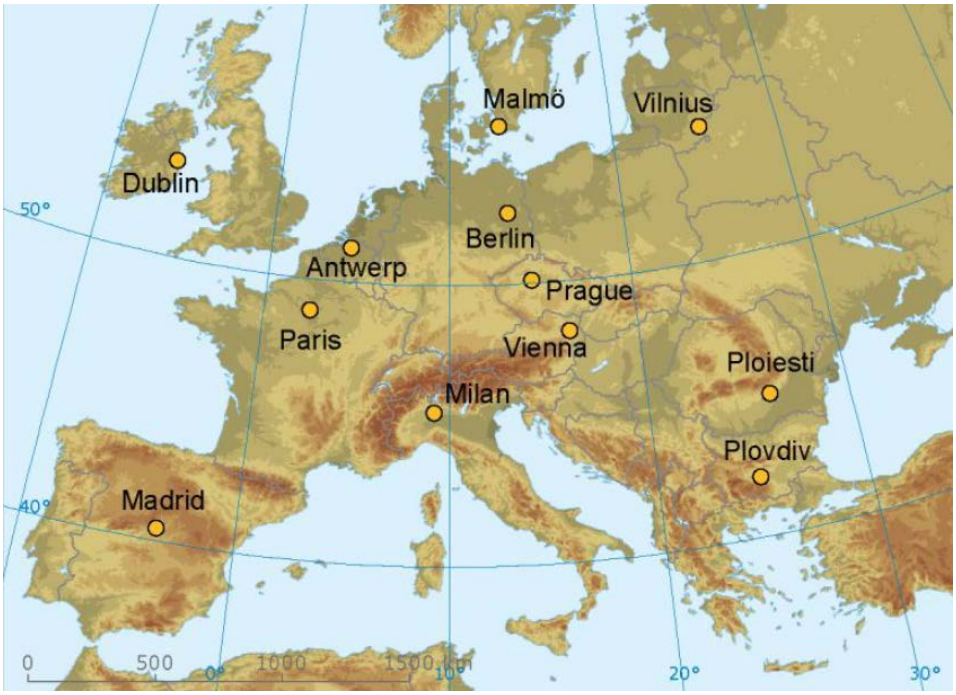
Air Implementation Pilot:

Workshop on measures

Copenhagen, February 27th, 2013



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Front page picture:
The twelve cities participating in the Air Implementation Pilot project undertaken jointly by the EEA and the European Commission. (http://www.eea.europa.eu/themes/air/activities/the-air-implementation-pilot-project)

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0. Introduction: the Air Implementation Pilot

The Air Implementation Pilot[1] is a pilot project undertaken jointly by the EEA and the European Commission. It is focused on gaining a better understanding of what cities need in order to better implement EU air quality legislation.
A total of twelve cities are taking part in it:

Antwerp (Belgium),
Berlin (Germany),
Dublin (Ireland),
Madrid (Spain),
Malmö (Sweden),
Milan (Italy),
Paris (France),
Ploiesti (Romania),
Plovdiv (Bulgaria),
Prague (Czech Republic),
Vienna (Austria) and
Vilnius (Lithuania).

The Pilot is examining five themes in air quality implementation: local emission 'inventories' (the measurements of what pollutants are being emitted and where); computer modelling activities to assess how these pollutants disperse in the atmosphere; monitoring networks that measure air quality using monitoring stations based across a city; management practices by city authorities; and public information measures to inform citizens about air quality in their city.

1. Analysing management practices

Under the task on management practices the trends in measured concentrations in the stations located in the pilot cities were analysed. To complement it, the measures officially reported by the Member States in the plans and programmes questionnaires, and the Time Extension Notifications for the cities were assessed[2], From these analyses it was seen that it is unfortunately not possible to identify which are the most efficient measures in each city, as not all the cities have reported the expected local impact on ambient concentration of the measures. So, in the Air Implementation Pilot progress meeting hold in Madrid in October 2012 it was decided to hold a workshop to get the direct feedback from the cities on the issue.

For the preparation of this workshop, a questionnaire (see Annex I) was sent out asking the cities to provide information about a maximum of 3 most important measures each city has implemented to improve air quality. The response received was very good, with replies from all cities. The objectives of the workshop were to understand:

- The process leading to the choice of measures;
- How expected effects are estimated (before implementation) and how result effects are calculated (after);

[1] http://www.eea.europa.eu/themes/air/activities/the-air-implementation-pilot-project

[2]. See "Progressing to cleaner air: Evaluating non-attainment areas", ETC/ACM Technical Paper 2012/10 (http://acm.eionet.europa.eu/reports/ETCACM_TP_2012_10_progressing2cleaner_air) and "Air Implementation Pilot: Management practices (update 2013)", ETC/ACM Technical Paper 2013/7 (http://acm.eionet.europa.eu/reports/ETCACM_TP_2013_7_AirImplPilot_management_upd2013).

* Estimation of costs/benefits;
* Challenges in implementation;
* General feasibility of measures;
* Need for further guidance.

