D	E
Administrative level	84	42	20		
Type of measure	35	95	58	4	
Time scale of the concentration reduction	39	79	102		
Source sector affected	87	19	14	35	20
Spatial scale of the sources affected	108	104	21	22	0

The measures implemented or to be implemented in Madrid are mainly related to technological improvement or associated with infrastructures (46%) addressed to reduce traffic emissions. For instance some of the measures are 1) Renewal of the vehicle fleet or 2) The Air Quality and Climate Change Strategy of the Community of Madrid. The second big group of measures that Madrid is implementing is related to campaigns as for instance 1) tax measures to promote the use of less pollutant fuels or 2) promoting pedestrian mobility. 13% of the measures are related to industry and they include measures like the renewable energy plan for the whole Spain or the Energy Plan for the Community of Madrid. The measures related to buildings represent 11% of the total measures; these include for example several measures concerning the renovation of heating systems, part of the buildings such as windows, etc. The measures concerning limiting traffic emissions only represent the 5% of the measures implemented or to be implemented, examples of such measures are 1) creation of low emission zones or 2) ban of idling. Finally, the city of Madrid also describes one measure related with the agricultural sector, this measure is contained in the National Plan, and it is therefore managed outside of the administrative limits of the city.

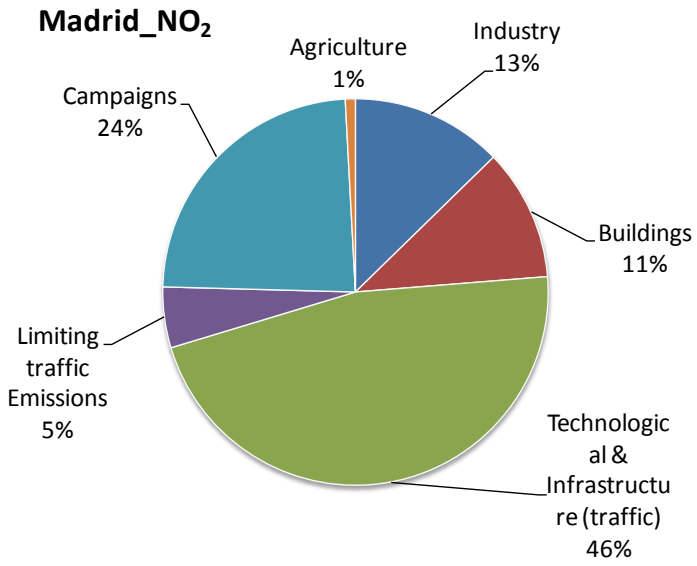

Figure 5: Overview of the types of measures implemented or to be implemented in Madrid in order to comply with the limit value established for NO2. Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

PLOIESTI (ROMANIA)

The city of Ploiesti has submitted both P&Ps and a TEN to the EC for compliance with the PM10 LV. The TEN has 2007 as a reference year and contains only the description of three measures while the P&Ps has 2009 as reference year and includes 11 measures. The analysis is based on the 11 measures described in the P&Ps.
All the set of measures implemented or to be implemented in Ploiesti correspond to the local administrative level, and mainly affect the transport sector (64%), followed by commercial and residential sources (18%) and other sources (18%). The expected time for the concentration reduction is long term, although some of the measures are foreseen to have also a short term impact on PM_{10} concentrations (18%) or a medium term impact (55%).

Table 8 Summary of the measures implemented or to be implemented in Ploiesti and reported in the P&Ps to comply with the limit value for PM10. For A, B, C, D and E in each category see Table 1

	A	B	C	D	E
Administrative level	11	0	0		
Type of measure	6	8	3	7	
Time scale of the concentration reduction	2	6	11		
Source sector affected	7	1	1	2	2
Spatial scale of the sources affected	6	9	1	0	0

Most of the measures in Ploiesti can be classified as related with technological improvement and infrastructure modification aiming to reduce traffic emissions (46%; Figure 6). These measures include for instance 1) making bypass round; 2) rehabilitation, upgrading and maintenance of urban road infrastructure and utilities or 3) cycle paths and pedestrian. The next big group of measures is related with campaigns (27%) and it includes measures as 1) promote public transport or 2) public awareness on the importance of measures to reduce air

pollution. There is only one measure taken to reduce traffic volume, one measure concerning energy efficiency of buildings and one measure directly related with the industrial sector.

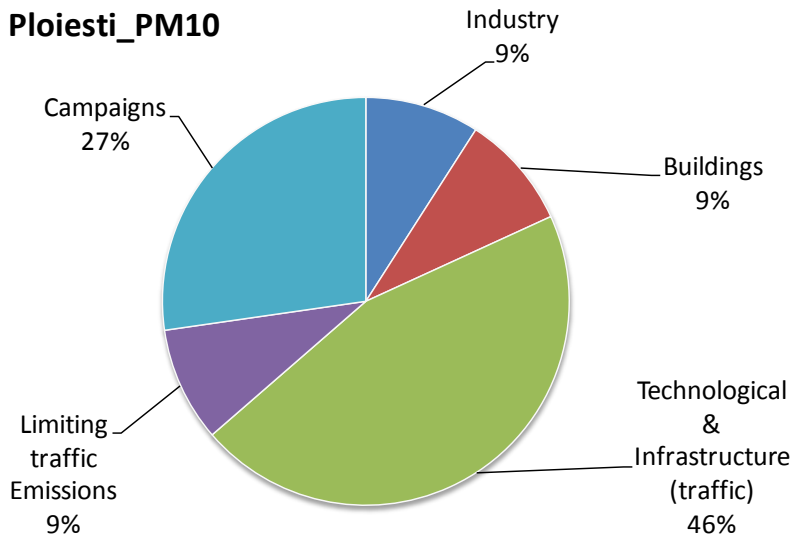

Figure 6: Overview of the types of measures implemented or to be implemented in Ploiesti in order to comply with the limit value established for PM_{10}. Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

