Ambient air pollution abatement strategy in Moscow

State Environmental Protection Institution “Mosecomonitoring”

Better cities for better life 2013, 12-13 May 2014
Factors influencing ambient air quality in a city

Abatement measures

Emission sources:
1. Road transport;
2. Industry and stationary sources;
3. Rail, air, water transport

Climatic factors, transboundary pollution, resuspension of fine particles from the earth surface

City planning – density and height of buildings

Evaluation of the influencing factors

Air pollution level

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Reorganization of industrial zones into the public spaces

Moscow, prior to 2004.
Garages on the territory of the “Red October” Factory

Moscow , 2010
Strelka Institute for Media, Architecture and Design
Public space

Industrial zones take up about 20% of the city territory. During reorganization about 30% of these areas will be given to green plantations
Tailpipe emission monitoring system

58 industrial enterprises

175 emission sources

213 monitoring systems
Evaluation of road transport emissions

Road transport emissions

Road and tire wear
- Fleet structure
- Fuel quality

Exhaust emissions
- Traffic parameters

By engine type
- By engine volume

By emission standard
- By mass

Mean speed
- Jams

Traffic intensity

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Air quality monitoring network

Mobile air quality monitoring stations ("mixed" areas - residential areas near industrial sources and minor motorways)

Moscow oil refinery AQMS

AQMS near major motorways

Residential AQMS

"Mixed" AQMS

Multilevel AQMS (0, 130, 230, 305 m)

City background AQMS (natural areas)
Moscow transportation system: issues

Motorization rate, with population density 100.3 persons/Ga and road density 3.95 km/km² (motorization is 2 times lower than in European cities, with road density 2-4 times lower)

- 296,8 (345,8*) vehicles/1000 persons
- 350-450 km
- 60%
- 74%

Road length shortage

Portion of overloaded roads in total road length, with mean vehicle speed in the city of 15-20 km/h

- Growth of mean trip distances
- Emissions growth for up to 30% **
- "start-stop" traffic
- Growth of mileage emissions by up to 2 times
- Extensive development of public transport is needed to take on more passengers

Portion of public transport in total transportation volume

Transport system in Moscow in 2011 was limiting further development of the city

* All registered cars including heavy duty and buses. ** Based on trip distance
Bad transport connections in Moscow

- City territory is divided by the railways, rivers and city forests:
  - maximum distance between railway underpasses is 10.6 km, minimum – 0.8 km;
  - maximum distance between bridges – 13.7 km, minimum - 0.7 km);
- Lack of correspondence between Moscow city and Moscow region transport systems (lack of 23 road lanes)

Existing under and overpasses:
- Properly sized
- Outsized
- Existing bridges

13.67 Distances between passes
No connection between areas
Air pollution near roads is up to 3 times higher than in residential areas far from major roads.
In traffic conditions of 2012 if PC fleet in Moscow consisted of the same vehicles as it did in 2004 emissions would have been by 45% higher.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Emissions reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>City fuel quality standards (since 2006 – Euro 3; since 2013- Euro 4), fuel quality control</td>
<td>11 % ; 3,5%</td>
</tr>
<tr>
<td>Ban on entry to the city center of LDV&amp;HDV which do not meet Euro 2 (since 2008)</td>
<td>8 000 tons/year</td>
</tr>
<tr>
<td>Replacement of HDV used in city communal and building sectors with vehicles meeting Euro 2 and higher requirements – since 2009 (for public transport – Euro 3 and higher)</td>
<td>9000 tons/year 3 000 tons/year</td>
</tr>
<tr>
<td>Since 2006 only buses meeting Euro 2 and higher requirements are allowed to operate on newly opened city routes, since 2008 – only those meeting Euro 3 and higher requirements</td>
<td>2,3-3,4 g/km (28-32%)</td>
</tr>
<tr>
<td>Public transport using compressed natural gas – 270 in 2013</td>
<td>Euro-4,5 vehicles</td>
</tr>
<tr>
<td>Experiment to stimulate use of small-capacity cars (2008 - 2011 )</td>
<td>4 000 tons/year</td>
</tr>
<tr>
<td>Special lanes for public transport (2010-2011)</td>
<td>Effect in future</td>
</tr>
</tbody>
</table>
# Currently implemented measures to reduce transport emissions in Moscow*