2. Preliminary results from the analysis of the questionnaire replies

A summary of the measures chosen by the cities is shown in Table 1.

Apart from those in the table, cities also choose the following:

- AIR QUALITY PLANS: generic action plans, instead of highlighting measures, in Malmö, Ploiesti (switch to gas in residential heating, renewal of industrial equipment) and Vilnius (street maintenance and detour) from 2014 on;
- INDUSTRIAL MEASURES: Industrial plants: Vienna;
- MEASURES IN THE PORT OF ANTWERP: Awareness: eco-sailing; Technological: hybrid crane, cargo handling equipment.

In general, the 3 most important measures target traffic and only Vienna has named a measure on industry among those chosen measures. Three cities target fuels (e.g., biomass/bituminous fuel burning). Most measures are ongoing, meaning that they have been implemented and are continued, and therefore must be effective in at least some way according to the cities' assessments.

The areas of implementation depend on the types of measures, affecting buildings for those measures related to residential and commercial sources, and extending from specific areas of the city (inner city, historical parts; e.g. congestion charges) to the whole city (e.g., renewal of public transport fleet) for those measures addressing road traffic emissions. In the case of Antwerp also the harbour has specific measures. Finally, in a few cases the implementation area extends further than the city to cover regional areas (for instance, the ban of certain fuels in Dublin and some other neighbouring cities, as well as the implementation of Low Emissions Zones (LEZ) in Milan and some other locations in the Po Valley).

Table 1. Summary of the measures chosen by cities in their replies to the questionnaire.

	DOMESTIC/ RESIDENTIAL	**TRAFFIC**				
***City*\ Measure**	**Fuels**	**LEZ**	**Public transport**	**Speed limits**	**Congestion charge**	**Mobility plan / awareness**
Antwerp		*In 2016*	Modal shift (+ bike sharing)			X
Berlin		X	Modernisation of fleet	30		
Dublin	Ban of bituminous					
Madrid			Renovation of buses fleet			
Malmö		For heavy vehicles	Conversion of fleet			
Milan	Regulation of biomass	winter			X	
Paris			New services (Vélib and Autolib)			
			Spatial measure (+ bike lanes + tramway)			
Plovdiv	Municipal buildings		+ bike lanes			
Prague		Heavy trucks	Alternative fuel + electro recharge			
Vienna	District heating		Increase of use			

The pollutants targeted by these measures were, depending on the type of measure:
Fuels:

- PM: all cities,
- Black smoke, SO_2, (Dublin),
- BC and B(a)P (Milan)

Traffic:

- PM and NO_2: all cities,
- CO_2: Antwerp, Malmö and Milan.
- HC, noise, CO: Malmö.
- EC and BC: Antwerp
- NH_3: Milan.
- Benzene: Paris

Air Quality Plans:

- SO_2, NO_2, PM_{10}, O_3 : Malm, Ploiesti, Vienna

Industrial:

- PM, NO_2: Vienna

Port:

- PM, NO_2, EC, BC, CO_2: Antwerp

In short, different pollutants are targeted depending on measure, but NO_2 and PM are targeted by all of them. Only one of the chosen measures targets B(a)P, whose main source is wood burning but can also be emitted by road traffic. No specific measures defined to reduce VOC emissions, as ozone precursors, have been selected. ¨

The public's reaction to the measures ranges from indifference (e.g. technological measures in public transport) to acceptance (e.g. bike sharing programmes) to rejection (e.g. LEZ, circulation restrictions). Experiences show evidence that **acceptance is higher when public perception and knowledge are high, when the city provides alternatives, and when there are economic incentives**. It is interesting to learn about the case of failed measures, and especially of the **"political use" of certain measures, which is something to be avoided (the use of measures by political parties in the fight for votes)**.

The criteria used by the cities to select the most important measures were:

- Effectiveness in emissions reduction: Berlin, Dublin, Milan, Ploiesti, Plovdiv;
- Co-benefits (with climate change mitigation, noise, mobility, traffic safety, etc.): Milan, Prague, Vienna;
- Legal feasibility / competences: Antwerp, Berlin, Madrid, Paris;
- Economic and social proportionality: Berlin, Antwerp, Vilnius;
- Technical feasibility: Berlin, Vienna;
- Previous experiences (failed or successful): Dublin;
- Contribution of sources: Berlin;
- Effect on air quality: Berlin;
- Reduce exposure to air pollution;
- Quickness in results: Malmö;
- Political and public acceptance: Vienna.