DUBLIN (IRELAND)

The city of Dublin has not applied for time extension for compliance with the LV for NO_2, but has reported plans and programmes to the EC. The city of Dublin reported 13 measures implemented or to be implemented to comply with the LV for NO_2. Most of the measures are taken at national level (54%; Table 14) and they affect only to the transport sector. The expected time scale of the concentration reduction is long term for 85% of the measures.

Table 9: Summary of the measures implemented or to be implemented in Dublin and reported in the P&Ps to comply with the limit value for NO_2. For A, B, C, D and E in each category see Table 1

	A	B	C	D	E
Administrative level	3	3	7		
Type of measure	2	10	1	0	
Time scale of the concentration reduction	1	1	11		
Source sector affected	13	0	0	0	0
Spatial scale of the sources affected	2	0	4	7	0

As commented before all the implemented measures in Dublin are related with traffic and most of them are technological or involve an improvement of the infrastructures in the city (85%; Figure 7). Some of the measures are integrated public transport fares and ticketing, real-time air quality monitoring by traffic control systems, local emission taxes, strategic logistics or school, workplace travel planning. Two of the measures can be classified as campaigns:

1) Car clubs;
2) Promoting health benefit of active travel.

None of the measures reported by Dublin are measures for limiting the emissions from traffic.

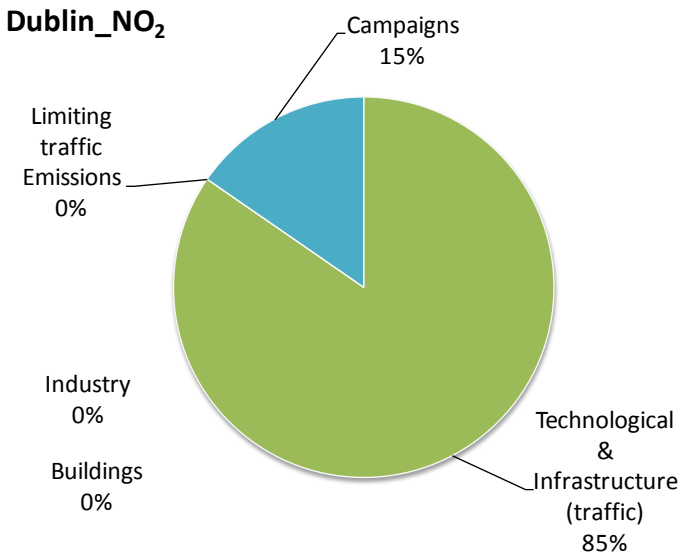

Figure 7: Overview of the types of measures implemented or to be implemented in Dublin in order to comply with the limit value established for NO_2. Classification according to the six categories defined in section 4.4, where every measure is classified in only one category.

Annex II: Inventory of measures

Annex II presents a list of the measures that have been reported in the TEN and P&Ps by the cities in order to comply with the limit value of NO_2 and/or PM_{10}.

II.1. Berlin (Germany)

Table A1. List of measures implemented or to be implemented to reduce NO_2 concentrations in the city of Berlin.

Code	Title
DEBE_M_01	Emission-side improvements in municipal bus fleet: Particle
DEBE_M_02	Emission-side improvements in municipal fleet
DEBE_M_03	Emission-sided improvement of taxis and driving schools
DEBE_M_04	Construction and improvement of infrastructure for natural gas filling stations
DEBE_M_05	Improving emission side of the truck fleet
DEBE_M_06	Financial incentives for users of environmentally friendly trucks
DEBE_M_07	Expansion of public transport in accordance with the plans for StEP - Transport
DEBE_M_08	Reduction of through traffic in the inner city
DEBE_M_09	Parking management
DEBE_M_10	Increasing the attractiveness of public transport
DEBE_M_11	Promote cycling
DEBE_M_12	Better traffic management and truck management in hotspots
DEBE_M_13	Speed reduction to reduce harmful emissions from transport
DEBE_M_14	Environmental Zone level 1
DEBE_M_15	Labeling regulations and road signs for the Environment Zone
DEBE_M_16	Tighter EU emission standards for vehicles
DEBE_M_17	Higher exhaust requirements for mobile machinery
DEBE_M_19	Emissions from stationary sources in Berlin
DEBE_M_101	Tightening of the emission zone
DEBE_M_102	Promotion of Euro 6 vehicles
DEBE_M_103	New campaigns for natural gas vehicles
DEBE_M_104	Promotion of electric vehicles
DEBE_M_105	SCR retrofit buses
DEBE_M_106	Conversion of the bus fleet to 5/EEV € / Euro 6 buses
DEBE_M_107	Testing of hydrogen and electric buses in regular service
DEBE_M_108	Retrofitting of Euro 4 diesel vehicles
DEBE_M_109	Environmental standards in order for local rail services
DEBE_M_110	Information campaign "Clean vehicles"
DEBE_M_111	reducing congestion
DEBE_M_112	Environmentally-sensitive traffic management
DEBE_M_113	Event and Incident Management
DEBE_M_114	Integrated commercial traffic concept (IWVK)
DEBE_M_115	Reorganization of bus traffic
DEBE_M_116	Promotion of pedestrian traffic
DEBE_M_118	mobility Management
DEBE_M_119	Promotion of car sharing
DEBE_M_120	Higher energy efficiency and energy efficiency of buildings

Table A2. Measures implemented or to be implemented to reduce PM_{10} concentrations in the city of Berlin.