<table>
<thead>
<tr>
<th>Direction</th>
<th>Implemented measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures to decrease number of vehicles on roads</td>
<td>Improvement of public transport, restriction of HDV use during daytime, paid parking in the city centre</td>
</tr>
<tr>
<td>Measures to improve fuel quality</td>
<td>Higher fuel quality requirements (since 1 January 2013 – Euro 4); development of infrastructure to use natural gas, public transport on natural gas</td>
</tr>
<tr>
<td>Measures to improve environmental characteristics of automobile transport</td>
<td>Emission standards (implemented by Federal government); restriction of HDV use by environmental characteristics; incentives for electric cars (free parking in the city centre, development of electric charging infrastructure)</td>
</tr>
<tr>
<td>Better city planning</td>
<td>New road junctions, bridges, rail crossings, better planning of new districts to minimize travel demand etc.</td>
</tr>
</tbody>
</table>
Transportation impact reduction

- Special bus lanes
- New public transport Euro 4 - 5
- Low emission zones

Fleet turnover
Euro 4 and Euro 5 portion in Moscow passenger car fleet

Improvement of fuel quality/alternative fuels

Electric public transport

Euro 4-Euro 5 CNG

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</thead>
<tbody>
<tr>
<td>%</td>
<td>0%</td>
<td>19%</td>
<td>30%</td>
<td>37%</td>
<td>44%</td>
</tr>
</tbody>
</table>

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Paid parking in the city center

- 25% reduction of traffic
- 6-9% increase in mean speed

Free parking for electric vehicles – economy up to 3,200 Euro/year
Electric vehicles for Moscow

In 2012, 43 electric charging stations are set up in Moscow region + 10 stations on protected nature areas

- Since February 2013 until February 2015 import duty on electric vehicles is ZEROed (used to be 19% of the price)
- Free parking for electric vehicles can save 2,400 - 3,200 Euro/year

100 more electric charging stations are to be opened in 2015-2016 near trade centers + around 100 are planned on paid parking spaces
Incentives to promote use of environmentally friendly vehicles

- **paid parking/paid entrance** to the city centre and/or in the overloaded areas, with discounts for environmentally friendly vehicles (for example, hybrid cars, electric cars, cars using natural gas, euro-5 cars);

- **fuel tax**, with lower rates for high quality fuels (diesel and gasoline) and for natural gas;

- **transport tax**, with lower rates for environmentally friendly vehicles;

- **import tax**, with lower or null rates for environmentally friendly vehicles and higher rates for used vehicles;

- **subsidies/one-time tax discounts** for purchase or registration of environmentally friendly vehicles.

Incentives in RED are introduced in Russia and/or Moscow.
Low emission zones

- **Step 1. Low emission zones for LDV and HDV**
  1.1. **since 2008** – Euro 1 and lower prohibited in the city center
  1.2. **September 2015** –
     - Euro 2 and lower prohibited in the city center;
     - Euro 1 and lower within the boundaries of the Moscow ring automobile road

- **Step 2. Low emission zone for buses**
  - **January 2015** buses Euro 2 and lower are not to enter city boundaries within the Moscow ring automobile road

- **Step 3. Low emission zone for passenger cars**
  - Since 2017 (?)