The estimation of the measure's effect was carried out by different strategies in the different cities. Before the implementation of the measures, emissions and emission factors were used by 4 cities, air quality modelling by 4 cities, and air quality impact studies by 2 cities. After implementation, the effect of the measures was assessed using the following tools:

- Monitoring networks (6)
- Changes in emissions (4)
- Evaluation of specific indicators defined by the cities for the specific measure (3)
- Changes in fleet composition (2)
- Specific measures: number of retrofitting, change in fuel use, fuel consumption, or modal split
- Scientific study (of different sorts)
- Dispersion modelling

Cost/benefit estimation is clearly the most complex issue, based on the input received from the cities. In general, specific data are available when it comes to traffic technological measures (e.g., cost of a new or retrofitted bus), but not when measures are structural. **From the questionnaires only very few cities stated that costs are a relevant criterion to select air quality measures, which was a highly surprising result. However, during later discussions almost all the cities agreed that the current economic situation is a clear limiting factor for the implementation of air quality measures.**

Implementation challenges identified during implementation of measures were:

- Opposition (public, political, commercial)
- Competences/administrative
- Lack of funds
- Lack of technology
- Illegal trading of banned fuels
- Legal loophole
- European rules for grants
- Side-effects (increase of congestion)
- Technical and administrative risks

3. Impact of measures

The aim of this session was to analyse the estimation/assessment of effects of measures before/after implementation. The session was opened by the presentation "Impact assessment of measures on the example of the LEZ, particle filter retrofitting of busses and speed limit in Berlin" by Dr. Annette Rauterberg-Wulff, Berlin.

The city of Berlin makes use of a **comprehensive toolbox to assess the effect of measures**, comprised of emission calculation (very detailed data on fleet composition, emission factors calculated for Germany and traffic counting), dispersion modelling and air quality monitoring (based on the data from 16 automatic stations + 30 "minimised samplers" in streets for OC, EC, NO_2, NOx, meteorological data and radon). These minimised samplers provide aggregated data every 2 weeks. Radon is used as an indicator for atmospheric dispersion conditions.

Low Emission Zone (LEZ)

The Berlin LEZ extends over 88 km^2 and includes about 1 million inhabitants. It was implemented in 2 stages: it was announced in 2005, implemented in 2008 (stage 1, requiring Euro 1 for gasoline, and Euro 2 or Euro 1 plus retrofitting for diesel vehicles) and in 2010 (stage 2, requiring for diesel vehicles Euro 3 + particle filter, or retrofit of Euro 1 to 3 towards Euro 4 particle).

The impact estimation **before** the implementation of the LEZ was carried out by 1) calculation of emission reductions under different scenarios and 2) impact assessment

on residents. The first was undertaken looking at the impact of different percentages and types of vehicles affected by the LEZ (e.g., whether all vehicles comply, if only 50% comply; if only passenger cars, or only trucks, etc.). **Results showed that effects would only be visible if all vehicles are affected by the LEZ (including all passenger cars), not only municipal fleet or trucks. For exhaust PM, the emission reduction was estimated to be up to 60%, however, compared to total PM (e.g. including re-suspension), the reduction is about 15%.** The importance of looking at the population affected by the reduction was highlighted, rather than at the reduction in terms of $\mu g/m^3$, i.e., the effect of the LEZ in certain streets may be high and thus an important portion of the population may be positively affected, and this was estimated to be a **much more positive message from the point of view of raising public awareness (including political)**.

From the impact estimation **after** implementation of the LEZ the following conclusions were extracted:

- Impact on traffic volume (automatic counting devices): a general decrease in traffic volume was observed inside and outside the LEZ from 2002 to 2010, verifying that **traffic is effectively reduced and not simply pushed to other areas of the city**.
- Impact on vehicle fleet composition: the proportion of different vehicle types/groups (to compare the trend in composition with the LEZ versus the one if business was as usual) was assessed based on license plate recognition by CCTV cameras (only 1 day/year to ensure privacy). **An increase in "green" sticker cars was confirmed** (90% for diesel passenger cars, 75% for duty vehicles), and this trend continued from 2010-2012. The data from the license plates were used as input to apply emission factors and recalculate new and "real life" emissions.
- Impact on emissions (calculated using the Handbook for emission factors): NOx emissions in Berlin are 15% lower than the average German city. As for PM_{10}, a source apportionment study carried out in Berlin in 2007 stated that , and only 22% of PM_{10} mass came from traffic exhaust emissions inside Berlin (before the LEZ). In 2010, after the implementation of the LEZ, this contribution from traffic to PM_{10} concentrations was reduced to 12%. The local traffic increment for NO_2 has decreased by 12%, and **the local increment for BC by 56%. This is the clearest evidence of the effectiveness of the LEZ, and it is used as the message to be communicated to raise public and political awareness.** M**eteorology has been less favourable in recent years, overcasting the effect on PM pollutant levels. This is a problem when data are publicly discussed**. In 2008 the LEZ was introduced but meteorological conditions were less favourable than in 2007 and without introducing the LEZ the adverse dispersion conditions might have resulted in higher concentrations than in 2007.

In conclusion, the implementation of the Berlin LEZ has led to an accelerated modernisation of the vehicle fleet, with >98% of the passenger cars now having a "green sticker", and 85% for duty vehicles. The impact on air quality was quantified as reductions of 7% in annual mean PM_{10} levels (resulting in 10 exceedance days less per year), 5% in annual mean NO_2, and 56% in annual mean soot concentrations.