Code	Title
DEBE_M_01	Emission-side improvements in municipal bus fleet
DEBE_M_02	Emission-side improvements in municipal fleet
DEBE_M_03	Emission sided improvement of taxis and driving schools
DEBE_M_04	Construction and improvement of a Community Features for natural gas stations
DEBE_M_05	Emission side improve truck fleet
DEBE_M_06	Financial incentives for users of green trucks
DEBE_M_07	Further expansion of public transport within the STEP - Traffic
DEBE_M_08	Reduction of through traffic in the down town Berlin by tangential derivative
DEBE_M_09	Reducing the source and destination traffic in the inner city by expanding the areas with parking management
DEBE_M_10	Increasing the attractiveness of public transport by accelerating the buses and trams at traffic lights
DEBE_M_11	Increasing the attractiveness of bicycle use through ongoing development of cycling infrastructure
DEBE_M_12	Better traffic management and truck leadership in hotspots
DEBE_M_13	Speed reduction to reduce transport-related emissions
DEBE_M_14	Introduction of an environmental zone with traffic restrictions in accordance with § 40 (1) BImSchG and exceptions for low-emission diesel vehicles
DEBE_M_15	Adoption of a regulation on the labeling of low emission vehicles in accordance with § 40 (3) and amendment of the Road Traffic Regulations BImSchG
DEBE_M_16	Enhanced wet cleaning of roads to reduce the resuspension of road dust during dry weather periods
DEBE_M_17	Tightening of the European emissions standards for vehicles
DEBE_M_18	Reduce dust emissions by construction activity and residential
DEBE_M_19	Stricter emission standards for mobile machinery, coupled with economic incentives
DEBE_M_20	Reduction of emissions from stationary sources in Berlin
DEBE_M_21	Reduction of emissions from stationary sources in the eastern neighborhood

II.2. Vienna (Austria)

Table A3. Measures implemented or to be implemented to reduce NO_2 concentrations in the city of Vienna.

Code	Title
AT09_M1975001	Speed limit of 80 km/h on all urban motorways in Vienna
AT09_M1994001	Implementation of parking space management
AT09_M1999001	Intense expansion of district heating system and dust-free energy sources
AT09_M1999002	Increase of efficiency of power plants
AT09_M1999003	Reinforced measures for heat insulation of old buldings
AT09_M1999004	Acceleration of solar systems
AT09_M2000001	Change of the bus fleet to pure LPG
AT09_M2003005	Attractiveness of public transport
AT09_M2003006	Extension of the public transport
AT09_M2003007	Extension of traffic-calmed zones
AT09_M2003008	Restriction of the traffic on high-level roads with underground lines sections and enclosures
AT09_M2003009	Matching the master plan to the aims of the climate protection program
AT09_M2003010	Permanent modernisation of the fleet in Vienna
AT09_M2003011	Intensive expansion of bike paths
AT09_M2003012	Extension of P&R facilieties
AT09_M2003013	Establishment of a transport management

AT09_M2003015	Emission inventory of Vienna "emikat"
AT09_M2004003	Increased checking of heating systems especially solid fuel heating
AT09_M2004005	EU-project "TAQI (tansnational air quality improvement)"
AT09_M2005019	Project "Urbane Luft Initiative (ULI)"
AT09_M2005020	working group "Regionale Initiative Luft (REINLuft)"
AT09_M2005003	Action with main focus on „heating systems“ of companies/households
AT09_M2005007	Limitation of use for diesel aggregates on construction sites (stricter inspection of construction-noise law)
AT09_M2005008	Veranstaltungen (NEA) Limitation of use for current generator at events (NEA)
AT09_M2005009	Accelerated use of low-emission working equipment at the municipality
AT09_M2005010	Speed limit of 50km/h in Vienna
AT09_M2005011	Truck ban before 1992
AT09_M2005012	Acceleration to convert to low emission vehicles in the urban fleet
AT09_M2005014	Environmental orientated mobility management
AT09_M2005017	Low emission urban development (especially in STEP-target areas)
AT09_M2008001	Package of measures for public transport
AT09_M2008002	Package of measures for cycling 2008
AT09_M2008003	Operating mobility management
AT09_M2008005	Intelligent Transport Systems (ITS) Vienna Region
AT09_M2008006	Emission-low vehicles at the municipal
AT09_M2008007	Promotion of low-emission taxis, driving cars and rental cars
AT09_M2008010	Reduction of diesel proportion in passenger car fleet
AT09_M2008011	Driving defensive
AT09_M2008012	Correct tyre pressure
AT09_M2008013	Acceleration of heating valuetechnology
AT09_M2008014	Emission reduction of block power plant BKW 3 Donaustadt
AT09_M2008016	Measure package of building envelopes
AT09_M2011001	Driving ban for EURO 0+1 trucks
AT09_M2011002	Further extension of parking space management
AT09_M2011003	Electric mobility in Vienna
AT09_M2011004	Purchase of vehicles with alternative power unit
AT09_M2011006	Increase of district heating proportion up to 50%
AT09_M2011007	Ban of coal heating
AT10_V_NO2_M01	MÖSt (tax on mineral oil)
AT10_V_NO2_M02	toll increase
AT10_V_NO2_M03	costsaving and fuelsaving driving
AT10_V_NO2_M04	EURO 5/6 funding
AT10_V_NO2_M06	mobility management
AT10_V_NO2_M07	commercial rail transport
AT10_V_NO2_M08	inspection of commercial road transport
AT10_V_NO2_M09	promotion of pedestrian and bicycle traffic
AT10_V_NO2_M10	relocation of traffic on the Danube River
AT10_V_NO2_M11	scrapping bonus
AT10_V_NO2_M12	emission-dependent truck toll