Future for HDV and LDV low emission zones in 2015

Up to 30% reduction of emissions
### Emission reduction for some of the possible LOW EMISSION ZONES configurations

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Restriction</th>
<th>HDV</th>
<th>LDV</th>
<th>PC</th>
<th>Emission reduction (compared to scenario without restrictions), %</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>CO</td>
<td>VOC</td>
<td>NOx</td>
<td>PM</td>
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<tr>
<td>1</td>
<td>Emis. standard</td>
<td>EURO 2</td>
<td>EURO 2</td>
<td>no</td>
<td>3,3</td>
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<td></td>
<td>Zone</td>
<td>MK MKJD</td>
<td>TTK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vehicle type</td>
<td>&lt; 7 tons (weight)</td>
<td>&lt; 1 tons (load)</td>
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</tr>
<tr>
<td></td>
<td>Hours</td>
<td>7-22 hours</td>
<td>7-22 hours</td>
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</tr>
<tr>
<td>2</td>
<td>Emis. standard</td>
<td>EURO 2</td>
<td>EURO 3</td>
<td>EURO 3</td>
<td>EURO 2</td>
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<tr>
<td></td>
<td>Zone</td>
<td>MKAD</td>
<td>MK-MKJD</td>
<td>TTK</td>
<td>CK</td>
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<tr>
<td></td>
<td>Vehicle type</td>
<td>&gt;12 tons</td>
<td>&lt;3,5 tons</td>
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<td>all</td>
</tr>
<tr>
<td></td>
<td>Hours</td>
<td>24 hours</td>
<td>24 hours</td>
<td>24 hours</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Emis. standard</td>
<td>EURO 3</td>
<td>EURO 2</td>
<td>EURO 3</td>
<td>EURO 2</td>
</tr>
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<td>TTK</td>
<td>CK+TTK</td>
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<tr>
<td></td>
<td>Vehicle type</td>
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<td>bus</td>
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<tr>
<td></td>
<td>Hours</td>
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<td>24 hours</td>
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<td>4</td>
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<td>EURO 3</td>
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<td>EURO 3</td>
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<td>MKAD</td>
<td>MK-MKJD</td>
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<tr>
<td></td>
<td>Vehicle type</td>
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<td>all</td>
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</tr>
<tr>
<td></td>
<td>Hours</td>
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<td>5</td>
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<td>MKAD</td>
<td>MKAD</td>
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<tr>
<td></td>
<td>Vehicle type</td>
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<td>all</td>
<td>all</td>
<td>all</td>
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<tr>
<td></td>
<td>Hours</td>
<td>24 hours</td>
<td>24 hours</td>
<td>24 hours</td>
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</tbody>
</table>
Perspectives of emission reduction due to improvement of fuel quality

Since 1 January 2013 new fuel quality standard is introduced in Moscow – all fuel must meet EURO 4 requirements (environmental effect – emission reduction: sulfur dioxide by 70%, benzo(a)pyrene-by 22 %, particulate matter - by 9 %)

27 August 2013 Moscow City Government and JRC “Gasprom” have signed an agreement to further increase use comprised nature gas as motor fuel in Moscow

Permissible portion of sulfur, mg/kg

Permissible portion of aromatic hydrocarbons in gasoline, %
Projected improvement of Moscow transport system by 2016

<table>
<thead>
<tr>
<th>Metric</th>
<th>2011</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road density</td>
<td>3.95 km/km²</td>
<td>4.28 km/km²</td>
</tr>
<tr>
<td>Road length</td>
<td>3600 km</td>
<td>4000 km</td>
</tr>
<tr>
<td>Mean length of overloaded roads</td>
<td>533.5 km</td>
<td>491 km</td>
</tr>
<tr>
<td>Over-run index</td>
<td>1.58</td>
<td>1.42</td>
</tr>
<tr>
<td>Portion of public transport in total</td>
<td>74%</td>
<td>74%</td>
</tr>
<tr>
<td>transportation volume</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Emission reduction by up to 25% (depending on the scenario of traffic growth)

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Perspective ways to reduce emissions from transport in Moscow

- Polycentric development of the city;
- Improvement of communication between peripheral areas of the city;
- Intensive development of public transport, including special bus lanes;
- Expansion of the paid parking zone to TTK;
- Restriction of traffic of the oldest vehicles (low emission zones);
- Incentives to promote environmentally friendly vehicles (hybrids, electric cars, cars on natural gas etc.)
THANK YOU FOR ATTENTION!

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State Environmental Protection Institution “MOSECOMONITORING”

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