<u>Modernisation of bus fleet</u>

The objective of this measure was to retrofit all buses (1200) to have particle filters (600 buses with Euro5/EEV). Currently, 94% of the buses have filters and 520 buses are Euro 5. The overall effectiveness of this measure, estimated by comparing emissions calculated using the Handbook of Emission factors, is lower than the LEZ but very effective for specific PM emissions. The next step will be to retrofit buses with SCR, but due to high costs this measure is still under discussion.

Speed limit of 30 km/h

The objective of this measure is to set speed limits of 30 km/h on main roads. Initially the main objective was noise, but it is now also used for air pollution mitigation. The reduction in noise may be up to 3dB(A) with the co-benefit of pedestrian safety, however the effects on air pollution are still under discussion.

Estimating the impact of the 30 km/h speed limit measure before implementation was not possible because no realistic emission factors were available. The effect after implementation was assessed comparing pollutant levels close to main roads with and without speed limits of 30 km/h. Changes in local increments obtained were -34% for PM_{10}, -19% for EC, -15% for NO_2, and -18% for NOx due to the lower speed limits. **This measure has large effect on re-suspension, as seen by the larger reduction in PM_{10} than in EC.** This is a very cost-effective measure, but political discussions are still going on. Long-term evaluations (>6 months) are deemed necessary. An interesting result is that it takes several months before car drivers are used to the new traffic situation; so it takes about 6 months for the average speed to decrease. Therefore speed limitations may be considered a medium or even long-term measure.

Discussion after the presentation

Specific questions were raised concerning LEZs and their implementation, as well as concerning the public's opinion of them and administrative issues (e.g., competences, etc). The notes from the entire discussion are included in Annex II.

4. Costs/benefits of measures

The aim of this session was to analyse the estimation of costs and benefits. The session was opened by the presentation "Air Quality Parisian policy", by Olivier Chrétien, Paris.

Measures focus on redistributing and sharing the public space, with new priorities for pedestrians, bicycles and public transport, and offering new solutions to travel into the city. Public transport is used for almost 60% of daily trips inside Paris and between Paris and its suburbs; and for 16 % of trips between suburbs, making a total of 29% of the daily trips within the region of Île-de-France. The aim of the measures is to remodel public space so that traffic gets only the place it needs, the rest being for bike, pedestrians and bus lines and more green spaces. Examples: redevelopment of the Place de la République, giving back the river bank to pedestrians by turning the riverside into an urban boulevard. All these measures are meant to redistribute public space to new priorities. The ultimate goal is to achieve a modal shift from traffic to pedestrian. Other measures implemented are a Pedestrian plan, a Plan Vélo 2014 and Mobilien (a strategic bus network).

Cost estimates provided for the city of Paris:

- **Bikes, pedestrians and buses**: it is aimed that costs for measures focusing on bikes, pedestrians and buses are low, by working with architects to minimise the costs of solutions and looking for solutions without needing to rebuild large parts of the city structures. **Estimated costs are approximately 1 million € for 1 single bus line across Paris**.
- **Trams**: an investment was made by State, Region and Départements in the tram around Paris Marechaux Boulevards, to regenerate also a degraded zone. It is considered a large investment with a cost of **400 million € for a 15km long line** (50% of the investment made for all roads for the same period of time, showing that it is a priority for the Mayor). Prior to the tram, the area was entirely dedicated to cars.

- **Vélib (bike sharing programme)**: the project is a big success, but **cost estimation is complex** because it is managed by a private company which in addition obtains co-funding from publicity. The project started in summer 2007, with a network of 1450 stations in Paris, stations every 200 to 300 m, a specific website and a smart phone application. The bicycles are used for 70000 to 130000 trips per day. Thanks to the public-private cooperation, there is a stable funding of the Vélib system. The cost is estimated to 50 cent per trip (higher than public transport).
- **Autolib programme (self-service electric cars on one-way journeys)**: this programme started in December 2011. This was a **totally private initiative, with no cost for the administration,** but supported by the Mayor and most communes within the agglomeration. There are approximately 1000 stations, and each commune invested 50000€/station. After this, the company needs to make it profitable over 10 years. The price for the customer is approximately 10€/trip (similar to a taxi), but the main advantage is that parking is ensured. Now approximately 3000 trips/day are done with Autolib (small in comparison to Vélib). The second objective of the Mayor was to promote electric vehicles, and Autolib helps with this.

Discussion after the presentation
Specific questions were raised concerning the measures implemented in Paris and the cost estimation of measures in general. The notes from the entire discussion are included in Annex II.

5. Implementation challenges

The aim of this session was to analyse the implementation process, including "failed" measures, and the relationship with short-term action plans measures. The session was opened by the presentation "The regulation of wood burning in small appliances", by Guido Lanzani, Milan.

In Lombardia 50% of primary PM_{10} emissions is originating from wood burning in stoves and fireplaces. In Milan, 31% of primary PM_{10} emissions originated from this source. In Lombardia B(a)P emissions by wood burning are the major source (75%); exceedances of the target value occur in suburban areas. Traditional open fireplaces emit 860 g/GJ PM_{10} while natural gas stoves only 0.2 g/GJ. Source apportionment data provide evidence that in Milan 8-10% of PM_{10} in winter is due to wood burning, and in the Po valley this estimate reaches 15-25%. B(a)P is becoming a problem linked to domestic heating.