AT10_V_NO2_M13	research and development
AT10_I_NO2_S01	facilitation of extra light and sulphur free oil
AT10_I_NO2_S02	voluntary arrangement of the electricity industry
AT10_I_NO2_S03	voluntary agreement of the cement industry
AT10_I_NO2_S04	voluntary reduction of emissions at the refinery Schwechat
AT10_I_NO2_S05	Amendment of combustion law

Table A4. Measures implemented or to be implemented to reduce PM_{10} concentrations in the city of Vienna.

Code	Title
AT09_M1975001	Speed limit of 80 km/h on all urban motorways in Vienna
AT09_M1994001	Implementation of parking space management
AT09_M1999001	Intense expansion of district heating system and dust-free energy sources
AT09_M1999002	Increase of efficiency of power plants
AT09_M1999003	Reinforced measures for heat insulation of old buldings
AT09_M1999004	Acceleration of solar systems
AT09_M2000001	Change of the bus fleet to pure LPG
AT09_M2003001	Conversion to poorer abrasion grit
AT09_M2003002	Stop obligation to grit
AT09_M2003003	Improved logistics in winter service
AT09_M2003004	Promotion and intensification of street cleaning
AT09_M2003005	Attractiveness of public transport
AT09_M2003006	Extension of the public transport
AT09_M2003007	Extension of traffic-calmed zones
AT09_M2003008	Restriction of the traffic on high-level roads with underground lines sections and enclosures
AT09_M2003009	Matching the master plan to the aims of the climate protection program
AT09_M2003010	Permanent modernisation of the fleet in Vienna
AT09_M2003011	Intensive expansion of bike paths
AT09_M2003012	Extension of P&R facilieties
AT09_M2003013	Establishment of a transport management
AT09_M2003014	Alocation of particulate matter
AT09_M2003015	Emission inventory of Vienna "emikat"
AT09_M2004001	Conversion of the winter maintenance fleet to wet salt technology
AT09_M2004002	Sole use of sweepers
AT09_M2004003	Increased checking of heating systems especially solid fuel heating
AT09_M2004004	Package of measures to reduce dust emissions from construction sites
AT09_M2004005	EU-project "TAQI (tansnational air quality improvement)"
AT09_M2005019	Project "Urbane Luft Initiative (ULI)"
AT09_M2005020	working group "Regionale Initiative Luft (REINLuft)"
AT09_M2005001	Particulate filters for off-duty diesel engines with more than 18 kW
AT09_M2005002	Prohibition of "easy oil" in operating systems
AT09_M2005003	Action with main focus on „heating systems“ of companies/households
AT09_M2005004	Good practice dust key action "dust" in Industry & Trade
AT09_M2005005	Edition catalog dust abatement during storage / handling (for operating systems-approvals)
AT09_M2005006	More dust abatement during construction transport (monitoring compliance with traffic regulations in the field worksites)
AT09_M2005007	Limitation of use for diesel aggregates on construction sites (stricter inspection of construction-noise law)

AT09_M2005008	Veranstaltungen (NEA) Limitation of use for current generator at events (NEA)
AT09_M2005009	Accelerated use of low-emission working equipment at the municipality
AT09_M2005010	Speed limit of 50km/h in Vienna
AT09_M2005011	Truck ban before 1992
AT09_M2005012	Acceleration to convert to low emission vehicles in the urban fleet
AT09_M2005013	Construction traffic on the railway
AT09_M2005014	Environmental orientated mobility management
AT09_M2005015	Further optimization of street cleaning
AT09_M2005016	Inter-regional air data system
AT09_M2005017	Low emission urban development (especially in STEP-target areas)
AT09_M2008001	Package of measures for public transport
AT09_M2008002	Package of measures for cycling 2008
AT09_M2008003	Operating mobility management
AT09_M2008004	Package freight in 2008
AT09_M2008005	Intelligent Transport Systems (ITS) Vienna Region
AT09_M2008006	Emission-low vehicles at the municipal
AT09_M2008007	Promotion of low-emission taxis, driving cars and rental cars
AT09_M2008008	Minimize the empty taxi rides
AT09_M2008009	Parking policy
AT09_M2008010	Reduction of diesel proportion in passenger car fleet
AT09_M2008011	Driving defensive
AT09_M2008012	Correct tyre pressure
AT09_M2008013	Acceleration of heating valuetechnology
AT09_M2008014	Emission reduction of block power plant BKW 3 Donaustadt
AT09_M2008015	Emission reduction in power plant Simmering block BKW 3
AT09_M2008016	Measure package of building envelopes
AT10_V_M01	MÖSt (tax on mineral oil)
AT10_V_M02	toll increase
AT10_V_M03	costsaving and fuelsaving driving
AT10_V_M04	EURO 5/6 funding
AT10_V_M05	Sulfur-free fuel
AT10_I_M01	Environmental Support Domestic (UFI)
AT10_I_M02	Trade Regulations 1994 (Federal Law Gazette No. 194/1994)
AT10_I_M03	ZementV 2007
AT10_I_M07	Combustion Plants Ordinance - FAV (Federal Law Gazette II No. 331/1997)
AT10_I_M09	Clean Air Act for Boiler Systems - LRV-K
AT10_I_M10	Voluntary agreement between VEÖ and BMLFUW / BMWA
AT10_I_M11	Amendments to the Renewable Energy Act
AT10_R_M01	climate: active renewable energy programs, building and renovation and energy conservation.
AT10_L_M02	Nitrates Action Programme 2008