Regulation of wood burning in Lombardia has resulted in the limitation of the use of the worst and oldest stoves and fireplaces. **One of the challenges is if only existing stoves are classified for regulatory purposes, then the probably cleaner future technologies are not included, which are probably the best technologies available.** Therefore, it is necessary to have a view for the future. Rules on installation, maintenance and control are also very important since the emissions depend on the way the stove or the chimney is maintained and this can result in several other benefits like safety, energy saving. Control on maintenance may form a legal obstacle as this might forms a violation on one's privacy.

Another major challenge is cultural: the public's perception of biomass burning is that it is good, "bio", environmentally friendly. The risks of wood burning (increased exposure to air pollution) are not recognised by the public. This also affects negatively the interest of politicians in implementing measures that can be non-popular.

Another one is **economical**: wood costs half as much as natural gas. Adding new equipment to existing stoves to increase their efficiency has a cost.

Technological: **methodologies to measure emissions are not defined yet at an EU level**, and the methods existing at present can lead to very different results. Furthermore, **new developments are needed to make stoves more efficient**.

Finally, there is a **need for EU policies**. A PM emission measurement methods needs to be defined, and new EU regulation for small domestic stoves & fireplaces (<35 kW) are necessary. Ecodesign and energy labelling requirements which are really "environmentally friendly" need to be available, and this will have an impact on public awareness. Other typical challenges are **lack of human resources and funding**.

Discussion after the presentation

Specific questions were raised concerning European legislation and the challenges faced in implementing measures. The notes from the entire discussion are included in Annex II.

6. General Conclusions

The analysis of the replies to the questionnaires and the discussions during the workshop offered a number of answers to the workshop´s objectives, regarding the following topics:

6.1. Process leading to the choice of measures

The actual decision processes and criteria were not discussed in detail during the workshop. The results from the questionnaires showed that the criteria used to select measures were:

- Effect to reduce emissions (5)
- Co-benefits (with acclimate change mitigation, noise, traffic safety, etc.) (3)
- Legal feasibility / competences (4)
- Economic (3) and social proportionality
- Technical feasibility (2)
- Previous experiences (failed or successful)
- Contribution of sources
- Effect on air quality
- Reduce exposure to air pollution
- Quickness in results
- Political and public acceptance

Some additional comments regarding this issue during the discussions referred to the importance of the cost as a major criterion.

It was also pointed out that some of the measures implemented were not always targeting air pollution control as first aim, but for instance GHG emission reduction, noise reduction, re-design of the city center, etc. although they also report benefits in terms of air quality.

Finally, it was raised the issue of what can be considered as an effective measure and the more generic discussion of improving not only air quality but life quality.

6.2. Effects estimation (before and after implementation)

Real-life experiences were only provided for Berlin city, and it was concluded that data on expected effects before implementation of mitigation measures is a complex issue

which depends strongly on the specific measures to be implemented. As an example, whereas estimating the impact of introducing speed limits before implementation is not possible because no realistic emission factors are available, this is possible in the case of the LEZ by calculation of emissions reductions under different scenarios and by assessing the percentage of the population affected by the mitigation strategies (as opposed to strictly assessing the reduction in terms of pollutant concentrations). In short, estimation of effects before implementation of measures is carried out by modelling tools.

Conversely, estimating effects after implementation of measures is possible and several approaches are available such as emissions calculations, dispersion modelling, air quality analysis, and mixed approaches. Estimating costs and effects of technological measures seems to be slightly more feasible than for other types of measures (e.g., structural). One critical factor identified is data availability, in particular technical data (e.g., proportion of vehicles using EGR, SCR; emission factors, etc.). A very useful tool which was highlighted is the simultaneous analysis of different pollutants, especially elemental carbon (EC) as it provides new and relevant information from an emission and health-related perspective. In sum, methods are available to assess the effectiveness of measures.

6.3. Cost/benefit estimation

Questions were raised concerning the difficulty to assign precise costs and benefits to specific measures, given that the investment in measures should not be seen only from the perspective of pollutant mass reductions, but instead more overall approaches should be taken (considering economic but also social, urban etc. criteria). If strictly economic or emission criteria are considered, measures such as bicycle lanes would seem ineffective when compared to technical measures (e.g., particle filter traps). Several cities agreed that social benefits are not simple to be calculated, but they are especially relevant for policy-makers and politicians. In general, impact assessments based on premature deaths are not preferred by policy-makers and politicians because the figures are too abstract, and they are often questioned. From the experience of the cities, decision-makers tend to appreciate data on technical and social costs whereas valuation of benefits seem too abstract. Other factors such as the proportion of the population affected by the measures should also be included in calculations to estimate the investment required for specific measures.

In general, actual cost estimates are extremely complex to obtain. There is a general lack of information on costs and benefits, but at least initial investments (e.g. the cost to set up a bicycle sharing scheme) should be known. It seems much easier to assess the costs for technological measures than for other types (e.g. structural, implying also a change of habits, which seem not to be cost-effective and where air quality is only a part of the benefit). One interesting result from the workshop was that, despite counting on scarce cost/benefit estimates, cities are still able to implement measures.