II.3. Milan (Italy)

Table A5. Measures implemented or to be implemented to reduce NO_2 concentrations in the city of Milan.

Code	Title

I03_P2T_01	Limit emissions from gas turbine in power plants
I03_M0E_02	Action Plan traffic
I03_P1T_03	Emission limits energy production facilities
I03_D1T_04	Ban on use of fuel oil and other fuels in the civil
I03_E0E_05	Emission inventory INEMAR
I03_M0E_06	Compulsory check of emissions from the exhaust of motor vehicles of residents in the region
I03_M0E_09	bicycle paths
I03_M0E_10	bicycle paths
I03_D0F_11	Thermal gasification plants
I03_M3F_12	Call for buying commercial vehicles with low environmental impact
I03_P0F_13	Energy saving hospitals
I03_D0F_14	Solar thermal
I03_D0F_15	Solar photovolatic
I03_P1T_16	OB2 energy saving
I03_D0T_17	Guidelines thermal plants
I03_M2F_18	Renewal of bus fleet with environmentally friendly buses
IO3_M2F_19	Financing Investment in local public transport
I03_M1F_20	Incentives for the diffusion of environmentally friendly cars
I03_M2I_21	Sustainable mobility projects
I03_M2F_22	Taxi CNG or LPG
I03_M2E_23	Programming Underground network, metrotranvie
I03_M2E_24	Programming railway network
I03_M0F_25	Natural gas distributors
I03_M3F_26	Call commercial vehicles to LPG / CNG
I03_M1F_27	Call conversion to LPG / CNG car
I03_M1F_28	CNG / LPG-off paper
I03_M1F_29	Incentives for the purchase of motorcycles and mopeds
I03_E0F_30	Call for the use of materials containing photocatalytic substances
I03_P2T_31	Technical requirements for reduced emissions from production plants belonging to the steel industry
I03_P2T_32	Technical Annex plastic and rubber sector
I03_P2T_33	Reducing emissions from installations in the sector "chipboard"
I03_P2T_34	Best abatement technologies available to reduce air pollution to some productive activities
I03_E0E_35	Search for the definition of environmentally friendly building standards
I03_P1F_36	District heating plants
I03_P1F_37	Incentives for energy production in agriculture
I03_E0E_39	Law on Air Pollution
I03_E0E_40	Air table - Agreement between the regions of the Po Basin
I03_M0E_41	Bicycle paths
I03_M0E_42	Call of contribution to sustainable mobility
I03_P1F_46	Call for district heating
I03_P2F_48	Solar thermal industry
I03_E0F_49	Solar Thermal public sphere
I03_M1F_50	Voluntary agreement for the deployment of low emission vehicles
I03_E0T_51	Research Program for Air Pollution Reduction in Lombardia
I03_P3F_52	Interventions to support environmental restoration in the conduct of craft business
I03_P0F_53	Second Convention saving hospitals

I03_M1F_54	Incentives for the scrapping of Euro 0 cars in favor of those with limited income ISEE
I03_M1F_55	Incentives for the renewal of vehicles of public administration and use of alternative forms of ownership of the vehicle
I03_M0E_56	Spatial Development Framework Agreement Milan
I03_E5F_57	Regional Action pilot program of investment for agrofuel production and for reducing the nitrogen load in vulnerable areas
I03_M0E_62	Bicycle paths
I03_D0T_63	Energy certification of buildings
I03_D4F_64	Call INNOVA RETAIL
I03_D4F_65	Announcement innovative technologies for logistics
I03_M0E_66	OP Competitiveness 2007 - 2013, Axis 3
I03_D0F_69	Call accounting and thermoregulation
I03_E0F_70	Call photovoltaics on public schools and equal
I03_D0T_71	Edit L.R. 33/2007
I03_E0F_72	Public Lighting
I03_D0F_73	Call energy audit
I03_E6T_77	Photocatalytic treatment for the transformation of the nitrogen compounds contained in the slurry
I03_P6E_78	Economic, managerial and technological implementation of the Nitrates Directive
I03_E6E_79	Expert systems for the development of livestock manure, environmental protection and land conservation
I03_E6T_80	Nitrogen load reduction in manure by pyrolytic gasification of the solid fraction contained therein
I03_E6E_81	Regulatory, technological and economic placing of biomethane into the gas grid existing
I03_E6E_83	Regional action program investment for productions agroenergy and for containment of the nitrogen load
I03_M0E_84	Regional law on cycling
I03_P0T_85	Limits emissions from facilities and activities with low environmental impact
I03_P2T_86	Indications for investigation of the Integrated Environmental Authorisation
I03_P0T_87	Creation of a network for the collection, storage and processing of large data EMS systems
I03_E5F_88	Special program of action for the implementation of the Nitrates Directive
I03_M3F_91	Call replacement vehicle freight (Guilder) - 2009
I03_M3F_92	Call replacement vehicle freight (Guilder) - 2010
I03_M1F_93	Call replacement car for limited income groups - 2010
I03_P0F_94	Investment support for the purchase of machinery / equipment / equipment to support innovation and energy efficiency
I03_M1F_95	Incentives for the use of mobility services alternative to the private car in replacement of polluting vehicles
I03_M3F_96	Projects of infrastructure for the development of intermodal freight
I03_P1T_97	Regulations for the installation of geothermal probes that do not involve the removal of water
I03_E0F_98	Promotion of redevelopment energy through ESCO
T-1	Trucks, buses and commercial vehicles with diesel - scrapping
T-2	Passenger cars - scrap
T-3	Motorcycle private
T-4	Gaseous fuels for automotive
T-6	Intervention programs in the rail sector.
T-7	Intervention programs in metropolitan and metrotranviario.
T-8	Implementation of TPL services performed in Lombardy and renewal of the fleet assets
T-9	Pollution charge
T-10	Bicycle paths
T-11	highways
E-10	Thermal non-industrial
E-11	Energy certification of buildings
E-12	lighting

E-13	Heat metering
E-14	household appliances
E-15	Energy recovery from incineration of municipal waste
E-16	Recovery of biogas from organic fraction of MSW
E-17	Systems with heat pumps
E-19	Centralized production of energy-efficient
E-20	Renewables and district heating
E-21	Development District heating gas
E-23	Solar thermal energy saving public
E-24	Solar thermal in school building
E-25	Development of solar thermal in residential: new construction
E-26	Development of solar photovoltaic
E-27	wind farm development
E-28	Hydropower production incentive
E-29	Of-river hydroelectric plants irrigation canal
E-30	BAT plants burning civilian
E-31	Power consumption of the motors

II.4. Prague (Czech Republic)

Table A6. Measures implemented or to be implemented to reduce NO_2 concentrations in the city of Prague.

Code	Title
K.2.1.1.	Construction of rail public transport routes
K.2.1.2.	Supporting the development of an integrated transport system
K.2.1.3.	Preference for public transport vehicles
K.2.1.4.	Increasing the attractiveness of public transport
K.2.1.5.	Construction of roads for vehicular traffic
K.2.1.6.	Restrictions on entry of heavy trucks in the city
K.2.1.7.	Temporal organization of supply
K.2.1.8.	The introduction of the toll system
K.2.1.9.	Parking policy in the city center and local centers
K.2.1.10.	Support for car parks P + R
K.2.1.11.	Comprehensive support the use of alternative fuels for automotive transport
K.2.1.12.	Operational control of emission parameters of vehicles
K.2.1.13.	Reducing emissions from public transport buses and other vehicles of
K.2.1.16.	limiting sources and destinations automobile traffic
K.2.2.1.	Development of environmentally friendly energy infrastructure
K.2.2.2.	The greening of energy sources
K.2.2.3.	Promotion of energy saving and efficient use of energy
K.2.2.4.	Support conversion of heating systems in homes
K.2.4.3.	Definition of low emission zones

Table A7. Measures implemented or to be implemented to reduce PM_{10} concentrations in the city of Prague.

Code	Title

CZ010_1.1.1 (2004), CZ010_1.1.1 (2006)	Promoting quality public transport
CZ010_1.1.2 (2006)	Organisational measures for public transport preference
CZ010_1.1.3 (2004), CZ010_1.1.3 (2006)	Restrictions on entry of heavy trucks in the city
CZ010_1.1.4 (2006)	Temporal organization of supply
CZ010_1.1.5 (2006)	Parking policy in the city center and local centers
CZ010_1.1.6 (2004); CZ010_1.1.6 (2006)	Support for car parks P + R
CZ010_1.1.7 (2006)	Limiting sources and destinations automobile traffic
CZ010_1.1.8 (2006)	Promoting cycling
CZ010_1.1.9 (2006)	Establishment pedestrian zones and other types of communications zklidněných
CZ010_1.2.1 (2004); CZ010_1.2.1 (2006)	Building capacity communication networks
CZ010_1.3.1 (2006)	Operational control of emission parameters of vehicles
CZ010_1.3.2 (2006)	Reducing emissions from public transport buses and other vehicles of
CZ010_1.3.3 (2006)	Comprehensive support the use of alternative fuels in cars. transport
CZ010_2.1.1 (2004), CZ010_2.1.1 (2006)	The development of energy infrastructure
CZ010_2.2.1 (2004), CZ010_2.2.1 (2006)	Support conversion of heating systems and prevent the return of the use of solid fuels in households
CZ010_3.1.1 (2006)	Reducing dust emissions from area sources
CZ010_3.1.2 (2004); CZ010_3.1.2 (2006)	Reducing emissions of particulate matter from traffic
CZ010_3.1.3 (2006)	Reducing dust targeted planting of greenery - increasing the proportion of green areas in urban areas and reducing the share of arable land for
CZ010_5.1.1 (2006)	Land-use planning
CZ010_5.1.2 (2006)	Regional decision making
CZ010_5.1.3 (2006)	The public information and education of the population
CZ010_5.1.4 (2006)	Conditions for procurement

II.5. Madrid (Spain)

Table A8. Measures implemented or to be implemented to reduce NO_2 concentrations in the city of Madrid.