6.4. Challenges in implementation

Major challenges described were technological, cultural, legal, political and economical. From a technology perspective, it was stated that evolving technologies limit the optimisation of measures, given that measures may only be implemented based on the best available technology at the time, whereas better technologies may be developed in the future. Public opposition is considered a significant challenge, referring to the difficulty linked to modifying the public's perception of a given environmental problem (e.g., climate change versus air quality) or solution (e.g., biomass burning to reduce CO_2 emissions). Legal aspects such as competences which may be split between different levels (State/region/municipality), or legal issues regarding privacy, and the way the public opinion determines actions taken by policy-makers, also pose limitations

when implementing air quality measures. From an EU perspective, support from EU was requested regarding legislation including sanctions for non-compliance. Finally, politics are also a challenge given that air quality does not rank very high in political agendas. General challenges discussed are lack of human resources and funding in the framework of the current economic situation and trying to change this situation to convert AQ improvement in an opportunity for economic growth.

6.5. General feasibility of measures

This topic was not developed in detail, although two references to specific measures were made: (1) LEZ: the implementation of LEZ is considered an effective measure and is recommended in spite of public opposition; and (2) the application of TiO_2 asphalt blocks to reduce NOx is not advised, due to their high costs and lack of efficiency (plus, the aim of measures should be to reduce emissions at the source, rather than to capture pollutants once emitted).

6.6. Need for further guidance

Further guidance was requested mainly in the form of EU-wide regulations and legislation. Examples of this lack of guidance are the absence of EU-standard methodologies to measure emissions from boilers, and of new EU regulation for small domestic stoves & fireplaces (<35 kW) and for retrofitting of non-road heavy machinery. New regulations should include sanctions to raise public awareness, as it is estimated that the public does not understand the long-term effects of air pollution. Environmentally friendly eco-design and energy labelling requirements need to be available. Regarding vehicular emissions, a larger number of tests of EURO 6 vehicles would improve the data found in emissions inventories and therefore the modelling exercises to assess the effectiveness of measures. Finally, EU support for initiatives such as www.airqualitynow.eu was requested. Existing frameworks as FAIRMODE (http://fairmode.ew.eea.europa.eu) can also support the cities in the application of models for regulatory purposes as for instance assessing emission control scenarios for long term planning.

Annex I: Questionnaire

AIR IMPLEMENTATION PILOT – WORKSHOP ON MEASURES

Please fill in the questionnaire and send it to Alberto González (Alberto.Gonzalez@eea.europa.eu) by 15th February.

1. What are the most important measures that your city has implemented to improve air quality (max. 3)[3]?
   a) Name of the measure (and code in Plans & programmes or time extension notification, if reported);
   b) Short description of measure;
   c) Date of implementation and planned duration;
   d) Area of implementation (e.g. whole city, some roads, neighborhoods, …);
   e) Targeted pollutants;
   f) Reference, background material if available;
   g) General reaction of the population: acceptance, rejection or indifference;
   h) Do you plan follow-up measures after implementation?

2. Which criteria were followed for the choice of these measures (e.g. cost/benefit, co-benefit with other environmental or social issues, proved experience from other cities, political/public acceptance)?

3. How do you estimate the impact (on air quality, emissions or activity) of the measure before implementation? And how do you evaluate its results after implementation (methodologies, indicators used for the estimate and for the evaluation after implementation)?

4. Can you provide information on the measures costs (estimated costs, actual costs (implementation and maintenance), challenges (cut in annual budgets, etc.))? Please specify for whom these costs accrue (e.g. public administration, companies …) and if these are annual or one-time costs.

5. Have you faced any challenges when implementing the measure (political/administrative, public acceptance, technical, negative side effects, etc.)?

6. Do you have examples of "failed" measures (or trials)? For example,
   a) not possible to implement due to e.g. high cost, feasibility, political/public acceptance, no viable measure;
   b) have been implemented, but the results were not as expected,
   c) other reasons.

[3] If available, please choose 1 to 3 measures that have been implemented and evaluated. Be aware that "measure" can in some cases be a set of different actions (for example, the establishment of a "Low Emissions Zone" (LEZ) implies a set of different measures, but for the purpose of this study will be considered as one measure)

7. If also short-term measures are implemented in case of high pollution episodes, what is your experience with such short-term measures? Do they interfere (positively/negatively) with the structural measures?