Code	Title
ES01	Strategy of energy saving and efficiency in Spain 2004-2012, 2005-2007 and Action Plan 2008-2012 Action Plan
ES02	Planning of the Electricity and Gas sectors 2008-2016. Development of transport networks
ES03	Activation Plan and Energy Efficiency Savings 2008-2011
ES04	Renewable Energy Plan in Spain 2005-2010
ES05	Renewable Energy Plan in Spain 2011-2020
ES06	Spanish Strategy for Climate Change and Clean Energy and Emergency Measures Plan
ES07	National Plan to Improve Air Quality
ES08	Technical Building Code
ES09	Regulation of Thermal Installations in Buildings and Technical Instructions
ES10	RD 47/2007, of 19 January, approving the Basic Procedure for certification of energy efficiency of new buildings
ES11	Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on the efficient end use of energy and energy services and repealing Council Directive 93/73/EEC
ES12	Legislation on the promotion of cogeneration (Royal Decree 616/2007 of 11 May on the promotion of cogeneration)
ES13	Directives 2008/1 / EC and 96/61/EC on integrated prevention and control of pollution. (Law 16/2002 and RD 509/2007)
ES14	Strategic Infrastructure and Transport (PEIT) 2005-2020

ES15	Renewal of the fleet of vehicles by applying the EURO Standards
ES16	Legislation relating to the promotion of the use of biofuels or other renewable fuels for transport
ES17	Spanish Strategy for Sustainable Mobility
ES18	Legislation on the limitation of emissions of non-road mobile machinery
ES19	National Integrated Waste Plan 2008-2015 (PNIR)
ES20	Measures contained in the National Plan to Improve Air Quality with effects in the agricultural sector
ES21	Monitoring measures, awareness, information and awareness
ES22	Royal Decree 61/2006, of January 31, by laying down the specifications of petrol, diesel, fuel oil and liquefied petroleum gases, regulating the use of certain biofuels and the sulfur content of marine fuels.
ES23	National Plan for Reducing Emissions from Large Combustion Plants (PNRE-GIC)
CAM01	Energy Plan 2004-2012 Community of Madrid
CAM02	Air Quality Strategy and Climate Change of the Community of Madrid (2006-2012), Blue Plan
CAM03	Domestic Boiler Renewal Plan
CAM04	Renewal Plan Boiler
CAM05	Renewal Plan Windows in Residential Buildings
CAM06	Driving courses
CAM07	Sustainable Urban Mobility Plans (PMUs). Alcobendas
CAM08	Sustainable Urban Mobility Plans (PMUs). Fuenlabrada
CAM09	Sustainable Urban Mobility Plans (PMUs). Getafe
CAM10	Sustainable Urban Mobility Plans (PMUs). Leganes
CAM11	Sustainable Urban Mobility Plans (PMUs). Móstoles
CAM12	Sustainable Urban Mobility Plans (PMUs). Parla
CAM13	Sustainable Urban Mobility Plans (PMUs). Torrejón de Ardoz
CAM14	Plan for Modernization of transport services permanent regular travelers commonly used by road within the Community of Madrid, which is set to renew the fleet of intercity bus Madrid
CAM15	Industrial Machinery Renewal Plan for the Community of Madrid
CAM16	Measures affecting air traffic (fleet renewal, continuous descent approaches (CDA), minimizing the use of auxiliary power units loaded onto the aircraft, shooting Establishing a platform with n-1 engines loaded onto the aircraft)
CAM17	Measures on the machinery used in construction activities / demolition
MAD01	Local Strategy for Air Quality in the City of Madrid 2006-2010
MAD02	Plan for Sustainable Use of Energy and Climate Change Prevention of the City of Madrid
MAD03	Air Quality Plan of the City of Madrid 2011-2015. 78 steps as outlined below to MAD03 MAD03-01-78
MAD03-01	Implementation of a Low Emission Zone (LEZ)
MAD03-02	Residential new priority areas and restricted traffic passing through the Low Emission Zone (LEZ)
MAD03-03	Comprehensive peatonalizaciones New Low Emission Zone (LEZ)
MAD03-04	Reducing road capacity in the Low Emission Zone
MAD03-05	Implementation of a differentiated rate of Controlled Parking Service (SER) in the Low Emission Zone (LEZ)
MAD03-06	Increased schedule Regulated Parking Service (SER)
MAD03-07	Implementation of an intelligent
MAD03-08	Ban ignition engine maintenance vehicles parked
MAD03-09	Promotion of electric mobility
MAD03-10	Consolidation and expansion of the network of supply points of cleaner fuels
MAD03-11	Consolidation and expansion of the tax measures to promote the use of cleaner fuels and technologies
MAD03-12	Consolidating and strengthening the renovation and optimization of municipal fleet to cleaner technologies
MAD03-13	New regime taxis schedule
MAD03-14	Renewal Impulse taxi fleet to cleaner fuels and technologies

MAD03-15	100% of the bus fleet of EMT serving in the Low Emission Zone incorporate clean technologies
MAD03-16	Increasing the number of alternative supply points in the centers of the EMT
MAD03-17	Promoting good practices and new technologies for more efficient use of buses EMT
MAD03-18	Platforms reserved bus
MAD03-19	Complete network of transverse lines of EMT
MAD03-20	Expand the network of lines with special vehicles
MAD03-21	Removal of barriers, secure and optimize space infrastructure Madrid bus stops
MAD03-22	Increased conventional bus lanes and separating
MAD03-23	Improved payment systems
MAD03-24	Improved passenger information
MAD03-25	Center integrated interpretation of public transport
MAD03-26	Management Tools busing services and regular transportation of special purpose
MAD03-27	Plan for the management of services and parking discretionary transport and tourist buses
MAD03-28	Promoting the use of car sharing (Carpooling) and multi vehicle (Carsharing)
MAD03-29	Promoting cycling
MAD03-30	Promoting pedestrian mobility
MAD03-31	Promoting the use of motorcycle
MAD03-32	Promoting alternative school mobility
MAD03-33	Promotion of mobility to work by public transport
MAD03-34	Promotion of voluntary agreements with the private sector to promote the renewal of trade and delivery fleets to cleaner technologies
MAD03-35	Grant of advantages in mobility and commercial vehicles with cleaner technology sharing
MAD03-36	Study on loading and unloading more sustainable
MAD03-37	Promotion of municipal action on parking for residents and rotational
MAD03-38	Promotion of Sustainable Paving
MAD03-39	Using paint cleaner signage
MAD03-40	Mesa Mobility
MAD03-41	Promotion of studies and projects
MAD03-42	Specific measures for environments with high pollution records
MAD03-43	Line municipal subsidies for renewal of centralized oil boilers
MAD03-44	Promotion of energy rehabilitation of housing
MAD03-45	Pulse Energy Optimization Plan in buildings and facilities of the City of Madrid
MAD03-46	Voluntary agreements with private sectors to increase efficiency and energy saving
MAD03-47	Promoting good practices to reduce air pollution in the construction and demolition of buildings
MAD03-48	Promoting good practices in mobility infrastructure works
MAD03-49	Installation of centralized collection of municipal waste in urban areas newly created
MAD03-50	Pollution abatement by public roads washdowns
MAD03-51	Technological renewal of the fleet of vehicles and machinery Municipal Services and Urban Cleansing Waste Collection
MAD03-52	Technological renovation motogeneración teams used in sewage treatment
MAD03-53	Integration considerations for air quality in the new General Urban Plan
MAD03-54	Development and review of road systems
MAD03-55	Measures to revitalize the city center
MAD03-56	Ecobarrios: towards a more comprehensive concept of sustainability
MAD03-57	Strengthen the contribution to the fight against air pollution green heritage city

MAD03-58	Reducing emissions in the work of conservation parkland
MAD03-59	Improving governance of the city
MAD03-60	Promotion of green procurement
MAD03-61	Promoting sustainable public events
MAD03-62	Promoting sports activities and infrastructure more sustainable
MAD03-63	Improved system monitoring, forecasting and reporting of air quality in Madrid
MAD03-64	Improved analysis applications and data control and forecasting systems and air quality information
MAD03-65	Development tools for surveillance and health information health protection
MAD03-66	Sustainability training personnel providing municipal services
MAD03-67	Training on air quality in schools
MAD03-68	Training for the promotion of sustainable mobility
MAD03-69	New model of comprehensive municipal information mobility alternatives sustainable in the city of Madrid
MAD03-70	Promotion of citizen information on Air Quality Plan
MAD03-71	Renovation with cleaner technologies of intercity bus fleet
MAD03-72	Improvements in customer service intercity buses
MAD03-73	Improvements to the user in the Metro service
MAD03-74	New Metro railway infrastructure and commuter
MAD03-75	Promotion of sustainable transport in localities of the Community of Madrid
MAD03-76	Comprehensive Transportation Center of Madrid (CITRAM)
MAD03-77	Performances in areas intermodal exchangers
MAD03-78	Reducing emissions from Barajas Airport

II.6. Ploiesti (Romania)

Table A9. Measures implemented or to be implemented to reduce PM_{10} concentrations in the city of Ploiesti.

Code	Title
RO0302_M01	Making bypass round
RO0302_M02	Traffic restrictions
RO0302_M03	Promote public transport
RO0302_M04	Rehabilitation, upgrading and maintenance of urban road infrastructure and utilities
RO0302_M05	Cycle paths and pedestrian
RO0302_M06	parking
RO0302_M07	Parks
RO0302_M08	Introduction / Extension of gas distribution
RO0302_M09	Measures of industrial sources
RO0302_M10	Control compliance with the urban and environmental documents approved
RO0302_M11	Public awareness on the importance of measures to reduce air pollution

II.7. Dublin (Ireland)

Table A10. Measures implemented or to be implemented to reduce NO_2 concentrations in the city of Dublin.

Code	Title
Dublin 1	Integrated public transport fares and ticketing

Dublin 2	Road Pricing
Dublin 3	Real-time airquality monitoring by traffic control systems
Dublin 4	Car clubs
Dublin 5	Local emissions taxes
Dublin 6	Retrofit demand management into Draft 2030 Vision Strategy
Dublin 7	Intelligent transport systems.
Dublin 8	Strategic logistics
Dublin 9	Workplace travel plans
Dublin 10	Personalised travel planning
Dublin 11	School travel planning
Dublin 12	Promoting health benefit of Active Travel
Dublin 13	Enhanced local weather forecasting