Annex II: Discussions

Session 2 – Effect of measures

- Milan: do the vehicle fleet composition changes affect only the LEZ, or the whole Berlin area? *A change in fleet composition is seen in the whole city, even the suburbs and outer regions of Berlin (e.g. nearby cities such as Potsdam).* Is retrofitting done by closed or open filter? *It is regulated by national law, and open filters are mainly used for passenger cars and closed filters for trucks.* Speed limits: are they implemented during night only, or all day? *Some all day, some only during night due to noise problems*. Why do you see a reduction in emissions at 30 km/h? The theoretically (based on emissions factors) optimal speed is 40 km/h. *Berlin sees an even lager reduction at 30 km/h. They don't understand it for sure but it could be related to driving style, it could be that drivers drive more smoothly at 30 km/h with less accelerations, etc.*

- ETC: could the decrease attributed to the speed limits be due to the renewal of the vehicle fleet originating from the LEZ? *No.*

- Prague: the publicity of the Berlin LEZ is rather negative, and this is affecting the public acceptance of a LEZ in Prague. What is the presenter's opinion on this? *Berlin is also dealing with this negative publicity. Even if in absolute terms the reduction in PM is very low, it is high for EC and for this reason they are publicising those results rather than total PM. The Courts favour the LEZ, but the car owners and drivers clubs are negative about it.*

- Paris: are the stickers on cars uniform for Germany, and if so, who decided for them? *They stem from national law, nation-wide regulation.* Were grants provided to help fleet renewal? *Yes, if you retrofit your vehicle you can get 330€ (national government funding), but no such programme exists for trucks (but they pay less for highway use).*

- DG ENV: was research done in-house, or in collaboration with universities etc.? *It was done in combination with universities, research centres and engineering offices.* Regarding competences, could all German cities implement the same kind of measures, or does it depend on competences? *Indeed, some cities would have more difficulties than Berlin, which has a bigger influence as it is also a Bundesland.* In some academic circles LEZ does have bad publicity, how does Berlin deal with it? *There is disagreement on the effects of LEZ according to the scientific community. The experience of Berlin is that the effect on PM_{10} is small and difficult to see due to meteorological conditions and to the fact that PM_{10} is affected by numerous sources. The effect on NO_2 is also small (a few ug/m^3). But if BC is used as an indicator, it may be seen that the reduction is important for health. All measures have only small effects on PM_{10}, it is necessary to implement several measures to obtain reductions and comply with LVs. If we look only at one measure we will see small impacts only, but this doesn't mean it doesn't work. The combination of several measures is necessary.*

- EEA: were re-bound effects detected of the LEZ on other areas of Berlin? *No, maybe only slightly regarding parking spaces outside the LEZ.*

- DG ENV: when there are Court issues, are they at a local, national, or EU level? *They are at the local level.* Are fleet composition data also used for modelling? *Yes.*

- Dublin: just comments: we need to stop monitoring PM_{10}, it is not useful for protecting public health, and move on to $PM_{2.5}$, ultrafines or BC. PM_{10} is actually harming our case. Also, we should use diverse arguments to support our cause, not only air-pollution related, e.g., speed limits are beneficial for air pollution but much better for traffic safety.

- Ploiesti: doesn't the 30 km/h speed limit cause traffic jams when the rest of the city is at 50 km/h? *Not if the speed limits are well managed.*

- ETC: The buses have been retrofitted, but did you also consider cleaner fuels? *Berlin considered CNG, but found problems with the implementation costs. There are 4 H_2 buses as a pilot project, and hybrids were tested but were not deemed worth the cost*. Regarding the speed limits, were they enforced by traffic signs only, or also by

road reconstruction? *Mainly by traffic signs; reconstruction of roads is undertaken in speed limit zones at minor roads.*

- Malmö: Malmö has only CNG buses, initially the costs were higher but now the costs are equal.
- Vienna: an efficient measure is one that fits into the strategy of the city and which looks into the future. We need to improve public transport, because growing cities will always have transportation needs and a LEZ doesn't help with that. Moreover, with a further penetration of clean cars, the effectiveness of a LEZ will reduce over time. We need to keep in mind the overall picture, look at all effects and measures. *An important strategy in Berlin is promoting environment-friendly transport modes such as public transport and cycling*.
- EEA: we need indicators of quality of life, in order to be able to "sell" these measures and plans to the politicians and public.
- Milan: cities are ever-growing we need to talk to other experts so that air pollution considerations are included in all aspects of city planning.

<u>Session 3 - Costs</u>

- DG ENV: were all these measures included in the Mayor's political programme when he was elected? Does he have the support of the constituents for this? *It's very controversial, he arrived in 2001 and didn't include these measures in his programme initially, but developed them while in office. However, he was re-elected including these measures in his programme.*
- DG ENV: have you measured differences in numbers of cars? *Yes.*
- Vienna: it is difficult to assign each euro to a specific measure/strategy ("fractal costs").
- Milan: the cost of the measures cannot be seen only from the perspective of how many kg of emission are avoided. If we do so, then measures such as bike lanes will not seem effective when compared to particle filter traps. However, bike lanes have other benefits such as the improvement of quality of life, etc. Therefore, we need to decide how to assess these effects, how to quantify them. *It is necessary to avoid too much bureaucracy. It is not easy to calculate social costs but they are very important to politicians. Writing financial reports is important, but very difficult if we want to include all these variables.*
- EEA: once again, we need indicators, otherwise how will the message be conveyed to politicians and the public?
- Dublin: one of the difficulties is that we are not economists. We need to look at costs but also benefits. We don't really know the full cost or the full benefits. Only after implementing the measures were we able to see the real benefits. The monetary value of the lives saved needs to be determined by the economists, not by us because we don't have the skill sets. Therefore, we must collaborate with other specialists. If we put a number on costs, we must put a number on benefits as well.
- Prague: Prague is trying to include the part of population who will have a better environment as a result of the measures, but this is complicated. The expert agrees with Dublin that it is hard to get those numbers on health effects.
- Antwerp: in the port of Antwerp the costs are investigated by a consulting company and they have attributed a financial value to health effects. Eco-sailing practices are promoted, which achieve 80% of speed with 20% of fuel consumption.
- EEA: how to monetise the benefits? *Berlin: we try to make some estimates with impact assessments from EU on premature deaths etc, but these figures are not optimal for politicians because the figures are too abstract and often questioned. For information to the public and politicians, it is more useful to speak of the number of people who will be affected/benefit from the measure.*

Measures like cycling or promoting public transport help but they don't have many costs (especially cycling), but they should also be included in the financial analysis. Also, there may be costs which are not carried by the city itself, they may be paid at national level, for example.

- Malmö: Malmö exceeds the Swedish regulations for NO_2 so they have an action plan, but in its initial version it had no cost estimates for the action proposed.
- Paris: economic and social estimation is very difficult, as the models used for this in Paris are designed for large projects (e.g. new train line). Predicting how people's habits will change is a complicated issue (for instance, new people using cycling lanes are not previous car drivers).
- Plovdiv: a 22 million € project is starting, with various impacts including bike lanes for 42 km and reorganisation of public transport to reduce traffic flows. The project was not aimed originally for air pollution, but it is expected that it will have an impact on it.
- Milan: politicians like to hear the costs (technical) and also the social costs, but they don't like to hear the benefits as they seem too abstract.

Session 4 – Challenges in implementation

- DG ENV: the EU is developing measurements for boiler, stove and oven emissions. So new EU legislation is coming for this. Industry experts working on measurement standards agree that in the medium term particle size distribution will have to be measured as well, not only PM_{10}. This is a new break-through in technology and it will take a while.
- Plovdiv: what about the stoves that are already in use? Will some sort of retrofit be possible? *Ecodesign can only apply to new appliances. But for older appliances there are ways, even if not through ecodesign. Note that filters are not sufficient to limit emissions for older stoves; after one month they usually do not work properly.*
- DG ENV: another aspect: energy labelling for central heating installations, an energy label will be introduced. For now, it is not clear to what extent emissions can be part of this energy label. It is complex at EU level, and the Member States will have to vote on it. A distinction has to be made between energy labelling which is mandatory and which gives the consumer information, and Ecodesign which is targeting the producers by establishing requirements that have to be met if their products are not to be banned from the market. In addition there may be voluntary ecolabels.
- Berlin: they are discussing possible regulations for biomass burning. They have experience with coal-fired stoves, and it is now not possible to build new buildings with coal or biomass as the main heating system. But they can do nothing for small stoves for "comfort". There is a need for retrofitting systems and for European regulation on retrofitting.
- Dublin: this is partly a problem of air quality *vs.* climate change. Appliances are a global issue, given that producers also come from China. Bad fuel quality increases emissions, even if using very efficient stoves (that's why producers are actually in favour of regulating fuels).
- Vilnius: implementation challenges: no mechanism of control due to the lack of human resources. People even rent an approved stove to pass the inspection, and once they get the stamp then they put in whatever other stove. Having EU regulations and threats of fines would be very helpful, because the public doesn't understand the long-term effects of this pollution. Currently, inspection is hardly possible as there is no mandate for indoor inspection.

EEA questions: to steer the discussion, EEA had prepared some questions related to challenges in implementation:

- Malmö: *any measures that you would NOT implement?* TiO_2 asphalt blocks to reduce NOx, due to their high costs and no efficiency. Berlin and Milan agree. The aim should be to reduce the emissions at the source, rather than to capture or convert pollutants once emitted.
- Berlin: *how to deal with public opposition?* Berlin tries to ignore it. Air quality is not very high on the political agenda. Berlin: *measures the city would like to implement*: for non-road heavy machinery (tractors etc) they want to start retrofitting. They have no regulation for this yet, they are following Swiss certifications. They ask for EU regulation on this. They would like all vehicles to be Euro 6 so, regarding the handbook of emission factors, they would like that the number of Euro6 vehicles tested would be larger, to improve the emission inventories. This should be an EU issue, not local. Malmö and Milan agree.
- DG ENV: JRC is testing vehicles and it is an ongoing task, so the Commission is working on it but it takes time and DG ENV needs the inputs form cities to influence other DGs policies.
- Prague: asks for support from the Commission for initiatives such as www.airqualitynow.eu.
- Dublin: the obvious challenge is the economic situation. We should also promote air quality because it feeds into economic recovery.
- DG ENV: ecodesign and ecolabelling also create jobs, because behind them there is a strong need for R+D. We need to make it understood that investing in green technologies is good for the economy.